

LEVERAGING DIGITAL TECHNOLOGY TO IMPROVE HEALTH SYSTEMS AND EQUITY WORLDWIDE



FRIENDS
OF THE GLOBAL FIGHT

AGAINST AIDS,
TUBERCULOSIS
AND MALARIA

Executive Summary

Digital technologies are helping improve health care access and outcomes in countries across the world. The critical role of digital tools has been especially apparent during the COVID-19 pandemic, when conditions demanded innovative ways to deliver health services and information.

The mobile phone has a key role to play in health, increasing access to health information, linking patients to health services, supporting disease surveillance and enabling self-management of chronic diseases through technologies as simple as SMS messaging and interactive voice response. More extensive digital strategies include centralized electronic health data systems that link and manage the disclosure of health information, digital data visualization tools that aid decision-makers in identifying and addressing health disparities, analysis of large datasets to enable sound priority-setting and resource allocations and digital ways of managing and improving the delivery of clinical services.

While digital technologies are making real contributions, the full promise of digital tools remains unrealized, as efforts to date have been partial, fragmented and underfunded. Moreover, without thoughtful and well-planned efforts, digital technologies for health, like other innovations that preceded them, can widen rather than narrow health disparities. Fully leveraging the benefits of digital tools for health requires that we move beyond ad hoc uses of individual tools and focus on strengthening and transforming health systems to effectively leverage the full array of digital technologies.

To explore how best to leverage digital technologies for health in a way that promotes health equity, Friends of the Global Fight Against AIDS, Tuberculosis and Malaria collaborated over several months with partners in sharing of perspectives and analyzing available evidence. This effort culminated in a virtual convening of diverse experts and stakeholders in January 2022. This process yielded several key recommendations:

- ***We must seize the promise of digital transformation for health.***
An inclusive, strategic, well-resourced effort is needed to identify and fully leverage the benefits of digital technology for health equity.
- ***Urgent efforts are needed to close the digital divide.***
Individuals and communities cannot benefit from digital technologies for health if they lack digital access. Major investments are needed to increase connectivity and digital literacy, especially among the poorest and most vulnerable populations.

- ***Health-related innovations must be people-centered.***
Digital approaches for health should be specifically designed to meet the needs of end users and intended beneficiaries rather than solely expecting people to adapt themselves to technology. Technological solutions for health must be designed and rolled out with providers and beneficiaries in mind. Users must be part of the process from the outset. This approach is in line with the growing focus on “human-centered design,” which has gained considerable attention and support in the technology field but has not yet been comprehensively applied in the field of global health.^{1, 2, 3, 4}
- ***Digital solutions for health must be tailored for specific settings and populations.***
Every national health system and every population have unique needs and diverse relationships with digital technologies and health data that mirror the diversity of health challenges between and within countries. No “one size fits all” solution exists for digital technologies for health. This is why people must drive the digital transformation agenda – to ensure that digital strategies can be utilized by end users to address their real-world health needs.
- ***A specific focus on ensuring equity and protecting human rights is essential.***
Careful, thoughtful steps are needed to ensure that digital technologies reduce rather than exacerbate health inequalities. All populations deserve equal access to digital tools for health and health data, regardless of wealth, gender, age, education, social status or stigma. All digital tech and data applications must be grounded in privacy, confidentiality, social inclusion and a respect for human rights.
- ***Public sector infrastructure and capacity must be built and sustained.***
One of the foremost barriers to ensuring the health systems can thrive in the digital age is the limited digital capacity of the public sector. This is true in countries both rich and poor. In addition to broad-based efforts to close the digital divide, specific focus is needed to equip the public sector to understand and effectively use digital tools to improve health access, and outcomes need to be prioritized at a local, regional and national level.

Tech solutions are meaningful only if one has access to them as well as the ability and motivation to use them.

Introduction and background

Digital technology is affecting virtually every aspect of life in the 21st century. Nearly 16 billion mobile devices are in operation worldwide⁵, with rapidly increasing access and adoption in low- and middle-income countries. The internet, currently used by nearly five billion people⁶, has opened up a world of knowledge and enabled people around the world to connect in unprecedented ways.

