



CLOSING THE
DIGITAL DIVIDE:
**MORE AND BETTER
FUNDING FOR
THE DIGITAL
TRANSFORMATION
OF HEALTH**

A Conceptual Framework to guide
investments and action towards health
for all in the digital age



**Transform
Health**

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Foreword



The World Health Organization (WHO) recognises the critical role that digital technologies and health innovation play in helping us achieve the Triple Billion targets and our global goal to achieve Universal Health Coverage by 2030. The digitalisation of all aspects of our life is happening at an unprecedented scale. However, the opportunity that this presents to improve the equity, quality and efficiency of health systems has yet to be fully harnessed - and is unlikely to happen without increased and improved financing.

We welcome Transform Health's new report, *Closing the digital divide: More and better funding for the digital transformation of health*, which makes a strong case for the necessary catalytic investment and action to achieve health for all in the digital age. This is a timely and valuable resource as we reach a stage in global digital health where we are collectively thinking beyond the introduction of individual digital solutions and services, instead focusing on guidance and investments in the architecture and the enabling environment for digital transformation of health systems.

The vision of WHO's Global Strategy on Digital Health 2020–2025, adopted by Member States in 2020, is to improve health for everyone, everywhere by accelerating the development and adoption of appropriate, accessible, affordable, scalable and sustainable person-centric digital health solutions. Closing the digital divide is a valuable resource to help move us towards the vision set out in this Global Strategy. By setting out the amount, focus, and nature of investments needed to support the digital transformation of health systems, with clear recommendations for all stakeholders, it sets us on a pathway towards achieving these important objectives. With just eight years to achieve the Sustainable Development Goals, the time for action to achieve health for all by 2030 is now. WHO is committed to supporting countries to achieve this goal, and we believe that appropriate, costed digital strategies will accelerate our pace in getting there.

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About Transform Health

Transform Health is a global coalition of organisations, individuals and institutions committed to achieving universal health coverage through the use of digital technologies and data. To learn more about Transform Health visit www.transformhealthcoalition.org.

Glossary



Access – the availability of telecommunication devices and services for use by any member of the household at any time. In its broadest sense, it considers the economic, sociological and psychological factors that influence persons' opportunities to use technologies (gender, race, age, place of residence, etc.).

Application – a piece of software that can be installed on a device to perform one or more digital health interventions. Mobile applications are add-on software for handheld devices, such as smartphones and personal digital assistants.

Broadband – internet connection with capabilities higher than 256 kilobits per second.

Connectivity – the various physical means to connect people and machines to the internet or other communication networks. It usually requires either a fixed-line or a wireless solution via a broadband or dial-up service.

Data – information, usually in the form of facts or statistics, that can be analysed and used in decision-making.

Data equity in health – everyone has access to the benefits of data flows, including the poorest, most disenfranchised and at-risk persons. For example, robust disaggregated data help improve decision-making at different levels of the health system to ensure a more equitable and effective distribution of resources so that all people can access the right care at the right time, no matter where they live.

Data governance – practices for making decisions about data throughout its lifecycle to optimise an individual's, organisation's or government's capability for data-informed policy, strategy and operational management.

Data solidarity – an approach to the collection, use and sharing of health data that safeguards individual human rights while building a culture of data justice and equity. It ensures that the value of data is harnessed for public good.

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 e-health to include digital consumers, with a wider range of smart devices and connected equipment.

Digital innovation for health – innovative application and use of existing or new products, processes or models using digital technology platforms as a means within and across health systems and organisations.

Digital literacy – the skills, knowledge and attitudes necessary to successfully use digital solutions and effectively understand and utilise data outputs from such solutions as well as actively participate in the digital information society.

Digital public goods – open-source software, data, artificial intelligence models, standards and content that adhere to privacy and other applicable international and domestic laws, standards and best practices and that do no harm.

Digital technologies – the application of organised knowledge and skills in the form of electronic, mobile and frontier data-driven technologies to solve health issues and improve quality of life. Digital technologies for health care encompass definitions, components and systems included in digital health, e-health, m-health (and related terminology). Some examples include electronic medical records, telemedicine and health management information systems.

Digital transformation – the multiple processes of integration of digital technology and data into all areas of everyday life and the resulting changes that they bring.

Digital transformation of health – the multiple processes of integration of digital technology and data into all areas that affect individual and collective health and well-being. This includes the necessary changes in the enabling environment, including legislation, regulation, funding, public awareness, understanding and involvement.

Digitalisation – the integration of digital technologies into everyday life.

Digitisation – conversion of analogue data and processes into a machine-readable format.

Health data governance – the process of managing and making decisions to guide the generation, collection, storage and management of health data through normative, actionable and cross-cutting policies, practices, standards, benchmarks and regulations.

Information and communication technologies – the set of technologies developed to store, send and receive information from one place to another.

Internet of Things – a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

Interoperability – the ability of different applications to access, exchange, integrate and cooperatively use data in a coordinated manner through the use of shared application interfaces and standards, within and across organisational, regional and national boundaries, to provide timely and seamless portability of information and optimise health outcomes.

Open source – access to knowledge and tools without the need to pay for the knowledge itself, although there may be marginal fees for access.

OpenSRP – short for “open smart register platform”, which is an open-source, mobile-first platform built to enable data-driven decision-making at all levels of the health system. However, it was designed to address problems with existing technology solutions that are fragmented, unscalable, functionally limited and not interoperable with national-level information systems.

Personal data – any information that relates to an identified or identifiable living individual.

Primary health care – a whole-of-society approach to health and well-being centred on the needs and preferences of individuals, families and communities. It provides whole-person care for health needs throughout the lifespan, not just for specific diseases, ranging from promotion and prevention to treatment, rehabilitation and palliative care.

Principles for Digital Development – nine guidelines designed to help integrate best practices into technology-enabled programmes that are intended to be updated and refined over time. They offer guidance for every phase of a project life cycle and are part of an ongoing effort among development practitioners to share knowledge and support continuous learning.

Principles of Donor Alignment for Digital Health – 10 principles that are meant to guide investments in countries' digital health systems by aligning with countries' digital strategies, by working in a collaborative way with development partners and governments and by developing global goods.

Soft infrastructure – programmes and resources in an ecosystem that provide both physical assets, such as specialised buildings and equipment, as well as non-physical assets, such as communication, regulations, the financing of these systems and the training and mentorship of professionals.

Sustainable Development Goals – 17 goals adopted by the General Assembly of the United Nations in 2015 to achieve a better and more sustainable world for all by 2030. Sustainable Development Goal 3 (Ensure healthy lives and promote well-being for all at all ages) includes a target to achieve universal health coverage by 2030.

Telehealth – the use of mobile and telecommunications to deliver health services outside of traditional health care facilities. Telehealth refers to clinical and remote non-clinical services, including providing training and continued medical education for practitioners.

Telemedicine – a subset of telehealth that refers solely to remote clinical services.

Universal access – reasonable telecommunication access for all persons. It includes universal service for those who can afford individual telephone service and widespread provision of public telephones within a reasonable distance of others.

Universal health coverage – all individuals and communities receive the health services they need without suffering financial hardship. It includes the full spectrum of essential, quality health services, from health promotion to prevention, treatment, rehabilitation and palliative care across the life course.

Young people – a heterogeneous group with significant differences across age, gender, ethnicity, religious identity, sexual identity, economic status and other factors. There are also differences in definitions of young people. For the purpose of this report, we define “young people” or “youth” as individuals between the ages of 15 and 30 years, unless otherwise stated.

Abbreviations



CDC	Centers for Disease Control and Prevention
COVAX	COVID-19 Vaccines Global Access
FIND	Foundation for Innovative New Diagnostics
Gavi	Gavi, the Vaccine Alliance
GDHI	Global Digital Health Index
GIZ	German Agency for International Cooperation
ICT	Information and communication technologies
IDSR	Integrated Disease Surveillance and Response
IMCI	Integrated Management of Childhood Illness
IT	Information technology
LiST	Lives Saved Tool
NGO	Non-government organisation
OECD	Organisation for Economic Co-Operation and Development
OpenSRP	Open Smart Register Platform
PPP	Purchasing power parity
SDG	Sustainable Development Goal
SORMAS	Surveillance, Outbreak Response Management and Analysis System
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization

Executive Summary



The world's health systems are changing rapidly, driven by the introduction of digital technologies, artificial intelligence and the use of large data sets. The digital transformation has the potential to expand access to health care and accelerate progress towards the Sustainable Development Goal target of reaching universal health coverage by 2030.

We have reached a stage in the digital health journey where we need to think beyond enhancing health systems through the introduction of individual digital technologies and to instead consider the digital transformation of health systems in its broader sense. We need to remove the underlying obstacles and challenges to sustainability and scale. We need to focus on the actions and the investments that are necessary to drive a more equitable, inclusive and sustainable transformation of health systems in low- and lower-middle-income countries.

The past 20 years have seen renewed focus on health governance and have led to a deeper appreciation of the impact of good governance, in its broadest sense (to include legislation, regulation and funding, as well as political leadership, oversight and accountability) on health care delivery across all tiers of the health system. An inclusive governance structure and processes that are transparent, ensure the meaningful engagement of diverse stakehold-

ers and include strong accountability mechanisms will shepherd a digital transformation that responds to the concerns, expectations and needs of a broad spectrum of stakeholders. This encompasses civil society, patient groups, health professionals, academia, young people, women and other traditionally marginalised communities, as well as the private sector, under the convening and leading role of governments. This would also help safeguard against unwarranted or unanticipated exclusions or negative consequences of that digital transformation. This means involving people in the design and the oversight of the digital transformation, understanding their needs and responding to their concerns about existing or potential violations of privacy and human rights.

Countries must develop costed strategies to guide the digital transformation of their health system and governments must be in the driver's seat of this complex, fast-moving and challenging process, with other stakeholders aligning with and supporting their plans. This also includes promoting and expanding digital connectivity and digital literacy across societies; for health workers across all cadres, including community health workers; and also, for patients, policy-makers and all people who will interact with a digitalised health system.

Little information exists about the financial resource requirements or how funding should be invested and in what sequence to achieve a successful digital transformation of health systems. In this Conceptual Framework, we have identified and costed nine priority digital health investment areas, selected on the basis of input from more than 350 global stakeholders. We have also identified other areas that will require greater investment to ensure that the enabling environment will facilitate the digital transformation in an equitable, inclusive and sustainable manner.

By modelling the estimated cost of these nine investment priorities in low- and lower-middle-income countries¹, we have come up with an indicative figure for resource needs for a digital transformation of health systems in those countries, including five-year cost projections for each area.² Based on this modelling, we estimate that an investment of US\$ 12.5 billion is needed for the nine priority investment areas in 78 low- and lower-middle-income countries over the next five years, or approximately US\$ 2.5 billion per year on average.

Health infrastructure accounts for approximately 75% of the total projected investment. But this only includes health sector costs (health record digitisation, wide and local area networks within facilities and information and communication technology equipment needed at facilities) and not the general investment required to increase digital connectivity or usage among the population, which must also be prioritised. Operational costs, which include ongoing expenses for maintenance, equipment replacement, refresher training, software licensing, project management and help-desk support and make up half of the total projected costs, are often not fully accounted for in current costing analyses and are absent from most data sources. They are included in this investment estimate.

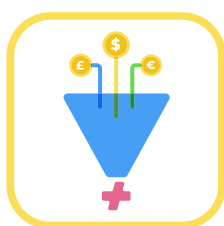
The total projected cost represents approximately 1% of the annual government health spending of the group of low- and lower-middle-income countries. It is not unreasonable to assume that, on average, 60–70%³ of this amount can be met from national resources, with the remainder to be externally supported. While countries must take the lead in funding their health system, in many resource-constrained contexts, donor agencies, philanthropic organisations and the private sector are also critical. The relatively modest scale of the needed funding should encourage more donors to reassess the potential of catalytic investments in the opportunities presented. To ensure that the digital transformation of health systems is funded and supported in the most effective manner, coordination and alignment of international investments are necessary.

The digitalisation of all aspects of life, including health, will progress relentlessly. But this progress must be led and guided by a clear and inclusive process if it is to lead to better health, greater inclusion, reduction of inequalities and closing the growing digital divide. Even modest additional investments during this period, if well directed, have the potential to build stronger and more resilient health systems.

This Conceptual Framework outlines the amount, focus and nature of the investments needed to support the equitable, inclusive and sustainable digital transformation of health systems in low- and lower-middle-income countries and offers recommendations for how that transformation should occur.



Recommendation 1 – More investment from domestic and international sources. Governments and international donors should prioritise funding to support low- and lower-middle-income countries in digitally transforming their health system, ensuring it is equitable, inclusive, sustainable and protective of people’s interests, their right to health, their privacy and their capacity to participate in its governance. Although we have projected an average funding need of US\$ 2.5 billion per year for the next five years for nine priority digital health investments areas for these countries, the true investment requirement will ultimately be determined country by country and based on costed plans. It will need to be complemented by wider investment to increase digital connectivity and usage among the population, as well as investments to address the broader enabling environment.

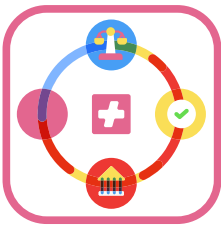


Recommendation 2 – Better coordinated and aligned investments. International donors and the private sector should ensure that their investments are coordinated and aligned with national priorities. This should include identifying and strengthening systems and processes that improve the coordination of funding. Without it, there is a risk of fragmentation, duplication and waste. At national level, there is a need for coordination among stakeholders and international donors through transparent processes and under the leadership of the government. The widely endorsed Principles for Donor Alignment for Digital Health provide the blueprint for this coordinated action and should be fully adhered to and monitored.

To enhance transparency and accountability, there is also a need for multilateral development institutions to introduce tools at national scale that track and publish data on funding for digital health as part of their wider health investment. In addition, WHO should fulfil the wide-ranging strategic, normative and technical role envisioned for the organisation at the World Health Assembly meeting in 2018. In this capacity, WHO must monitor the needs and flow of funds for the digital health transformation.



Recommendation 3 – A costed digital health strategy and investment road map. Countries must each develop an inclusive digital health strategy as an integral component of their universal health coverage and health system-strengthening agenda. The strategies must be aligned with the country's digital health maturity levels, and they must promote interoperable solutions for connectivity, capital investment, data governance, legislation and regulation, literacy and workforce. These solutions need to be developed in an inclusive and participatory manner, with sufficient time for consultation with different stakeholders, including civil society, youth, women and marginalised and hard-to-reach communities, as well as health workers at all levels of the health system. These strategies need to be costed and accompanied by a prioritised and sequenced investment road map that lays out the different sources of funding as well as the gaps.



Recommendation 4 – A robust regulatory framework and policy environment. National governments must prioritise establishing a legislative and regulatory framework and the necessary policies to guide the digital transformation of their health system so that it is inclusive, equitable and sustainable. This process must be based on multistakeholder engagement and include the broad participation of civil society, including youth, women, older people, people living with disabilities and marginalised and hard-to-reach communities. This needs to lay the legal foundations in terms of health data use, privacy, digital literacy and the policies for what kind of digitalised health system a country needs to ensure universal health coverage. A transparent public policy environment increases planning and investment certainty for international donors and the private sector and clarifies the incentives and expectations.



Recommendation 5 – Mechanisms for meaningful multistakeholder engagement. For a digital transformation to be effective in improving health outcomes and accelerating progress towards universal health coverage, civil society, including young people, women, older persons, persons with disabilities and marginalised and hard-to-reach communities, needs to be involved at all levels of planning, strategy, execution and monitoring of the transformation. Such participation needs to be supported financially to ensure that communities across all strata of society are represented and can hold decision-makers and service providers accountable.



Recommendation 6 – Improved digital connectivity. There is urgent need for all stakeholders – national, international, public and private – to prioritise strategic, targeted and coordinated actions to close the divide in digital access. This is a prerequisite for equitable access to technology-enabled health services. This means addressing coverage gaps, affordability and digital literacy. It requires political will at all levels and civil society engagement to mobilise policymakers and to generate public awareness. If ignored, the divide in connectivity will widen the health equity gap and further marginalise already disadvantaged populations.

INTRODUCTION

01



Digital transformation has the potential to accelerate universal health coverage and ensure that lagging countries accelerate progress towards their Sustainable Development Goal target (3.8) by 2030. The increased use of digital technologies offers many possibilities to improve the health outcomes of all people. If unchecked or poorly regulated, however, it has the potential to exacerbate the existing social inequalities and exclusions.

To ensure that digital technology drives access and inclusion rather than becoming another barrier to health services, governments, donors, civil society and the private sector must work together to harness its potential for delivering health care for all.

As internet coverage grows and more people get connected, access to information and services and the efficiency and effectiveness of these services to respond to the health needs of the population is improving constantly. However, across many countries this growth has been uneven. Many interventions to digitalise health systems have been characterised by siloed approaches and interventions, a lack of coordination and poor adoption at the front-line or at the community level. The way many digital interventions have been implemented also places high transaction costs on health systems because health professionals are requested to adopt more tools and use different systems to respond to different populations or different health needs.

Across many jurisdictions and in the absence of strong regulation, digital technology multinationals wield significant influence over the population's access to information. They are shaping the way this information is collected, used, stored and disposed of. Some progress has been made to regulate data use, for example, in the European Union⁴. And principles⁵ and recommendations⁶ have been developed to guide the governance of health data. But the task of implementing robust and equitable data governance regulation is daunting for many countries. Adding to this complexity is the enormous power that the control of the data and information provides governments and the private sector. The possible misuse of this power by authoritarian regimes cannot be overlooked and must be considered when digital systems for collecting personal health data are developed.

We have reached a stage in our digital health journey where we need to think beyond enhancing health systems through the introduction of digital technologies. We now must consider the digital transformation of health systems in its broader sense and address the underlying obstacles and challenges to sustainability and scale. We must focus on the actions and the investments that are needed to drive a more equitable, inclusive and sustainable digital transformation of health systems.

What does digital transformation mean when we speak about health systems? Transform Health draws on “The Lancet and Financial Times Commission on Governing Health Futures 2030: Growing Up in a Digital World” and its general definition for digital transformation: “the multiple processes of integration of digital technology and data into all areas of everyday life, including health, and the resulting changes that they bring.”⁷ Applied to health systems, the digital transformation necessarily encompasses the enabling environment that touches on different social and political spheres and involves multiple sectors and stakeholders.

A 2018 World Health Assembly resolution characterises the digital transformation of health as a systemic and fundamental change in how health care will be thought about and delivered in the future.⁸ The World Health Organization’s (WHO) Global Strategy on Digital Health 2020–2025, which grew out of this resolution, stresses that “digital health should be an integral part of health priorities and benefit people in a way that is ethical, safe, secure, reliable, equitable and sustainable. It should be developed with principles of transparency, accessibility, scalability, replicability, interoperability, privacy, security and confidentiality.”⁹





A Conceptual Framework to guide future action and investment

This Conceptual Framework looks at how systematic and coordinated investment – by governments, international donors and the private sector – can overcome many challenges crowding the path towards an equitable, inclusive and sustainable digital transformation.

It takes as its starting point and foundation the WHO's Digital Health Strategy and the Governing Health Futures 2030 Commission's report¹⁰. The process to develop this Conceptual Framework involved interviews with experts and partners and other research led by Transform Health's regional and youth partners in Asia; Eastern Mediterranean; Eastern, Southern, West and Central Africa; and Latin America. It also included global cost and impact modelling and discussions with development partners and international donors in standing forums and dedicated meetings (Annex I).

The Conceptual Framework describes an approach that emphasises building up and supporting the enabling environment through:

- an emphasis on expanding access and use of digital devices and the internet among the whole population;
- capacity and modalities for putting in place a regulatory and policy environment to steer digital health transformation;
- support for and engagement of a broad array of stakeholders, including health workers, parliamentarians, civil society, communities and citizens seeking health information and care, to guide, participate in and oversee these modalities;

- development of transparent national strategies, costed plans and public accessibility;
- investment in digital skills across the health system;
- incentives and guidance to enable private sector investment in support of a national digital strategy.

