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Proven methods for expanding access to digital health services in developing and middle-income nations

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Abstract

Many digital projects have targeted healthcare difficulties in low and medium income countries (LMICs), with the goal of improving healthcare access and quality. These projects have progressed beyond the experimental and piloting stages and are now squarely focused on the need of efficient integration and scalability in order to provide long-term value to healthcare systems.

We have identified five essential emphasis areas based on real-life case studies of growing digital health in LMICs. First, with early feedback from end-users, the program or initiative's core features must provide real advantages to fill a demand. Second, the project's technological profile should be driven by simplicity, interoperability, and flexibility. Third, all stakeholders must be engaged, trained, and encouraged to execute the program. The fourth area of emphasis is the policy framework within which the digital healthcare initiative is expected to operate. Here, it is crucial that the initiative is in line with healthcare policy as a whole, and that there is enough, long-term financing to enable its expansion, with private sector funding being considered as necessary. The provision of suitable infrastructure to facilitate the adoption of digital initiatives at scale is an important aspect of the extrinsic ecosystem that should be evaluated last.

Innovative solutions may reach healthcare personnel and patients in LMICs if global collaboration toward a less-siloed strategy to scaling and integrating digital health can offer the leadership that is needed. From real-life case studies, this study draws lessons on how to scale digital health efforts in low- and middle-income countries (LMICs), and it discusses how these lessons could shape future health program design and execution.

Keywords: Digital health, Health policy, Health system, Intervention, low and middle income countries, mHealth, Programme sustainability

Background

In order to address certain healthcare issues, some digital health projects have been tested in low and medium income countries (LMICs). Incorporating ever-improving national health information systems and data exchanges, they make use of pervasive technology like mobile phone networks and gadgets. Digital health efforts are now aiming to improve health system procedures and health outcomes by focusing on scalability, integration, and sustainability as they progress beyond the pilot stage. Governments, partner agencies, and the private sector in low- and middle-income countries (LMICs) are eager to engage in projects that will have a noticeable and lasting effect on health program delivery, which is why there is a focus on size and sustainability. Experiential learning from low- and middle-income countries' (LMICs') digital health scaling and integration efforts has revealed inherent criteria and enabling circumstances that may back new initiatives to scale up and integrate seamlessly into healthcare systems. Based on real-life case studies presented at a Digital Health Dialogue in Ghana, this paper outlines important factors to consider when expanding digital health solutions in low- and middle-income countries. Considering the viewpoints of end-users, patients, healthcare policy makers, investors, and the unmet requirements within the relevant healthcare systems is essential in order to define "scale" and evaluate the effectiveness of digital health efforts that aim to scale. When a digital solution is no longer perceived as an independent entity, it might be considered a successful scaling. operation, but is integrated without a hitch into the healthcare system. Table 1 shows the potential aspirations for scale that the Program for Appropriate Technology in Health (PATH) has put out, in addition to integration. These include sustainability in terms of finance and government backing, as well as the capacity to duplicate, refine, and develop over time.

The mHealth Assessment and Planning for Scale Toolkit (MAPS) was created in 2015 by a joint effort between the WHO, the UN Foundation, and the Johns Hopkins University Global mHealth Initiative. It contains a self-scoring rubric that evaluates the maturity of digital health projects along six dimensions (Fig. 1) [2]. Lastly, the digital solution's impact on other health ecosystem players

is investigated by looking at external relationships and links [2].

Gaining hands-on experience with expanding digital health developments

Five key areas have been identified from real-life case studies of digital health initiative scaling and sustainability in LMICs: program characteristics, human factors, technical factors, healthcare ecosystem features, and the larger extrinsic ecosystem (Fig. 2). Planning for scale requires careful consideration of each of these components, but they must also work together as a system.