Not surprisingly, digital tools have enormous potential to improve human health and bolster the systems that deliver essential health services. Indeed, a blue-ribbon commission convened by the *Lancet* and the *Financial Times* recommended that “decision makers, health professionals, and researchers consider – and address – digital technologies as increasingly important determinants of health.”⁷ COVID-19 has underscored the importance of digital access to good health outcomes, as communities lacking internet access experienced consistently higher mortality during the first year of the pandemic.⁸

The increasing attention on the potential for digital technologies to improve health is occurring at the same time that global health ambitions have justifiably expanded. The Sustainable Development Goals call for achievement of universal health coverage by 2030; ending the epidemics of AIDS, tuberculosis and malaria as public health threats and markedly reducing mortality from non-communicable diseases; and eliminating preventable deaths under age five.⁹ In response to the COVID-19 pandemic, which had as of mid-April 2022 contributed to more than 18 million deaths worldwide,¹⁰ the world is now focused on strengthening preparedness for future pandemics. Hopes for addressing this urgent, expanding global health agenda confront underlying weaknesses in health care systems, including shortages of healthcare workers that are projected to become even more acute in the coming years.¹¹ COVID-19 has set back progress towards the Sustainable Development Goals, increasing poverty and malnutrition, diminishing access to immunizations and basic health care and undermining progress in reducing the health burden associated with infectious diseases.¹²

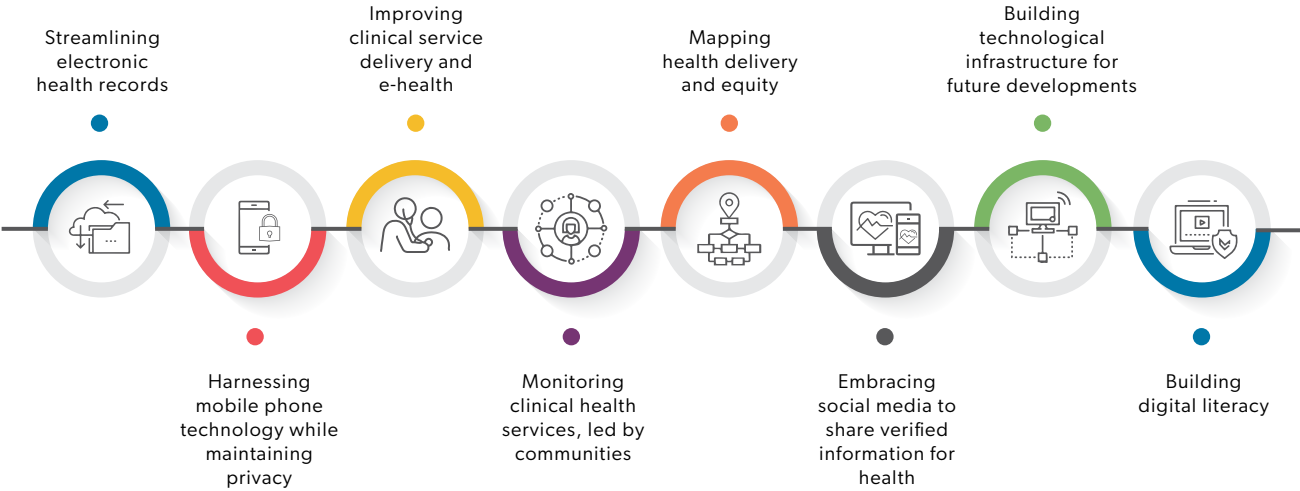
Digital technologies and the stronger personal and aggregate health data that digital tools enable offer hope for helping overcome these many challenges and for improving health care access and outcomes – to reach the most vulnerable populations, to enable sound public health strategies that optimize impact, to make health care workers’ jobs easier and more efficient, to make finite financing go further and to provide individuals with the tools they need to make healthy decisions and set evidence-based priorities. Before COVID-19, digital technologies were already making important contributions to health, through such means as telemedicine, innovative uses of social media and mobile phones, and establishing health information systems for priority setting and resource allocations. COVID-19 accelerated the uptake of tech solutions for health – including the use of digital tools for disease surveillance; to allocate ventilators, hospital beds and other health supplies; tech solutions to

streamline supply chains; software for scheduling vaccinations; and the use of social media and other digital methods to communicate to the public regarding COVID-19 risks, mitigation measures and vaccination.