It highlights the importance of engaging and serving traditionally marginalised communities and groups, such as women, youth, older people, persons with disabilities, remote or rural populations and communities of people living with communicable or noncommunicable diseases.¹¹

In the Conceptual Framework, we chose to highlight the situation and the expectations of young people. While Transform Health advocates for the needs of all marginalised groups to drive the digital transformation, the partnership with Young Experts: Tech4Health¹² provides access to the perspectives of young people at the global level. Young people are a heterogeneous group with significant differences across age, gender, ethnicity, religious identity, sexual identity, economic status and other factors. For this report, we define “young people” and “youth” as individuals aged 15–30 years, unless otherwise stated.

This Conceptual Framework frames the thinking on how investments can be used to steer and shape low- and lower-middle-income countries' digital health transformation. It assesses the scale of meaningful investment

required in these countries over the coming five years. It explores some of the investment challenges and their consequences in relation to digital health care in low- and lower-middle-income countries and makes recommendations on how governments, donors and other stakeholders can collaborate to ensure that digital technology supports the ambitions to achieve universal health coverage by 2030. The Conceptual Framework argues that an investment of US\$ 2.5 billion a year over the next five years, with ongoing costs of US\$ 2 billion in the sixth year and beyond, could support low- and lower-middle-income countries¹³ achieve the digital transformation of their health system. It also recognises that this must be complemented by greater investment to increase digital connectivity and use among populations and to strengthen the enabling environment.

Following this introduction, **Chapter 2** describes the status of the digital transformation of health and the main processes, trends and tools within the global landscape. **Chapter 3** discusses the necessary conditions that need to be in place so that a comprehensive national strategy on digital transformation can be resourced and implemented successfully. **Chapter 4** presents the outcome of the modelling analysis of the projected investment needed for nine priority areas that would promote the digital transformation of the health system in 78 low- and lower-middle-income countries. **Chapter 5** looks at the potential impact of digital technologies and artificial intelligence on health outcomes. **Chapter 6** lays out the case for more and better aligned resources for the equitable, inclusive and sustainable digital transformation of health systems. And finally, **Chapter 7** presents the recommendations.

BOX 1

Explaining digital health and digital transformation

What is 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 e-health 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.*

What is digital transformation?

The multiple processes of integration of digital technology and data into all areas of everyday life and the resulting changes that they bring.†

Source:

*=WHO, Global strategy on digital health 2020–2025, 39–40;

†= Kickbusch et al., “The Lancet and Financial Times Commission on Governing Health Futures 2030: Growing Up in a Digital World,” 1730.

‡ = Transform Health

What is the digital transformation of health?

The multiple processes of integration of digital technology and data into all areas that affect individual and collective health and well-being. This includes the necessary changes in the enabling environment, including legislation, regulation and funding as well as public awareness, understanding and involvement.‡

What is data solidarity?

An approach to the collection, use and sharing of health data that safeguards individual human rights while building a culture of data justice and equity and ensuring that the value of data is harnessed for public good.‡

WHERE WE
ARE TODAY

2022





From ad hoc digital solutions to a national, strategic approach

The potential of digital technologies to provide improvements and efficiencies in health care has been evident for at least 20 years. Its uptake, however, has been relatively slow, uneven, unsystematic and mostly limited to individual products, services and processes, such as digitalising the supply chain for a few health products or, at most, a procurement system. This typically has been spearheaded by a specific disease response, for example, a national malaria programme's supply chain may be digitalised. This leads to different disease programmes using different systems that are not interoperable. That practice, along with a large number of pilot projects that do not progress to a system-wide or national scale adoption, lead to a fragmented landscape, with health care providers often compelled to learn how to use multiple systems.¹⁴

This experience has been shared across the countries and regions covered by our research, which identified some of the following challenges:

- In Cameroon, many digital applications are in use at the community and health facility levels, as well as at the district, regional and national levels, but without any overall coordination or selection based on national need or suitability.
- In Kenya, a total of 123 different digital transformation projects were identified, with 230 different organisations active within the country's digital health space.
- Latin America and the Caribbean face

a proliferation of uncoordinated digital health projects, denoting a fragmented system, leading to unnecessary duplication of expenditures and data silos that hinder their systemic use.

- In Asia, systemic deficiencies, such as silos in data, poor integration, and lack of interoperability within and beyond the public health system continues to be a challenge in many countries.
- In the Eastern Mediterranean region, sporadic and isolated digital health interventions risk leading to system fragmentation and double spending.

The many isolated pilot projects and often incompatible initiatives that have emerged in the absence of national plans lead to an expensive and fragmented approach to the digitalisation of health services. Most countries accept that they need a comprehensive, strategic approach to the digital transformation of their health sector. Our research shows that many countries have developed some framework for digital planning within their overall national health strategy or strategy to achieve universal health coverage. However, the quality and level of detail of these plans vary greatly. Inclusion is not well reflected in these digital planning processes. All regions reported little to no engagement of civil society, let alone marginalised groups in the decision-making processes around the digital transformation of health.

Digital health maturity



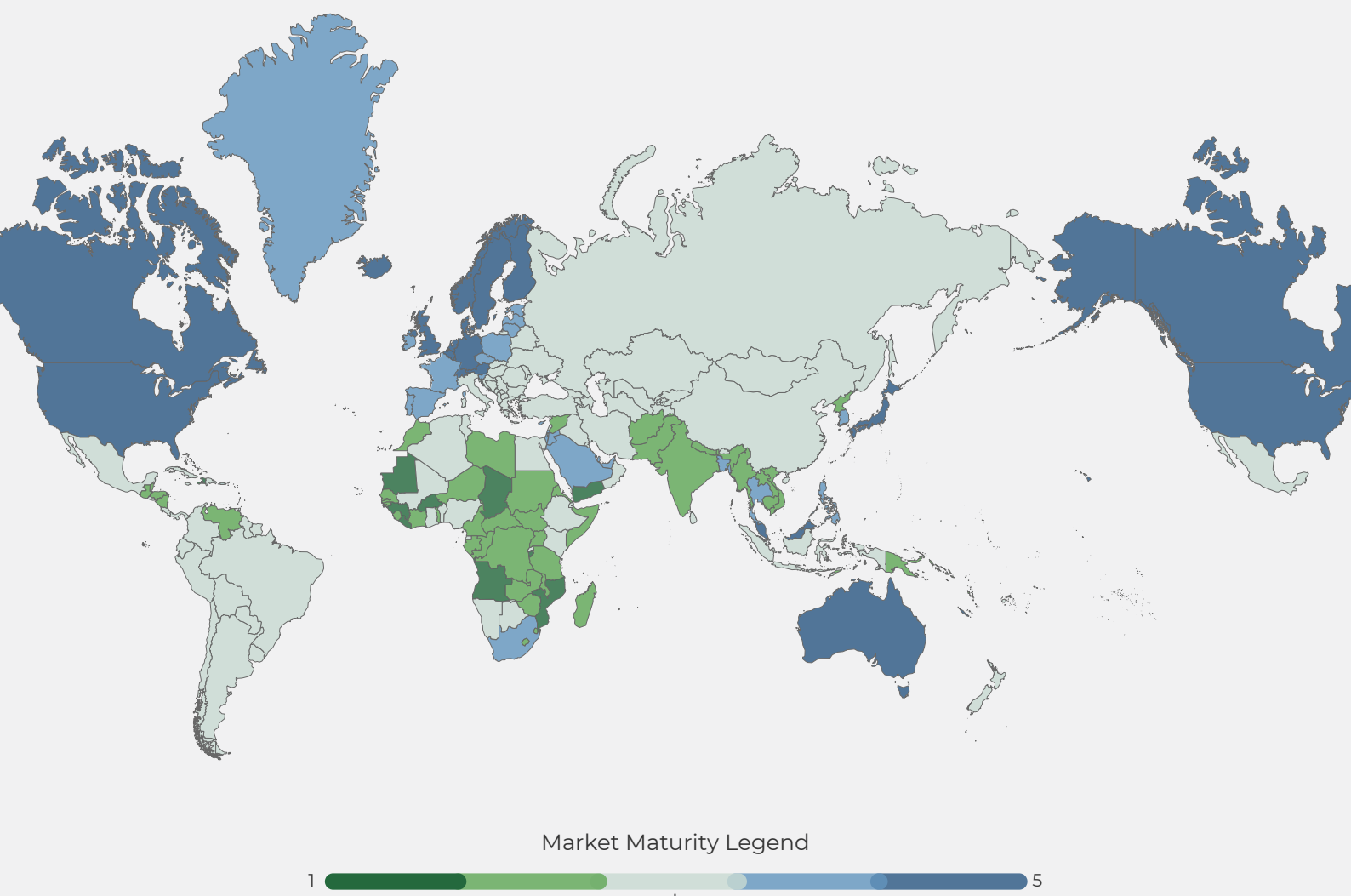
A country's capacity for digital transformation depends on its levels of connectivity, penetration of digital tools (such as computers, tablets, laptops and smartphones) in the population, digital literacy and financial resources. In order to raise a country's digital maturity level, it is imperative that political leaders and parliamentarians understand the potential benefits of the digital transformation and its risks. The current level of that understanding varies greatly from country to country. If a digital transformation is to accelerate health equity, differentiated approaches, based on each country's "digital maturity" level, are needed.

Digital health maturity models help to understand which national digital strategies are the most useful. These diagnostic assessment tools assess the current state of a country's political, infrastructural and educational environment for the digital transformation of health care. Several models exist, but they largely follow similar systems of ranking countries' digital maturity. The Global Digital Health Index (GDHI) is a broad collaborative effort of different partners that has built a five-point scale using the eHealth Building Blocks of WHO and the International Telecommunication Union.¹⁵ Digital Square

developed an extension to the GDHI model using the World Economic Forum's Network Readiness Index indicators for the political and regulatory environment, infrastructure and digital context and skills (Figure 1). In this model, the lowest-ranking digital health maturity countries are a level 1, with the highest at level 5. Digital maturity does not always correlate with income classifications.¹⁶

This classification found that 150 million people live in the lowest maturity tier (level 1). More than 5 billion people live in levels 2 and 3, with roughly 1.5 billion people in the top two maturity tiers, levels 4 and 5. For the 1.5 billion people living in high-maturity countries, digital transformation is well under way. However, as the COVID-19 pandemic has revealed, the wealthiest countries also face challenges in the governance of data among other things.

Figure 1 Global market maturity map



Digital Square segmented all countries in the world into five digital health maturity market levels to better understand end users' needs and digital health product requirements. The market segmentation framework leverages data from 25 early-adopter countries on the Global Digital Health Index (GDHI). For the remaining countries, Digital Square developed an extension to the GDHI based on 17 World Economic Forum Networked Readiness Index indicators. These indicators include political and regulatory environment, infrastructure and digital context and skills. Lower digital health maturity markets (levels 1–3) completely lack digital policies or have planned policies that are not yet implemented. They also likely have 2G infrastructure and variable electricity. The workforce has less digital literacy skills. In contrast, higher maturity levels have digital policies that are enforced. In addition, they are more likely to have 3G infrastructure and reliable electricity with a digitally literate workforce.

Source: Digital Square, "Market Analytics", <https://digitalsquare.org/market-analytics>.

Broadband coverage is improving, but access to digital tools is lagging



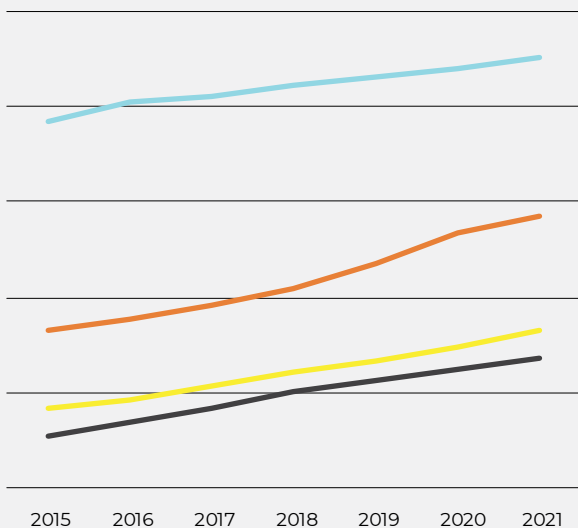
Mobile network coverage (3G or higher) – the measure of who lives within the footprint of a mobile broadband network – has expanded rapidly in recent years. In 2021, the International Telecommunication Union estimated that 95% of the world’s population was within broadband coverage, with Africa, the continent with the lowest rate, reaching 82%. This bodes well for rolling out digital tools and services across the health system. In most countries, even district health posts are likely to be connected to the internet through mobile broadband.

The situation, however, is not matched by usage. Despite living in areas with broadband coverage, a large part of the global population is still not online because they do not have access to digital tools.¹⁷ An estimated 2.9 billion people are offline,¹⁸ including 1.7 billion people in the Asia–Pacific region, 29.1% of the population of China¹⁹ and 50% of the population of India.²⁰ In Africa, 738 million people remain offline – that’s two out of three people unconnected, which increases to around five out of six people in rural areas.

Figure 2 Internet use versus mobile broadband coverage

INDIVIDUALS USING THE INTERNET

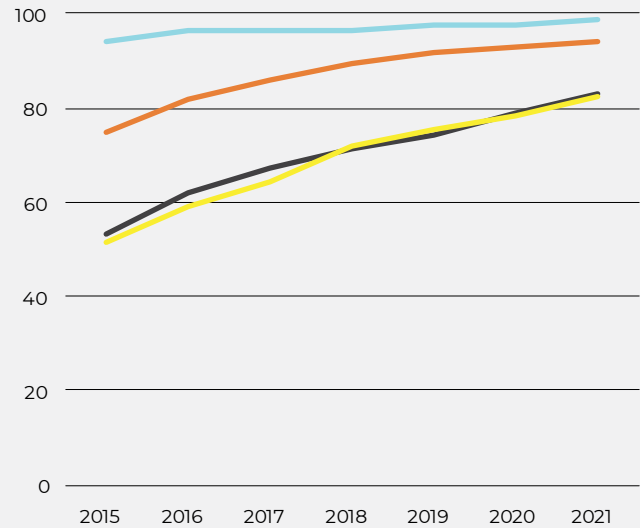
Per 100 inhabitants



— Developed
 — Developing
 — Least Developed Countries (LDCs)
 — Africa

POPULATION COVERED BY AT LEAST 3G MOBILE NETWORK

Per 100 inhabitants



Source: Based on ITU’s statistics from Measuring digital development: Facts and figures 2021.

This gap between coverage and access – and the critical role that political will plays in overcoming this gap – was highlighted in our research:

- In Kenya, investments to increase internet connectivity have been made by state and non-state actors. Fibre Optic cables have been laid along major highways in most counties by the Ministry of ICT, Innovation and Youth Affairs. In the 2022–2023 Digital Master Plan, the Kenyan Government announced plans to deploy 100 000 kilometres of fibre optic cables to schools, health facilities and government institutions.²¹
- The Botswana Communications Regulatory Authority boasted that as of 2020, the national fibre coverage was more than 9000 kilometres, covering cities, major towns and villages, with 164 out of a target of 206 areas covered.
- In 2021, Malawi launched the second phase of its national fibre backbone to drive digital transformation. The project includes 3000 kilometres of fibre optic cables connecting homes and businesses across the country.

Uneven access, affordability and digital literacy are considerable challenges



Although many countries are now in the situation that their mobile broadband coverage allows them to plan for a rapid digitalisation of their health system, significant segments of their population are not able to connect to or benefit from basic internet content. This means many are not able to make use of digital services for health care, with the risk of increasing health inequalities.

The previous examples of investments towards digital infrastructure by national governments in Eastern and Southern Africa are a crucial starting point for promoting inclusion because most aim to achieve last-mile connectivity. At the same time, access and therefore usage are lagging:

- In Malawi, for example, only 44% of the population possesses the foundational skills required to leverage digital technology, and 60% of the population lacks the competency to operate a computer or access the internet on their mobile device. This situation is not unique to Malawi but is evident across Eastern and Southern Africa and in sub-Saharan Africa. According to the World Economic Forum, eight of the ten most disconnected countries are in sub-Saharan Africa.

- Approximately 200 million people lack access to basic digital infrastructure in Latin America and the Caribbean, and others have access, but the service is of poor quality and/or very expensive. This means that more than a third of households still do not have an Internet connection. The digital divide between rural and urban areas in Latin America and the Caribbean remains significant, with 67% of households in urban areas having internet connectivity while only 23% of households in rural areas are connected.

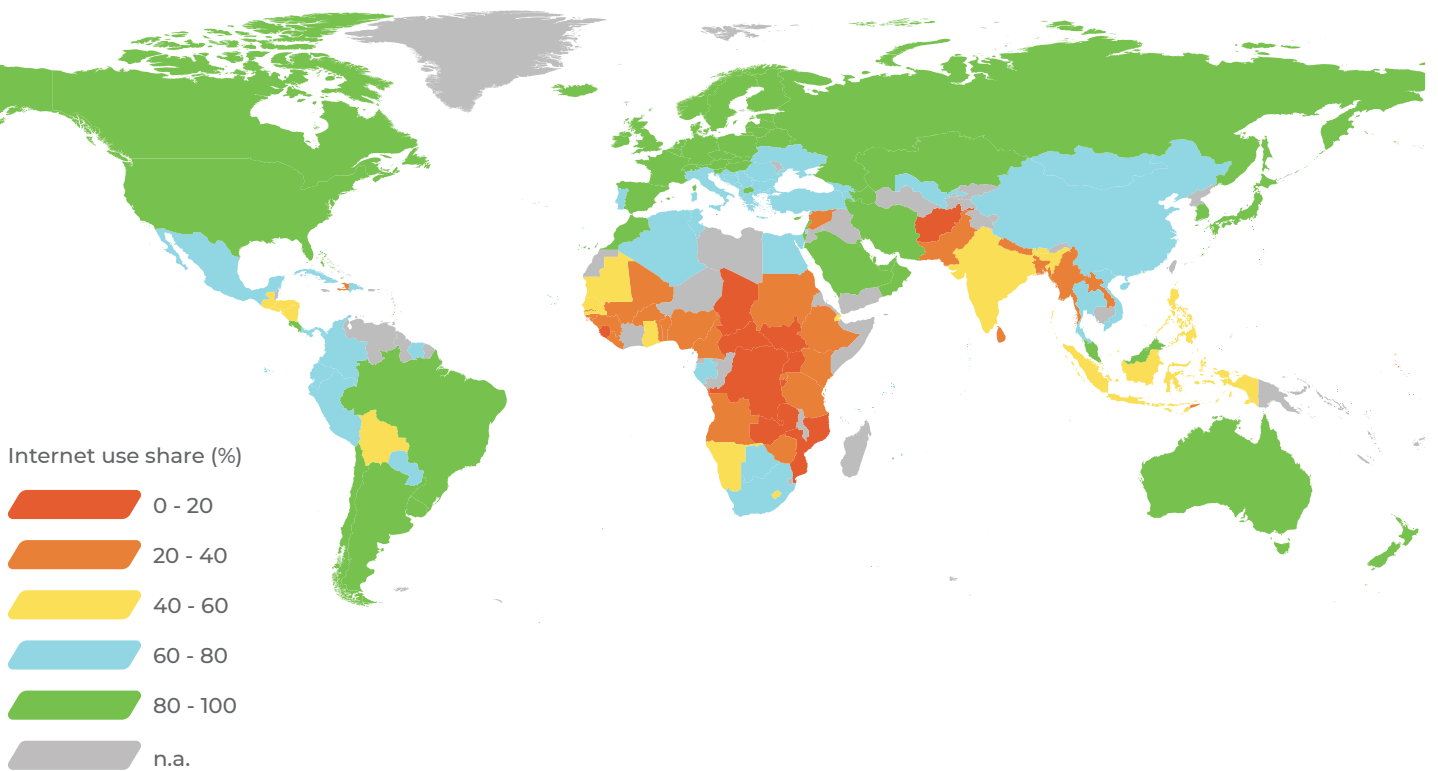
Our research found several countries facing significant barriers, such as non-existent or unreliable power supply, network outages, lack of equipment maintenance and highly uneven digital literacy. Informants in Eastern and Southern Africa noted that despite the introduction of digital systems, health workers still capture data on paper primarily and resist the digital systems, viewing them as a waste of time. The main reasons for this resistance include unreliable systems due to downtime and difficulties navigating the sometimes complex systems.



Closing the global digital divide



Figure 3 Percentage of the population using the internet, 2020



Source: Based on ITU's statistics from Measuring digital development: Facts and figures 2021.