Table 1 Aspirations for investment in and scaling of digital healthcare innovations [1]

• Triggered and selected according to the needs of the health system
• Mandated and driven by the Ministry of Health (or country-specific equivalent)
• Enabled by committed, long-term funding and robust programme management so solutions have time and support to iterate, evolve and embed into existing systems and practices
• Built around realistic, long-term funding models
• Integrated into existing national platforms
• Selected and designed to conform to agreed standards
• Designed and implemented with the participation of the end-users and long-term implementers

All stakeholders, including end-users, legislators, and in-vestors, benefit from innovations that are both contextually relevant and beneficial (Table 2) [3]. It is usual practice to exclude end-users (e.g., frontline health workers, community-based clinicians, etc.) from the design and development process when government-led programs are concerned with funding decisions regarding information system tools [3]. As an example of how to scale digital health based on end-user data, a telemedicine initiative in Ghana was highlighted [4]. Community health workers in outlying areas and districts were the initiative's end-users, and their usage of mobile phones was crucial to its success. Sustained levels of adoption and usage were achieved in large part due to user-based design. With this, telemedicine services could be developed and implemented over the whole country of Ghana, which had a positive impact on the health system and led to less unnecessary hospital referrals.

Capturing and using real-time data is an often-overlooked opportunity in digital program design for scale. This includes making sure that policymakers, supervisors, end-users, and administrators of health systems have access to and are educated to utilise real-time information. Health care providers may be motivated by peer comparisons or distance-from-targets, and users can improve their own performance tracking. Additionally, the incenti-sation process can be made more transparent, which can improve results. This is often a big departure from the usual monthly or yearly reporting, and it may need new policies, training, and accountability measures. This potential might be lost if there isn't enough decentralisation to enable local decision-making using real-time data. Benefiting frontline healthcare workers greatly, the CommCare platform [5] permits real-time monitoring and immediate data entry, which decreases average data entry timelines and enables healthcare workers to immediately monitor their adherence to protocols or identify areas that needed improvement [6, 7]. By analysing real-time data, not only can performance be improved, but scalability and further expenditure may be justified. The Ministry of Health in Bangladesh digitises paper records in maternal and child health using the Open Smart Register Platform [8, 9]. Individual patient data may be synchronised, duplication can be reduced, and critical data can be sent directly to the national health information system using this method. Health center performance may be fine-tuned and programs can be scaled up with the use of real-time dashboards that allow managers at both the local and national levels to monitor and compare data.

Human factors

To achieve scale, it is critical that end-users are also mo-tivated, trained and prepared to fully embrace and utilise

Fig. 1 Conceptual model of the MAPS Toolkit to measure digital health project maturity across six axes [2]

any digital health solution. Effective, sustainable support systems and training, as well as clarity on roles and ac-countability for decision-making and supervisory struc-tures are essential components. Often, improvements in health systems can fail to provide adequate training for the supervisors of frontline workers equipped with new technologies, potentially excluding them from an infor-mation flow that was built around multiple layers of quality control and oversight. Experience has shown that any training should be easy to replicate and to roll-out at large for end-users across locations.

A highlighted example of effective end-user training was the community-based hypertension improvement project (ComHIP) in the Eastern Region of Ghana, which offered training to licensed chemical sellers in the community to screen for hypertension and provide adequate health

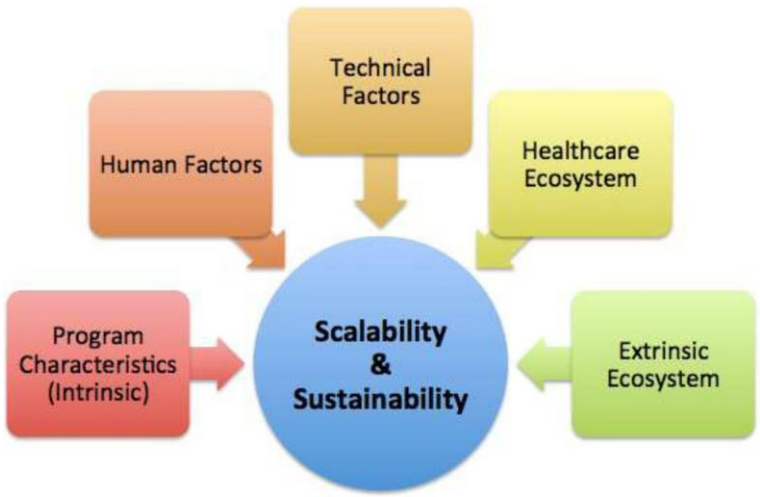

Fig. 2 Practical considerations for scaling digital health initiatives in LMICs

Table 2 Principles for Digital Development, a consensus statement of best practices (2014) [3]