Yet, while digital technology has a demonstrated capacity to improve access to health information and services, it also has the potential to widen health disparities. The so-called “digital divide,” separating those who have access to digital technologies and health data from those who do not, is widening between lower and higher income countries.¹³ As the disparities in uptake of home schooling in the United States during the COVID-19 pandemic underscore, there are also glaring inequities in digital access within countries.¹⁴ Tech solutions are meaningful only if one has access to them as well as the ability and motivation to use them. Households with low income or those that are socially marginalized are least likely to have access to digital technologies.¹⁵ These are also the populations in greatest need of health services.¹⁶ Closing this digital divide by making rapid progress towards universal digital access is a prerequisite to maximizing healthcare access and optimizing health outcomes in the digital age.

This report by Friends of the Global Fight Against AIDS, Tuberculosis and Malaria (“Friends of the Global Fight”) explores a pivotal strategic question for the future of global health and well-being: *How can we best leverage digital technologies to improve global health outcomes in a*

HOW HEALTH TECHNOLOGY CAN ADVANCE GLOBAL HEALTH EQUITY



PRINCIPLES THAT SHOULD GUIDE TECHNOLOGY:

- 1 Strengthen public health systems
- 2 Put people at the center of innovations
- 3 Ensure equity in access and protect privacy and individual rights

way that improves health equity and leaves no one behind? It draws on discussions of best practices and opportunities at a virtual convening in January 2022, co-hosted by Friends of the Global Fight and the Bay Area Global Health Alliance, of 60 stakeholders, including private sector technology companies, national health ministries, global health experts and civil society and community representatives. The January 2022 convening followed on a previous meeting in 2021, hosted by Friends of the Global Fight, GBC Health and Wilton Park, that focused on the role of digital tech solutions in pandemic preparedness and response.¹⁷ For development of this report, Friends of the Global Fight complemented information presented at the January 2022 convening with a review of the peer-reviewed and grey scientific literature on the impact that digital technology is having in the health arena.

Health in the digital age: How technology can improve health access and outcomes

Digital technologies are revolutionizing and reordering entire industries, improving the efficiency, reach and user-friendliness of operations. Likewise, digital technologies have the potential to have similarly transformative effects in the health arena, improving health access and outcomes in many ways. Potential technological platforms and applications for health range from the most sophisticated and extensive (including artificial intelligence and software linking all aspects of health service delivery) to the most simple (including the mobile phone).¹⁸



Electronic health records

Electronic systems of health record-keeping permit the automatic transfer of de-identified data from clinical service sites to national health information systems.¹⁹ Electronic health records have important benefits, improving service quality, reducing medical errors, enhancing health system efficiency

and enabling health research.²⁰ Transitioning health record-keeping from paper to digital platforms can also have benefits at the level of clinical service provision, allowing the tracking of wait times, missed appointments and clinical markers such as viral suppression and TB treatment-to-cure. The most effective electronic health records systems are user-friendly, making it as easy as possible for health care workers to input, transmit and effectively use health data at a local level for planning, priority setting and system optimization.

The President’s Emergency Plan for AIDS Relief (PEPFAR) and other donors have provided important financial support to help cover the up-front costs associated with implementation of electronic health records, and the World Health Organization (WHO) and others provide technical support in the roll-out, maintenance and adaptation of such systems.²¹ To aid countries in making the digital transition, WHO and UNAIDS have developed a roadmap to guide diverse stakeholders in planning and implementing electronic health record systems.²² A number of countries – such as Cameroon, Haiti and Nigeria – have implemented electronic health information systems.^{23, 24} By taking an “architectural” approach to up-front planning of their electronic health record systems, low- and middle-income countries have the potential to avoid some of the problems and inefficiencies that have bedeviled health data systems in some high-income countries.²⁵

Some users of health services, especially those from marginalized and stigmatized communities, may worry that their digital health information will be disclosed without their consent. That is why it is essential that health systems implement clear, enforceable, transparent protections for the privacy, confidentiality and security of personal health information, accompanied by trust-building information for communities.²⁶