Closing the use gap will be considerably harder than ensuring coverage of broadband networks. This is because the main and long-entrenched barrier to getting people online is the same factor that prevents people from accessing health services in the first place: financial hardship. This is exacerbated by the fact that data plans are generally comparatively more expensive in countries with lower incomes than in wealthier ones.²²

Gender, age, health status, whether one lives in rural or urban settings, education levels and digital literacy, also determine who has access to a digital device and who doesn't. These factors affect the same groups that tend to fall through the cracks of most health systems. Cultural differences, resistance or community unwillingness to accept and adopt digitalisation also can be a barrier.

“One of the key objectives of digital health transformation is to achieve health equity, which is the absence of unfair, avoidable or remediable differences in health care access and health outcomes among groups of people.”

– Conceptual Framework research, Eastern Mediterranean

The United Nations High-level Panel on Digital Cooperation, convened by the United Nations Secretary-General in 2019, makes clear that marginalisation is an expanding problem.



People who lack safe and affordable access to digital technologies are overwhelmingly from groups who are already marginalised: women, elderly people and those with disabilities; indigenous groups; and those who live in poor, remote or rural areas. Many existing inequalities – in wealth, opportunity, education, and health – are being widened further.

– United Nations High-Level Panel on Digital Cooperation, 2009²³

From our youth-led engagement process

Young people tend to be more digitally literate and better at finding information and negotiating digital environments that may be less intuitive and difficult to understand for older persons. Yet, they often face challenges in accessing traditional quality health care services due to social, cultural and/or legal barriers that limit their agency, especially in sensitive health areas like sexual and reproductive health and mental health. With the advent of digital health care, they are now able to access more information, support and services without experiencing discrimination or stigma.

To the extent that young people, more than older generations, rely exclusively on social media for information, they struggle with separating valid from false information. They display a higher level of distrust of official sources of information, and they are concerned about data privacy. There is therefore a danger that increasing access to digital sources of information on health may increase misinformation and confusion and reduce trust among young users.

If we are going to manage a digital transformation of health in a way that benefits everybody, we will need to overcome the challenge of ensuring that everybody can connect to digital services. And we will have to safeguard against unintended harmful consequences as the health sector moves rapidly to introduce digital technologies and artificial intelligence, so that digitalisation does not inadvertently become a means of excluding populations from health services rather than a driver of greater inclusion.

“This digital divide makes inequality worse. The vast majority of the world’s unconnected people live in low- and middle-income countries. And access is not the only issue. We know that the transformative power of digital technology is sometimes misused, often in ways that reinforce inequality and exclusion. Digitalisation is a double-edged sword: used for both good and ill.”

– Organisation for Economic Co-operation and Development, 2021²⁴

Tools, guidance and assistance are growing



WHO's Global Strategy on Digital Health 2020–2025 provides a framework for how countries should go about a digital transformation. A central objective in WHO's strategy is to promote "people-centred health systems that are enabled by digital health". Building solutions around people's needs and rights – rather than being driven by technological opportunity – is the main purpose of all digital transformation efforts.

Through its headquarters and regional and country offices, WHO provides countries with support and advice in their efforts to develop and implement a national digital health strategy. WHO acknowledges²⁵ that while they take a supporting, coordinating and norm-setting role, they are operating within an already busy environment where other actors also have important roles. Low- and middle-income countries now have a broad range of organisations, institutions and donor agencies to draw support from as they embark on their digital transformation journey.

Some of these organisations focus on better structuring the digital transformation by assisting low- and middle-income countries in developing a digital health transformation strategy, issuing guiding documents and manuals, suggesting how to prioritise investments, assessing the need to support and to regulate the private sector, generating research and organising platforms for accessing and sharing data for health research.

Major bilateral and multilateral funders are dedicating significant funding to countries to support their digital transformation, either directly or through non-government organisations or consultants. These funders include the World Bank; the United States Agency for International Development (USAID); the Global Fund to Fight AIDS, Tuberculosis and Malaria; Gavi, the Vaccine Alliance; the German Development Cooperation (GIZ); and regional development banks. Although the scale is hard to assess, significant investments in digital technologies are taking place through traditional investments for health. Most health funds and initiatives are already investing heavily in digitalising their systems in programme countries. However, our research could not find evidence of the systematic programming of and dedicated funding for inclusive governance processes, let alone mobilisation and engagement of stakeholders at the community level. This is an important gap, given the critical role of civil society and community engagement in health planning, promotion, emergency response, governance and accountability.

Private sector engagement is evolving



A myriad of smaller initiatives within the area of digital technologies and artificial intelligence for health that have relevance for low- and middle-income countries are increasingly being developed and marketed by the private sector. These range from apps and other software for self-testing for different diseases and conditions and collecting and organising patient data to phone-based health insurance and payment systems. The rapid development of wellness and health monitoring apps and e-health systems aimed at high-income populations are spreading globally and inspiring innovation in the use of technologies to track health and facilitate access to e-health services in low-and middle-income countries. The market for consumer-focused digital health products and services has traditionally been seen as too small for the largest information technology companies to invest in low- and lower-middle-income countries. Instead, private sector investment and engagement in these countries has mostly relied on developing technologies funded by donors. However, this situation is changing rapidly.

As governments digitalise their health services and as open-source communities and large companies start offering digital health and wellness services in parallel, countries are increasingly facing complex and often fraught questions about ownership and privacy of data. These are issues that an increasing number of countries are wrestling with. Starting an informed national debate early and seeking best practice from other countries is a good first step to address these issues. Developing a robust regulatory framework and policy environment is essential to manage the challenges as they emerge. This is one particular area where international assistance may be an important supplement to local expertise and resources.



BUILDING THE ENABLING
ENVIRONMENT FOR THE
EQUITABLE, INCLUSIVE
AND SUSTAINABLE DIGITAL
TRANSFORMATION OF
HEALTH SYSTEMS

2030

The graphic features three overlapping, rounded rectangular shapes in the bottom left corner. The top-most shape is orange, the middle one is cyan, and the bottom one is dark blue. These shapes overlap each other and the large white numbers '2030' which are set against a blue background.

Digital transformation is not simply about ensuring that stand-alone digital solutions can be technically connected. It is also about transforming health systems through digital means in a way that is equitable, inclusive and sustainable. It must accommodate future needs, technological innovation and human rights. And it must be backed by the necessary scale of investment to deliver on people's and health professionals' needs. Digital transformation is complex and challenging and goes beyond the remit of one single ministry (health). It requires a "whole of government approach", which in turn must include all stakeholders.

There is clear recognition of the vital importance of a systematic, national strategic planning process for this transformation.²⁶ Governments and donors must also be cognisant of the potential consequences of a rushed and haphazard deployment of digital technologies in health care without proper ethical and political frameworks, good governance and conducive regulation in place.

It is imperative to ensure the meaningful engagement of civil society and communities, including representatives of the most marginalised and vulnerable persons as well as health workers, in the digital transformation. They must be empowered to contribute to this change and to hold decision-makers accountable.

The following sections outline essential elements that are needed. The specific needs of a country are of course context-specific and may go beyond this core list.



Inclusive governance



An inclusive governance structure and processes that are transparent, ensure the meaningful engagement of diverse stakeholders and that include strong accountability mechanisms, will help ensure a digital transformation that responds to the concerns, expectations and multiple perspectives of the full population. This includes civil society, patient groups, health professionals, academia, young people, women, traditionally marginalised communities as well as the private sector, with government in a convening and leading role. This will help safeguard against unwarranted or unanticipated exclusions or negative consequences of that digital transformation.

Looking at additional investment in the digital transformation of health systems, it is critical to begin with fostering leadership and governance. This includes the establishment of a high-level coordinating body under the leadership of the Ministry of Health, with the mandate and the power to define the purpose, goals and direction of the digital transformation of health systems and to oversee the progress of this work. This body must involve the planning and finance ministries and those arms of the government that oversee ICT, research, education and data security. The recent cross-country analysis conducted as part of the Data Use Acceleration and Learning initiative in Burkina Faso, Ethiopia, Malawi, South Africa and the United Republic of Tanzania underlined the need for – and the role of – such cross-ministerial and multistakeholder governance.²⁷

Building on this, the process of the digital transformation of health systems needs to be grounded in national debates, hearings and consultations, and its decision-making process must be transparent. Although political

leadership is essential, this leadership should be challenged when needs arise, encouraged and scrutinised by stakeholders knowledgeable of and directly engaged and affected by the transformation, including communities and health workers. Our research suggests that currently many actors and stakeholders are not engaged.

“While there is a vibrant digital and e-health ecosystem in the country, there is limited participation of patients and health workers in health facilities in the process of digital and e-health transformation in the country.”

– Conceptual Framework research, Asia

Realising the commitment to “design with the user” and to “understand the existing ecosystem”, which is summarised in the Principles for Digital Development,²⁸ requires governments to have the network and the trust to engage diverse stakeholders and for communities to be empowered and have the platforms to channel their expertise and their expectations into decision-making forums.

The youth consultations for this report unequivocally called for inclusion of young people in all aspects of the digital health transformation, leveraging their unique position as actors and consumers of digital health care.



Robust regulatory frameworks

The COVID-19 pandemic has increased people's attention and political awareness in relation to the collection, processing, storage, analysis, use, sharing and disposal of health data. One of the most common themes observed across the youth consultations in different countries is the lack of trust in data protection. Repeatedly, the request for more personal details was seen as an encroachment on an individual's privacy that potentially exposes that person's identity. This was cited as a major concern.

A growing number of organisations, including from civil society, are working on the issue of human rights and digital technology with recommendations and guidance to strengthen the governance of health data. In 2021–2022, Transform Health, for example, stewarded the development of rights-based Health Data Governance Principles, which centre on protecting people, promoting health value and prioritising equity. Developed through an inclusive, bottom-up process, the principles combine contributions from more than 200 experts across diverse geographies, sectors and stakeholders and have so far been endorsed by more than 130 organisations.²⁹

The Organisation for Economic Co-operation and Development (OECD) has a Council Recommendation on Health Data Governance that all its member countries are expected to implement. This legal instrument aims to guide “in setting the framework conditions for enabling the availability and use of personal health data to unlock its potential”.³⁰

The tracking, influencing and oversight of digital transformation and how data is being governed is gaining political attention. The Digital Health and Rights Project recommends learning from the model of the HIV response, whereby “community-led networks of people living with and affected by HIV have translated arcane human rights law, medicine and pharmaceutical knowledge into user-friendly, actionable language and have used this process to mobilise marginalised groups and have a meaningful say in decision-making”.³¹

The digital technology revolution over the past three decades has been characterised by technological advances outpacing legislative and regulatory processes. As we have seen, governments and lawmakers constantly play catch-up with industry but often not before the negative consequences of unregulated commercial application of new technologies have become apparent and nearly impossible to reverse.

Areas in which regulation is particularly needed are linked to the ownership and use of data, the nature of and basic principles for national health insurance systems and the private sector's role in providing individualised health care and digital health solutions, along with the conditions under which these solutions can be delivered. At a policy level, guidance on the use of open source versus proprietary software, the compatibility of data, standards of care and an ethical framework for digital platforms are among the many areas that would need formulation.

By necessity, this work will be a complex process of building a vehicle while moving at high speed, and countries will need to be pragmatic in their approach. The starting point in this regulatory journey will be different for each

country. Countries should map their existing legislation, identify gaps and establish a priority order in which to develop the regulatory framework they need.



“Leveraging the data governance and the legal system is essential to enable many digital health transformation projects, especially the ones addressing identity management, information access, privacy and data-sharing rights.”

– Conceptual Framework research, Eastern Mediterranean

Advocating for stronger health data governance regulation

Transform Health and partners are calling for a global health data governance framework, underpinned by equity and rights-based principles, to be developed and adopted by governments through a World Health Assembly resolution. It is vital that such a framework be developed through a transparent and inclusive multistakeholder process, including the meaningful engagement of civil society and communities.

This would lead to much-needed regulatory standards that countries could adopt into national legislation to ensure the equitable governance of health data. Such a framework should be based on norms and standards that draw on duty obligations that countries have made to respect, protect and uphold basic rights, according to the different international

treaties, from the International Covenant on Civil and Political Rights and the International Covenant on Economic, Social and Cultural Rights to the Convention on the Rights of the Child and the Convention on the Elimination of All Forms of Discrimination Against Women, as well as commitments made in the Universal Declaration of Human Rights, the Declaration on the Future of the Internet and other ICT norms and standards.

It would lay the foundation for improved public trust in health data systems, whereby individuals feel protected, respected and in control of their own data while allowing institutions working to protect the health and well-being of the population to access and use it for the public good.

The role of parliamentarians in digital health transformation

Over the past decade, parliamentarians, individually or as members of dedicated parliamentary groups and international networks, have become increasingly engaged in the debate for universal health coverage. And they have become effective advocates for global health issues. Both internationally and within their own parliaments, these networks have built up coalitions, coordinated advocacy and shared information in ways that are increasing the visibility of important health

issues. This engagement is also extending to digital health care. As one example, the parliamentary network UNITE* recently created a dedicated global hub on digital health and innovation to promote parliamentary leadership and strengthen ethical policy ecosystems on innovation for universal health coverage.

See www.unitenetwork.org.

Comprehensive plans and strategies

Comprehensive plans and strategies³² are vital to guide the digital transformation of health systems. Governments must be in the driver's seat in their development and delivery while providing the strategic direction that donors and other stakeholders can get behind. Our research confirmed that many countries have begun developing or have some form of strategic plans for the digitalisation of their health sector. However, several plans are already outdated, having been rendered obsolete by technological developments or the dramatic challenges brought on by the COVID-19 pandemic. The plans differ greatly in detail, feasibility and comprehensiveness, and few of them are costed. Although no systematic review has been undertaken, an assessment of a sample of these plans as part of our research indicated that few would qualify as comprehensive or realistic

guidance for a country as it moves through an inclusive and equitable digital transformation of its health system. Few of these plans are the product of broad, multistakeholder engagement or consultative exercises.

At the same time, good practice for such strategic plans is beginning to emerge, driven by the sharing of experience across borders and based on a systematic combination of bottom-up needs assessments with top-down clarity of purpose and goals.³³ Growing expertise is developing – both in countries and in donor and advisory organisations that have been supporting this work. This expertise, if shared with and deemed relevant to other countries, could greatly assist a large number of countries in their process to digitally transform their health systems.

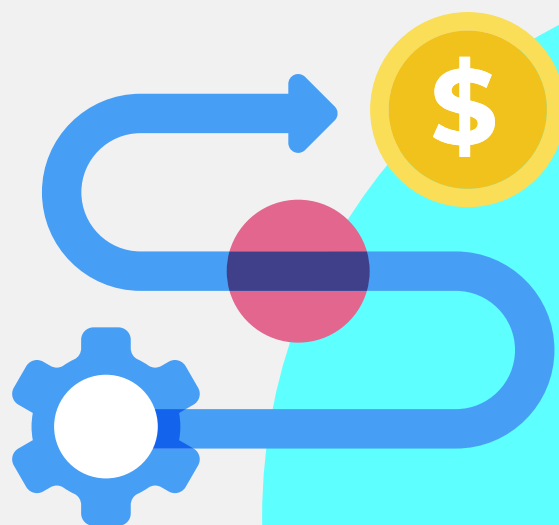
Costing strategies



Countries' strategic plans for the digital transformation of health systems need to be realistically and transparently costed. A few countries have costed plans for the digital transformation of the health system in their country. However, they tend to focus predominantly on the cost of acquiring and deploying digital technology and systems, rather than on undertaking an inclusive process that can guide the transformation of the health system. The fact that a digital health plan often is a subset of a larger national health plan makes the exercise even more complex. Where calculations of cost do exist, they are most often not public and can therefore not be assessed for feasibility or be the basis for funding requests by international donors.

“Despite the detailed digital strategies, it is widely observed and believed by experts that most countries do not have a designated national budget for their digital health programmes.”

- Conceptual Framework research, Asia





“Digital health has not been detected [as] budgeted in national health strategies and/or plans or in relevant national strategies and/or plans. There is no information on the estimated percentage of annual public expenditure on health committed to digital health.”

– Conceptual Framework research, Latin America

In all regions covered by our research, more robust costing data are needed to inform decisions on the adoption and scaling up of digital health strategies. In the absence of such data, there is a lack of information to effectively plan and budget for the implementation of these strategies. In no region did we find evidence of the cost of inclusive processes and/or the realisation of human rights-based approaches in the digital transformation of health being considered.

This is where comparisons of data between countries, good practice and sharing of experiences are of particular importance. The cost modelling for this Conceptual Framework (Chapter 4 and Annex II) provides an orientation

for what may be possible with more data and at larger scale. A number of countries have developed national investment road maps, such as the Democratic Republic of the Congo and the United Republic of Tanzania. Their strategy, investment road map and digital health architecture development processes are emerging as models for other countries. At the same time, WHO is building up its capacity as a repository of global goods and national experiences to advise and support countries undertaking their digital health strategic planning process.

Leveraging the full digital ecosystem, including the private sector



The private sector has generally been the driver of digital technological changes, although in health, as with the initial development of the World Wide Web, the basic research has often been conducted by universities and research institutions. As countries progress in their digital maturity, much of the digital transformation of the health sector is likely to be delivered by the private sector, either as a supplier to public entities of software and hardware solutions or as a provider of ICT infrastructure and services. Where there are viable markets or incentives to create such markets, the private sector is also a crucial source of innovation and new solutions.

The private sector is an important provider of health care in low- and middle-income countries,³⁴ and the research for this report indicates that the private sector already has an important role in countries' digitalisation of health systems, with coordination as one of

the main challenges. The research from Asia, for example, featured digital health strategies of most countries that already include active private sector participation, and the private sector is consulted in framing policies and strategies. However, active collaboration between the public and private sectors for implementation is still at the nascent stage.

It may be necessary to create both a clear policy environment for what a country expects from the private sector and what it wants to encourage. It may also be necessary to develop an incentive structure to ensure that relevant and important innovations can benefit populations in the low- and middle-income countries.



Develop digital competency at every step



From national decision-makers to community health workers, sufficient knowledge and training on the management and use of digital technology is necessary. However, this also needs to be accompanied by an incentive structure for the workforce that supports the adoption and use of this digital technology. This, of course, also holds for patients and the general public who need to understand how the digital processes work, know how to enter and submit their information and decide how their data will be used, stored and shared.

To ensure greater accountability for the adoption and use of digital technology, it is critical to outline and support capacity-strengthening activities across the health sector. It is also important to support academic institutions and civil society to conduct research and to advocate for the development and implementation of strategic plans and commitments to ensure digital systems are being deployed to accelerate universal health coverage.

The findings from the research in all regions are unanimous, that investment in digital literacy at every level is crucial for improving service delivery and achieving health outcomes. As one informant in the Latin America and Caribbean region said, “The technology implemented in the health sector should not be focused on replacing the competencies of health personnel but rather, the objective should be to increase or complement human capabilities.”

Several stakeholders also raised the issue that the tasks, requirements and the overall working reality of the health workforce is changing with the digital transformation of the health system. This is a change that needs preparation at all levels, as underlined during the research in the Eastern Mediterranean.

“Innovation in digital medicine, wearables, artificial and augmented intelligence and telemedicine is disrupting health care systems and operating models. Health care decision-makers must compel health workforces to capitalise on this disruption by creating and implementing a comprehensive digital literacy charter. Both medical and IT colleges should embark on this journey of continuous digital learning through knowledge transfer and benchmarking processes. They should compare their curricula and training programmes against digital health competency standards and develop a consistent way of measuring performance. It is also imperative to establish certification programmes in digital health leadership, enterprise architecture, health data interoperability and change management.”

– Conceptual Framework research, Eastern Mediterranean

IDENTIFYING AND COSTING
PRIORITY DIGITAL HEALTH
INVESTMENTS



This Conceptual Framework includes a modelling analysis to estimate the cost of nine priority digital health investment areas (Table 1) for 78 low- and lower-middle-income countries.³⁵ This analysis suggests an estimated investment of US\$ 12.5 billion is needed to support the digital transformation of health systems in these countries over the next five years. This translates to an average of US\$ 2.5 billion a year, or US\$ 0.60 per person per year³⁶. It represents approximately 1% of the annual health spending of these same countries.³⁷

This modelling analysis focuses on nine priority investment areas that were selected based on input from more than 350 global stakeholders³⁸ who responded to a survey as part of the research for this Conceptual Framework (annex II). The estimated investment of US\$ 12.5 billion is based on a medium cost scenario (with the low case at US\$ 7.1 billion and the high case at US\$ 20.5 billion). These results are presented in Table 2 by priority investment area.

