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Tech-enabled primary healthcare innovation in Africa

A framework, a rapid scan, and early reflections

BRIEF ONE

Introduction

Strengthening primary healthcare (PHC) is paramount to achieving the Sustainable Development Goal of universal health coverage (UHC) by 2030 because it is central to providing cost-effective healthcare. This is especially critical in low- and middle-income countries (LMICs), where there is a need to do more with the available funding[1] – a situation which has become further exacerbated by the economy-linked effects of Covid-19. If used effectively, PHC can reduce costs at higher levels of care by preventing disease progression and managing illness in its initial phases. However, in many contexts, PHC has to be re-engineered, and new approaches to care delivery experimented with in order to initiate contact with users, retain patients, promote greater access, equity, and quality, and move to greater cost-effectiveness.

> "The introduction of tech-enabled PHC delivery models may provide the leverage required to strengthen the system by improving access, quality and efficiency of care"

ABOUT THIS SERIES

This series of five briefs describes the current use of tech-enabled PHC tools in Sub-Saharan Africa. We highlight the key lessons and insights from some of the leaders in innovation, and put forward the enablers and constraints that exist in this resource-constrained setting.

Enhancing the impact of the PHC system through novel innovations may lead to UHC more rapidly.[1] The introduction of tech-enabled PHC delivery models may provide the leverage required to strengthen the system by improving access, quality and efficiency of care.[2] However, the uptake of tech-enabled solutions has been slow. This has been, in part, due to restrictive legislation and policy, which has mostly aimed to protect patient data, ensure informed consent and prevent litigation.[3] More conducive policies have been further delayed due to a lack of international guidelines and no existing central bodies controlling the implementation of telehealth solutions. In sub-Saharan Africa, a lack of enabling information technology (IT) infrastructure has also been a barrier to entry for innovators.[3] Financially, many LMICs have been unwilling to invest in telehealth due to large start-up costs and due to a lack of coverage by insurers of telehealth solutions.

Covid-19 is creating opportunities for the rapid growth and evolution of tech-enabled healthcare delivery models. Many countries instituted national lockdown strategies to control the spread of the disease. This resulted in the

shutdown of healthcare facilities and instilled fear of contracting the virus when accessing healthcare services in many, both of which led to a drop-off in routine care. Due to the high burden of non-communicable diseases and HIV, this was recognised as detrimental. The need to re-establish ongoing care drove the initiation of virtual consultations and other telehealth solutions. Lessons in virtual care have been taken from China, the epicentre of the disease, where the transformation towards virtual care took place when the national health insurance entity agreed to fund virtual consultations.[4] The need for rapid adaptation to a global pandemic led countries worldwide to waive or adjust policy and regulation surrounding the implementation of virtual health services. Whether these regulations will be maintained following the pandemic remains to be seen. Covid-19-linked recessions have further accentuated the need for models that deliver PHC in more cost-effective ways.

This is the first of a series of briefs that aims to provide a deeper understanding of innovative PHC models observed in sub-Saharan Africa. It does so by interrogating the tools developed in response to the needs of each country within its health system context, and by providing recommendations for the further rollout and implementation of these technology-enabled solutions. Recently, many of these models have responded in some way to the health system challenges posed by Covid-19. While this is not the focus of the briefs, where appropriate and relevant, we explain how models have been adjusted and influenced to deal with the pandemic.

This first brief describes the landscape of the PHC tech-enabled tools developed for and currently available in sub-Saharan Africa. It does so to address gaps in evidence, to provide a framework to catalogue these innovations, and to reflect on the lessons and insights that can be drawn. The aim of the proposed framework is to allow for consistency and enable further innovation in areas where gaps have been identified.

This is not an exhaustive list of innovative technologies within the sub-Saharan PHC space. These are novel tech-enabled healthcare models that are used at various points in the patient's or provider's journey of care and result in a change in the patient's journey through the healthcare system. Many of these innovations can also be incorporated at multiple points in the chain of care. Although these innovations are primarily situated at the PHC level of service, some may feed into higher levels of care, e.g. patient triage models that connect the primary and higher levels.