Mobile phone technologies

As much as innovations to come, the mobile phone offers a broad range of opportunities to improve health and health service access. As one example, WHO in 2021 reached 2.2 million people with mental health messages on the popular Angry Birds application.^{27, 28}

Mobile phone apps are being used for disease surveillance, the foundation for informed public health decision-making and priority-setting. In Myanmar and India, mobile phone applications are supporting timely and accurate surveillance of malaria.^{29, 30} Use of a simple phone app for case reporting by public health workers in Senegal revealed a gap in use of the partogram, a basic graphic that enables midwives to monitor the birth process, prompting health authorities to intensify health worker training to improve uptake.³¹

An expanding spectrum of phone applications and home devices are available for individual use in diagnosing or managing both infectious and chronic disease. These include tools for self-diagnosis of TB, monitoring of diabetes and hypertension and adherence reminders to support good treatment outcomes.^{32, 33, 34, 35} Studies indicate that these tools improve

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Harnessing data for health impact

Digital technologies are essential to effective use of health data, allowing ready access to a universe of information and enabling analysis and effective use of large data sets.

The Visualize No Malaria initiative – a joint undertaking of the Zambian Ministry of Health, PATH and eight tech companies – highlights the transformative potential of digital technologies to apply data to real-world health challenges. The project leverages improved data analytics, state-of-the-art technologies and capacity-building to improve malaria outcomes. Over a three-year period, improved data access was associated with a 92% reduction in malaria-related deaths in one Zambian province (<https://www.path.org/articles/it-helps-to-have-friends-in-tech/>).

health outcomes and are cost-effective complements to facility-based clinical service delivery. Another benefit of these devices is that they encourage self-care and contribute to patient autonomy and empowerment.

One key opportunity offered by mobile phones, underscored by the response to COVID-19, is to use digital tools to empower community health workers and other community-led responses to address the health needs of the most vulnerable. There is emerging evidence that mobile phones or other hand-held devices increase the reach and impact of community health workers, help reduce their workload and enable community workers to serve as the link between individuals and the health care system.^{36,37,38} Of course, community health workers, like frontline health workers in primary care settings, require training in how to use mobile devices in order to incorporate and fully leverage digital tools in their work.



Delivery of clinical services

The COVID-19 pandemic, which led to broad-based lockdowns and increased fears of visiting health clinics, accelerated the use of telemedicine for health services.^{39,40} Evidence suggests that patients are generally satisfied with the increased use of telemedicine.^{41, 42, 43} However, telemedicine approaches should be informed by input from patients and effectively address concerns that some individuals might have, such as privacy, resistance to new technologies and loss of more intimate, face-to-face encounters with health providers.⁴⁴

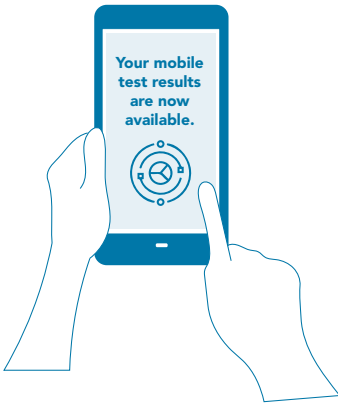
**Privacy, confidentiality and data security:
Non-negotiable building blocks for use of data**

It is imperative that digital tools for health adhere to the strictest standards for privacy, confidentiality and data security. There are compelling ethical reasons for doing so, as the right to privacy is recognized in the Universal Declaration of Human Rights and other national and international legal instruments.

But there are also powerful practical reasons for protecting these rights. Communities, especially those who are marginalized or whose behaviors or existence is criminalized, are unlikely to consent to data collection or participate in health-related research without confidence that their privacy and confidentiality will be protected. In a time where trust in health expertise and health systems is more uncertain than ever in many places, no effort should be spared in establishing and reinforcing this essential trust.

The importance of privacy, confidentiality and data security underscores the critical role of good health governance. Despite privacy protections being fundamental to sound and rights-based use of data for health, available information indicates that most countries have yet to implement comprehensive legal frameworks governing the collection and use of electronic health records. Having such protections in place – and vigorously enforcing and adequately communicating these protections to patients – are prerequisites for the use of digital data for health.

