

EXECUTIVE SUMMARY

ASSESSMENT OF DIAGNOSTIC GAPS AND RELEVANT DIGITAL HEALTH SOLUTIONS IN UGANDA

INTRODUCTION

This assessment identifies the priority diagnostic gaps in Uganda and the relevant digital health solutions that can address those gaps.

The findings are based on interviews with 10 in-country experts that included government, implementing partners (IPs), patient advocates and digital health experts/vendors, as well as desk research. Diagnostic gaps were identified within the context of disease burden and the diagnostic patient pathway, inclusive of pre-point of care (pre-POC) stages of health information seeking and

early care-seeking, and point of care (POC) stages at the facility level, consisting of screening, diagnosis, linkage to treatment and treatment monitoring. Identified diagnostic gaps were prioritized based on their direct impact to patient health outcomes, stakeholder feedback, and the extent to which the gap affects multiple stages in the patient pathway. Relevant digital health solutions and the barriers and enablers of their scale were identified based on a broad landscaping and stakeholder feedback.

COUNTRY CONTEXT AND DISEASE BURDEN

Uganda is a low-income country in East Africa with a very young and rapidly growing population of 42 million people, half of whom are under the age of 15 and two thirds of whom reside in rural areas. Similar to many countries in sub-Saharan Africa, Uganda's healthcare system is significantly underfunded. Domestic spending on health per capita has decreased almost 40% over the last 15 years, resulting in an ongoing strain on health resources.¹ This was a key root concern cited impacting the accessibility and quality of primary health care (PHC) services.

Although diagnostic guidelines enable appropriate POC testing at PHC, with an established referral structure², the lowest levels of care are significantly under-resourced. Healthcare is delivered through a referral-based facility model, with the public sector comprising almost half of all available facilities nationally³. However, stakeholders report that 60% of the population access the private sector for basic health services, due to patients' lack of access and lower confidence in public sector services. The

Ministry of Health (MOH) deploys Village Health Team (VHT) volunteers who work as community health workers (CHWs) and provide significant support to PHC, especially in the rural areas where the proportion of skilled healthcare workers (HCWs) is lower than other settings; however, geographic coverage of these VHT volunteers is not consistent.^{4,5} Diagnostic service guidelines also vary based on level. Community-based basic rapid diagnostic tests can be delivered through VHTs and at healthcare (HC) level II facilities, and laboratory services are expected at HC III level and above, increasing in range and complexity at higher level facilities. The public national laboratory network is largely decentralized, disease-centric and hospital-based, governed by the MOH's Central Public Health Laboratory (CPHL).^{6,7,8} Support from donors, particularly on malaria, HIV/AIDS and tuberculosis (TB), have contributed to strengthening of the laboratory network and availability of diagnostics services for these diseases over the last decade in Uganda, especially at higher level facilities and hub laboratories.

DIAGNOSTIC GAPS IN THE CONTEXT OF DISEASE BURDEN

Uganda's disease burden is dominated by infectious and maternal, newborn and child health (MNCH) diseases, with a growing burden of non-communicable diseases (NCDs). Around 54% of all deaths in Uganda are from the combined categories of communicable, maternal, neonatal and nutritional diseases, and the top five causes of morbidity and mortality include neonatal disorders, HIV/AIDS, malaria, lower respiratory infections and TB. Although NCDs are not as prevalent as infectious diseases, they still account for 33% of all deaths.⁹ Rapid population growth, urbanization, lifestyle transition, and air pollution have contributed to the growing burden of NCDs in Uganda.¹⁰ In addition, the growth of antimicrobial resistance was noted as an area of rising concern.

With government and IP support, Uganda has experienced gains in closing diagnostic gaps in infectious disease case-finding and treatment monitoring over the past ten years. However, diagnosis for malaria is often skipped in favour of obtaining treatment and with 35% of TB cases in 2018 undetected, case-finding is still an area of priority.¹¹

Under-five mortality is decreasing thanks to community case management approach.
Community screening for malaria in rural Uganda.



Uganda's maternal, neonatal and under-five mortality rates are still two to four times higher than their respective Sustainable Development Goal targets and above the average rates in sub-Saharan Africa.¹ An integrated community case management approach to diagnosing and treating malaria, diarrhoea and pneumonia has contributed to halving under-five mortality between 2007 and 2017. However, among the remaining challenges to improve MNCH-related health outcomes, the availability of integrated antenatal care screening and ultrasound testing at lower levels is an important and contributing gap.