ACRONYMS AND ABBREVIATIONS

IT	Information Technology
LMICs	Low- and middle-income countires
PHC	Primary health care
UHC	Universal health coverage

SECTION 1

A framework for tech-enabled PHC innovations

Although the tech-enabled PHC innovation landscape is large and varied, a lack of a consistent framework and classification system makes it difficult to have coherent conversations about model types, similarities, and differences. Moreover, the development of a consistently used framework could enable health-sector stakeholders to communicate more clearly about the nature of models, their benefits, and limitations. It also allows innovators and developers of tech-enabled tools to identify gaps in the innovation landscape.

This communication is essential for ensuring that innovation takes place optimally, and that experiences of innovators and innovations in varied contexts are shared.

For the purposes of this note, we have developed a functional categorisation of tech-enabled PHC innovations. Given that most new, innovative health delivery models leverage technology in some way, a categorisation that focuses on virtual health tools can be a useful way of looking at available models and tools (Table 1).

Table 1: Definitions of tech-enabled health innovations[5]

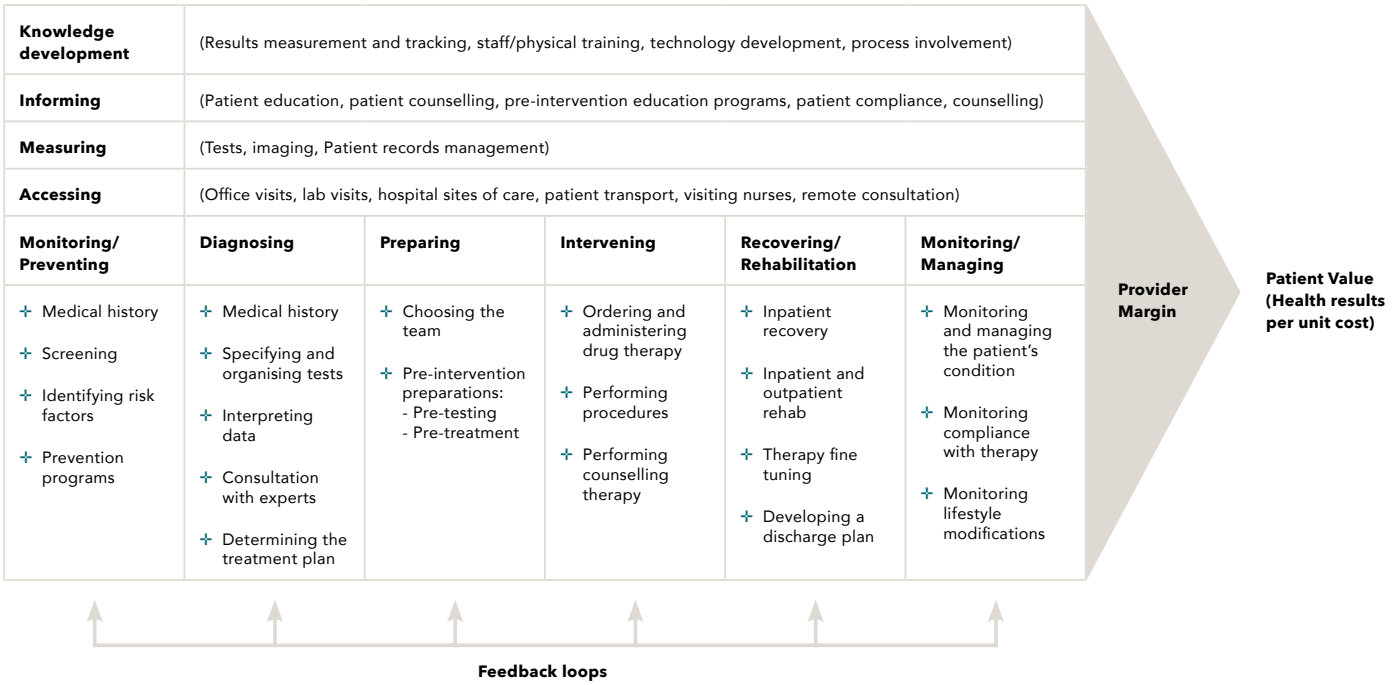
TECHNOLOGY CATEGORIES	MODES OF HEALTHCARE DELIVERY	FUNCTION OF THE INNOVATION	EXAMPLE OF HEALTH DELIVERY
Telehealth	**Synchronous**	Live, two-way audio-visual interaction between patients and providers **(Direct-to-Patient). Telemedicine** refers to synchronous telehealth services provided by physicians only.[6] Live, two-way interaction between provider and provider **(Provider-to-Provider)**	Video conference visits Video conference review of pharmacy prescriptions Sending a lab test, X-ray, or MRI to a specialist to request a clinical opinion
	Asynchronous (store and forward)	**Provider-to-Provider** transmission of recorded health history **Provider-to-Patient** transmission of patient information	Sending a lab test, X-ray, or MRI to a specialist to request a clinical opinion A provider emailing/texting a patient to check on them in post-visit follow-up; a patient sharing photos of a skin rash for review and diagnosis
	Remote patient monitoring	Collection of electronic personal health/medical data which is transmitted for review by a remote provider	