• Design with the user
• Understand the existing ecosystem
• Design for scale
• Build for sustainability
• Be data-driven
• User open standards, open data, open-source and open innovation
• Reuse and improve
• Address privacy and security
• Be collaborative

providing hypertension education and information to their clients [10, 11]. The hypertension screening and diagnostic chances in a peri-urban region of sub-Saharan Africa are maximised by this strategy, which is supported by a comprehensive digital health platform, and chronic disease treatment is brought closer to the community [11]. Referral sites, community health professionals, and licensed chemical merchants are all brought together by the digital health platform. Additionally, it gives people greater agency over their own health care. One way that digital health is helping to relieve pressure on primary healthcare systems that are frequently overwhelmed is via this innovative initiative [10, 11]. Reusing and recycling already-existing technology is another way to deal with the problem of new digital health projects requiring training and support. In Kenya, the M-TIBA mobile health wallet was developed using the M-PESA technology, which is already in use for digital money transfers [12]. Users were able to pay for healthcare services using savings accounts and a simple mobile payment system. The widespread use of M-PESA made it easy for the M-TIBA mobile health wallet to gain traction and expand quickly throughout Kenya. In terms of long-term financing, technical know-how, and operational efficacy, this project exemplifies the advantages of private sector engagement.

One ongoing issue in settings with limited resources is the potential for digital advances to bring forth more scrutiny of efficiency and performance, which might reveal institutional dysfunctions. In order to properly prepare for scale, it is necessary to think about and comprehend such elements as inertia, resistance to change, competing priorities, insufficient training, disengagement, and unclear roles and duties. Last but not least, programs' plans to scale up must take human resource capability into account. There is a critical shortage of qualified technical personnel with backgrounds in health informatics, information science, statistics, and technology management.

This could be a problem when trying to scale up operations unless schools are willing to fund the creation of better employees and the implementation of pre- and in-service training programs.

Issues pertaining to technology

Scalability and sustainability in the digital health endeavour are highly dependent on technical elements, both internal and external. Functional simplicity may be an important "technical" attribute to think about. According to a recent worldwide evaluation of technologies used by frontline health workers, simpler systems may be easier to scale than complicated ones with numerous functionalities [13]. Who knows whether this is because of problems with the technology or because it's hard to get people on board with a more complex solution. It seems that under risk-averse policy and budgetary contexts, it is similarly difficult to get stakeholder acceptability for sophisticated technology. When it comes to simpler solutions, the external environment isn't always a deciding factor. Instead, stronger cellular channels like voice, SMS, IVR, or USSD (unstructured supplementary service data) are commonly used. Several digital health innovations have been able to quickly scale up due to their inherent simplicity. For example, the mDiabetes Project in Senegal offers daily health advice to diabetes patients through SMS [14], and BBC Mobile Kunji in Bihar helps community health workers counsel families through audiovisual aids [15].

A new worldwide alliance called the Health Data Collaborative (HDC) and the Principles for Digital Development [3] include interoperability as one of its primary focus areas. Systems that are interoperable are able to "talk" to one another and, more crucially, exchange information in order to minimise paperwork, ease the load on patients and their families, and increase the impact of teamwork. In 2012, the Ugandan Ministry of Health imposed a ban on mobile health initiatives due to the growing number of standalone initiatives that were not exchanging data or integrating with the existing healthcare infrastructure [16]. This decision was a watershed moment in the history of using ICT for development, as it