MOH, donor and IP priorities are aligned with infectious disease and MNCH burden statistics but the increasing prevalence of NCDs has not translated into domestic or donor funding, with little advocacy from patients. This has left a growing need to provide education, diagnostics and care for key NCDs, such as cardiovascular disease, diabetes and cancers. However, providing quality care for NCDs in a low-resource environment is expensive and challenging, demonstrated by the lack of diagnostics tools, equipment and specialists in the public or private sector in Uganda.

“There has been less focus on NCDs. It has been difficult to get patients with NCDs coming together, like for diabetes or cancer. Movement creation has been difficult and hence [establishing a] voice to create action around this area has been difficult”.

– Patient advocate, Uganda

DIAGNOSTIC GAPS IN THE PATIENT PATHWAY

Pre-POC stages were stated as fundamental and significant barriers to driving demand for diagnostic services. These barriers cause patients to delay engagement with the health system until they are seriously ill, as their efforts in seeking care are costly in time and money, and often unfruitful.

THE HIGH-PRIORITY PRE-POC GAPS ARE:

- 01 Lack of access to accurate, timely and trusted information.** Trusted influencers at community level, such as VHT members or traditional and religious leaders are not well-equipped to support health education and information dissemination. VHT members are regularly under-resourced and lack sufficient training and traditional and religious leaders are not usually qualified to provide health advice.
- 02 Low perception of health service quality, leading to reduced patient trust.** Patients have low confidence in being able to obtain quality health services from the public sector, based on previous poor patient experiences. This is reflected in patient-facing concerns such as unfriendly HCW, long wait times and a lack of available diagnostics services, creating a cycle of avoidance in seeking diagnosis and care, driving patients to the private sector where cost can be another barrier.

At the POC level, the under-resourced health system has led to continuing and severe gaps in physical and power infrastructure, human resources and supplies, especially at the district level. In-country facility surveys^{12,13,14} and stakeholder feedback indicate that the basic diagnostic services expected at PHC is very limited at HC levels II and III, with much better availability of rapid diagnostic tests and basic diagnostic equipment at HC level IV, the highest PHC level. Overall, variable and inadequate financial and operational capacity at the district level drives gaps in access to high-quality diagnostic service delivery.

THE HIGH-PRIORITY POC GAPS ARE:

- 01 Poor physical infrastructure and power supply.** Major inequity exists in the availability of facilities between rural and urban areas, which can range from 0.4 facilities per 10 000 population in a remote and rural region (Yumbe) to 8.4 per 10 000 population in urban Kampala, requiring patients to travel long physical distances to facilities. Additionally, significant infrastructural gaps are a key barrier to service provision, such as the absence of electricity and essential general equipment, affecting the viability of diagnostic sample collection and storage.
 - 02 Inadequate availability and capacity of HCWs.** Uganda experiences understaffed, overburdened and under-trained VHTs and PHC HCW teams. Nationally, Uganda has 14 HCWs (doctors, nurses, midwives) per 10 000 people, only a third of the minimum of 44.5 per 10 000 people recommended by the World Health Organization.¹⁶ HCWs are disproportionately found in urban areas and unavailability is cited as high in rural and remote areas.⁵ VHT coverage is heavily partner-supported and considered insufficient, primarily due to a lack of domestic funding.¹⁷ HCWs at PHC often lack the knowledge and skills to deliver quality screening or diagnosis, worsening quality of experience for the patient. Laboratory staff also face shortages due to deprioritized resourcing and training, especially at lower levels.⁶
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- “Workforce at facilities are never ever adequate to support diagnostics services. [So we have] non-formal health workers performing laboratory tests”.*
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- MOH representative, Uganda**
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03 Insufficient availability of diagnostic tests and equipment. Although the situation has improved over the last few years for key infectious diseases, stakeholders emphasize that shortages of the basic tests, reagents and equipment are still frequent at HC II and III facilities.^{14,15} This is driven by inaccurate quantification, procurement planning and uncoordinated supply chain logistics for diagnostic commodities and equipment¹⁸, partly a result of a stronger focus on medicines and the greater complexity of managing diagnostic supplies. In higher-level PHC facilities (HC IV), the availability of basic tests is not an issue but still gaps appear, especially for NCD-specific testing.¹³ Weak supply chain capacity and coordination, especially at district level, reduces the overall effectiveness of last mile distribution.