Table 1: Definitions of tech-enabled health innovations[5] ***(continued)***

TECHNOLOGY CATEGORIES	MODES OF HEALTHCARE DELIVERY	FUNCTION OF THE INNOVATION	EXAMPLE OF HEALTH DELIVERY
Digital therapeutics	**Replacement therapies**	Evidenced-based therapeutic interventions which leverage software to prevent, manage, or treat a medical condition, in lieu of conventional treatments	Digital behavioural intervention for diabetes
	Treatment optimisation	Optimises medication, extending the value of pharmaceutical treatments	Improving medication adherence, monitoring side effects of medication
Care navigation	**Patient self-directed care**	Patients accessing their own information	Messaging to remind women of their family planning history and to nudge the next engagement
	e-triage	Tools that provide support in searching for and scheduling appropriate care based on symptoms/ conditions, as well as price and quality of providers	

We have combined the commonly used technology-related classification with the adapted healthcare delivery value chain proposed by Michael Porter and Elizabeth Teisberg (Figure 1).[7] As this framework is mostly informed by experiences in the American health system, we have adapted it to the context of LMICs in sub-Saharan Africa through the cases presented below. It may also be useful for thinking about the same types of innovations in LMICs on other continents. However, in this brief we only showcase African models.

Figure 1: Michael Porter and Elizabeth Teisberg's healthcare delivery value chain[7]



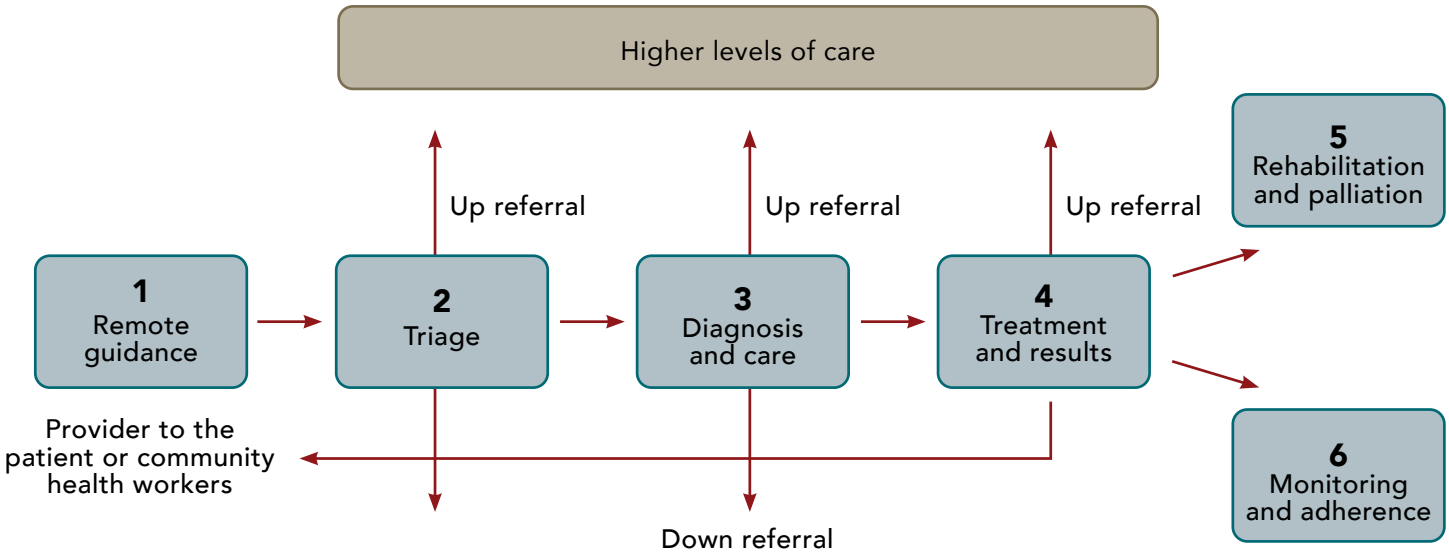
It is important to recognise that innovation does not only occur in terms of the use of technology but also in terms of other important areas of care delivery, such as care measurement innovation (e.g. measurement of business processes, the creation of tools for adaptive management, measurement of patient-reported outcomes) and on the payment side of delivery (e.g. an explicit move away from fee-for-service to a more value-based approach to care payment). However, for the purposes of this note we adopt a strong technology lens when assessing PHC innovations.