In the Asia-Pacific region, a variety of e-health strategies have been used to improve linkage to and retention in HIV treatment, including text messages, instant messaging, social media and health promotion websites. A systematic review of grey and published scientific literature found that these various e-health approaches were associated with increases in HIV testing and improved antiretroviral treatment (ART) adherence among men who have sex with men and other priority populations.⁴⁵ In South Africa, young people living with HIV, who sometimes face challenges in accessing care, responded well to an Android smartphone app for the delivery of HIV lab results, information, support and appointment reminders.⁴⁶ In an observational study at one hypertension clinic, use of a mobile app was associated with a significant reduction in blood pressure among highest-risk patients.⁴⁷ A study in Siberia found that a mobile app for linkage to and engagement with HIV care among people living with HIV, tuberculosis and substance use was associated with increased ART refills, fewer deaths and increased rates of viral suppression.⁴⁸ Incentivizing the creation and promotion of user-friendly health apps is an important opportunity to improve health service utilization and continuity.



Monitoring of clinical services

Communities are uniquely positioned to aid in the monitoring of clinical services and in holding governments and implementing partners accountable for providing good-quality, people-centered services. Community-led monitoring helps ensure that health monitoring and evaluation systems collect meaningful data on issues of importance to the users of health services. Community-led monitoring has been shown to improve service delivery and drive improvements in health infrastructure.⁴⁹

Digital tools are aiding communities as well as governments in monitoring the quality of clinical services. In the multi-component, PEPFAR-supported system for community-led monitoring, the starting point for monitoring is client feedback (either through a mobile phone app or on a secure tablet at the service site) on clinical service encounters.⁵⁰ In Moldova, an online platform enables governments, service providers and communities to track the effectiveness of HIV services and programs.⁵¹ Ensuring that community monitors have access to mobile technology and are linked to broader data collection and reporting systems offers an important opportunity to improve health services and make them more accountable.



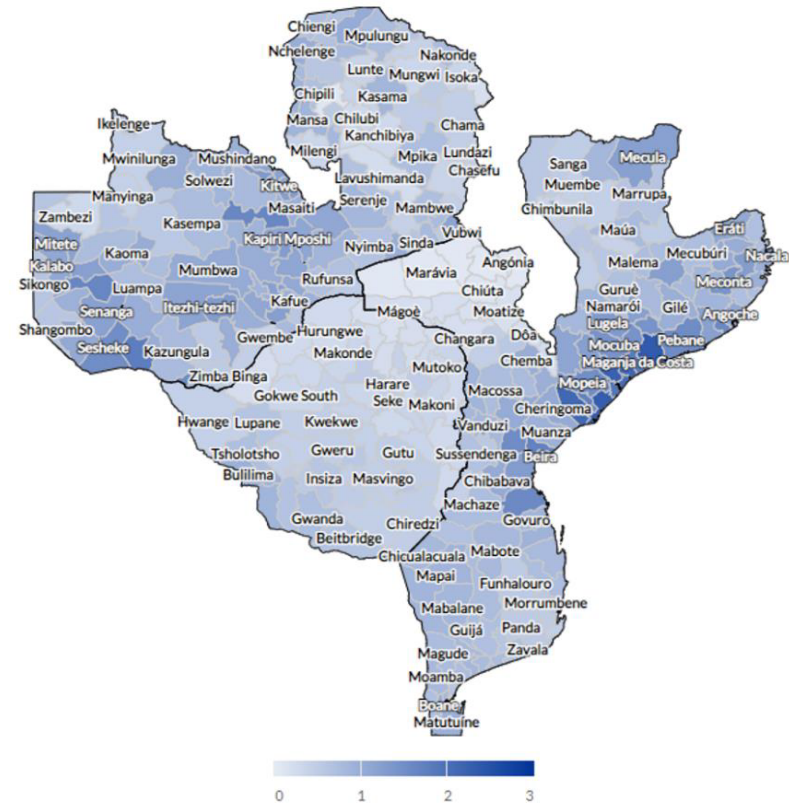
Technological support for health planning