The analysis conducted includes five-year cost estimates for the nine-priority digital health investment areas in the low- and lower-middle-income countries.³⁹ It drew on 14 primary data sources from the literature and programmatic data review of costed data sources in nine countries in sub-Saharan Africa and Asia (Democratic Republic of the Congo, Ethiopia, Malawi, Mozambique, Nepal, Senegal, United Republic of Tanzania, Zambia and Zanzibar). This included national digital health investment road maps, globally available costing resources, programme data and published literature (Annex II).



Table 1

Prioritisation of the nine investment areas

Category	Area*	Abbreviated area definition
1. Digital connectivity	Digital connectivity infrastructure (connecting every health worker and health facility)	The backbone infrastructure, hardware and services required for reliable internet access are available, accessible and affordable for all.
2. Financing and financial management	Health financing	Digital approaches to manage financial transactions for health system-related expenses, such as payments to the health workforce and administrative budget management.
3. Health worker management and support	Decision support	Digitalised job aids that combine an individual's health information with the health care provider's knowledge and clinical protocols to assist them in making diagnosis and treatment decisions.
4. Information systems and data services	Data exchange and interoperability	The capability of two or more systems to communicate and exchange data through specified data formats and communication protocols.
5. Policy, governance and research	Data and digital governance	Regulation of the use of digital technologies and data through adequate legal frameworks and impact assessments that seek to identify the broader harms that might be caused by machine learning and other data-driven tools.
6. Policy, governance and research	Enterprise architecture, including governance, guidelines and standards for interoperability	The development of guidelines and standards for interoperability.
7. Supply chain and logistics	Supply chain management	Digital approaches for monitoring and reporting stock levels, consumption and distribution of medicines and medical commodities.
8. Service delivery	Telemedicine	The delivery of health care services where patients and providers are separated by distance.
9. Service delivery	Client identification and registration	A digital system that identifies clients and enrolls them in patient portals with a unique user identity.

Note:







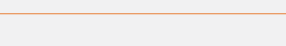
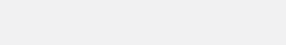

*=Prioritised investment areas received the largest number of votes within each category from more than 350 survey respondents who use digital health tools or are digital health experts.

The analysis provides an important new contribution on the resourcing needs for the digital transformation of the health sector, given the paucity of costed digital health strategies and investment road maps and the consequent challenge in accessing data. It is not, however, a substitute for individual country-by-country costed investment road

maps. Nor does it represent an exhaustive list of investments needed for the full digital transformation of health systems. Nevertheless, it provides the first-ever measure of the level of investment needed to roll out nine selected high-priority digital investments for low- and lower-middle-income countries.

Table 2 Five-year total cost projections, 2021

Year — 1 — 2 — 3 — 4 — 5

Investment area 5-year costs Costs in 2021, US\$ millions	Low-cost scenario	Medium-cost scenario (most realistic)	High-cost scenario	5-year breakdown (based on the medium scenario)
Digital connectivity infrastructure (connecting every health worker and health facility)	4820	9693	17 001	
Telemedicine (provision of health care services at a distance)	819	983	1228	
Decision support (digitalised job aids combining patient health information and clinical protocols)	515	618	772	
Health financing (digital approaches to manage financial transactions)	400	480	600	
Supply chain management (digital approaches for monitoring and reporting stock levels)	255	306	382	
Data exchange and interoperability (multiple systems communicating and exchanging data)	139	167	209	
Client identification and registration (identifying and enrolling clients in a patient portal)	118	141	177	
Enterprise architecture, including governance, guidelines and standards for interoperability	79	95	118	
Data and digital governance (regulating the use of digital technologies and data)	17	20	25	
Total 5-year costs, US\$ millions	7 162	12 503	20 512	

As the analysis shows, digital connectivity infrastructure costs are the highest cost intervention and account for more than three quarters of the total projected cost. These costs are limited to the health sector (health record digitisation, wide and local area networks within facilities and ICT equipment needed at facilities) and do not include the greater investment required to increase digital connectivity and use among the population. Of these infrastructure costs, 40% is for the capital equipment that would serve as the foundation on which the other investment areas would operate. The corollary of this is that the cost of adding the other eight priority areas, which would generally benefit from and build on the infrastructure investment, is relatively modest in comparison. This would likely be the case for the many digital health areas not making our priority list for this analysis, but which could be pursued by countries. Although each investment area was costed separately, careful consideration was given to the benefits of implementing a suite of solutions (such as cost-sharing of laptops at facilities) so that duplications are avoided.

Costs were assumed in three distinct phases of the implementation process:

- **Development costs**, which include software development, the human resources associated with scoping and planning implementation and the development of capacity-building materials.
- **Deployment costs**, which include all costs of scaling up a programme, including one-time costs for equipment, software development to address arising challenges and capacity-building through new deployment training.

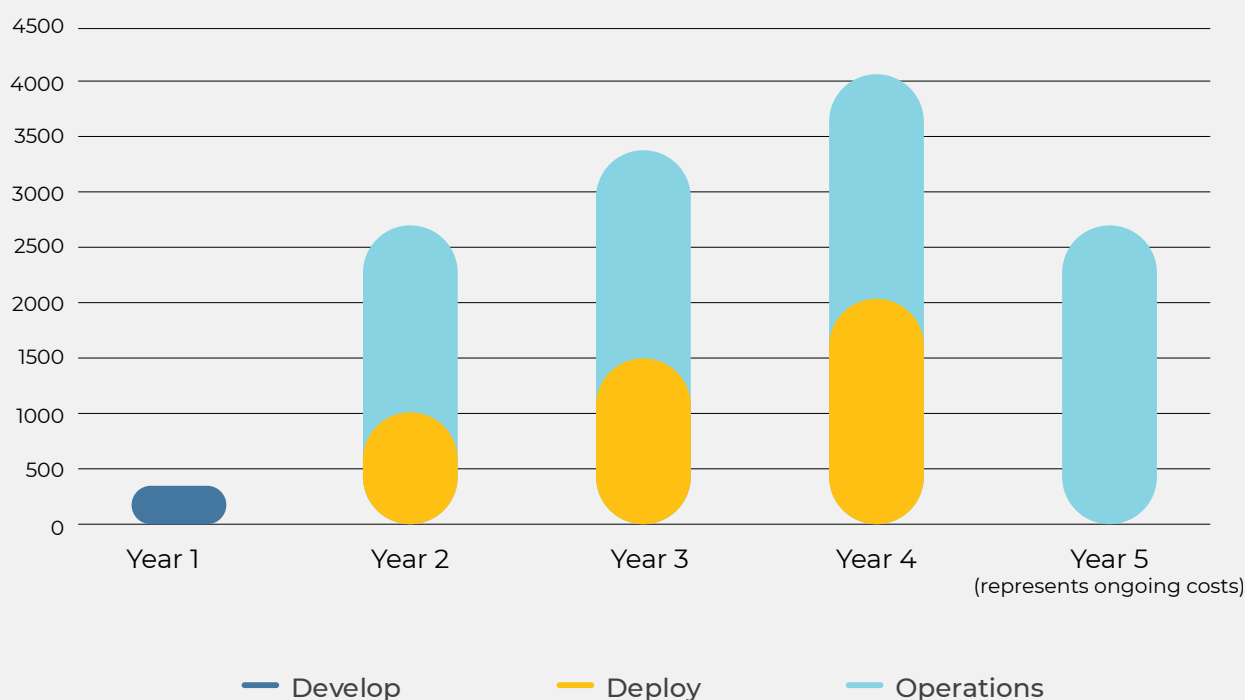
- **Operations costs**, which include the ongoing costs of maintaining an intervention, such as replacement equipment, refresher training, software licensing, project management and help desk support.

The derived costs were extrapolated to other low- and lower-middle-income countries. “Deployment” costs, subject to certain exceptions, were extrapolated on a per capita basis. “Development” costs do not scale based on population size. For “operations” costs, in the absence of better data, high, medium and low ranges were developed in reference to the total system costs over a five-year period. Operations costs were assumed to continue in each year of a product’s lifespan. Costings were then adjusted to reflect differences in prices across countries by applying purchasing power parity (PPP) ratios, and inflation was accounted for by adjusting all values to be representative of 2021 US dollars.

The five-year breakdown of costs (Figure 4) is based on modelled estimates of when the expense would occur, in line with the three phases. Year-five costs represent the ongoing year-on-year operating costs that are needed to maintain the investment areas. The annual breakdown of costs for low- and lower-income countries is then shown in Table 3.

Figure 4

Development, deployment and operations costs, by year
(medium scenario, in US\$ millions)

**Table 3**

Projected costings, by country income classification

Annual investment by country income classification 2021 US\$ millions	Year 1	Year 2	Year 3	Year 4	Year 5	Years 1-5
Low-income	102	469	595	720	378	2264
Lower-middle income	274	2184	2752	3322	1706	10 238
Total by year	376	2653	3347	4042	2084	12 502

The overall investment need strongly skews, at more than 75%, towards the lower-middle-income classification of countries. This is a function of the larger number of countries (54

versus 24) and the highly populated countries within the lower-middle-income country cohort, which includes Bangladesh, India, Indonesia, Nigeria and Pakistan.

Inherent limitations of the analysis

These nine investment areas do not represent an exhaustive list of the investments needed for a full digital transformation of health systems. Nor do they represent the priority investments that any particular country may choose. Instead, they represent building blocks that likely will require complementary investments.

A further limitation of the cost extrapolation is the availability of cost data. Even where data exists, there is often a reluctance to share what might be seen as commercially sensitive information. The analysis thus relied on costing information primarily from countries in sub-Saharan Africa. And the costing data that were used frequently excluded the operations costs that are required to maintain the digital health solution. Scenario analysis was performed specifically for operating costs based on the limited available data. The research confirmed that costing information is scarce even within countries with developed national digital health strategies.

Observations arising from the modelling analysis

- While acknowledging the limitations of the modelling analysis, this exercise has enabled an estimation of the projected cost for a set of nine priority investment areas in digital health, selected based on the input from the global stakeholders.
- The largest cost by far relates to the investment in infrastructure needs within health facilities, which accounts for around 75% of the total projected cost. Of this 40% is for the capital equipment that would serve as the foundation on which the other investment areas would operate. The corollary of this is that the cost of adding the other eight priority areas, which would generally benefit from and build on the infrastructure investment, is relatively modest in comparison. This would also likely be the case for the many digital health areas not making our priority list for this analysis, but which may in reality be pursued by countries based on their unique choices.
- Development costs, including software development and human resource costs related to scoping and planning implementation, are relatively low as a proportion of total costs for most investment areas and are estimated in this analysis to occur in year one.
- Digital health solutions can have a rapid deployment and are modelled to occur in years two through four of this model, with a linear scale each year.
- Available data suggests that operations costs, which include ongoing costs for maintenance, equipment replacement, refresher training, software licensing, project management and help desk support, are significant. They make up between 40% and 60% of total costs occurring over years two through five. These essential costs are often not fully accounted for in costing analyses.
- Year-five costs represent the ongoing year-on-year operating costs that are needed to maintain the investment areas.

The methodology for prioritisation, costing and extrapolation of the nine priority investment areas and the inherent limitations of this analysis are more fully described in Annex II.

“

The report is a milestone for Transform Health, as it will underpin the coalition’s advocacy efforts in the coming years to call for increased and coordinated domestic and international financial investments along the costed nine priority investment areas, to ensure that digital transformation of health systems is equitable, inclusive and sustainable.”

Mathilde Forslund

Executive Director of Transform Health

“

There is a clear need to develop a more comprehensive approach to the digital transformation of health systems and medical care, particularly in Low-and Lower-Middle-Income Countries. This is why Fondation Botnar is so thrilled to work with other members of Transform Health to develop the Conceptual Framework for Digital Transformation. We hope that this important collaboration will lead to increased and improved investments for the digital transformation of health systems, and to more equitable access for generations to come.”

Stefan Germann

CEO of Fondation Botnar

“

If we truly want to leave no one behind, bridging the digital divide is fundamental. Now more than ever before, our governments need to prioritise funding the digital transformation of our health systems. However, if not intentionally centered around community mobilisation and ownership, youth engagement, digital literacy and gender equality, any investments made will only further deepen the digital divide.”

Yacine Ndiaye

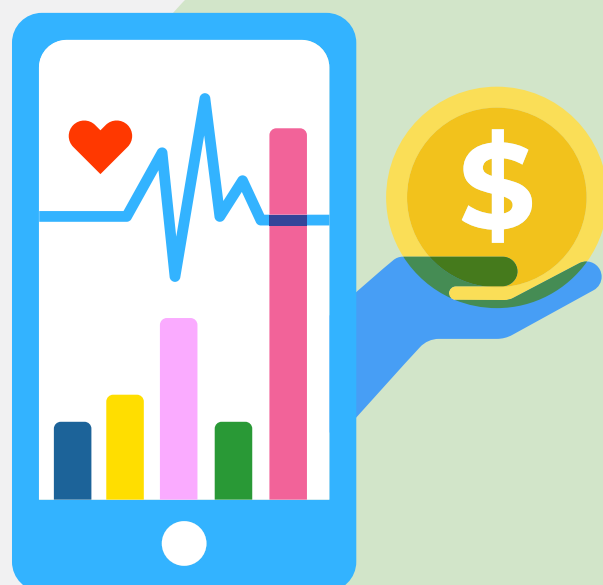
Member of Young Experts: Tech for Health

THE IMPACT FROM DIGITAL
HEALTH INVESTMENTS



If done right, digital health can enable health provision to be more nimble, responsive to population needs, equitable and effective in all aspects of the care continuum. This can deliver healthier populations, cost efficiencies and enhanced economic growth. However, quantitative measurement of the impact of digital health interventions – whether health outcomes or financial or economic gains – is complex. First, digital health interventions are typically embedded within and are an integral part of a larger health system. The impact is often a collective outcome of many elements of the health system, digital and non-digital. Second, the benefits from these interventions are shared by multiple stakeholders, including health care providers and beneficiaries, making them complicated to quantify and assess. Third, there is a dearth of available data, making it difficult to assess the health gains (lives saved, illness averted) or financial or economic gains directly attributable to a single digital health investment, let alone the digital health segment as a whole. Although several groups are developing frameworks and methodologies to standardise economic evaluation and impact measures from digital health interventions, at present there are few studies to draw upon.

Notwithstanding the challenges in quantifying impact, there is no shortage of case studies (see national and regional impact examples) and evidence that illustrate this impact, including recently from the global response to COVID-19 (Box 5). For example, digital health can improve equity by connecting remote, rural and underserved communities with referral centres and expert care; improve quality of care by training health care providers and with digital solutions for diagnosis, clinical decision-support systems, supervision or monitoring patient compliance; optimise resource allocation and lower health care costs through more efficient care coordination (with electronic medical records); improve data management for surveillance, reporting, accountability and monitoring; and facilitate communications between health workers, specialists and patients.⁴⁰



Digital health in the times of COVID-19

In 2020, COVID-19 brought the provision of health services and digital services into an ever-closer relationship, as governments, regulators and commercial operators scrambled to collaborate for the common good in a context in which human contact was necessarily limited. Emergency measures were hasty and unplanned but delivered valuable lessons. Digital services and tools had an instrumental role in how the world responded to the pandemic, and they continue to guide the world as it strengthens systems for pandemic prevention, preparedness and response.

As the International Telecommunication Union reported, “COVID 19 has been a uniquely powerful game-changer, with digital connectivity now at the top of every nation’s agenda. The crisis has acted as both catalyst, upending legacy processes and effecting cultural change, and [as an] accelerator, driving online trends that may otherwise have taken a decade to emerge.”⁴¹

“Rapid innovations in the development and use of digital applications in tracing and combating COVID-19 in most regional countries evidence the growing digital health maturity in the region.”

– Conceptual Framework research, Asia

Digital tools have been used extensively in the response to the COVID-19 pandemic and in relation to better pandemic preparedness, for example:

- Digital contact tracing systems via smartphones were rapidly developed to protect the public (often in collaboration with commercial actors), after manual systems began breaking down under caseload levels. For example, the Arogya Setu, a mobile application launched in April 2021 by the Government of India for self-assessment, contact tracing and syndromic mapping of COVID-19, soon became the most downloaded health care application in the world, with nearly 218 million downloads as of 27 August 2022.⁴²
- Vaccine certification was introduced using digital IDs, smartphones and ICT access to government services, all of which were made accessible by changes to the cost and governance of ICT infrastructure by national, regional and commercial actors.
- The Surveillance, Outbreak Response Management and Analysis System (SORMAS), a process management tool, uses algorithms to generate early warnings of potential outbreaks when

disease cases increase over expected levels. It is aligned with the Africa-wide Integrated Disease Surveillance and Response strategy (IDSR). The integration of infectious disease surveillance with the management of outbreak response in a single software platform can strengthen disease control capabilities. Developed in Nigeria in 2015, this digital public good has been introduced at the national level in Nigeria and Ghana. In at least 10 other countries in sub-Saharan Africa, Europe, Asia and the Pacific as well as in two subregions in sub-Saharan Africa, SORMAS is being used or recently introduced.⁴³

The pandemic has highlighted how health (human, animal and environmental) can be served by digital solutions. But it has raised issues of equality, public trust and the interconnectedness of health benefits with other public goods. While services improved for those who already had internet access, the International Telecommunication Union noted that “those without service in a world functioning increasingly online were literally and figuratively disconnected.”⁴⁴

Health impact from two priority intervention areas



As part of this Conceptual Framework, analysis was conducted to estimate the potential health impact from digital health investment in terms of lives saved, focusing on two of the priority

investment areas: supply chain management and decision-support tools (Box 6; see also Annex III for more detail).

BOX 6

Lives saved case studies for two priority investment areas

Digitalised supply chain management

In many low- and lower-middle-income countries, paper-based systems requiring manual data entry are common at the most peripheral levels of the health system. Digitalised last-mile supply chain management systems can improve the supply and distribution of health commodities by automating the different steps, thus reducing stockouts, waste and supply chain inefficiencies.^a Based on a Lives Saved Tool (LiST) analysis,^b we estimated that more than 348 000 lives could be saved in low- and lower-middle-income countries with a

10% reduction in stockouts^c of vaccines during the five years 2023 to 2027. And nearly 1 million lives could be saved through a similar reduction in stockouts of non-vaccine medicines across all countries (Table A)^d. Three scenarios were run in the model based on the reduction in stockout data.

A PATH and Digital Square literature review identified a 5–14 percentage point reduction in stockouts with digitalised last-mile supply chain management. The modelling was based on stockout rates of 5% (Low case), 10% (Medium) and 15% (High)^e.

Table A Child lives saved by digitalised supply chain management scenario, 2023-2027

	Low 5% stockout reduction	Medium 10% stockout reduction	High 15% stockout reduction
Vaccines*	214 658	348 149	456 283
Non-vaccines medicines**	495 746	961 499	1 483 358

Note:

*=Vaccines refer to Bacillus Calmette-Guerin (BCG), diphtheria-pertussis-tetanus (DPT), haemophilus influenza type B (HiB), hepatitis B, measles, pneumococcal, polio, rotavirus and tetanus toxoid. ** Non-vaccines refer to antibiotics for premature or prolonged rupture of membrane, antibiotics for dysentery, injectable antibiotics, oral antibiotics for pneumonia, oral rehydration salts, syphilis detection and treatment, vitamin A for treatment of measles, zinc treatment for diarrhoea.

Decision-support tools

The health impact of electronic clinical decision-support tools that combine an individual's health information with a health care provider's knowledge and clinical protocols was estimated for children younger than 5 years suffering from pneumonia. WHO and UNICEF created a strategy for the integrated management of childhood illness (IMCI)^f that provides health care workers with evidence-based algorithms using history, signs and symptoms to determine the best course of management. The decision-support tools have potential for enhanced management of childhood illnesses in primary care settings^g.