A strong focus has been placed on strengthening PHC in sub-Saharan African and increasing community participation and empowerment. This has strongly guided the direction of innovation. As such, we have created a framework that aims to address the unique focus and needs of sub-Saharan African countries.

The proposed framework classifies the identified innovation according to the relevant technology-related categories and places the innovation at a specific point in the patient journey in the context of a PHC system. This includes **remote guidance, triage, diagnosis and care, treatment and results, rehabilitation and palliation, and monitoring and adherence** (Figure 2).

Care is initially provided to patients by community health workers, which have been largely advocated for by the WHO.[8] The community health worker will either provide the necessary support to the patient or refer them to a local healthcare facility. This is a form of triage at the PHC level but can also link to higher levels of care. Patients may also present to a facility or health professional where their condition is evaluated, and they are triaged to the appropriate point of care. The patient may then be seen by a primary care practitioner and receive an assessment, which leads to a potential diagnosis and treatment. This may be an acute episode that only requires once off treatment. However, in the case of chronic conditions, patients may require chronic treatment or rehabilitation. In cases where the patient is terminally ill, palliative care may also be provided. At any point in the patient journey, the patient may be referred to higher levels of care if the condition is more severe than the primary care facility is equipped to deal with.

Figure 2: The flow of a patient through the PHC system



This framework for PHC innovations can potentially be of use to both innovators and health service delivery policy makers. It highlights areas for possible innovation, while placing the patient journey and health system at the forefront, in keeping with a patient-centred approach.

SECTION 2

Mapping of African innovations

Through a wide internet-based search of tech-enabled PHC innovation in sub-Saharan Africa, we have identified some PHC delivery models that have created a fundamental shift in the journey of the patient through the health system. We have used a combination of frameworks to classify the identified innovations. This includes the categorisation of the technology used and the point in the patient's PHC journey in which it is applied. We have categorised the models according to their main functionality. However, these models may evolve over time, and as such, their main classification may change. Our classification is intended to help identify trends and gaps in the service delivery landscape.

Initial and ongoing patient engagement with the health system plays an important role in creating good health outcomes and cannot be ignored. The innovations we encountered tended to be focused on shifting the patient's journey through the system, as opposed to stimulating demand for care. As most countries in sub-Saharan Africa struggle with a high burden of disease, addressing the demand for healthcare is vital.[9]

The models included are all focused on improving PHC in sub-Saharan Africa, although some may transverse other levels of care.

Table 2: Models focused on providing remote guidance to community health workers or directly to patients

INNOVATION	COUNTRY	TYPE OF eHEALTH	DESCRIPTION	CHANGE CREATED	LEVEL OF CARE
SaferMom	Nigeria	Care Navigation, patient self-directed care	The cloud system allows new or expecting mothers to receive vital pregnancy and postnatal information via SMS, voice services and an app.	Mothers are able to receive health information and improved health literacy without requiring contact with the health system.	PHC only.
Ubenwa	Nigeria	Care Navigation, patient self-directed care	The mobile app analyses the sound of a child's cry in order to translate the cry based on the child's need and diagnose perinatal asphyxia.	Parents are able to be alerted of a possible diagnosis and seek care while addressing the child's needs.	PHC. May be used at higher levels of care by practitioners and may result in parents seeking care if alerted to by the app.
Triggerise	Kenya	Care Navigation, patient self-directed care	The Tiko platform creates digital ecosystems that connect patients with providers. It also provides nudges to patients, encouraging them to seek care.	Patients receive digital reminders and are able to access the network of providers using the digital platform.	PHC only. The platform also includes community organisations and micro-entrepreneurs.

