



Accelerating Harmonization in Digital Health



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Abstract

Digital tools play an important role in supporting front-line health workers who deliver primary care. This paper explores the current state of efforts undertaken to move away from single-purpose applications of digital health towards integrated systems and solutions that align with national strategies. Through examples from health information systems, data and health worker training, this paper demonstrates how governments and stakeholders are working to integrate digital health services. We emphasize three factors as crucial for this integration: development and implementation of national digital health strategies; technical interoperability and collaborative approaches to ensure that digital health has an impact on the primary care level. Consolidation of technologies will enable an integrated, scalable approach to the use of digital health to support health workers.

Purpose: As this edition explores a paradigm shift towards harmonization in primary healthcare systems, this paper explores complementary efforts undertaken to move away from single-purpose applications of digital health towards integrated systems and solutions that align with national strategies. It describes a paradigm shift towards integrated and interoperable systems that respond to health workers' needs in training, data and health information; and calls for the consolidation and integration of digital health tools and approaches across health areas, functions and levels of the health system. It then considers the critical factors that must be in place to support this paradigm shift. This paper aims not only to describe steps taken to move from fractured pilots to effective systems, but to propose a new perspective focused on consolidation and collaboration guided by national digital health strategies.

Background: Integration in Primary Care and Digital Health

In a mixed methods research in Zambia, health workers in rural primary health cited access to technologies as a factor that enabled them to provide quality care through reduced reporting time, improved tracking of patient information and better access to health information. Health workers also cited lack of access to technologies as a factor that limited quality of care. Digital tools are often used to assist health workers in diagnosis, education and training, data collection and more (Agarwal et al. 2016). However, only 10% of technology-driven health interventions reach the desired level of integration and scale, with 45% stalling after 12 months (Scott and Mars 2013), and

58% of mobile health interventions addressing only one health domain (such as maternal health, nutrition or child health.) (Agarwal et al. 2016).

From a history of fragmented application of digital technologies, the field of digital health is placing increased emphasis on coordinated investments and implementations. Integrated, scalable systems guided by the Principles of Digital Development (Principles n.d.) can harmonize efforts across the health system, respond to health workers' needs and drive action around national strategies. This paper provides examples of efforts to improve alignment of digital health efforts to support health workers in three areas: data, health information systems and training.

To improve harmonization in digital health, we propose that three factors – strategy, interoperability and collaboration – are critical. (For purposes of this paper, interoperability is defined as “the extent to which systems and devices can exchange data, and interpret that shared data ... and subsequently present that data such that it can be understood by a user,” abridged from the definition used by HIMSS 2013.)

There is a recognized need to integrate systems, interventions and services in primary healthcare, not only in digital health (WHO 2016; WHO 2017). This requires a broader perspective on primary healthcare systems, paired with a focus on how primary care connects to other parts of the health system, and how to better integrate vertical programs (Frenk 2009). The use of information and communication technologies for health (hereafter “digital health”) can enable such integration; and in digital health, as in primary care, efforts are being made to move from single-purpose tools and deployments towards interoperable, nationally-owned structures (van Gemert-Pijnen et al. 2011). While this orientation is evident across the field of digital health, this paper draws on examples of digital health interventions and systems that support health workers in primary care.

Current State: Integrating Digital Health in Information, Data and Training

This paper documents efforts underway to improve integration of digital systems and actors in three critical areas: health information systems, data and training. These have been selected for their critical nature, applicability to health workforce needs and the volume of work that has been done in these areas. As technologies are introduced into primary healthcare systems, a holistic approach combining information systems, training and strengthening data use can address the challenges countries (and the

health workers themselves) face. These areas emphasize the need for digital development that responds to health workers’ needs, and illustrate principles and approaches that allow digital health interventions to be effective and sustainable.

The importance and interdependence of these three factors are evident in the context of outbreak prevention and response (Wilton Park 2015). A WHO consultation in 2015 aimed to develop global norms for data sharing and transparency during public health emergencies; and led to the agreement that timely exchange of information is critical for informed decisions about response. Data must be processed and stored, and stakeholders agreed that there was a clear need to enhance data management capacity, both in terms of technology support and expertise. (Modjarrad et al. 2016) The role of health workers in preparing for and responding to outbreaks has received less attention in the context of Ebola, but a well-trained, well-supported health workforce is arguably the most important factor in outbreak response. Nigeria’s ability to contain Ebola was availability of a health workforce with critical skills for prevention and response (Balajee et al. 2016). The importance of collection and sharing of data, the means for processing data to drive decisions and the assurance of a well-supported health workforce is equally applicable to the primary care setting.