The potential impact in terms of lives saved among children younger than 5 years in low- and lower-middle-income countries was modelled by multiplying average pneumonia incidence across these countries to estimate the number of children with pneumonia^h. By applying case fatality rates of pneumonia with or without an electronic clinical decision-support tool, the potential number of lives

that can be saved was estimated. Sensitivity analysis was performed to highlight ranges in the data for select inputs. For this analysis, we assumed that a decision-support tool will enable a health care provider to fully adhere to the IMCI guidelines, thus reducing the case fatality rate by 13%ⁱ.

Based on this analysis, implementing electronic clinical decision-support tools could reduce childhood pneumonia mortality by around 55 000 (most likely scenario) by improving adherence to the IMCI guidelines. More than 40% of these lives saved occurred in the fifth year, once reaching full scale – suggesting that over a five-year period – following scale up – around 110 000 lives could be saved. While this modelling exercise focused on pneumonia in children younger than 5 years, the decision-support tool could also have impact on other disease areas (fever, cough, breathing problems, diarrhoea, vomiting and other symptoms in primary health care settings) and patient age groups, depending on the scope of the clinical algorithm.

Table B Child lives saved by eCDST scenario, 2023-2027

	Low	Medium	High
Electronic decision-support tool	19 559	54 255	125 949

Notes:

a = Bjørn-Ingar Bergum, Petter Nielsen and Johan Ivar Sæbø, "Patchworks of Logistics Management Information Systems: Challenges or Solutions for Developing Countries?" *IFIP Advances in Information and Communication Technology*, 504. Springer, Cham. (2017): 47–58. https://doi.org/10.1007/978-3-319-59111-7_5.

b = The Lives Saved Tool (LiST), developed by the Johns Hopkins Bloomberg School of Public Health, was used for this analysis. The model quantifies the potential number of lives saved of children younger than 5 years with changes in intervention coverage rates.

c = Stockouts are commonly defined as a commodity that is expected to be available at a health facility but that has zero reported stock at any point during a defined period.

d = This analysis extended a study previously conducted by PATH and Digital Square, which estimated the lives saved in children younger than 5 years in three countries using the LiST, to the remaining low- and lower-middle income countries. The literature review conducted by PATH and Digital Square identified a 5–14 percentage point reduction in stockouts through implementing a digitalised last-mile supply chain management. Five years of impact were modelled between 2023 and 2027 to match the costing analysis. This analysis should be interpreted with caution, given the stockout rate reduction data was derived from a small number of studies. Furthermore, there are many factors that influence coverage of vaccines and essential medicines beyond stockout levels, including ability to pay, having a qualified workforce, trust in the health system and infrastructure to support the supply chain.

e = This analysis extended a study previously conducted by PATH and Digital Square, which estimated the lives saved among children younger than 5 years in three countries using the LiST, to the remaining low- and lower-middle income countries.

f = World Health Organization, "Integrated Management of Childhood Illness," www.who.int/teams/maternal-newborn-child-adolescent-health-and-ageing/child-health/integrated-management-of-childhood-illness.

g = Kristina Keitel and Valérie D'Acremont, "Electronic Clinical Decision Algorithms for the Integrated Primary Care Management of Febrile Children in Low-resource Settings: Review of Existing Tools," *Clinical Microbiology and Infection* 24 no. 8 (2018): 845–855, <https://doi.org/10.1016/j.cmi.2018.04.014>.

h = The modelling used the scenario analysis to highlight different uptake curves for the clinical decision-support tool and different levels for links to the appropriate diagnostics and treatments. Adaptations to the IMCI guidelines may be needed, depending on the epidemiological profile of a country, availability of medicines and commodities and other factors. Health care providers will need to learn how to use the electronic clinical decision-support tools and may need to receive refresher IMCI training. Even if a decision-support tool is in place, it is also important to consider whether there are links to quality care, such as access to appropriate diagnostics and medicines. The ranges in the model inputs, such as the case fatality rate of pneumonia in children, the coverage uptake of the intervention and the link to care, highlight limitations in this analysis. The data on a support tool improving patient care decisions are still limited, and the results need to be interpreted with caution.

i = Tarun Gera et al., "Integrated Management of Childhood Illness (IMCI) Strategy for Children Under Five," *Cochrane Database of Systematic Reviews* 6. no. CD010123 (2016), <https://doi.org/10.1002/14651858.CD010123.pub2>.

Examples of national and regional impact



There are many examples of how digital health is making a real, though not always quantifiable, impact on health services.

In **Malawi**, a broad partnership of public and private bodies⁴⁵ is piloting a smart register based on Digital Square's global good **OpenSRP** in a rural area without reliable energy. User-friendly handheld tablets powered by solar panels and batteries ensure that the local health staff have access to decision-making support and digital recordkeeping tools, based on WHO standards to guide diagnosis and treatment. Registration of women and children in maternity clinics also captures data used for future postnatal, vaccination and child health programmes.⁴⁶

Zipline, a logistics innovator known for drone delivery of medicines and other medical supplies to health programmes and patients in remote areas, started in 2016 as a public-private partnership with the Government of **Rwanda**. "This partnership focused entirely on benefit versus risk to iterate through test phases, to share data that would support next steps and to cultivate an unparalleled culture of safety now attempting to be mirrored the world over." In 2019, the Government of **Ghana** integrated Zipline's services into its supply chain with support from Gavi, the UPS Foundation, the Bill & Melinda Gates Foundation and other partners. Today, the level of ambition is at national scale, "Increasingly, Zipline is focused on partnering directly with national governments. The company sees this approach as key to going to scale."⁴⁸

Through a dedicated **Data Science Catalytic Fund** of currently US\$ 25 million, the Global Fund invests in the introduction and strengthening of digital solutions to improve the collection and use of community health data in **Burkina Faso, Ethiopia, Rwanda** and **Uganda**. First results include combining previously siloed COVID-19 data systems in Rwanda and developing e-learning materials for health extension workers in Ethiopia. The Global Fund has attracted leading private sector partners to join the Tech Collective, which was founded to support the aims of the Data Science Catalytic Fund. Moving forward, the Data Science Catalytic Fund aims to "accelerate the way countries supported by the Global Fund allocate resources in future funding cycles to support digitalisation and data use for community health".⁴⁷

Leap, an m-Learning platform for training community health workers in **Kenya**, is the outcome of a partnership between the NGO Amref Health Africa, the Government, the M-Pesa Foundation and three private sector companies – Accenture Development Partnerships, Safaricom Ltd and Vodafone (Mezzanine). Each has a unique role and offerings, from financial and managerial to cultural and technical. Amref was responsible for Leap’s vision and strategic direction and provided day-to-day project leadership and community engagement.⁴⁹ The outcomes of the platform include 60 000 community health volunteers being trained on COVID-19 across Kenya in 2021,⁵⁰ and the platform is being adopted in Ethiopia as part of the Government’s COVID-19 response.⁵¹

CarePay was founded through a collaboration of Safaricom and PharmAccess Foundation and established as a social enterprise through blended finance. CarePay developed a smart health exchange platform branded as M-TIBA (in **Kenya**). M-TIBA streamlines the management of large-scale health financing schemes, including enrolment, payments scheme administration and data management. M-TIBA is accelerating the transformation of the health care market in sub-Saharan Africa by creating new digital solidarity mechanisms, whereby people pay for each other, which demonstrates how funding can be channelled to target groups at low transaction costs. Since its launch in 2016, the cloud-based platform has connected more than 4.7 million people to M-TIBA and to more than 3 700 health care providers.⁵²

In **India**, three electronic medical record systems have been successfully scaled up to support health service provision. **eHospital**, launched in 2017, provides a national health management system with electronic medical record functionality in the public sector and has been adopted by many states. **ANMOL**, launched in 2016, is a mobile electronic medical record system that supports nearly 300 000 auxiliary nurse midwives. **PM-JAY**, rolled out in 2018, connects patients and health workers with the national health insurance scheme and processes 50–60% of India’s health transactions across the public and private sectors. In all cases, robust domestic government financing, strong ICT capacity and local vendor engagement, including the private sector, were critical for enabling the scaling up and the sustainability.⁵³

In **Lebanon**, the Ministry of Health started an initiative in 2017 to provide **remote primary care coverage to refugee camps**. The project successfully integrated telehealth services in 30 primary health centres across 26 districts, with three main hubs (the American University of Beirut, Hotel Dieu de France and St. Georges Hospital University Medical Center). The implementation plan and solution design of this project included the provision of a cybersecure medical tablet, with the ability to conduct a secure video conference and a full range of vital sign measurements. For instance, the system can measure cardiopulmonary data, SPO2 Pulse oximetry and non-invasive blood pressure through its electronic stethoscope.⁵⁴

There is increasing evidence of the beneficial impacts – health and financial – that can flow from digital health-enabled health systems. These benefits, which flow to multiple stakeholders, are difficult to quantify on a whole-of-digital health basis. But based on analysis available and anecdotal and other evidence gathered from the regions for this Conceptual Framework, the potential for impact is clear. This underscores why the appropriate, planned and balanced application of digital technologies should be central to the global efforts to achieve universal health coverage by 2030.

“Digital transformations have the potential to bring both enormous long-term benefits and substantial disruption in many different areas of health and health care – in fact, the effect of digital transformations has been so pervasive that it might soon become a dominant prism through which we can understand and address health and well-being dynamics.”

– Governing Health Futures 2030 Commission, 2021

A CALL FOR INCREASED,
BETTER COORDINATED
AND ALIGNED INVESTMENT



The projected funding of US\$ 2.5 billion a year (on average) for the next five years provides a gauge of the collective investment required from all stakeholders to support important aspects of next phase of the digital transformation of health systems in low- and lower-middle-income countries.

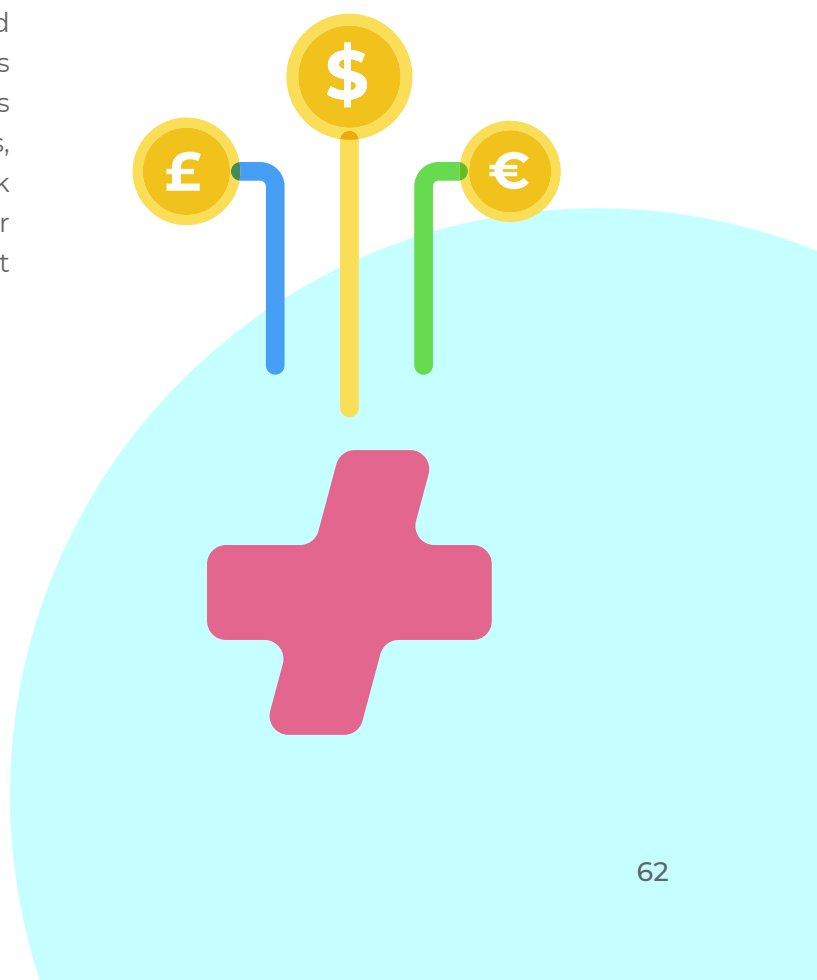
Countries must take the lead in funding their own public health system and in attracting other resources to cover the gaps. This will require collaboration between national governments, the international donor and philanthropic community and the private sector, each with pivotal roles. Critically, this requires coordination to avoid the challenge of fragmentation, which this Conceptual Framework highlights as a major concern. It also requires an engaged civil society to create demand for this funding and to hold decision makers to account.

The need to increase coordinated and aligned international investments in the digital transformation of health is particularly important for the initial task of developing strategic plans and in ensuring the legislative, regulatory and policy environment is updated and enabling a more equitable, inclusive and sustainable transformation. Support for this aspect of the digital transformation agenda is vital, both through the disbursement of funds, which signals the importance of this work to all stakeholders, and by ensuring better coordination among donors and alignment with domestic funding.

The resource needs presented here do not appear prohibitive. We contend that much of this need, in the order of 60–70%,⁵⁵ can be covered by domestic funding. The remaining gap, which we estimate to be in the range of US\$ 1 billion per year, can conceivably be covered by multilateral donors and development banks, existing global funding mechanisms, such as Gavi, the Global Financing Facility for Women, Children and Adolescents (GFF), the Global Fund, private foundations and bilateral donors.

Coordination platforms should be strengthened and expanded to indicate investment pathways. WHO should take a strong role in this coordination effort while working with other actors engaging in this space.

This chapter explores the role of the funding stakeholders – domestic and international – in contributing more and better coordinated financing to accelerate the pace of the digital transformation of health systems so that low- and lower-middle-income countries can reap the benefits that digital health technologies offer.



National governments' critical role in financing and enabling digital health investments



Governments have the core responsibility to deliver on the right to health of their populations. Similarly, they hold the key to the digital transformation of their health systems. Governments must commit adequate domestic funding to digital health and through their actions, strategies and policies, have the capacity to encourage and enable bilateral, multilateral and private sector investment. They are therefore both investors and enablers of greater investment: as part of health system investment and in relation to the broadband infrastructure that supports all digital health services.

National governments' share of funding for digital health transformation will vary from country to country, based on national income level, access to donor and concessional funding and level of digital maturity. Commitment to digitalisation will also be driven by political will. The digital transformation of health must be an all-of-government endeavour. Health ministries may advocate for funding but will not necessarily take the lead role in allocating financial resources to the digital transformation of health systems. This is more likely a responsibility of ministries of finance, information, technology or planning. But these ministries might, in many countries, have a significant budget for digital transformation, a proportion of which should be made available for the health sector.

“Few countries have this [legal environment] in place, and digital health is currently a bit of a wild west.”

– Transform Health Survey respondent

If there is no prioritised costing of the digital health investment needs through national digital health strategies, it is unlikely that allocations for such plans will feature in national budgets. This will undermine the prospects of securing funding from non-health ministries. As discussed in Chapter 3, a well-articulated digital health strategy, enabling legal and regulatory frameworks, a comprehensive costing, and high-level political leadership and commitment are requisites to attracting investment, including from the national budget. Developing digital health strategies and an associated investment road map as an integral part of health and health systems' strategies should be national government priorities. However, in many low- and lower-middle-income countries, there is insufficient funding and political support to develop these strategies and road maps. This lack of funding often leads to national health Ministries not being able to draw in the latest technical expertise and advice that would enable them to optimise their health systems. Many countries also lack the legislative and policy environment necessary to guide the development of digital health strategies. This is where international donor funding can play a catalytic role.

“The main problem found in the region is that in the absence of a national digital health strategy, it is extremely difficult for donors to align their investments with these strategies.”

– Conceptual Framework research,
Latin America

Donor alignment for more effective digital health investment



As the modelling indicates, at US\$ 2.5 billion annually for priority investments, the investment for a digital transformation of the health system of low- and lower-middle-income countries is of a relatively manageable scale. Of this we have argued that 60–70% is likely to be met from domestic resources. The remaining US\$ 1 billion per year that should be channelled through international donor funding will be catalytic for areas that are difficult for countries to finance, like strategic planning, research, international expertise on good practice and preparations for legislative and policy work. It will also be supportive for inclusive processes that engage all relevant stakeholders (Chapter 3). Complementary international support can also be catalytic in shaping markets for commodities and incentivizing other investments, for example, from the private sector. Often, the availability of even modest resources from the international community provides an enormous incentive for low- and lower-middle-income countries to invest scarce national resources and human capacity in developing and implementing these plans.

International donors – multilateral agencies, such as the World Bank, regional development banks, the global health funds, global programs and bilateral donors – in conjunction with national authorities and civil society need to both identify the crucial missing elements in

a country's digital journey and help finance them, while governments remain in the driver's seat. They must also align among themselves to avoid duplication, competition and waste. This must be prioritised to avoid fragmentation, which is sometimes exacerbated by donor investment practices.

USAID, one of the largest bilateral donors for the digital transformation of health, acknowledges in its digital health investment strategy⁵⁶ that it “must shift away from siloed, programme-specific funding of information technology systems and toward co-investing in foundational country-managed and -owned digital infrastructure that supports national health goals”. It also notes the need to invest in enabling components, such as people, processes and policies.

The Principles of Donor Alignment for Digital Health⁵⁷ also recognise the need for alignment (Box 7). The principles were developed through broad consultation and adopted in 2018, with wide endorsement since. These principles call on donors to prioritise⁵⁸ investments in national plans; to engage in the dialogue around the costs of operating, maintaining and sustaining digital health systems; and to invest in the development of digital health strategies that are commensurate with the digital maturity of a country.

“

“This fragmentation [uncoordinated digital health projects] is also observed on the side of external investors and donors due to a lack of coordination between them and a lack of knowledge of the situation in the region.”

– Conceptual Framework research, Latin America

“

“There are various programmes supported by donors who have their own indicators. Some of these do not align with national [health system strengthening] indicators.”

– Conceptual Framework research, Western and Central Africa

“

“...digital transformation of health systems is funded by donor partners, including CDC, USAID, PEPFAR, Global Fund, GIZ and the Gates Foundation among others.... This funding led to the development of digital health systems with disease-based modules to facilitate the management and tracking of various diseases like HIV and AIDS. Key informants note that there are challenges in maintaining and running these donor-funded systems....”

– Conceptual Framework research, Eastern and Southern Africa

Principles of donor alignment for digital health

While adhering to the Principles of Digital Development* and working through existing global and regional efforts, donors will:

- 1. Collaborate:** Collaborate to align investments with national digital health strategies.
- 2. Prioritise national plans:** Prioritise investments in national plans that incorporate “digital global goods” and avoid bespoke systems.
- 3. Quantify costs:** Engage early to determine and quantify long-term costs of operating, maintaining and supporting digital health systems for sustainable country ownership.
- 4. Track and measure:** Track investments, progress, learnings and successes in digital health systems in a transparent manner.
- 5. Strengthen donor skills:** Strengthen donor technical skills and core capacities, including awareness of the Principles for Digital Development.

At the same time, donors will invest in:

- 6. National strategies:** The creation and evolution of a country's national digital health strategy, policies and regulatory framework. Strategies include such components as architecture, standards, investment frameworks, privacy protection and detailed operational and monitoring plans.
- 7. Maturity continuums:** Systems at a level appropriate to the country's progress along the digital health maturity continuum.
- 8. Country capacity:** Sustainable country capacity for digital health leadership, governance, implementation, oversight, global good adoption and donor coordination.
- 9. Global goods:** Scalable, sustainable, accessible, interoperable and evidence-based digital health global goods that meet country priorities.
- 10. Sharing and peer-learning:** Diverse stakeholder information-sharing and peer-learning networks at country and regional levels to foster coordination and alignment of implementation activities.

Source: <https://digitalprinciples.org>.

Catalysing multisectoral and multistakeholder coordination

The Asia e-Health Information Network (AeHIN), with support from development partners, has assisted health ministries in several Asian countries to convene consultations and coordination with various national and international stakeholders to support national digital health programmes. These “convergence workshops” aim to establish a multisector coordination mechanism, with the health ministry as the lead agency. They are designed to align with the Principles of Donor Alignment for Digital Health and typically cover digital health landscaping and gap analysis. They intend to secure the involvement and participation of a great spectrum of stakeholders whose support is essential for the digital transformation in the country, including academia, development partners, NGOs, national professional societies in health, informatics, digital health, the industry and other decision-makers, like ministries of telecommunications, information technology, communications, finance and planning.