Data visualization methods and other digital tools are supporting health planning, aiding health officials and program implementers to identify and address key gaps and inequities. To aid decision-making on COVID-19 and other health priorities, the Institute for Health Metrics and Evaluation generates a broad array of visual tools on disease trends and disparities.⁵² In a number of countries in Southern Africa, sub-national data have been used to develop “heat maps” that enable health planners to see where need is greatest and where service access and outcomes are falling short. For

example, such a visual tool is enabling program planners in Mozambique, Zambia and Zimbabwe to zero in on districts where adolescent girls and young women are at highest risk for HIV acquisition.⁵³ In Nigeria, results from electronic medical records have helped generate a map that stratifies the frequency of HIV treatment interruption by location and track the transition to optimal HIV treatment regimens, enabling national health authorities to target services more effectively to improve outcomes and improve health equity.⁵⁴

As more and more data move online, there is an opportunity to leverage large datasets to guide and inform health efforts. For example, analysis of the prevalence and patterns of social media mentions of HIV in South Africa revealed both geographic variations as well as examples of how civil society could better leverage social media to communicate HIV-related information to communities, such as enhancing use of Facebook and Instagram to communicate with the public.⁵⁵

SUB-NATIONAL ESTIMATES OF HIV INCIDENCE, ADOLESCENT GIRLS AND YOUNG WOMEN (AGED 15-24 YEARS), MOZAMBIQUE, ZAMBIA AND ZIMBABWE, DECEMBER 2020



Source: UNAIDS epidemiological estimates, 2021.



Social media

In 2022, more than 4.6 billion people, or over 58% of the world’s population, were using social media.⁵⁶ Social media has proven to have powerful effects on people’s attitudes and behaviors, linking people with one another, facilitating the growth of social movements and influencing public opinion. Although it can be challenging to quantify effects, there is emerging evidence that social media can promote healthy behaviors.⁵⁷ For example, social media plays an important role in self-care for many people with diabetes.⁵⁸ Social media users have contributed to the development of patient education and self-management tools for hypertension.⁵⁹ Social media also presents opportunities for encouraging healthy behaviors and health care service utilization among adolescents and young adults.⁶⁰ The Alliance for Advancing Health Online is a multi-partner project that uses social media to reduce vaccine hesitancy and promote equitable access to vaccination.⁶¹

In the context of HIV, a systematic review found that social media has bridged communication among a broad range of users, with the ability to share and receive HIV-related information cited as the single most important benefit.⁶² By linking young people, social media can help reduce HIV-related stigma and social isolation among those who have experienced trauma or are otherwise marginalized.⁶³

Social media also has the potential to increase access to health services. A 2017 systematic review found that social media interventions are effective in catalyzing HIV testing uptake among men who have sex with men.⁶⁴ A campaign by Blued, the largest social media network for gay men in China, resulted in a marked increase in HIV testing at six drop-in testing sites in Beijing.⁶⁵

At the same time that social media has enormous potential to improve health, it can also be a source of dangerous misinformation and disinformation. This has become especially apparent during the COVID-19 pandemic, when both social media and mass media published mountains of information and perspectives on the pandemic, many of them ill-informed and some of them nefarious.^{66, 67} In response, WHO has worked to combat COVID-19 misinformation through communications campaigns and other efforts.⁶⁸ Some social media companies have taken steps to improve their monitoring of false COVID-19 information on their platforms and to remove misinformation or misleading content.⁶⁹



Further innovations

Although the rapid evolution of digital technologies has transformed life in countless ways, we are likely only at the beginning stages of digital innovation in health. With respect to low- and middle-income countries, the immediate priority is to enable people to fully leverage existing technologies and devices, while ensuring the needs of these countries are taken into account as new innovations emerge. Emerging innovations will inevitably generate new technologies and applications that are relevant to health, such as the use of artificial intelligence for

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data analysis, to guide precision medicine, and to anticipate and prevent commodity stockouts. Rapidly identifying, evaluating and seizing new digital opportunities for health will require ongoing dialogue between key stakeholders, an entrepreneurial ethos and meaningful and fair balancing of the risks and benefits of new technologies.