Data collection, access and use

Data is critical at all levels of the health system, particularly at the primary level, to plan and provide timely health services to populations. For example, nurses delivering immunization services need patient data to evaluate the proportion of population their services are reaching, plan the amount of vaccine stock needed and to follow up with caretakers whose children who do not come for immunizations on time. Data can also help health workers to follow expectant

mothers through prenatal care and reach out to those who miss key appointments.

The use of technologies for data collection and reporting can save health workers time spent maintaining multiple paper register books and filling out paper reports from various data sources, while also decreasing the high risk of human error. Digital technologies also enable integration with analytical tools, enabling faster use of data through customized reports, dashboards and other data visualization tools.

Data can be used to address the complex roles and workflows health workers face daily. For example, the PATH Malaria Control and Evaluation Partnership in Africa project works with community health workers (CHWs) to monitor and report on malaria infections in their catchment areas. CHWs were provided with a basic mobile phone, which served as a motivating factor and enabled them to report data on infections in their catchment areas in a timely fashion. They were more easily able to communicate with other health workers in their area, connect patients with the local health facility and provide critical information to track trends and areas of high infection to target key interventions; and thus timely reporting of malaria infections has improved, helping to provide greater access to treatment (MACEPA 2017).

To improve healthcare outcomes, data provided by information systems must be usable and digestible by those who need it: notably health workers, district supervisors and policy makers. Data tools must be appropriate to the contexts and the users, as well as reliable, stable and suitable for their data use needs. When developing systems designed to assist front-line health workers in data collection and use, in-depth user input and feedback on the content and presentation of data, as well as the system development process itself, can help to ensure that systems meet the information needs of front-line health workers (Pakenham-Walsh and Bukachi 2009). Including health workers in

systems development contributes to the overall motivation of health workers and their ability to influence their work environment and align with larger efforts. Beyond (and often more successful than) financial incentives, motivating factors can include power to make or influence decisions, recognition and appreciation and overall support and sufficient resources to conduct their work (Franco et al. 2002).

Data have the potential to connect health workers to multiple levels of the health system, and it is critical to do so. A data use culture with strong practices around data collection and use for decisions will ensure that users sustain use of technologies, and make the technologies themselves more successful. Key ways to build an appreciation for the importance of accessing and using data include streamlining complex work flows, ensuring usability of data for practical purposes, motivating health workers to demand and appreciate data in their work and strengthening supervision and feedback loops (BID Initiative 2015). Hearing from superiors that the data they collect are important, and reviewing it with them, increases the value of that data to the individual health worker and makes them more likely to invest in the data use culture and adoption of technologies. The African Routine Immunization System Essential project found that the routine review of data and performance information were key to improving immunization coverage (Larson and LaFond 2011). To maximize the impact of data, many countries are adopting quarterly district-level meetings to review performance data and targets, or are incorporating data review into supportive supervision, to strengthen the value of data to health workers and strengthen decision-making throughout health service delivery.

Health information systems

For front-line health workers and policy makers alike, robust health information

systems (HIS) are needed to supply data for informed decision-making as described in the previous section. Recognizing the benefits of moving from paper records to digital systems, Ministries of Health and other stakeholders are turning to open-source systems to track health services, health workforce, commodities and records. This allows them to improve management, supervision, supplies and support for health workers. Health workers can also use HIS dashboards and other data visualization tools to inform decisions on how best to provide support to clients. Software code in open source systems is made freely available, saving costs from software and licensing fees and providing flexibility for countries to adapt tools to meet their needs.

Health management information systems provide tools to collect, manage, analyze and visualize aggregate data of health services at facilities. Over 60 countries are using DHIS 2, which was developed by the Health Information Systems Programme at the University of Oslo. DHIS 2 has capabilities for system interoperability with other systems. Interoperability makes it possible for data to be exchanged with other systems (such as messaging or supply chain systems) using common standards (DHIS 2 n.d.). Another open source and interoperable system is iHRIS, a human resource information system developed by IntraHealth International. iHRIS allows Ministries, professional councils and health service delivery organizations the ability to track and manage their health workforce. Over 20 countries are using iHRIS data to collect data that enable them to understand health workforce shortages, manage health worker distribution and aid in other health workforce needs (iHRIS n.d.).