Table 2: Models focused on providing remote guidance to community health workers or directly to patients ***(continued)***

PROVIDER FOCUSED					
Leap mHealth	Kenya	Telehealth	Field healthcare workers are able to use any mobile device to access guidance related to diagnosing, treating and monitoring health conditions.	Healthcare workers are able to access information remotely, improving the efficiency and quality of care.	PHC only.
LivingGoods	Kenya, Uganda	Telehealth, Remote patient monitoring	The smartphone app allows community health workers to access guidance, store data and monitor for outbreaks.	The quality of care provided is enhanced and patient data can be accessed remotely.	PHC Data may be sent and received by higher levels of care.
mHero	DRC, Uganda, Kenya, Liberia, Sierra Leone, Guinea, Mali	Telehealth	The platform allows healthcare workers to receive and store data through platforms that are already in use. Messages from government and guidelines can be sent to health workers, while patient data can be stored and communicated.	The efficiency of the system is improved through rapid communication between levels of care.	Multiple levels of care.
Medic Mobile	Uganda, Kenya, Ghana, Ethiopia, Malawi, Liberia, Zambia, Zanzibar, Tanzania, Nigeria, DRC	Telehealth, asynchronous	The digital Community Health Toolkit provides a platform for providers to monitor deliveries, track outbreaks faster, treat illnesses door-to-door, keep stock of essential medicines, and communicate about emergencies.	Consolidation of information to create a more efficient system.	Communication may take place between providers at multiple levels of care.
upSCALE	Mozambique		A smartphone app assists community health workers register patients and provides guidelines that assist with diagnosis, advice and referral. Supervisors are also able to use the app to monitor patient data.	The quality of care provided is enhanced and patient data can be accessed.	PHC National departments may access data captured on disease trends.

Table 3: Models focused on triaging patients

INNOVATION	COUNTRY	TYPE OF eHEALTH	DESCRIPTION	CHANGE CREATED	LEVEL OF CARE
ThinkMD	South Africa, Zambia, Somalia, Kenya	Care Navigation, e-triage	The digital platform allows patients to access information that guides them as to the next steps to take.	This increases access to medical knowledge and decentralises care.	PHC. Patients may access higher levels of care once triaged.

Table 4: Models focused on providing a diagnosis and patient care/management

INNOVATION	COUNTRY	TYPE OF eHEALTH	DESCRIPTION	CHANGE CREATED	LEVEL OF CARE
mDoc	Nigeria	Telehealth, synchronous and asynchronous	The digital platform allows patients with chronic illnesses to access clinical support online.	The healthcare system is decongested as more chronic illness patients access care from their homes	PHC only.
Vonage	Uganda	Telehealth, synchronous	Patients are able to contact healthcare workers directed and received a medical diagnosis virtually.	The healthcare system is decongested as more chronic illness patients access care from their homes.	PHC only.
babyl	Rwanda	Telehealth, digital therapeutics	The patient is able to receive the full spectrum of care virtually – from booking appointments to consultation and care.	The healthcare system is decongested as more chronic illness patients access care from their homes.	PHC only.
APMIS Health	Nigeria	Telehealth, synchronous and asynchronous	Patients are able to make contact with health providers, view results and refill prescriptions.	Patients are able to access information remotely.	PHC only.
Management Systems Thalamus	Nigeria, Ghana and South Africa	Telehealth, synchronous and asynchronous	Patients are able to make contact with health providers, view results and refill prescriptions.	Patients are able to access information remotely.	PHC only.