These convergence workshops seek to determine and rectify gaps in digital health planning. They focus on four domains: governance; architecture; people and programme management; and standards and interoperability. Since 2015, Asia e-health Information Network has facilitated such workshops in seven countries (Bhutan, Indonesia, Lao People’s Democratic Republic, Myanmar, Nepal, Timor-Leste and Viet Nam). These workshops have raised awareness of the gaps in terms of governance, architecture, people and programme management, standards and interoperability and what different stakeholders can do to remove the gaps and streamline the national digital transformation in health care. However, the workshops have also highlighted the challenges in coordination of national and international stakeholders, emphasising the need for greater alignment within countries and with and among the development partners.

According to the OECD,⁵⁹ digitalisation (overall and not specific to health) is not an expressed priority for most of its Development Assistance Committee members,⁶⁰ including the largest financiers of digital development, despite the fact that many have explicit digital development strategies for their official development assistance funding. Each of these strategies adheres to the Principles of Digital Development and recognises the interlinkages between foundational enablers (universal access to the internet, digital public infrastructure, policy and regulation and digital skills) and the use of digital technologies for service delivery. Important aspects across all strategies are expansion of internet access and affordability, supporting whole-of-government and society processes and the evidence-based mainstreaming of digitalisation across all sectors. Looking at health and digital health, the Governing Health Futures 2030 Commission found that “the strategic backing is less structured, with the US Agency for International Development being the only development agency having published a strategy specifically for digital health in 2020”. However, from our research we learned that more development partners and donors (bilateral and multilateral) are strengthening their portfolio and capacity in this area.

The three largest multilateral funders of health – the World Bank, the Global Fund and Gavi – are all reviewing their investments in digital tools as part of their programme funding. Both the Global Fund and Gavi are developing specific digital strategies.

In view of coordination, the Global Action Plan for Healthy Lives and Well-being for All (known as the SDG 3 Global Action Plan),⁶¹ which brings together 13 multilateral health, development and humanitarian agencies to improve coordination, includes the Data & Digital Health Accelerator as well as the Sustainable Financing for Health Accelerator, which could potentially

be leveraged to help improve the coordination of digital health investment. But it would require a commitment from these partners as well as stronger accountability around delivery against the Accelerator’s goals and commitments. Other initiatives, such as the European Union’s Digital for Development Hub (D4D), the Digital Health Centre of Excellence (DICE) and the Digital Impact Alliance (DIAL), also provide opportunities to enhance coordination.

“To make programmes sustainable and scalable, we need to help strengthen the mainstream government health systems. This means that we ought to first align our programme strategies with our respective partner governments to work in service of their priorities and goals. Having governments drive the digital health framework and structure would enable transformational impact, as they are the strongest institutions in developing countries with long-term and expansive health policies and programs.”

– Transform Health survey, donor respondent

Four years after adoption of the Principles of Donor Alignment for Digital Health, there is a need to reaffirm commitment to them and develop specific action plans to ensure better coordinated investments.

Role of the private sector as investor



“The private sector will outpace public sector investment, and the private and public sectors must work together to ensure high-quality health delivery for all via collaboration, standards, compliance bodies and private–public sector partnerships.”

– World Bank, quoted in Conceptual Framework research, Asia

Digital health sits at the juncture between two large industries: the health sector and the technology sector, both of which include a large array of industries. Within the health sector there are companies focusing on insurance, pharmaceuticals, medical technology, health care providers and device and diagnostic manufacturers. The tech sector includes hardware, software, cloud, connectivity and a multiplicity of data technology companies. Others are engaged in supply chain activities, including digitalisation of medicine and vaccine delivery and storage. These diverse private sector entities have many different roles in the digital transformation of health. This includes driving innovation, productivity and scaling up viable solutions. Businesses can also contribute their expertise and knowledge across a range of areas, including logistics, management, business modelling, knowledge sharing and technical support.

However, in the absence of proper coordination, collaboration, oversight and partnership with the public sector, there is a risk of fragmentation, inconsistent standards and interoperability challenges. To capitalise on the diverse offerings of the private sector while safeguarding the privacy and human rights of their populations, governments must make clear, through legislation and the right governance mechanisms, how the collaboration should work, emphasising the public good.

“The major risks attributed to the fast-emerging private sector are lack of integration and interoperability, too many similar solutions creating a competing market, solutions developed with a poor understanding of the country’s digital health ecosystem and lack of focus on improving the country’s digital health maturity, especially in areas such as digital infrastructure, enterprise architecture and interoperability.”

– Conceptual Framework research, Asia

“To ensure that private sector investment supports sustainable and equitable digital transformation, aligned with national priorities and plans and complements domestic financing. It is important to establish a coordination platform for all stakeholders, including the private sector and also define a specific strategy targeting the private sector.”

– Conceptual Framework research, Western and Central Africa

Where there is potential for profitability at reasonable risk, the private sector needs no incentives. A participant in a recent Wilton Park discussion with private sector, government and other partners on Private Capital to Achieve Public Health Goals in Africa made the point not to “be romantic about why the private sector invests in projects – businesses seek to get a return on their investment. If they choose to risk capital, they need a minimum return”.⁶² For digital investments in low- and lower-middle-income countries, where private sector technologies and services may be desired, the companies might find it too risky or not sufficiently lucrative to invest. We have seen this dynamic play out for decades with the pharmaceutical industry, and the parallels to the digital technology sector are many and illuminating. We have also seen over the past 20 years that innovative financing for health – where public and private finances are combined in ways that reduce risk or allow for financial return – is considerably more difficult to achieve than what is hoped, and few of the many ideas that have been discussed have. However, some mechanisms have worked in specific contexts. To reduce risk, minority investments by public entities or credit at concessional rates have been effective, in some cases, to de-risk investments and lower the cost of credit.

The Medical Credit Fund is a debt fund dedicated to financing small and medium-sized enterprises in the health sector in Africa, with a focus on primary health care providers. It has a blended fund structure from both public and private donors that has generated substantial capital from multiple sources, including impact investor foundations and local commercial banks. The Medical Credit Fund has disbursed more than 7800 loans totalling 145 million euros to 2,000 health enterprises across Ghana, Kenya, Liberia, Nigeria, United Republic of Tanzania and Uganda.⁶³

Gavi’s pneumococcal Advance Market Commitment is an example of a mechanism aiming to reassure companies that a market would be forthcoming to encourage them to invest in innovations that may otherwise have been too risky or just not a priority for them, given a less profitable market. More recently, the mechanism addressed the COVID-19 vaccine supply through the COVAX facility is another example. Such advance market commitments, impact investments or export credits could in some cases also be explored for digital innovations and investments. But it requires clear parameters and success indicators, and it must ensure the inclusive involvement of different stakeholders so that innovations respond to the needs of communities and health workers.

Promote inclusion through targeted funding



While there is consensus on the need to include current and potential end users and groups, especially the most marginalised communities and health workers, among others, in all stages of the digital transformation, few resources are currently available to support this at the national and subnational levels. There is also a lack of data on costs for the necessary actions and approaches to include these populations and their representatives. Nor have adequate costings been carried out to assess the funding needs of establishing an effective and enabling legislative and regulatory environment. The lack of data on the costs of these interventions means that we did not include the necessary resource needs for these critical aspects of the digital transformation of health systems in the costing analysis carried out for this Conceptual Framework. Nonetheless, inclusion must be prioritised by governments and international funders.

“...inclusion is a key factor to address in building the business case [for digital health interventions] ... submitted business cases should inform donors on measures taken to eliminate the risks of exclusion of these groups due to their lack of ability to engage with underlying technologies.”

– Conceptual Framework research, Eastern Mediterranean

Targeted international funding to civil society, including marginalised groups, can, in this phase of the digital transformation of health, make a tremendous difference to support community mobilisation and engagement. It should involve support to enhance civil society’s capacity to engage in the digital transformation dialogue, including to assess and express their support and funding needs. Community mobilisation, gender equality and human rights interventions in the context of HIV, AIDS, tuberculosis and malaria can provide guidance to define and cost any relevant programmatic interventions. Public health history and achievements have routinely shown – most recently in the response to COVID-19 – that community engagement is critical. Communities that are empowered and with the right support can make a unique and invaluable contribution to people-centred policies, costing, implementation and oversight. Of course, an essential step – as underlined by our youth-led research – is to provide marginalised groups, other civil society stakeholders as well as young people with a seat at the decision-making table.

“Civil society, affected populations and related organisations are rarely consulted during digital strategy development and the planning process.”

– Conceptual Framework research, Asia



Improving data on financing for digital health transformation

There are knowledge gaps on funding for the wider digital transformation more broadly and digital health specifically. As the OECD reported,⁶⁴ there is no specific guidance in the Development Assistance Committee creditor reporting system to track finance for digitalisation, let alone digital health.

Targeted international funding to civil society, including marginalised groups, can, in this phase of the digital transformation of health, make a tremendous difference to support community mobilisation and engagement. It should involve support to enhance civil society's capacity to engage in the digital transformation dialogue, including to assess and express their support and funding needs. Community mobilisation, gender equality and human rights interventions in the context of HIV, AIDS, tuberculosis and malaria can provide guidance to define and cost any relevant programmatic interventions. Public health history and achievements have routinely shown – most recently in the response to COVID-19 – that community engagement is critical. Communities that are empowered and with the right support can make a unique and invaluable contribution to people-centred policies, costing, implementation and oversight. Of course, an essential step – as underlined by our youth-led research – is to provide marginalised groups, other civil society stakeholders as well as young people with a seat at the decision-making table.

The promising news, however, albeit based on imperfect analysis (in view of data shortcomings), is that development finance for digitalisation, comprising bilateral, multilateral

and philanthropic funding, more than tripled between 2015 and 2019, from US\$ 2 billion to US\$ 6.8 billion. Of this, 62%, was from multilateral institutions. Of this funding for digitalisation, only 3% and 4% of multilateral and bilateral contributions, respectively, were found to relate to the health sector.⁶⁵

While there are potential approaches to seek relevant financing data – the Development Assistance Committee policy marker, key word searches, machine learning – none are easy or rapidly implementable. This places a greater burden on national strategies to identify and track funding needs and gaps and for organisations, such as WHO and the International Telecommunication Union, to capture and disseminate this information.

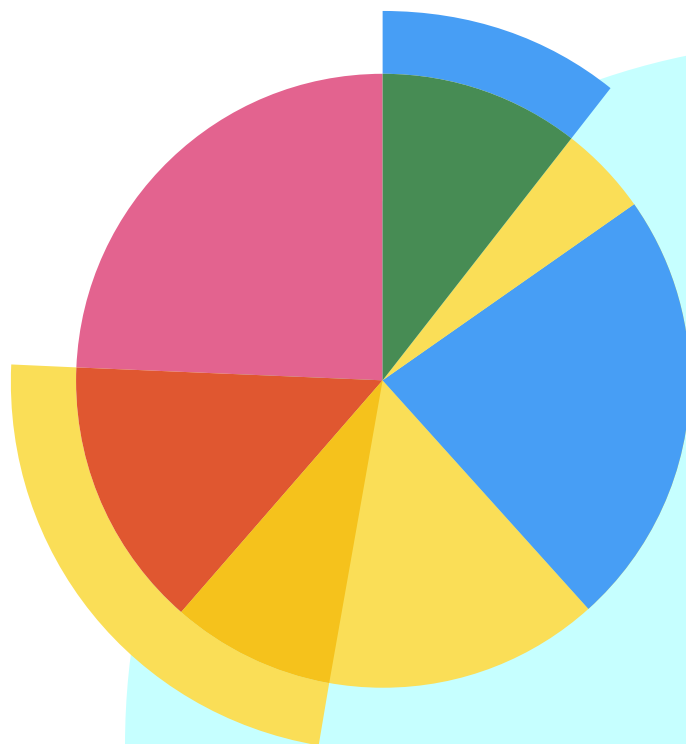
There is a clear need for better information on who funds what in digital health, and increased transparency is important for the better alignment of all sources of funding discussed in this chapter.

Despite all these shortcomings, now is the time to provide additional investments for the digital transformation of health systems in low- and lower-middle-income countries. Priority investment areas have been identified and the evidence of the benefits of these investments is compelling. Even countries that have made considerable efforts in developing high-quality costed strategies would not necessarily know where to turn to if they wanted to complement their domestic funding with international resources.

There is a need for a mechanism to support better coordination and alignment of international funding. A focused dialog between countries requiring additional resources, international organisations and potential international funders is urgently needed. Without it, there is a risk of greater fragmentation, duplication and waste and a perpetuation of these widely reported pervasive practices. There is also a need for strong accountability mechanisms to scrutinise funding allocations and to hold funders accountable, both governments at the national level and donors at the global level.

There is an urgent need in the coming years to secure more funding for digital health and to do so in a manner that is better coordinated and aligned with national plans and priorities.

The digitalisation of all aspects of life, including health, will progress relentlessly but the question is whether this process will lead to better health, greater inclusion, improved equity and stopping the growing digital divide. Even modest additional investments during this period have the potential to build stronger and more resilient health systems. As part of people's right to health, health systems must be able to cope with the new and old multiple threats and risks, including the effects of climate change and health emergencies, while delivering quality essential health care for all.





As the digital transformation of healthcare grows as a priority agenda, it is imperative to address the emerging reality that, if we are to achieve UHC by 2030, systems thinking and execution entails not only digitizing healthcare systems through introduction of individual digital technologies, but also addressing in tandem the broader enablers of available, affordable and meaningful digital connectivity for health systems, individuals and communities to be served. This is at once a technical and political challenge, that demands investments in digital infrastructure as well as reform of governance processes that are informed by upholding and protecting human rights. This approach is critical to the success of transforming health systems in LMICs by leveraging the promise and potential of digitalization.

Transform Health's Conceptual Framework is a timely contribution outlining how this 'wicked problem' can be tackled to ensure health for all in a digital age. The costing of the identified nine investment priorities for LMICs will be helpful for policymakers, investors and even citizens to appreciate the scale of effort ahead."

Nanjira Sambuli

Vice President of Transform Health



This report clearly shows there is only one way forward to create access to healthcare for all: together. We, as required ecosystem players - public sector, civil society, healthcare providers, private sector, funders and others- need to let go of short term gains and point-solutions, and focus on sustainable, lasting impact in the health system. It takes courageous leaders to join forces and to drive such collaborative transformation in complex ecosystems – yet if we team up, if we use each other's complementary capabilities, pool investments, and co-design innovative revenue models, we can build connected digital health systems that deliver better and affordable healthcare for all, everywhere."

Dr Jeroen Maas

Director, Access to Care Technology and Partnerships at Philips and member of the Digital Connected Care Coalition core team

RECOMMENDATIONS



This Conceptual Framework outlines the amount, focus and nature of the investment needed to support the equitable, inclusive and sustainable digital transformation of health systems in low- and lower-middle-income countries. It rounds out the argument with the ways forward for how that transformation should happen.

The information gathered through this effort and the analysis of the current landscape are summarised in the following six recommendations.

Recommendation 1 – More investment from domestic and international sources.



Governments and international donors should prioritise funding to support low- and lower-middle-income countries in digitally transforming their health system ensuring it is equitable, inclusive, sustainable and protective of people’s interests, their right to health, their privacy and their capacity to participate in its governance. Although we have projected an average funding need of US\$ 2.5 billion per year for the next five years for nine priority digital health investments areas for these countries, the true investment requirement will ultimately be determined country by country and based on costed plans. It will need to be complemented by wider investment to increase digital connectivity and usage among the population, as well as investments to address the broader enabling environment.

The necessary actions include:

National governments: (i) Governments must make the equitable, inclusive and sustainable digital transformation of health systems a political priority and reflect this in national budgets. (ii) Health ministries must prioritise digital health within the national health budget as part of wider health system strengthening. (iii) Ministries of finance, planning and information and communication technology will already have budgets for digital transformation, a proportion of which should be made available for the health sector.

Health administrators: (i) Health ministries must engage early with relevant government institutions and advocate for national funding, beyond the health budgets, with a clear sense of resource needs and gaps. (ii) The health administrators must engage with development partners and donors to secure support, including funding.

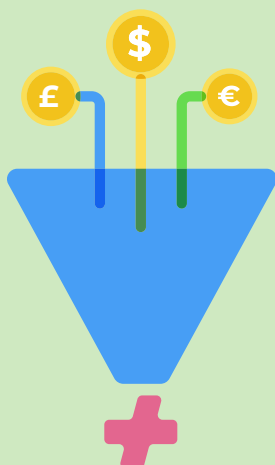
Development partners, including donors:

(i) Development partners and donors must increase investment in activities that will support an equitable, inclusive and sustainable digital transformation of the health systems in low- and lower-middle-income countries. (ii) They must encourage national stakeholders and other investors to make the catalytic investments into the necessary processes.

Civil society:

(i) Civil society must advocate with governments, donors and other financing mechanisms for increased and better coordinated and better aligned investments. (ii) Civil society groups must actively engage in budget and other processes and accountability mechanisms to continue holding governments and donors accountable to their digital transformation of health investment commitments.

Recommendation 2 – Better coordinated and aligned investments.



International donors and the private sector should ensure that their investments are coordinated and aligned with national priorities. This should include identifying and strengthening systems and processes that improve the coordination of funding. Without it, there is a risk of fragmentation, duplication and waste. At national level, there is a need for coordination among stakeholders and international donors through transparent processes and under the leadership of the government. The widely endorsed Principles for Donor Alignment for Digital Health provide the blueprint for this coordinated action and should be fully adhered to and monitored.

To enhance transparency and accountability, there is also a need for multilateral development institutions to introduce tools at national scale that track and publish data on funding for digital health as part of their wider health investment. In addition, WHO should fulfil the wide-ranging strategic, normative and technical role envisioned for the organisation at the World Health Assembly meeting in 2018. In this capacity, WHO must monitor the needs and flow of funds for the digital health transformation.

The necessary actions include:

National government: (i) Each government must establish a coordinating body under senior government leadership to guide international partners through robust governance processes. This national coordinating body must have the mandate and the power to define the purpose, goals and direction for the digital transformation of health systems. (ii) Each government must refer partners to its national strategies or to opportunities to support the development of its digital transformation.

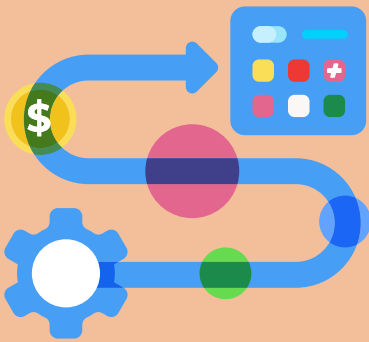
Development partners, including donors: (i) In designing and implementing digital health investment strategies, development partners must adopt, adhere to and report on the Principles of Donor Alignment for Digital Health and to commitments with the SDG 3 Global Action Plan. (ii) Development partners must use existing platforms in countries to align their support with the country-led priorities and goals while proactively steering away from siloed and programme-specific approaches. (iii) Development partners must be transparent about their investments in low- and lower-middle-income countries towards the digital transformation of health systems.

WHO, OECD, World Bank and others: (i) Multilateral organisations leading in this space must support a coordination mechanism that bridges the gap between countries wanting additional external funding and potential funders. (ii) They must systematically collect and share data on financing gaps and needs and (iii) track international funding, for example, through a code or a marker in the OECD's aid reporting system.

Civil society: (i) Civil society must advocate for a mechanism to support better coordination and alignment of international funding and (ii) must hold domestic and international funders accountable for better coordinated investments and for adherence to the Principles of Donor Alignment for Digital Health and to the commitments with the SDG 3 Global Action Plan.

Private sector: (i) Private sector must adopt and adhere to the Principles of Donor Alignment for Digital Health and (ii) align their funding to national digital health strategies and contribute towards overcoming funding gaps. (iii) Businesses must engage with governments so that their innovations are included in the national strategies.

Recommendation 3 – A costed digital health strategy and investment road map.



Countries must each develop an inclusive digital health strategy as an integral component of their universal health coverage and health system-strengthening agenda. The strategies must be aligned with the country's digital health maturity levels, and they must promote interoperable solutions for connectivity, capital investment, data governance, legislation and regulation, literacy and workforce. These solutions need to be developed in an inclusive and participatory manner, with sufficient time for consultation with different stakeholders, including civil society, youth, women and marginalised and hard-to-reach communities, as well as health workers at all levels of the health system. These strategies need to be costed and accompanied by a prioritised and sequenced investment road map that lays out the different sources of funding as well as the gaps.