04 Lack of interoperability between information management systems and/or applications. Having access to diagnostic results is dependent on building interoperability solutions between the laboratory information management systems, diagnostic devices, data sets from other programmes, electronic medical record systems and other in-field digital health solutions. This has been challenging to coordinate and fragmented donor activities have created parallel systems, without a common standard approach to interoperability. The need for better linkage and integration of laboratory and facility-level surveillance data in Uganda's disease surveillance programme was also highlighted.

“[There is] limited communication between platforms (government and donor) due to no standardization to allow open data exchange of health information across platforms”.

– Digital Health Expert and Implementing Partner, Uganda

05 Health data not used for clinical or programmatic decision-making. Utilization of data at both central and district level tends to be restricted to reporting purposes, with limited evidence of use for clinical or programmatic decision-making This is in part due to limited technical and analytical capacity at the MOH or CPHL and poor infrastructure. Additionally, paper-based repositories of unused patient data at facility and district level hinders the use of data to empower frontline HCWs to provide better services for patients.

“Every patient is seen as a new patient during every consultation as there is no recorded history to either trace previous diagnostics, treatment or health condition”.

– MOH representative, Uganda

Lack of basic tests, reagents and equipments is frequent in type II healthcare facilities with the consequence of low diagnostic capacities.



RELEVANT DIGITAL HEALTH SOLUTIONS

Digital health solutions can help address several of the high-priority gaps identified, summarized further below. The following recommendations take into account Uganda's low digital maturity level, behind the moderate average digital maturity of the sub-Saharan African region.^{19,20} However, Uganda's government is building a positive enabling environment for information, communication and technology (ICT) intervention in health and is in the process of developing the second iteration of its digital health strategy.

BARRIERS TO SCALE

Widespread implementation of digital health solutions at lower levels in Uganda has been challenged by a lack of sustainable operational funding and technical management capacity for scale, limited power, digital infrastructure and digital user skills at PHC level and/or in rural areas. Additionally, fragmented and donor-dependent financing results in parallel systems that are not compliant to the same programmatic and/or technical standards, creating silos.

ENABLERS OF SCALE

Although the MOH has shown promising efforts in evaluating, approving and coordinating the various digital health solutions in the country, this process is still evolving. Opportunities to strengthen decision-making frameworks, guidelines and/or regulations for the implementation of digital diagnostic health solutions, in a way that specifically considers the constraints of the government and Uganda's digital maturity trends, can be explored. Selected digital solutions for MOH investment should prioritize those that ensure interoperability with other systems

and integration with existing workflows, connect to a unique patient identifier, such as the Ugandan national ID, is built with simple, configurable and modular design that demonstrates scalability in low-resource environments, illustrate a roadmap to sustainable financing and generates value for its end-users by addressing their key pain-points.

DISEASE FOCUS

Based on the diagnostic gaps observed from a disease-specific lens, digital health solutions can help address case-finding gaps for TB, motivate the uptake of testing for malaria, improve access and quality of integrated antenatal care screening and increase diagnosis of childhood illnesses, specifically pneumonia and diarrhoea. With the Ugandan government and most IPs focused on 'the big three' disease areas of HIV/AIDS, malaria and TB, there is ample opportunity to bring focus to NCDs and build awareness, routine screening and diagnosis, particularly for cardiovascular disease and its major drivers, diabetes and hypertension. However, increasing demand for screening and diagnostics is most effective when treatment is adequately available in country, which is not currently the case for certain NCDs like cancer.



Enabling digital solutions at lower health centre levels increases the use of data for decision making by HCWs.