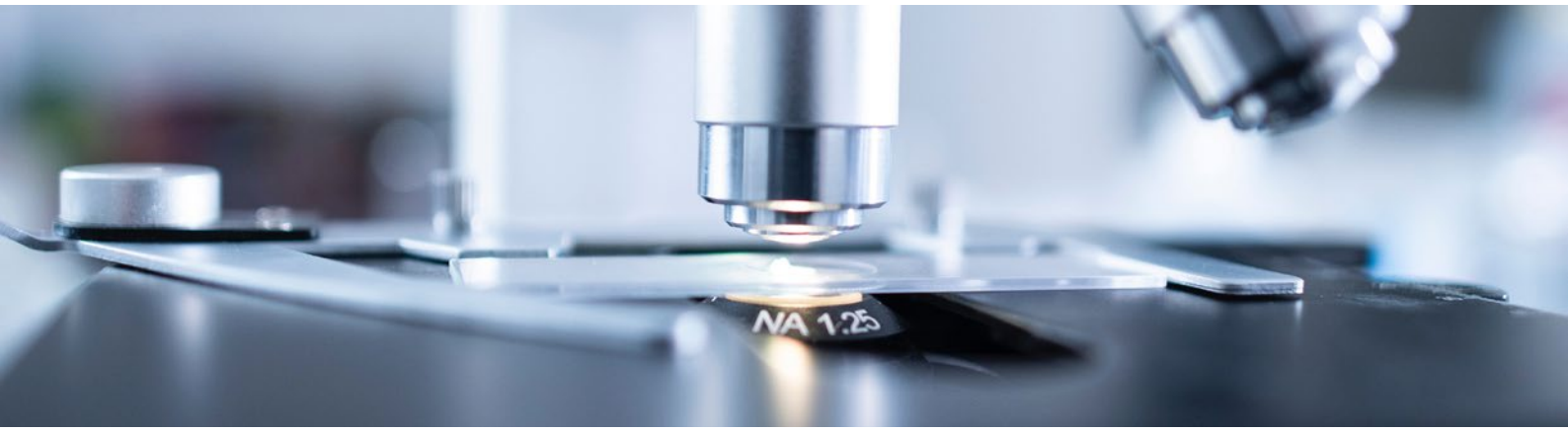


Table 5: Models focused on the treatment of patients and receiving results

INNOVATION	COUNTRY	TYPE OF eHEALTH	DESCRIPTION	CHANGE CREATED	LEVEL OF CARE
babyl	Rwanda	Telehealth, digital therapeutics	The patient is able to receive prescriptions and laboratory orders digitally.	Patients do not need to access the health system as they are sent the required documentation digitally.	PHC only.

Table 6: Models focused on monitoring and adherence

INNOVATION	COUNTRY	TYPE OF eHEALTH	DESCRIPTION	CHANGE CREATED	LEVEL OF CARE
CompanionApp	Rwanda	Telehealth, synchronous, treatment optimisation	HIV-positive patients and healthcare workers are connected via a mobile app that allows for monitoring and encourages adherence.	Decentralisation of care.	May be used at multiple levels of care.

SECTION 3

Reflections and learnings from the model landscape

From the brief overview of the tech-enabled PHC landscape in sub-Saharan Africa, it is evident that innovation in healthcare is fast developing and there are a variety of nuanced and rich models being created in response to the specific healthcare challenges experienced. With time and experimentation, overburdened healthcare systems will increasingly be able to run more efficiently and effectively with the strategic incorporation of these technologic solutions. However, because many of these innovations focus on a specific point in the patient's journey or a specific part of the system, they have limited ability to ensure overall continuity of care and continued engagement with the PHC system.

"With time and experimentation, overburdened healthcare systems will increasingly be able to run more efficiently and effectively with the strategic incorporation of these technologic solutions."

Much of the innovation supports remote guidance. Several digital platforms, such as Leap and LivingGoods, aim to provide healthcare workers, in particular community health workers, with remote guidance and knowledge while in the field. The focus of innovation in this area may be as a result of the current spotlight placed on community healthcare workers, particularly in underserved areas of Africa, following the release of the WHO guideline on health policy and system support to optimise community health worker programmes.[8] This guideline has emphasised the incorporation of community healthcare workers in order to tackle the burden of disease and address issues of inequality. The emphasis on innovation at the primary level of care may also be a response to resourcing constraints at the PHC level. The WHO has also highlighted the need to increase resourcing at the PHC level in order to improve access to basic care along with prevention and promotion activities.[10] It is thus only natural for innovations to occur at the level where the most emphasis is placed on improving access to care.