Health information systems can connect health workers and clients with national institutions, such as Ministries and Councils. For example, in Uganda, the Medical and Dental Practitioners Council made licensure

information of 3,877 health workers in its iHRIS available to the public through a mobile directory (Bales 2013). Patients could send a text message to inquire if their provider was licensed or registered. This transparency cut down on “quacks,” and the proportion of physicians renewing their licenses increased from 42% to 57% in one year (Bales 2013).

Responsibility for the development and implementation of HIS sits not only with technologists and Ministry of Health officials, but can include front-line health workers. For example, the Government of Liberia is implementing mHero, a two-way SMS system that connects front-line health workers and the Ministry of Health. This is possible through interoperability between iHRIS and UNICEF’s RapidPro messaging platform. After receiving messages from mHero, front-line health workers can report information to the national level in real time. In November 2014, the Ministry used mHero to contact over 480 health workers to validate their information and track healthcare provision during the Ebola outbreak (IntraHealth International 2016). Since then, the Ministry has used mHero to contact over 8,000 public-sector health workers and more than 1,000 general community health volunteers in all 15 counties to validate information, access feedback on client services and inform health workers of trainings and events.

To improve the impact of HIS, governments and stakeholders are calling for investments in nationally scaled systems and facilitation of interoperability, ensuring data can be accessed and shared among systems. In many countries, efforts have been made to ensure efficient data management and increase data quality by establishing Master Facility Lists so that a facility list in DHIS 2 correctly matches a list in iHRIS. Several challenges to strong HIS exist, including insufficient investments in HIS; inefficient investments and fractured systems in data

collection and analysis; lack of in-country capacity to use and understand data and limited access to data (Health Data Collaborative 2015). National governments have been unable to keep pace with the investments needed to customize and implement HIS – including technological updates and investments in human capacity. Donors have struggled to align the investments needed for development and scale of HIS tools. To address these challenges, many lower- and middle-income countries (LMICs) are developing national digital health strategies and implementation roadmaps to establish a framework for their systems and processes to share data and using additional investments in system development and analytics training to build in-country capacity to develop, implement and scale robust HIS. Governments are also calling for data access, privacy and security and data sharing to be standardized; and for investments to be coordinated.

Education and training

Training is an essential element for health workers to be able to understand and act upon the data and information they receive, and to provide high quality primary care services. However, many argue that insufficient emphasis has been placed on ensuring front-line health workers receive adequate training. Many front-line health workers in remote areas receive inadequate training and

information, and are therefore working outside of their clinical and professional knowledge (Pakenham-Walsh and Bukachi 2009). Digital tools have played a large role in education and training of health workers who provide primary healthcare to communities (Agarwal et al. 2016), and digital tools have shown effectiveness in increasing providers' knowledge. Research indicates that digitally based distance education can be as effective (and in some cases more so) than face-to face-training (Zhao et al. 2005). Table 1 provides examples of results from existing distance education programs using mobile technology to help health workers improve their knowledge and skills.

As smartphones and tablets become more affordable and accessible, and mobile applications accommodate offline access, these tools can support education for both health workers and communities (Agarwal et al. 2015). Digital training tools can enhance client-provider dialogue and the delivery of health services. Pre-loaded videos can convey crucial information to health workers and initiate dialogue between a health worker and client. Unfortunately, fragmented implementations of digital health systems often reflect vertical approaches to supporting health workers in more traditional methods of training. In Uganda, for example, the Ministry of Health found that while 109 partners were supporting Village Health Team (VHT) activities, they

Table 1. Sample results of digital training programs

Project, country and population	Objective	Sample results
OppiaMobile: Ethiopia, Health Extension Workers	Reinforce HEW Training Curriculum in primary care	Very high levels of user acceptance long after the formal training program had ended (Levine et al. 2015)
iDEA: Nigeria, Midwives	Provide counselling training and clinical training	Midwives recognized need for behaviour change, showed improvement in post-test following use (Bailey and Little 2014)
Gyan Jyoti: India, ASHAs and Clients	Provide decision support for FP clients	Women who used Gyan Jyoti app more likely to adopt modern contraceptive methods (Johns Hopkins Center for Communication Programs 2015)
VTR Mobile: Nigeria, Primary Healthcare Workers	Provide training on antenatal, obstetric and newborn care	Average of 32% improvement in scores post training (Anadach Consulting, 2016)

motivated VHTs differently, had different reporting formats, and used training with different methodologies and durations (Uganda Ministry of Health 2015). This approach prevents standardization in training content and procedures and leads to inequitable access to trained health workers for communities; it will also contribute to increasingly disconnected digital support systems unless standards are enforced and implementation is managed accordingly.