acknowledged that the fragmented environment was not exclusive to Uganda but rather mirrored the situation in many other nations. Small, poorly-funded innovation programs with good intentions have been working in isolation, solving individual health issues in a top-down fashion, and failing to improve the health system as a whole. This has led to a rise in funding for "global goods" that promote interoperability, such as the CIEL Concept Dictionary and other terminology services, as well as open-source health information exchange (HIE) architecture, which aids in the development of collaborative services (such as patient identities, facility registries, and workforce registers) [16, 18]. Data storage, access, and confidentiality were among issues highlighted by the case studies as obstacles to scalability, along with software's inability to communicate with one another and adapt to new needs. Smaller systems are often designed with a single project or pilot in mind, therefore they aren't scalable to handle a large influx of users without experiencing regular malfunctions. There was consensus that digital health solutions' scalability and extensibility help them gain traction. To facilitate adaption and promote interoperability, widely used systems including CommCare, OpenSRP, OpenMRS, and OpenDataKit [5, 19-21] are being used. The many health programs that have adopted and modified the CommCare model for implementation and expansion attest to its efficacy and usefulness [22]. Different CommCare deployments will soon be able to communicate and exchange data thanks to the platform's newly available HIE functionality [5].

The healthcare system

The environment is just as crucial as the program, the people, and the technology when it comes to the digital health initiative's ability to operate at scale. This encompasses monetary backing that permits operations to be sustainable over the long term as well as regulatory frameworks and standards that guarantee adherence to national health plans and recommendations. It is challenging to develop solutions for scale in many situations due to the lack of robust digital health regulations and standards. Emerging digital health regulations may be better informed by close cooperation with government stakeholders and other policymakers, who can also advise technical teams about regulatory changes that are about to be implemented. The Ugandan government decided to integrate digital health's aims into a larger national health strategy, as seen in the country's mHealth moratorium [16]. In contrast, the ComHIP initiative in Ghana exemplifies how to use current technology to manage chronic illnesses in low- and middle-income countries (LMICs) without involving policymakers [11]. To better educate patients on their nutritional health, medication adherence, and follow-up visits, ComHIP uses mobile phones to deliver daily reminders.

Case studies have highlighted the requirement of sustainable finance as an external factor. Initial planning for a digital health program's finance should focus on ensuring the program can continue to operate in the future, which may include public-private partnerships or the inclusion of contingencies to accommodate changes. Private sources provide for an estimated 60% of healthcare funding in Africa, with individual nations' healthcare circumstances influencing the exact contributions and funding mechanisms [23]. During the initial setup and pilot phase, a public-private partnership supplied funds and expertise to the Ghana telemedicine services; thereafter, local ownership was completely established [4]. The Ghana Health Service is now footing the bill for the initiative's operations and upkeep, and it's up to the local health authorities to implement the national telemedicine plan [4]. Similarly, funders and private sector partners in South Africa's MomConnect program financed its early stages as a public-private collaboration [24]. The program became available to all pregnant women in South Africa as a free government service in 2015 after being incorporated into the National Department of Health.

When thinking about how to scale digital health programs, it's also necessary to have a plan B. Emergence of new infections or the escalation of existing illnesses are two examples of how health-care priorities in LMICs may shift quickly. The latest Ebola outbreak exemplifies the necessity to redirect healthcare resources (both financial and human) in order to respond quickly. Nonetheless, the worldwide digital health community was able to assess its preparedness and ability to react to crises thanks to this lesson. The mHERO platform, which was developed during and after the Ebola crisis, is an excellent example of an open-source, built-for-scale system. It integrates several systems, including the Integrated Human Resource Information System (iHRIS) for workforce management, the RapidPro text messaging platform from the UN Children's Fund (UNICEF), the District Health Information System (DHIS2), and the Open Health Information Exchange (OpenHIE) backbone. mHERO aims to use robust, existing solutions to support information and communication needs in West Africa and beyond [26].

Conclusions

This manuscript's suggestions are based on case studies from real-world programs and interviews with professionals who were open about their experiences with digital health in low- and middle-income countries (LMICs). Digital health is a relatively new field in international development, therefore there will be many iterations of standards and recommendations for best practices. However, the guiding principles established in these five areas

should remain relevant for the foreseeable future. First and foremost, there has to be a dedication to fixing problems with current procedures and full participation from all stakeholders. The technological capability to increase the number of users, flexibility, and connectedness to national and parallel networks might be considered while honing a program's preparation for scale. In order to scale up their innovations, digital health pioneers must push for funding of the necessary external components. The scalability of digital health advances will undoubtedly be hindered by inconsistencies in rules and standards as well as an unreliable infrastructure.