Moving forward: Recommendations for effectively leveraging digital technologies for health

Efforts to leverage digital technologies for health must prioritize equity at every stage of the process – in assessing digital tools and applications for health, in balancing risks and benefits, in devising legal and regulatory frameworks for these tools, in developing and implementing roll-out strategies, and in monitoring the effects of digital tools on health access and outcomes. As digital tools have the potential to support and enhance virtually every aspect of health service planning, delivery and monitoring, a comprehensive, visionary effort is needed to ensure that health systems are fit for purpose in the digital age. As digital approaches are implemented, monitoring efforts must focus on whether and how these tools are being used to close health inequities.

Recommended action steps

- *Seize the opportunities presented by digital transformation to improve health care access and outcomes.* Concerted, prioritized efforts – synergizing and coordinating the efforts of global health programs, national health ministries, communities, the private sector and other stakeholders – are needed to transition from a fragmented and ad hoc approach to the use of digital technologies for health to one that is more thoughtful, strategic and inclusive.
- *Ensure connectivity.* Our ability as a global community to ensure equitable access to information and other global public goods will depend on the degree to which we are able to ensure that everyone, everywhere has digital access.
 - › As an essential first step, that means ensuring internet access for the 40% of the world’s population that currently lack it.⁷⁰ If digital tools and approaches are to have a meaningful impact on health and on reducing health inequities, major investments are needed with respect to connectivity, affordability and availability of mobile phones, broadband and telecommunications infrastructure, and removal of barriers to use of cloud technologies and data storage. The importance of connectivity has only recently been underscored by the threat the Russian invasion posed to internet access in Ukraine – a challenge that was resolved only when the billionaire Elon Musk intervened to ensure connectivity through his company’s Starlink system.⁷¹ Low- and middle-income countries

- both literally and figuratively need the bandwidth to leverage both *existing* and *future* digital technology.
- › Additional, important policy and implementation levers, such as digital identity, payments and infrastructure are cross-sectoral, and need to be addressed as a whole-of-government approach, while others, such as health worker cadre licensing, regulation and deployment are highly specific to the health sector.
- *Increase digital literacy.* Investments by donors, national governments, the private sector and other actors are needed to increase the capacity, facility and comfort of individuals, communities, health personnel and all of society to fully leverage and effectively use and navigate digital technologies.
- *Ensure inclusive dialogue, decision-making and action.* All stakeholders should be included in a collective effort to identify and bring to scale digital transformation that works for people. Key stakeholders whose participation is essential include civil society and affected communities; the tech industry; public health officials; donors; and key multilateral partners, such as WHO and the Global Fund (given its scalable and replicable inclusive multistakeholder governance and local ownership model).⁷²
 - › While global-level discussions are needed, these kinds of processes and platforms for dialogue are essential at the national and sub-national level in order to take account of the unique needs and circumstances of specific settings and communities.
 - › These discussions, as well as the decisions that arise from them, need to be premised on the open sharing of data to drive further innovation.
- *Forge genuine public-private partnerships.* The goal of public-private partnerships should be to generate win-win approaches that enable the public sector to fulfill its responsibility for protecting the health of people and securing equitable access to public health goods while also incentivizing and catalyzing marketable innovations in the private sector.
 - › Many of the challenges facing the digital transformation of national health systems can be seen as market failures, and merit the same kinds of market shaping approaches that have helped advance health innovations such as vaccines, diagnostics and medical devices. Through these partnerships and market shaping efforts, countries and communities can identify what they need, with the private sector stepping in to collaborate in formulating possible solutions.
 - › Digital tools and approaches that improve health workers’ jobs (including the ability of health systems to retain, motivate and enable life-long learning for health workers) should be prioritized.
 - › Further efforts are needed to leverage the efforts of multilateral entities to enable public-private partnerships for health, such as the WHO Tech Task Force and the Global Fund’s collaboration with the private sector on digital and other innovations to enhance the efficiency and impact of Global Fund grants.⁷³

Many of the challenges facing the digital transformation of national health systems can be seen as market failures, and merit the same kinds of market shaping approaches that have helped advance health innovations such as vaccines, diagnostics and medical devices.