"These forms of care, after users have adapted to receiving care remotely, can also increase patient agency and contribute to delivering person-centred care if users are able to access care at times and in places more convenient to them."

There is a focus on decentralised patient care to decongest facilities but to also enable person-centred care. Another focus has been on decentralising patient care by providing diagnosis and treatment virtually, using comprehensive digital tools such as babyl. These platforms tackle the

longstanding issue of overburdened healthcare systems in Africa, with provider-to-patient ratios far lower than recommended.[11] Along with providing virtual care to patients through telehealth solutions, e-triage has also gained some popularity as a means of decongesting the health system. The recent Covid-19 pandemic demonstrates the usefulness of this approach. Not only do e-triage systems allow patients to access care from home, but they also help prevent non-essential visits, further preventing exposure to diseases within health facilities. These forms of care, after users have adapted to receiving care remotely, can also increase patient agency and contribute to delivering person-centred care if users are able to access care at times and in places more convenient to them.

Rehabilitation, palliation, monitoring and adherence support are still lacking, reflecting the mostly curative nature of healthcare. Although a significant emphasis is placed on maintaining the health of the community through primary, secondary and tertiary prevention strategies as part of the PHC approach,[12] these principles appear to be neglected in the innovation space. Few (and in some cases, none) tech-enabled tools have been developed to address rehabilitation, palliation, monitoring and adherence support required to maintain and support the health of populations. This is of particular importance in many parts of sub-Saharan Africa where chronic infectious diseases are highly prevalent. Notably, there is also an evident lack of innovation in areas that address the soft skills required during patient-provider interactions. This is particularly noteworthy with the current global emphasis placed on patient-centred care in mind.

Innovation is concentrated in specific countries and sectors. PHC innovation is primarily taking place in countries such as Nigeria, Rwanda, Kenya, Uganda, and Ghana, with less evidence of innovation occurring in other countries in the rest of sub-Sharan Africa. These countries, with the exception of Rwanda, all have large populations, are mostly middle or upper-middle income countries, and are often observed to have large technology sectors with a recent boom in the digital industry.[13,14] This may act as the driver for innovation in these areas due to the availability of digital resources required for the development of tech-enabled healthcare tools. Further, in countries where innovation is more widespread, it occurs most frequently in the private sector, with little involvement of or clear linkages back to the public health sector. This is likely due to the need for private funding to drive innovation and the development of novel healthcare tools and, in certain countries, also to fill capacity gaps. This does not, however, mean that the innovations have to or should remain limited to the private sector and cannot be adjusted or funded for public sector use.

SECTION

4 Moving forward

> "These innovations are all trying to address various health system constraints by promoting potentially more efficient, decentralised care."

This initial broad scan of available tech-enabled healthcare models and tools at the PHC level in sub-Saharan Africa shows that there are multiple examples available. These innovations are all trying to address various health system constraints by promoting potentially more efficient, decentralised care. However, big questions remain about the contributions of these models. Some of these questions will be explored in greater detail in future briefs where we provide more detailed descriptions and evaluations of how specific types of models leverage technology, integrate with the PHC system, interact with patients, and collect data. These questions include:

- Has there been sufficient take-up by patients and users to demonstrably contribute to patient outcomes?
- Are these models necessarily more cost effective than more traditional ways of providing healthcare? If not, what amendments/changes will be required to maximise their impact?
- Are the solutions scalable across multiple settings?
- Do the models seamlessly integrate with PHC systems, or are they contributing to further fragmentation in healthcare delivery?
- Do the models collect sufficient data and integrate this with existing PHC and healthcare data systems so that patient triage does occur and patients are followed through the system?

In this first brief, which forms part of a series of briefs exploring PHC innovation in sub-Saharan Africa, we have proposed a framework and categorisation, and a series of case examples. Through this, we are able to draw tentative lessons on gaps in the innovation space that can still be filled. Moving forward, we aim to refine this framework and our learnings by taking a deeper dive into individual models in the PHC innovation space.

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