Technology can coordinate the sharing, certification and centralization of training content for health workers, including the conversion of print materials to digital format. A central library for digital training content can make it possible for Ministries and stakeholders to access and approve content; ensure materials meet training requirements and help standardize materials. When paired with technologies to structure content and deliver it to health workers' devices, these technologies can facilitate equitable, sustainable delivery on a national scale (Bailey, 2016).

Through integration of technologies, training and data, HIS can provide harmonized services to health workers and clients (further described below, and in Figure 2). For example, a distance learning application could share information with a data collection application so that health workers' training progress (e.g., modules covered, videos shown, etc.) could be fed into HIS and shared with Ministries and Councils.

Discussion: Critical Factors to Accelerating the Paradigm Shift towards Integrated Systems

To accelerate and support a paradigm shift towards integrated digital health systems that respond to health workers' needs, three factors, among many, are critical: a clear national digital health strategy, interoperability among technologies and collaboration of actors in digital health and health systems. While these three elements do not present a complete solution to the complex

problems that exist, we propose that they provide the framework and environment necessary for meaningful impact of digital health solutions. We have selected these elements as factors that will enable improved alignment and use of existing resources, will have a tangible impact on health workers' work by easing administrative burden or improving their ability to provide high-quality care and, if not addressed, will contribute to worsening duplication within the digital health field.

National digital health strategies

Specific and actionable national digital health strategies are necessary to move away from fragmentation, and attract investments for sustainable solutions (Scott and Mars 2013). The International Telecommunication Union National eHealth Strategy Toolkit (2012) provides governments a comprehensive roadmap from which to develop digital health strategies. It recommends a National Digital Health Vision, National Digital Health Action Plan and National Digital Health Monitoring and Evaluation and advises engaging stakeholders early in the process. While such toolkits provide overall frameworks, strategies must be country-specific and consider the broader socio-economic, political and environmental contexts and their impact on health needs (Khoja et al. 2012).

For example, Liberia's Ministry of Health developed a collaborative strategy for health information system management in response to fragmented health data and systems; weak infrastructure; and a recognized need to strengthen its national health systems and facilitate interoperability (Fighting Ebola with Information 2017). The Ministry led a four-stage HIS Strategic Planning Process aimed to close gaps exacerbated by the Ebola outbreak and create a stronger framework for the country's health information. The development of the 2016–2021 HIS Strategic Plan coincided with the National Health Investment and Resilience Investment Plan.

The UN Broadband Commission for Sustainable Development (2017) explored levers influencing HIS and digital health strategies, and pointed to the importance of government leadership, governance and intra-governmental cooperation in digital health. It recommends that national visions for digital health be aligned with a country's health priorities, as well as the existing and projected capacity of its information and communication technology (ICT) infrastructure and systems. Sustained senior government leadership and committed financing are critical, as well as effective governance mechanisms and a national ICT framework.

Interoperability

A lack of interoperability between digital health technologies leads to duplication of effort, inability to share information and unnecessary limitations on the capabilities of technologies – all because systems used in the same country do not “talk” to each other. This can mean that health workers lack access to data that exist at regional or national levels and, if accessible, would help them make decisions to care for their communities. On a national level, a lack of interoperability hinders the development of an integrated set of digital services in a health system. At a 2013 BID Initiative meeting, participants from 11 African countries expressed frustration at the inability to share data among digital systems within their countries, and pointed towards lack of interoperability as a major barrier to sustainability and future utility of digital health solutions (BID Initiative 2015).