Lancet-Financial Times Commission:
Four action areas

The recommendations here aim to build on and complement the priorities identified by the *Lancet-Financial Times Commission on governing health futures: growing up in a digital world*. The Commission recommended action in four areas:

1. “[D]ecision makers, health professionals, and researchers [should] consider – and address – digital technologies as increasingly important determinants of health.”
2. There is a need to “build a governance architecture that creates trust in digital health by enfranchising patients and vulnerable groups, ensuring health and digital rights, and regulating powerful players in the digital health ecosystem.”
3. The need to adopt “a new approach to the collection and use of health data based on the concept of data solidarity, with the aim of simultaneously protecting individual rights, promoting the public good potential of such data, and building a culture of data justice and equity.”
4. “[D]ecision makers [should] invest in the enablers of digitally transformed health systems, a task that will require strong country ownership of digital health strategies and clear investment roadmaps that help prioritize those technologies that are most needed at different levels of digital health maturity.”

- *Build public sector capacity.* Although private industry has a key role to play in developing digital innovations for health, governments in the end are responsible for ensuring the health and well-being of their populations. Governments play a central role in regulating digital transformation for health, including combatting misinformation and developing legal and regulatory frameworks to protect data privacy, confidentiality and security.
 - › Urgent efforts are needed to increase digital proficiency within the health sector and to build interoperability into data management systems. Essential capacities include enterprise architecture and health informatics specialties to ensure the appropriate selection and adoption of open standards for secure health data exchange.
 - › Health systems require the analytical capacity to sift through and analyze huge bodies of data and to engage with the digital industry to ensure that digital tools are informed by and not detached from governments and the communities that use health services.
 - › Investments are needed to sustain change management approaches and interventions to increase health data demand and use. Further efforts are needed to improve the nimbleness of WHO in approving new tools and applications as they emerge and are validated.
- *Monitor outcomes.* Although it is clear from available evidence that digital tools and approaches have an enormous potential to improve health access and outcomes, data remain spotty regarding which

digital approaches are most cost-effective – both as a general rule and in specific settings.

- › Concerted efforts are needed to ensure (through both careful planning and ongoing monitoring) that digital tools reduce rather than exacerbate inequalities.
- › Well-funded efforts are needed to build a robust evidence base and to broadly disseminate insights gained from such research to enable stakeholders to identify which digital innovations are working in specific settings (and why and how they are working) and how these innovations compare with each other in their effectiveness and cost. Findings from these efforts should be used to inform planning and drive uptake of the most effective innovations.
- *Mobilize resources.* The potential of digital technologies to improve health will be realized only if sufficient, sustainable funding is mobilized to support data-related activities. Domestic resource mobilization for health is critical, and technology can deliver more impact for each dollar spent. Still, tech innovations need to be locally implemented and supported with both national and donor resources. In this regard, countries should fully leverage funding opportunities for data innovations through the Global Fund, whose new strategy prioritizes digital innovations and digital capacity-building for HIV, TB, malaria and general health systems strengthening.⁷⁴

Science and innovation are global public goods that must be shared equitably across the world. Failing to address technological disparities will inevitably translate into countless millions of lives that are needlessly lost.

Conclusion

Innovation is a touchstone for contemporary life. Technological innovations continue to contribute to improved health and well-being in countries across the world.

But existing digital technologies need to be more widely accessible and leveraged in lower income countries or communities. Moreover, experience in health has shown that innovations can sometimes be a double-edged sword, especially with respect to considerations of equity. Science and innovation are global public goods that must be shared equitably across the world. Failing to address technological disparities will inevitably translate into countless millions of lives that are needlessly lost.

In the case of digital innovations for health, a field that is still young and growing exponentially, we have an opportunity to avoid the mistakes of the past. By ensuring that countries and communities are at the table from the outset – and by focusing first and foremost on the needs of the most vulnerable – we have the chance to forge a fairer – and healthier – digital future. In the case of infectious diseases, where no one is safe unless everyone is safe, the world has a shared interest in supporting and catalyzing the digital transformation of health systems in low- and middle-income countries.

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