The necessary actions include:

National governments: (i) Health ministries should lead the development and regular updating and monitoring of national digital health strategies and their costing in a process that involves all relevant ministries as well as health professionals from all levels of the health system, civil society, youth, women and marginalised and hard-to-reach communities, the private sector and academia. (ii) For greater orientation and accountability, health ministries must publish these plans and investment road maps and regularly and transparently report on progress.

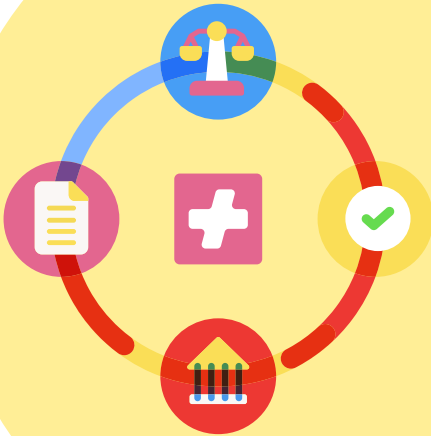
Development partners, including donors: (i) WHO, in coordination with other multilateral and bilateral technical partners, must technically support the development of national strategies. (ii) Donors must financially support the work to develop national strategies and associated investment road maps while ensuring that governments remain in the driver's seat

Civil society: (i) Civil society must request and prepare to engage in the development and the

oversight of national digital health strategies and their costing. (ii) Civil society groups need to create alliances across civil society and with youth, women and marginalised and hard-to-reach communities as well as with academia within a country and across countries and regions to enhance everyone's knowledge on the digital transformation of health. (iii) Civil society groups must socialise government plans and commitments and hold governments to account for ensuring the meaningful inclusion of all sectors of society in national strategic planning processes. (iv) Civil society groups must monitor the implementation of government strategies and plans and provide feedback on progress and impact at the local level.

Private sector: (i) Businesses must engage in strategy-planning processes, the costing of activities and the development of investment road maps. (ii) The private sector must support governments by bringing their industry expertise into the strategy-planning processes while ensuring that governments remain in the driver's seat.

Recommendation 4 – A robust regulatory framework and policy environment.



National governments must prioritise establishing a legislative and regulatory framework and the necessary policies to guide the digital transformation of their health system so that it is inclusive, equitable and sustainable. This process must be based on multistakeholder engagement and include the broad participation of civil society, including youth, women, older people, people living with disabilities and marginalised and hard-to-reach communities. This needs to lay the legal foundations in terms of health data use, privacy, digital literacy and the policies for what kind of digitalised health system a country needs to ensure universal health coverage. A transparent public policy environment increases planning and investment certainty for international donors and the private sector and clarifies the incentives and expectations.

The necessary actions include:

National governments: (i) A designated ministry must lead a multistakeholder process to create a robust regulatory framework and a policy environment that ensures compliance. (ii) Government agencies must publish policies, strategies and other frameworks for easy access.

Parliamentarians: (i) Policy-makers must stimulate political debate and initiate legislative and regulatory review on the use of data and digital technologies for health. (ii) Policy-makers must understand the gaps and challenges and propose new legislation and regulations. (iii) Policy-makers must engage with and create forums for health practitioners, academia, the private sector and civil society to bring their experiences and recommendations into the legislative environment to ensure that laws and regulations are based on the most up-to-date data and knowledge.

Development partners, including donors: (i)

The development partners must invest in the processes that create a regulatory framework and a conducive policy environment. (ii) The development partners must circulate good practices across countries and contribute to policy dialogues.

Civil society: (i)

Civil society must engage in political discussions on the digital transformation of the health system and the necessary regulations and policies. Where this does not exist yet, they must ask for meaningful engagement in relevant national and subnational forums. (ii) Civil society groups must actively participate in the demand for and consultation on the development of legislation, regulation and standards to govern the digital health transformation. (iii) Civil society groups must monitor compliance with new legislation and regulations governing the digital transformation of the health system.

Recommendation 5 – Mechanisms for meaningful multistakeholder engagement.



For a digital transformation to be effective in improving health outcomes and accelerating progress towards universal health coverage, civil society, including young people, women, older persons, persons with disabilities and marginalised and hard-to-reach communities, needs to be involved at all levels of planning, strategy, execution and monitoring of the transformation. Such participation needs to be supported financially to ensure that communities across all strata of society are represented and can hold decision-makers and service providers accountable.

The necessary actions include:

National governments: (i) Government agencies must set up inclusive processes to plan, implement and oversee the digital transformation. (ii) Government agencies must meaningfully engage and empower civil society, young people, women and marginalised communities to participate in the relevant forums and in all stages of planning, implementation and oversight.

Parliamentarians: (i) Policy-makers must only approve government budgets that include funding for the digital transformation of health systems. (ii) Policy-makers must ensure strong oversight of the government's digital health strategy. (iii) Policy-makers must reach out to civil society, young people, women and marginalised communities to seek their experience with and expectation towards the digital transformation of health systems.

Development partners, including donors: (i) The development partners must support and empower civil society, young people, women and marginalised communities in their engagement by dedicating financial resources. (ii) The development partners must seek

and promote the engagement of civil society, young people, women and marginalised communities in national coordination platforms and processes.

Civil society: (i) Civil society must collect and communicate the lived experience, concerns and recommendations from communities in relation to the digital transformation. (ii) Civil society groups must engage politicians at all levels, but particularly at the local level, on the need to use digital technologies to address health system weaknesses and challenges and to accelerate universal health coverage. (iii) Civil society groups working on digital technology and digital rights must amplify their messages by fostering exchanges and alliances across and between themselves and with young people, women and other marginalised communities.



Recommendation 6 – Improved digital connectivity.

There is urgent need for all stakeholders – national, international, public and private – to prioritise strategic, targeted and coordinated actions to close the divide in digital access. This is a prerequisite for equitable access to technology-enabled health services. This means addressing coverage gaps, affordability and digital literacy. It requires political will at all levels and civil society engagement to mobilise policymakers and to generate public awareness. If ignored, the divide in connectivity will widen the health equity gap and further marginalise already disadvantaged populations.

The necessary actions include:

National government: (i) Government agencies must recognize the importance of digital access by all sectors of the economy and society and commit to equitable access to the internet for all as a primary policy objective. (ii) Government agencies must work towards lowering prices for entry-level broadband towards the Broadband Commission target of 2% of gross national income per capita. (iii) Government agencies must establish the right incentive structures to encourage network build-out that ensures equitable coverage, including in less commercial areas and communities. (iv) Government agencies must take an active role in defining the design of digital solutions for health systems to ensure that they respond to the needs of the end users, taking into account age, language, literacy and physical and mental abilities. (v) Government agencies must ensure that the end users, including health workers and marginalised communities, are meaningfully engaged in the digital transformation processes, from development to deployment and oversight. (vi) Until such time as the usage gap is closed, government agencies must ensure that digital health technologies do not deepen exclusion and that services are available in an accessible analogue format to communities not yet connected.

Development partners, including donors: (i) Aligning with country plans and the national digital road map, the development partners must financially support the efforts to expand connectivity in a coordinated manner. (ii) Development partners must ask for and offer support targeting the needs of rural and marginalised communities specifically.

Civil society: (i) The representatives of the public's interests must call on local politicians to prioritise digital connectivity in their districts, counties and regions. They can create a scorecard to track local politicians' commitments and action on digital connectivity, taking into account local specificities. (ii) Civil society groups must raise community awareness of the necessity for digital connectivity and create greater public demand for the expansion of coverage. (iii) Civil society groups must build up local-level digital awareness and literacy in areas where they have a programmatic or membership presence as a means of driving demand for coverage

Private sector: (i) Starting from country plans and legislation, the private sector must diminish the persisting gaps in connectivity by offering services at affordable prices. (ii) The private sector must consider investing a share of their profits into connecting underserved communities.

ANNEXES



Development of this report

The analysis at the root of this Conceptual Framework was guided by a broad modelling exercise to estimate the costs for rolling out priority digital health investments across low- and lower-middle-income countries. This analysis set out to shed light on the quantum of funding that would be required for the necessary stepping up in digital health investments.

In addition to this quantitative approach, the work builds on specially commissioned regional research, perspectives from youth and private sector, a global survey and interviews.

In summary, the Conceptual Framework is based on the following approaches:

- a review of recent publications as referenced;
- a deep dive, including case studies, interviews and stakeholder discussions of country needs and experience conducted in five regional (in Asia; Eastern Mediterranean; Eastern, Southern, West and Central Africa; and Latin America);
- a report based on the work of a global youth team that led a survey and focus group discussions with young people;
- a report commissioned from Digital Health Partnerships on a private sector perspective on the digital transformation of health;
- a modelling exercise to determine indicative costing of the digital transformation in low- and lower-middle-income countries based on an expert ranking of investment categories; and
- two case studies exemplarily looking at the impact of digital technologies in two priority investment areas.

The sum of this combined effort is an indicative assessment of the scale of investment needed to drive a rapid and successful digital transformation of health in low- and middle-income countries over the coming five years and recommendations for how to prioritise these investments.

Methodology and assumptions underlying the identification and costing of priority digital health investments

Background and objectives

To strengthen the Conceptual Framework for an investment case in digital health interventions, this analysis first determined promising investment areas for digital transformation. Then, for the selected priority investment areas, PATH and Digital Square conducted analysis to develop a cost estimate of implementation across 78 low- and lower-middle-income countries.⁶⁶ Due to missing purchasing power parity (PPP) values, five countries were excluded from the analysis: Democratic People's Republic of Korea, Eritrea, South Sudan, Syrian Arab Republic and Yemen. All mentions in the discussion of low- and lower-middle-income countries exclude these five countries.

Selection of the prioritised investment areas

The selection of the nine prioritised investment areas featured in this report was based on a global survey, with more than 350 respondents, and confirmed through discussions with subject matter experts and with Transform Health's Global Research Consortium, whose members represent an array of regional and youth partners.⁶⁷

The investment areas featured in the survey were based on three primary sources:

1. WHO Classifications on Digital Health Interventions⁶⁸
2. Tanzania Data Use Partnership Investment Roadmap⁶⁹
3. The Lancet and Financial Times Commission on Governing Health Futures 2030: Growing Up in a Digital World⁷⁰

From these sources, more than 40 potential investment areas were singled out and included in the survey. These investment areas were grouped into seven categories that broadly aligned with WHO Building Blocks for Health Systems.⁷¹ See Table A1 for the categorisation of the investment areas and the resulting definitions. The survey participants were asked to select their priority investment areas within each category. This categorised approach was taken to ensure that at least one investment area from each category was included in the final output because each category represents an important step in the digital transformation of health systems.

The survey was translated into English, Spanish and French. The survey had minor modifications with youth-appropriate language for youth survey respondents to ensure inclusion of next-generation voices and ideas. In January 2022, the survey was launched with targeted outreach through regional and global networks to governments, the private sector, academia, civil society and to multilateral and international agencies, donors and foundations. More than 350 responses were received from individuals who are knowledgeable of or had experience working with digital health solutions. These respondents represented perspectives within the five focus regions: Asia; Eastern Mediterranean; Eastern and Southern Africa, West and Central Africa; and Latin America.

The survey results were analysed with a count method, whereby each individual selection of the investment area resulted in a count of one. The totals were then aggregated together to reflect all respondents and across groups of stakeholder types and geographic location. This analysis showed high levels of alignment across the different categories of stakeholders and resulted in the prioritisation of the nine investment areas listed in Table A1. These investment areas were then vetted by subject experts to ensure they reflected priorities across the regions and different sectors.

While the top investment areas were broadly aligned across the stakeholder types, with between 40% and 70% of individual respondents selecting most investment areas, there were a few notable nuances. For example, client identification and registration received only 35% of the total votes within service delivery, yet it was highly prioritised by donors and therefore was added as a second investment area within the service delivery category. While all stakeholder types prioritised telemedicine interventions, with many providing additional commentary that the COVID-19 pandemic has shown the need for digitally available services at a distance, youth stakeholders also mentioned the importance of personal health tracking interventions.

We acknowledge that these nine investment areas, although priorities, do not represent an exhaustive list of investments needed for a full digital transformation of health systems. Instead, they represent building blocks that may require complementary country-specific investments for a full digital transformation. For example, additional investment areas could include building digital health strategies, community mobilisation and additional tools for health care workers. Additional localised research is suggested to identify investment areas needed in a specific geography. This report has a chosen focus on the detailed analysis for costing the nine prioritised investment areas, given they were valued by diverse stakeholder types across the five regions of focus. Based on other costing analyses conducted by Digital Square,⁷² this investment is likely a sizeable component of the total investment needed and represents upwards of 50% of the total costs.

Table A1**Prioritisation of the nine investment areas**

Category	Area*	Abbreviated area definition
1. Digital connectivity	Digital connectivity infrastructure (connecting every health worker, health facility)	The backbone infrastructure, hardware and services required for reliable internet access are available, accessible and affordable for all.
2. Financing and financial management	Health financing	Digital approaches to manage financial transactions for health system-related expenses, such as payments to the health workforce and administrative budget management.
3. Health worker management and support	Decision support	Digitalised job aids that combine an individual's health information with the health care provider's knowledge and clinical protocols to assist them in making diagnosis and treatment decisions.
4. Information systems and data services	Data exchange and interoperability	The capability of two or more systems to communicate and exchange data through specified data formats and communication protocols.
5. Digital connectivity	Digital connectivity infrastructure (connecting every health worker, health facility and household)	The backbone infrastructure, hardware and services required for reliable internet access are available, accessible and affordable for all.
6. Financing and financial management	Health financing	Digital approaches to manage financial transactions for health system-related expenses, such as payments to the health workforce and administrative budget management.
7. Health worker management and support	Decision support	Digitalised job aids that combine an individual's health information with the health care provider's knowledge and clinical protocols to assist health care providers in making diagnosis and treatment decisions.
8. Information systems and data services	Data exchange and interoperability	The capability of two or more systems to communicate and exchange data through specified data formats and communication protocols.
9. Digital connectivity	Digital connectivity infrastructure (connecting every health worker, health facility and household)	The backbone infrastructure, hardware and services required for reliable internet access are available, accessible and affordable for all.

Note:

*=Prioritised investment areas received the largest number of votes within each category from more than 350 survey respondents who use digital health tools or are digital health experts.

Investment area limitations

Survey design limitations: The survey for prioritisation of investment areas included 54 unique investments, grouped into seven categories. They were not exhaustive of all investment areas and were included due to their prominence in the three sources provided.⁷³ In addition to the categorised investment areas, there was a write-in option for additional areas not included in the survey. For example, community mobilisation and the use of artificial intelligence were mentioned by survey respondents as high priorities. However, no unprompted write-in investment areas achieved enough votes to be featured as a high priority. This may in part be because respondents were not presented with these options in the survey.

Recruitment of respondents: Recruitment of the survey respondents was through targeted outreach from Transform Health's global and regional partners.⁷⁴ This snowball sampling method resulted in the more than 350 respondents and is indicative of the overall interest and trends. Further localised research should be conducted to assess the specific needs in each region.

Costing methods

The costing analysis looked to estimate the total cost of implementing the nine priority investment areas across all low- and lower-middle-income countries. To align with the length of typical national budget planning cycles, the costing analysis developed five-year cost projections for each investment area. The analysis began with a targeted literature and programmatic data review that led to costing data sources for the nine priority investment areas. This targeted review resulted in 14 primary data sources from nine geographies in sub-Saharan Africa and Asia (Democratic Republic of the Congo, Ethiopia, Malawi, Mozambique, Nepal, Senegal, United Republic of Tanzania, Zambia and Zanzibar) in the form of national road maps, globally available costing resources, programme data and published literature. The cost data within these sources was extracted into a central repository, resulting in more than 350 cost data line items across all investment areas (see examples in the next paragraph). The costing methodology then took a six-step approach to extrapolation and scenario development.

Coding cost data: Each unique line item was classified as development, deployment or operations costs. In circumstances in which there was not a clean division between the categories, costs containing similar items were grouped together in a similar method.

- Development costs include software development and the human resources associated with scoping and planning implementation.
- Deployment costs include all costs of scaling up a programme, including one-time costs for equipment, further software development – as needed – to connect the digital tool within the local ecosystem and address any new glitches or bugs in the software and then build up capacity through new deployment training.
- Operations costs include the ongoing costs of maintaining an intervention, including such items as replacement equipment, refresher training, software licensing, project management and help desk support.

While each investment area was costed separately, careful consideration was given to the benefits of implementing a suite of solutions. For example, cost-sharing of capital equipment, such as laptops at facilities, was considered and included as a line item within the digital connectivity infrastructure investment area. Other individual investment line items were modified to avoid duplication of these costs. For digital connectivity infrastructure, which has benefits beyond the health sector, a methodology was generated to only estimate costs for the health sector contribution. More specifically, infrastructure costs were limited to the digitisation of health records, wide and local area networks (WAN and LAN) within facilities and the physical information and communication technologies (ICT) equipment within facilities. The cost of establishing the national systems, such as national broadband or mobile data coverage, that would be required for these networks to connect into was not included in the analysis because they are often covered by different actors.

Scaling up the data to additional geographies: Triangulating among the most robust data sources, these costs were then extrapolated to other low- and lower-middle-income countries. It is important to stress that for most of the investment areas, the robust data sources came from global goods products. The donor-funded development and open-source nature of these products make them well-suited to low digital health maturity markets. Global goods also are more likely to have product features that are desired by end users in low digital health maturity markets, such as offline functionality and data compression.⁷⁵

Development costs are considered fixed costs and held consistent across all geographies. It is possible that there may be cost efficiencies for leveraging digital health solutions that are developed in another country, especially global goods, but these efficiencies were not accounted for in this analysis.

Deployment costs, for most investment areas, were scaled up linearly at a per-person level. A per-person extrapolation was used due to the limited availability of health facility data for the 78 focus countries. For data governance, enterprise architecture and data exchange and interoperability, costs were not scaled up based on a country's population size. These three investment areas were targeted at national-level stakeholders rather than direct engagement with health providers and patients. Therefore, the costs for each of these areas was assumed to be the same across all countries.

Operations cost data were not available for most of the investment areas. Therefore, high-, medium- and low-cost operations scenarios were developed to account for the ongoing costs needed to maintain digital interventions. These scenarios were built with the evidence from PATH and Digital Square's work on supply chain management⁷⁶ and have been validated as reasonable based on external resources⁷⁷ and subject matter experts. The high operations cost scenario allocates 60% of the total cost over five years to the ongoing operations. In other words, over the course of five years, 40% of the total cost will be spent during the development and the deployment of the investment area, while 60% of the total cost will be spent on operations costs. Similarly, the medium operations scenario cost allocates 50% of the total costs and the low operations cost scenario allocates 40%, of the total cost over five years to the ongoing operations. In all scenarios, it was assumed that these operations costs would continue in each year of a product's lifespan.

Adjusting for different purchasing power: Each costed line item was then adjusted to reflect differences in purchasing power across countries. To do so, PPP ratios were developed, comparing the source PPP to the extrapolated country PPP. Although the source data costed each investment area in US dollars, the PPP adjustment acknowledges the difference in the purchasing power of a currency for a set basket of goods and services between countries.

Adjusting for inflation: The data sources used were selected through a targeted literature and data review and included national road maps, globally available costing resources and programme data. These sources were developed between 2016 and 2021. While costed in US dollars, the source values were adjusted to account for annual inflation rates. The resulting figures represent total cost in 2021 US dollars.

Scenario analysis to highlight uncertainty: Different scenarios were developed to reflect the ranges in observed data. For digital connectivity infrastructure, a range was developed based on the varying costs in the data sources. There are many reasons infrastructure costs may vary across geographies, including a given country's digital health maturity level,⁷⁸ topography, population density and other factors. For the eight other investment areas, we developed ranges based on the potential range in operating costs. These operation cost scenarios created ranges that assume a consistent spread of 40–60% of the total investment area that could be spent on maintaining functionality of the investments after implementing.

Distributing costs over five years: To reflect patterns of spend down of the total cost, a five-year distribution was modelled. This distribution assumes that for all investment areas, all development costs would be spent in year one. For years two, three and four, a linear deployment of the investment area would take place and therefore one third of the total capital equipment, deployment and operations costs would be spent in each year. Year five assumes that the intervention has reached 100% deployment and annual operation costs are the only remaining costs. With this methodology, it can be assumed that the costs in year five would be recurring in perpetuity, such as in year six and beyond.