A 2016 report by the GSMA, an association of mobile operators, states that while the standards for interoperability are in fact available, a lack of adherence to existing open source standards is a primary barrier. Interoperability as a pillar of a country's health information system and the associated eHealth architecture can help countries address challenges as they implement,

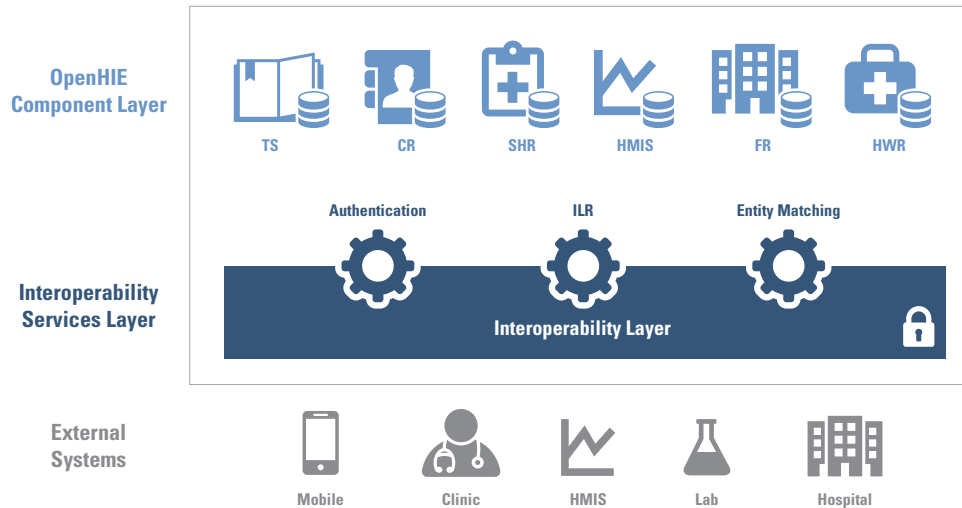
expand and adapt digital health solutions. An eHealth architecture lays the foundation for how data will flow through a health system, and acts as a blueprint detailing which HIS will be used, how they will connect to share data and what standards will be used to facilitate interoperability. In 2016, the government of Tanzania developed a roadmap of investments to strengthen all of their health data systems and data use. This extensive process laid out the necessary investments for the government to have the systems to effectively use data to improve the health of their population. A core aspect of the roadmap was being able to “connect and harmonize systems” and includes plans to develop governance, guidelines and standards for interoperability (Data Use Partnership 2016).

An emphasis on HIS interoperability has, in some cases, forced implementers and users to be collaborative and design systems to work together easily. The OpenHIE community is one example of how global implementers are addressing integration of data by creating a reusable architectural framework that leverages health information standards across systems. One key tool available through OpenHIE is an interoperability layer, which allows mobile applications to interact with each other and with the systems and infrastructure of the larger information system; meaning that data from multiple sources can be shared and used for decision-making (Figure 2).

Multi-stakeholder collaboration

We emphasize interoperability not only in terms of technical interoperability, but in its role to facilitate and enforce collaboration. The actors involved are equally critical to interoperable, integrated systems. This includes policy makers, and systems developers, but also health workers and users, who have the responsibility to engage in the demand and use of health training, data and information systems. Government actors must provide leadership and share

Figure 1. Sample information structure



Graphic: Adapted from OpenHIE n.d.

the commitment to achieve accessible, integrated digital systems that enable quality primary care services.

For sustainable national solutions to be possible, stakeholders must collaborate to change practices and overcome the present fragmented environment. Multi-stakeholder dialogues and processes can allow stakeholders from the nonprofit sector, donors and the private sector (among others) to develop shared action plans based on national strategies; acknowledge fragmentation; develop strategies for collaboration and align their activities and investments to national strategies (Ashraf et al. 2015). For example, a 2016 collaborative workshop for digital management in Pakistan brought together public and private sector representatives to examine the possibility of a shared interoperable platform to distribute digital health training content across the Sindh province. Participants recognized the use of duplicate and at times inappropriate technologies for the delivery of health information. This workshop also led to the acknowledgement that most proven digital technologies are already designed to operate at scale and that those technologies that provide critical services, (such as data collection and

information dissemination), do not need to be duplicated by multiple technologies across a single province.