PATIENT PATHWAY:

- 01 Pre-POC: improving access to accurate, timely and trusted information to increase efficient care-seeking.** Solutions that address pre-POC diagnostic gaps by targeting patients with accurate and relevant health information via basic mobile phone via short message service (SMS) messaging, unstructured supplementary service data (USSD) codes, WhatsApp social media like Facebook would help address the considerable need for health education and drive demand for earlier screening and diagnosis. These solutions should also be championed by trusted patient influencers, such as VHT members and traditional/religious leaders. These types of solutions can be expanded to other health areas, as they have been mostly MNCH-focused in Uganda and globally. Although such solutions have demonstrated promising impact, it has been small scale to date. With more dedicated support to the MOH to operationalize scale up within available resources, these solutions could be valuable to improve knowledge about diseases with high prevalence, such as NCDs, and promote early care-seeking for diagnosis and treatment.
- 02 POC: improving existing capacity of frontline VHT members and HCWs at PHC to increase the quality of screening and diagnosis and strengthen referral, especially in rural areas.** Solutions that address POC diagnostic gaps related to quality of care are best targeted to VHT members and HCWs in PHC. Mobile applications that provide job aids, screening and diagnosis workflows and/or clinical decision support to VHT members have been implemented in Uganda with moderate scale but good response from users. These types of solutions could be scaled up to aid in screening and diagnosis for other neglected or new health areas. Providing dedicated support to the government would help optimize the available resources for scale up of such solutions.
- 03 POC: increasing the availability of key diagnostic commodities and equipment to improve access to POC diagnostics, especially in rural areas.** Solutions that address POC diagnostic gaps around availability of commodities and equipment are best targeted to HCWs and district-level health system or supply chain personnel, to improve capacity. These can include simple digital job aids and automated tools to improve rational ordering or stock inventory management, especially as diagnostic supply management is considered more complex than for medicines. SMS or USSD code mechanisms have proven effective for reporting of facility data in Uganda and should be followed up with the strengthening of district capacity to respond and resolve issues.
- 04 POC: bringing screening and diagnostics closer to the patient through telemedicine and mobile digital diagnostics will improve access to accurate diagnosis.** Solutions that overcome topography and health infrastructure barriers can reach patients where they are and improve access to accurate diagnosis. Although not directly observed in Uganda, these solutions should be targeted to HCWs as holistic clinical decision support initiatives. They include provider-to-provider telemedicine and physically mobile vehicles that house a combination of artificial intelligence-powered software, telemedicine and connectivity solutions to provide rapid diagnosis and referral. Significant support is needed to design these solutions in a cost-effective way, with financial and operational commitment to the longer timelines required for expansion.
- 05 POC: bringing focus to disease prevention and screening to identify health risks, diagnose disease and target intervention earlier.** Mobile digital solutions that leverage geo-localization to facilitate individual case identification, contact tracing, and targeted alerts to individuals and the government enables real-time surveillance of on-going disease burden and speeds up the response and management of unanticipated outbreaks. Additionally, digital solutions that are tailored to support the integration and/or bundling of basic tests, provide an opportunity for the early identification of at-risk patients and faster intervention.
- 06 POC: supporting central, state and frontline HCWs to utilize data more effectively for decision-making.** Improving the use of data for decision-making, both clinical and programmatic, is critical to improving health outcomes. Interoperability solutions to connect the different disease-specific laboratory, logistics and electronic health information management systems would enable the utilization of data in a patient-centric way. Additionally, interventions that leverage the current functionality of existing digital systems could be used to provide visual data summaries for HCWs. Leveraging existing functionality of implemented digital systems or building configurable extensions can enable central and district-level HCWs, including laboratory staff, to use visual data summaries in an actionable way for programmatic intervention.

As mobile penetration and ICT literacy grows in Uganda's young population, scale-up of digital health tools will be necessary to optimize the nation's limited resources and increase access to quality diagnostic services at the lower levels of health services. Looking forward, Uganda's long history and lessons learned from its various digital health solutions' proof-of-concept experiences, combined with the recent spotlight on diagnostics from COVID-19 positions Uganda well to narrow down its focus on expanding digital intervention in diagnostics where it is needed most - at the frontlines of service delivery.

ACRONYMS, ABBREVIATIONS AND DEFINITIONS

CPHL: Central Public Health Laboratory

HCW: Healthcare worker

HC: Health centre

IP: Implementing partners

MNCH: Maternal, neonatal and child health

MOH: Ministry of Health, Uganda

NCD: Non-communicable disease

PHC: Primary health care

POC: Point of care

SMS: short message service

TB: Tuberculosis

VHT: Village health team (volunteer community health workers)

USSD: Unstructured supplementary service data

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For more information and examples of specific digital health solutions
that address diagnostic gaps,
please contact FIND at digitalhealth@finddx.org