Stakeholders should work closely together from the beginning all the way to scaling up. We can get closer to effectively scaling up digital health solutions in LMICs to meet unmet requirements by using the views and experience of various end-users, technology providers, health policy makers, and healthcare program administrators. The program's scaling procedure must be malleable enough to accommodate changes in the system's human or technological requirements. Initiating and growing digital health projects is a key responsibility of the private sector, which is contingent upon the healthcare policy climate [23]. The private sector may be able to provide infrastructural assistance, finance, and knowledge in areas where public sector resources are exhausted. To guarantee the long-term viability and scalability of digital health projects, it is crucial to have a clear understanding of the kind and length of the partnership [23].
Just as a seed needs a fertile environment to thrive, the most promising digital health solutions could not flourish unless those circumstances are just right. Multiple worldwide efforts are now underway to facilitate the expansion of effective digital health programs. Optimal circumstances for scaling, including the enabling policy environment, demands in human resources capabilities, and technical infrastructure, were defined in 2012 in the WHO-International Telecommunications Union (ITU) toolbox for national eHealth initiatives [29]. The reliability of the nation's power system, the reach of cellular networks in outlying areas, and the need of strong government support for digital health are all examples of issues that are beyond the control of specific initiatives. Project managers, on the other hand, play a crucial role in shaping and propelling this national goal forward. Members of the digital health ecosystem have been brought together via Advisory Committees established by the Ministry of Health or the Central Government in South Africa, India, Rwanda, and Uganda to push for better conditions for digital health. In an effort to improve health data through shared investments in 'global goods,' to accelerate progress and scale-up of successful digital health solutions, multilateral initiatives such as Digital Square and the previously mentioned HDC are working together with international agencies, governments, philanthropies, and donors [30–33]. To aid Advisory Committees and Government Agencies in establishing, expanding, and maintaining digital health innovations, these worldwide commodities cover a wide variety of topics, from policy recommendations to foundational technology. Sharing investments in particular nations and global products is one way the HDC intends to fix the current problem of donors not working together. The HDC's goal is to improve health and decision-making by bolstering national information systems [31]. Figure 3 shows the several HDC working groups that will be recommending tools for nations to gather, evaluate, and use health data. These tools will include standards, indicators, and more [34]. In terms of making digital health solutions more scalable, this may be a huge deal. Novartis Foundation and Nokia headed the digital health working group that submitted its report to the Broadband Commission for Sustainable Development at the start of 2017 [35]. The research delves deeply into the need of dedicated and persistent leadership as a prerequisite for digital health to reach its full potential.

Fig. 3 Working groups of the Health Data Collaborative (2016) [34]

Over the next decade, the trajectory of digital health to-wards scale will certainly continue to evolve and accelerate. In the past 10 years, we have witnessed a mobile phone revolution that has connected the most distant communi-ties. If Moore's 1965 law, which predicts the doubling of computer processing capacity every 18–24 months [36], holds true for digital health, we will continue to observe rapid increases in internet access and potential digital solu-tions to health problems. Digital innovations will continue to extend connectivity to the last mile of populations and it is difficult to anticipate how health systems will absorb and mainstream these technologies. In addition to the further democratisation of health information, the ubiquity and lower cost of technology may make the adoption and scale-up of innovation easier. Although not discussed enough, the possible risks associated with digital health innovations need to be considered. For example, the rapid spread of misinformation through social media or unscrupulous use of health information to promote self-medication make it essential for implementers to take responsibility to 'first do no harm'. Finally, it remains im-perative that the global health community doesn't grow enamoured with technology as an end in itself, but insists that digital innovation is a means to an end focused on solving problems, improving health, and saving lives. Only by realising the full potential of digital health, and provid-ing appropriate leadership, can we accelerate the achieve-ment of sustainable development goal 3, Health for All.

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