On a global level, collaboration can also establish approaches and standards to be responsive to health workers' diverse roles and needs. The Principles for Digital Development (n.d.) guide the development and implementation of digital health initiatives, and provide a forum for stakeholders to share experiences on their use of these principles. Global guidelines codify a shared vision for digital health in primary care, but user-centered design and consideration of health priorities on national, regional and community levels, allow digital approaches to respond to the varied needs of health workers such as the diversity of CHW roles and definitions as described by Olaniran et al. (2017).

Looking Ahead: Consolidation for Harmonization

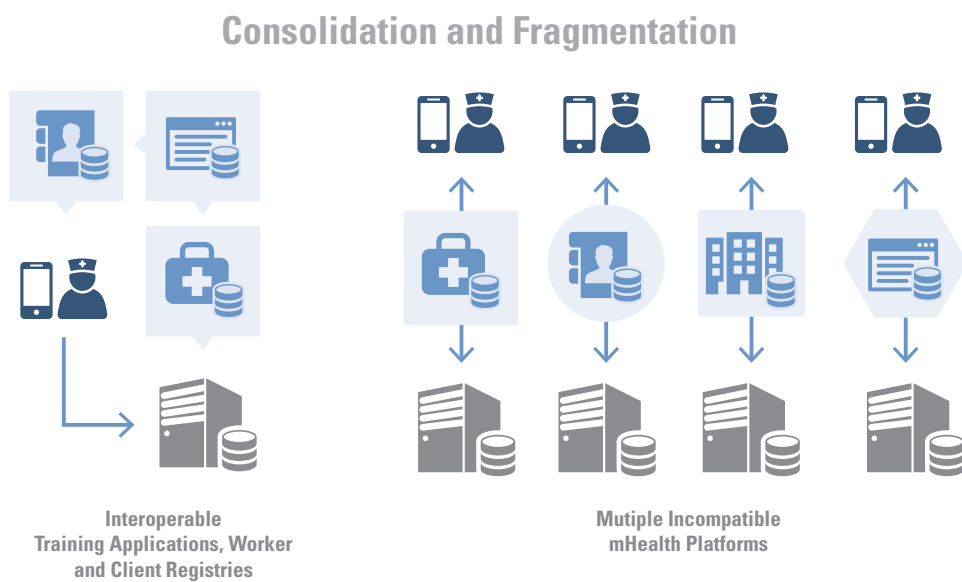
Technology plays a large part in making integration of health services possible. Increasingly, the challenge to accelerate harmonization and impact in digital health will be eliminating options that provide nearly identical functionality but fail to meet

criteria for sustainability (such as use of open source code). The volume of similar technologies in use for health is not sustainable, and for technology to be led by strategy, consistent with interoperability standards, and supported by collaboration, will require consolidation. By consolidating around systems that serve key functions (e.g., data collection, content dissemination, etc.), a government would be able to select, adapt and manage technologies to support their health workforces. For example, rather than developing separate training applications per health area, a single content delivery system would be able to disseminate training across cadres and health areas. For example, a single system could provide training to CHWs for HIV prevention, nurses for treatment, and community members for health education. A single data system could track vaccination coverage or community attitudes towards Ebola. This consolidation makes scale and interoperability possible; and until this consolidation takes place it will be difficult

for health systems to fully leverage the potential of digital health systems that respond to the complex needs of the health workforce. Figure 3 illustrates the potential of a set of interoperable technologies to meet key needs of the health workforce.

On the primary care level, digital tools can provide health workers with the training and data they need, and can provide governments with tools and information to support health workers. For digital technologies to support the integration of community health systems the paradigm must be shifted from single-purpose, time-limited, applications of technology, towards long-term, integrated systems that respond to health workers' needs, as well as the needs of the health system. This is not intended to limit innovation, but to aggregate efforts and resources towards an integrated approach led by national strategies with support from collaborative stakeholders, which can allow technology to truly support health workers who deliver primary care.

Figure 2. Interoperable technologies in support of health workforce



Note. Figure created by Mike Bailey. Icons adapted from OpenHIE n.d.

Summary

Digital health has demonstrated high potential to strengthen health systems, to support health workers and to improve primary care; but it has been hampered by short-term approaches that are not harmonized with other approaches or guided by national strategies. To change practices from this fragmented, duplicative approach, all actors must collaborate to support interoperable systems that serve key functions, are information agnostic, and are adaptable to different contexts. Meaningful collaboration between all actors – particularly health workers themselves – is essential to ensure that digital tools meet their potential to transform primary healthcare.

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