Costing assumptions

Capital equipment: Digital health interventions rely on the availability of capital equipment to operate effectively. To account for the benefit of implementing a suite of solutions, this analysis assumed that there is capital equipment-sharing across the priority investment areas. It further assumed that the nationally costed infrastructure investment area contains sufficient levels of capital equipment for the functioning of the entire suite of priority investment areas. Therefore, capital equipment expenditures were removed from all other priority investments.

National-level stakeholder engagement: Data governance, enterprise architecture and data exchange and interoperability investment areas were considered to have fixed costs due to their national-level stakeholder engagement and deployment.

Costing limitations

Data limitations

Geographic representation of data sources: This analysis was conducted with data from nine geographies in sub-Saharan Africa and Asia: Democratic Republic of the Congo, Ethiopia, Malawi, Mozambique, Nepal, Senegal, United Republic of Tanzania, Zambia and Zanzibar. Most of the cost data comes from countries in sub-Saharan Africa and were extrapolated to low- and lower-middle income countries globally.

Availability of operations costs: There was limited availability of cost data for operations of the priority investment areas. The team developed three scenarios to account for the total cost of implementing these solutions.

Availability of PPP values: To account for the localised cost of goods, the team leveraged the World Bank's 2020 World Development Indicator "Price level ratio of PPP conversion factor to market exchange" to adjust for purchasing power between geographies, as discussed previously. The following five low- and lower-middle income countries lack PPP values and therefore were excluded from the costing analysis: Democratic People's Republic of Korea, Eritrea, South Sudan, Syrian Arab Republic and Yemen.

Methodology limitations

Categorisation of investment area line items: The analytics reviewed each unique line item within the available data sources to classify the cost as development, deployment or operations. In circumstances in which there was not a clean division between the categories, costs containing similar items were grouped together in a similar method for extrapolation purposes.

Population-based scaling of costs between countries: For investment areas that are deployed at subnational levels, the deployment and operations costs were scaled on a per person basis. While the team acknowledges these investments would predominantly be deployed at health facilities, a lack of health facility count data across the majority of low- and lower-middle income countries prevented meaningful extrapolation to the health facility level and therefore population was used as a substitute to represent scale.










PPP application: PPP was used to account for differences in costs across the countries. PPP values were applied to all costs, including capital equipment and labour, but typically they were used only for tradable goods. There is limited publicly available data on labour costs across low- and lower-middle-income countries. Although anecdotally there is evidence that technology costs do not always follow PPP ratios in terms of cost adjustments due to differential pricing schemes by multinational companies, no data have been found to indicate the differences in cost from scaling technology when compared to PPP.

Digital connectivity infrastructure: For digital connectivity infrastructure, the range was developed based on varying costs in data sources. There are many reasons infrastructure costs may vary across geographies including a given country's digital health maturity level,⁷⁹ topography, population density and other factors. These factors were not directly addressed or adjusted for in the range provided. Further, the costing analysis assumed that the network connectivity (mobile data or broadband) that a health facility would connect into are in existence or would be funded by entities outside of the health sector.

Exclusivity: Globally recognized classifications of digital interventions may not be mutually exclusive from a costing perspective making data interpretation potentially challenging.

Potential for cost savings: This analysis focused on estimating the necessary investment needed to implement the nine priority investment areas and did not estimate the potential cost savings that could result from any of the included digital health interventions. Additional research is suggested to understand the localised potential for cost savings.

Table A2 Five-year total cost projections in 2021

Investment area 5-year costs Costs in 2021, US\$ millions	Low-cost scenario	Medium-cost scenario (most realistic)	High-cost scenario	5-year breakdown (based on the medium scenario)
Digital connectivity infrastructure (connecting every health worker and health facility)	4820	9693	17 001	
Telemedicine (provision of health care services at a distance)	819	983	1228	
Decision support (digitalised job aids combining patient health information and clinical protocols)	515	618	772	
Health financing (digital approaches to manage financial transactions)	400	480	600	
Supply chain management (digital approaches for monitoring and reporting stock levels)	255	306	382	
Data exchange and interoperability (multiple systems communicating and exchanging data)	139	167	209	
Client identification and registration (identifying and enrolling clients in a patient portal)	118	141	177	
Enterprise architecture, including governance, guidelines and standards for interoperability	79	95	118	
Data and digital governance (regulating the use of digital technologies and data)	17	20	25	
Total 5-year costs, US\$ millions	7 162	12 503	20 512	

The total five-year cost projections are US\$ 7.2 billion, US\$ 12.5 billion and US\$ 20.5 billion for the low, medium and high scenarios, respectively. This represents the anticipated cost of implementing all nine investment areas across the 78 low- and lower-middle-income countries and includes the development, deployment and operations of each investment area. In the medium scenario, the overall investment is projected to be US\$ 12.5 billion over five years, which translates to US\$ 2.5 billion on average annually. The annual distribution scenario model suggests that at full scale, US\$ 2 billion would be needed annually for recurring operations costs in the medium scenario. The primary driver of costs across the selected nine priority intervention areas is the needed digital connectivity infrastructure, which accounts for approximately 75% of the total projected costs. Within this investment area, approximately 40% of the cost is dedicated to capital equipment required within the health facilities that will form the foundation in which other digital health solutions operate. A second driver of cost is the operations costs, which across the scenarios account for 40–60% of the total cost over five years. These costs include ongoing maintenance, equipment replacement, software licensing, help desk support and refresher training and are essential to maintaining the digital investments. However, these costs are often omitted during budgeting processes.

Health impact case studies – Method and results

Health impact case studies

Aligned with the focus of this Conceptual Framework, PATH and Digital Square conducted an analysis to estimate the potential health impact in terms of lives saved for two of the Conceptual Framework investment areas across low- and lower-middle-income countries.⁸⁰ These case studies show the health impact of digital supply chain management systems and electronic clinical decision-support tool investments if implemented within these countries. These investment areas were selected because of the availability of data.

A growing number of groups are developing frameworks and methodologies to standardise economic evaluation and impact measures from digital health interventions. But at present, there is limited quantitative evidence on the potential impact of digital interventions on health outcomes.⁸¹ Measuring the value of digital health can be challenging due to many positive and negative externalities (workforce motivation, data privacy violations), the wide variety of potential outcome measures (health impact, financial savings), the challenge of attributing change to the digital health intervention as there are many determinants of health and because many different methods for measuring the resulting impacts.⁸² The modelling represents the health impact for each investment area in isolation, based on the inputs and scenarios provided. We could not quantify the amount of double counting that may occur between the two investment areas modelled and therefore the results should not be summed.

Further, the team acknowledges that while this analysis focused on the health impact in terms of lives saved, there are potential cost savings that could result from any of the included digital health interventions. This analysis was not undertaken due to the lack of available cost-savings data.

Digitalised supply chain management

The estimated health impact on children younger than 5 years through digitalising last-mile supply chain management systems with capabilities to monitor and report stock levels, consumption and distribution of medicines was estimated. In many low- and lower-middle-income countries, paper-based systems requiring manual data entry of health information are common at the most peripheral levels of the health system. Digitalised last-mile supply chain management systems can improve the supply and distribution of health commodities by automating the different steps thus lessening stockouts, waste and supply chain inefficiencies.⁸³

The Lives Saved Tool (LiST) that the Johns Hopkins Bloomberg School of Public Health developed was used to estimate the potential health impact of implementing a digitalised last-mile supply chain management system in low- and lower-middle-income countries. The model quantifies the potential number of lives saved in children younger than 5 years with changes in intervention coverage rates in low- and lower-middle income countries.⁸⁴ The tool includes country-level data from a variety of sources, including peer-reviewed journals, the United Nations Population Division, the Demographic and Health Surveys Programme and the Multiple Indicator Cluster Surveys.⁸⁵ The model assumes that each death is due to a single cause and that each death can only be prevented once.

This analysis extended a study previously conducted by PATH and Digital Square that estimated the lives saved among children younger than 5 years in three countries, also using the LiST,⁸⁶ to the remaining low- and lower-middle income countries. The literature review conducted by PATH and Digital Square identified a 5–14 percentage point reduction in stockouts from implementing a digitalised last-mile supply chain management system in low- and lower-middle income countries. Stockouts are commonly defined as a commodity that is expected to be available at a health facility but that has zero reported stock at any point during a defined period. Stockout reduction data were inverted to stock availability and improved coverage for vaccines and essential medicines using a 1:1 conversion factor. Three scenarios were modelled based on the range of stockout reduction data observed in the literature and five years of impact, between 2023 and 2027, were modelled to match the costing analysis.

Informant interviews indicated a rapid scaling up of a digitised supply chain management tool and thus the modelling assumed that the full increase in coverage would be realised in the first year. Implementing a digitalised last-mile supply chain management system in low- and lower-middle income countries could reduce child mortality by improving coverage of life-saving commodities. Three scenarios were run in the model based on the identified reduction in stockout data. In the medium, and most likely, scenario, more than 348 000 lives could be saved by a 10% reduction in stockouts for vaccine interventions and more than 961 000 lives could be saved by a 10% reduction in stockouts for non-vaccine medicines across all countries (Table A3). This analysis should be interpreted with caution, given that the stockout rate reduction data were derived from a small number of studies. Furthermore, there are many factors that influence coverage of vaccines and essential medicines beyond stockout levels, including ability to pay, having a qualified workforce, trust in the health system and infrastructure to support the supply chain.

Table A3 Child lives saved by digitalised supply chain management scenario, 2023-2027

	Low 5% stockout reduction	Medium 10% stockout reduction	High 15% stockout reduction
Vaccines	214 658	348 149	456 283
Non-vaccines	495 746	961 499	1,483 358

Vaccines: Bacillus Calmette -Guerin (BCG), diphtheria-pertussis-tetanus (DPT), haemophilus influenza type B (HiB), hepatitis B, measles, pneumococcal, polio, rotavirus and tetanus toxoid. Non-vaccine medicines: antibiotics for premature or prolonged rupture of membrane, antibiotics for dysentery, injectable antibiotics, oral antibiotics for pneumonia, oral rehydration salts, syphilis detection and treatment, vitamin A for treatment of measles, zinc treatment for diarrhoea.

Decision-support tools

The health impact of electronic clinical decision-support tools that combine an individual's health information with a health care providers knowledge and clinical protocols was estimated for children younger than 5 years suffering from pneumonia. To improve access to quality of care in children in primary health care settings, WHO and UNICEF created the integrated management of childhood illness (IMCI) strategy.⁸⁷ The IMCI provides health care workers with evidence-based algorithms that use history, signs and symptoms to determine the best course of management. However, there is low adherence with clinical algorithms featured in traditional paper-based guidelines, including the IMCI.⁸⁸ While there are many reasons for low adherence to paper-based guidelines, electronic clinical decision-support tools are promising tools for the management of childhood illnesses in primary care settings.⁸⁹

To estimate the potential impact in terms of lives saved in children younger than 5 years in low- and lower-middle-income countries, a model was generated in Excel. The modelling was achieved by summing the population of children younger than 5 years across the selected countries and multiplying average pneumonia incidence across these countries to estimate the number of children with pneumonia. The next step was to multiply the average proportion of children with acute respiratory illness that present at a health facility across these same countries to estimate the number of children with pneumonia that present at a health facility. A case fatality rate of pneumonia with or without an electronic clinical decision-support tool was applied for children that present at a health facility to estimate the potential number of lives that could be saved. Sensitivity analysis was performed to highlight ranges in the data for select inputs (Table A4). For this analysis, we assumed that an electronic clinical decision-support tool would enable a health care provider to fully adhere to IMCI guidelines, thus reducing the case fatality rate by 13%.⁹⁰

Several factors need to be considered when thinking about the uptake of the electronic clinical decision-support tools. For example, adaptations to IMCI guidelines may be needed, depending on the epidemiological profile of the country, availability of medicines and commodities and other factors. Furthermore, health care providers will need to learn how to use the decision-support tools and may need to receive refresher IMCI training. Even if a decision support tool is in place, it is also important to consider whether there are links to quality care, such as access to appropriate diagnostics and medicines. The modelling used scenario analysis to highlight different uptake curves for the clinical decision-support tool and different levels for links to the appropriate diagnostics and treatments (Table A4).

Table A4

Key child lives saved model inputs and assumptions by eCDST scenario

	Low	Medium	High
Population size of children younger than 5 years ^a	436 million	436 million	436 million
Incidence of pneumonia in children younger than 5 years ^b	24%	24%	24%
Case-fatality rate of pneumonia in children younger than 5 years ^c	0.4%	.65%	1%
Proportion of children with acute respiratory illness who seek care in a health facility ^d	67%	67%	67%
Peak coverage rates for the intervention*	43%	57%	72%
Coverage rates for linkages to care	55%	70%	85%
Percentage reduction in the pneumonia case fatality rate based on adherence to IMCI** 91	13%	13%	13%

Notes:

*= An s-shape uptake curve was generated for coverage of the electronic decision-support tool. For the medium scenario this represents 5%, 8%, 20%, 45% and 57% coverage over years 1 through year 5, respectively. **=The percent reduction in case fatality is based on the broad impact of IMCI rather than the pneumonia specific impact of IMCI.

Source: a= See <https://population.un.org/wpp/Download/Standard/Population/>

b= David A McAllister et al., "Global, Regional and National Estimates of Pneumonia Morbidity and Mortality in Children Younger Than 5 Years Between 2000 and 2015: A Systematic Analysis," *Lancet Glob Health* 7, no. 1 E47-E57 (2019), [http://dx.doi.org/10.1016/S2214-109X\(18\)30408-X](http://dx.doi.org/10.1016/S2214-109X(18)30408-X). Supplement: [https://www.thelancet.com/cms/10.1016/S2214-109X\(18\)30408-X/attachment/41ca9e56-e528-4788-bb38-1d4c9f76e6d4/mmc1.pdf](https://www.thelancet.com/cms/10.1016/S2214-109X(18)30408-X/attachment/41ca9e56-e528-4788-bb38-1d4c9f76e6d4/mmc1.pdf).

c= McAllister et al., "Global, Regional and National Estimates of Pneumonia Morbidity and Mortality in Children Younger Than 5 Years Between 2000 and 2015"; Jessica Floyd et al., "Evaluating the Impact of Pulse Oximetry on Childhood Pneumonia Mortality in Resource-poor Settings," *Nature* 528, no. 7580 (2015): S53-9, <https://doi.org/10.1038/nature16043>;

d= The DHS Program, Demographic and Health Surveys, <https://dhsprogram.com/Data>.

Implementing an electronic clinical decision-support tool could reduce childhood pneumonia mortality by improving adherence to IMCI guidelines. In the medium, or most likely scenario, nearly 55 000 lives could be saved across all low- and lower-middle income countries over the five-year period (Table A5). More than 40% of these lives saved occur in the fifth year, given the intervention is estimated to have fully scaled. While this modelling exercise focuses on pneumonia in children younger than 5 years, the decision-support tool could also have an impact on other disease areas and patient age groups, depending on the scope of the clinical algorithm. A recent observational study using a clinical decision-support tool found improvements in the quality of care for children presenting with fever, cough, breathing problems, diarrhoea, vomiting and other symptoms in primary health care settings.⁹²

The ranges in the model inputs, such as the case fatality rate of pneumonia in children, the coverage uptake of the intervention and linkage to care, highlight limitations in this analysis. Scenario analysis was performed to highlight uncertainty in the available data. In addition, a key assumption of this analysis is that an electronic clinical decision-support tool would enable health care providers to adhere to the IMCI guidelines and accurately diagnose and treat pneumonia. The data on electronic clinical decision support tools improving patient care decisions are still limited and the results need to be interpreted with caution.

Table A5

Child lives saved by eCDST scenario, 2023-2027

	Low	Medium	High
Electronic decision-support tool	19 559	54 255	125 949

Endnotes



- 1** The key focus of this report is on 78 of the 82 countries that at the time of writing fall within the World Bank classification of “low- and lower-middle income” countries. Due to missing purchasing power parity (PPP) values, five countries considered Low or lower middle income were excluded from the analysis: Democratic People’s Republic of Korea, Eritrea, South Sudan, Syrian Arab Republic and Yemen. These 78 countries are included in the modelling of the cost for nine priority investment areas in the digital transformation. They have a combined population of 4.1 billion people. In some cases, the report refers to figures and characteristics of all “low- and middle- income” countries. This term includes 54 upper-middle-income as well as the 82 low and lower middle income countries and therefore has a combined population of 6.6 billion.
- 2** The analysis drew from a targeted programmatic data review that identified costed data sources for the nine priority investment areas from 14 primary data sources relating to nine geographies in sub-Saharan Africa and Asia (where all but a few low- and lower-middle-income countries are situated).
- 3** This is an illustrative estimate by reference to the proportion of domestic spending to international aid spending in low- and lower-middle income countries health spending from WHO Global health expenditure data base, and domestic investment proportions from the Global Fund 7th Replenishment projection of available resources.
- 4** See General Data Protection Regulation (GDPR) of the European Union, <https://eur-lex.europa.eu/eli/reg/2016/679/oj>
- 5** See www.healthdataprinciples.org.
- 6** See OECD Recommendation on Health Data Governance, www.oecd.org/els/health-systems/health-data-governance.htm.
- 7** Ilona Kickbusch et al., “The Lancet and Financial Times Commission on Governing Health Futures 2030: Growing Up in a Digital World,” *Lancet* 398, no. 10312 (2021): 1727-1776, [https://doi.org/10.1016/S0140-6736\(21\)01824-9](https://doi.org/10.1016/S0140-6736(21)01824-9).
- 8** World Health Organization, Seventy-First World Health Assembly, Agenda Item 12.4, Digital Health (Geneva: WHO, 2018), https://apps.who.int/gb/ebwha/pdf_files/WHA71/A71_LR7-en.pdf.
- 9** World Health Organization, Global Strategy on Digital Health 2020–2025 (Geneva: WHO, 2021), <https://apps.who.int/iris/handle/10665/344249>.
- 10** Ilona Kickbusch et al., “The Lancet and Financial Times Commission on Governing Health Futures 2030: Growing Up in a Digital World,” *Lancet* 398, no. 10312 (2021): 1727-1776, [https://doi.org/10.1016/S0140-6736\(21\)01824-9](https://doi.org/10.1016/S0140-6736(21)01824-9).
- 11** The reference made to individual societal groups does not claim to be comprehensive. To the contrary, which group requires dedicated attention and what the engagement should look like depends on the country context and must be defined in an inclusive process.
- 12** Young Experts: Tech4Health is a network working to centre youth rights and perspectives at the heart of digital transformation for universal health coverage, <https://yet4h.org>.
- 13** The key focus of this report is on 78 of the 82 countries that at the time of writing fall within the World Bank classification of “low- and lower-middle income” countries. Due to missing purchasing power parity (PPP) values, five countries considered Low or lower middle income were excluded from the analysis: Democratic People’s Republic of Korea, Eritrea, South Sudan, Syrian Arab Republic and Yemen. These 78 countries are included in the modelling of the cost for nine priority investment areas in the digital transformation. They have a combined population of 4.1 billion people. In some cases, the report refers to figures and characteristics of all “low- and middle- income” countries. This term includes 54 upper-middle-income as well as the 82 low and lower middle income countries and therefore has a combined population of 6.6 billion.
- 14** Digital Square, “Closing the Health Equity Gap,” *The Atlantic*, 2021, www.theatlantic.com/sponsored/digital-square-2021/closing-health-equity-gap/3661/.

- 15** Global Digital Health Index, 2019, www.digitalhealthindex.org.
- 16** Digital Square, "Market Analytics: Understanding the Digital Health Marketplace" (2021), <https://digitalsquare.org/market-analytics>.
- 17** Organisation for Economic Co-operation and Development, Development Co-operation Report 2021: Shaping a Just Digital Transformation (Paris: OECD Publishing, 2021), <https://doi.org/10.1787/ce08832f-en>.
- 18** International Telecommunication Union, The Global Connectivity Report 2022 (Geneva: ITU, 2022), <http://handle.itu.int/11.1002/pub/81cd4170-en>.
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- 20** These are the countries where internet access is lowest, World Economic Forum, August 17, 2020, www.weforum.org/agenda/2020/08/internet-users-usage-countries-change-demographics.
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