

THE INTRODUCING NEW TOOLS PROJECT (iNTP)

Utilising Ultra-portable X-ray and Artificial Intelligence to Improve Detection of Missing People with TB in Uganda



Country in Focus: Uganda



Background

Uganda is on the World Health Organization's (WHO) list of 30 high TB burden countries, with an estimated 94,000 people falling ill each year with TB ¹. Although the country has made progress in TB detection over the past decade, significant challenges remain in its efforts to end TB by 2030.

Chest X-ray is one of the most sensitive tools to screen for TB, particularly in asymptomatic individuals. However, its use is hampered by inter- and intra-reader variability along with a lack of skilled radiologists in most high TB burden countries. These issues can be alleviated by using software for the computer-aided detection (CAD) of TB, which utilises artificial intelligence (AI) to detect abnormalities associated with TB. This innovative software, combined with the miniaturisation of digital X-ray technology into ultra-portable systems, allows people in remote and hard-to-reach areas to access screening services for TB.

¹ World Health Organization. Global TB Report 2023. Available from: <https://www.who.int/teams/global-tuberculosis-programme/tb-reports/global-tuberculosis-report-2023>

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The Ugandan National Strategic Plan for TB (2020/21-2024/25)² states that the use of innovative tools, including digital X-ray and CAD, is a key component of its strategy for improving TB screening and detection in Uganda, as advocated for by the Stop TB Partnership's Global Plan to End TB.³

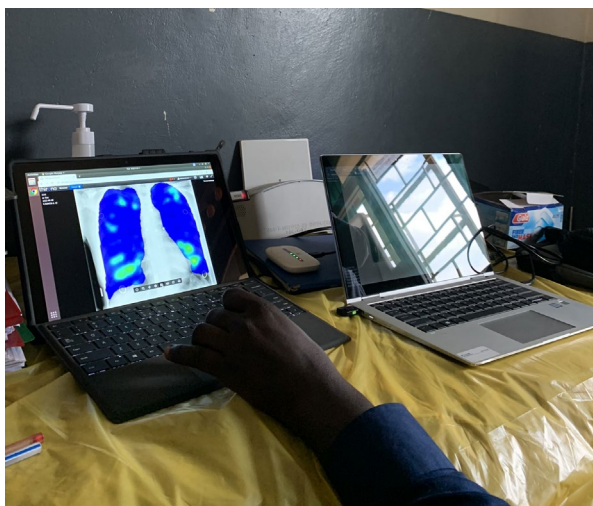
In line with this national strategy, the Stop TB Partnership, in collaboration with the United States Agency for International Development (USAID), provided five Delft light ultra-portable X-ray systems with CAD4TB software through the *introducing New Tools Project* (iNTP) to the Uganda National Tuberculosis and Leprosy Programme (NTP). This adds to the existing seven digital X-ray systems with CAD in the country, and fits into strategies to close the detection gap through the use of innovative tools in Uganda. The NTP, together with the USAID Mission in Uganda and the USAID Local Partner Health Services - TB (USAID LPHS-TB), has been implementing the roll-out of these innovative tools in five health facilities. These health facilities, which did not previously have access to X-ray services, are in the following areas: Apac, Kagadi, Kyenjojo, Mityana and Rakai.

Figure 1: Map of Uganda with stars indicating the five districts where ultra-portable X-ray and CAD systems have been deployed



Source: Based on United Nations map

Implementation of Ultra-portable X-ray and CAD under the iNTP



As part of the iNTP, the NTP in Uganda selected the Delft Light backpack systems with CAD4TB version 7 software from the Stop TB Partnership's Global Drug Facility (GDF) catalogue. The systems were provided at GDF-negotiated rates, and included a perpetual CAD4TB software licence, along with a full training, maintenance and support package of 4 years. After the products arrived in the country in early 2022, training was delivered by Stop TB and the manufacturer, Delft Imaging, in collaboration with the USAID Infectious Disease Detection and Surveillance (IDDS) project in February. Training took place over three days and attendees included operators from each of the five sites and programme managers from the NTP. Sessions included theoretical background on the principles of AI and CAD, the benefits of ultra-portable digital X-ray and threshold score selection, as well as practical sessions related to the set-up and installation of the Delft equipment. The training was conducted in a hybrid format, with theoretical sessions delivered remotely and practical sessions delivered in-person, sensitising and familiarising users with the equipment. Screening activities commenced shortly afterwards in March 2022.

² Ministry of Health of the Republic of Uganda (2020). National Strategic Plan for Tuberculosis and Leprosy Control 2020/21 - 2024/25. Available at: <https://www.health.go.ug/cause/national-strategic-plan-for-tuberculosis-and-leprosy-control-2020-21-2024-25/>

³ Stop TB Partnership. The Global Plan to End TB 2023-2030. Available from: <https://www.stoptb.org/global-plan-to-end-tb/global-plan-to-end-tb-2023-2030>

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Initially, the systems were used exclusively in facilities. Here, every person who underwent an X-ray screen was referred for confirmatory laboratory testing if their CAD score was over 50; however, utilisation was fairly low. During an in-country mission in June 2022, Stop TB coordinated a meeting with stakeholders, including the USAID Mission and USAID Local Partner Health Services – TB, to discuss how to increase screening numbers. This resulted in resources committed to mentoring visits and a new strategy to use the machines in the community for outreach visits, as well as in the facilities. Community screening locations were selected by mapping out TB hotspots and populations at increased risk of TB based on programme data. The implementing team identified

facilities with microbiological testing capacity near the targeted community screening areas and engaged the facility health workers to support TB screening, ensuring linkage to diagnostic testing and treatment. This community screening strategy resulted in screening numbers increasing by over 5-times between Q2 and Q3 2022.

The data from each X-ray unit is also in the process of being integrated into a connectivity dashboard, LabXpert, which is also supported by the iNTP and described in greater detail below. This ensures that data across the cascade of care, from screening to lab results and diagnosis, can be accessed on one central platform.

Project Impact

Uganda has been carrying out both facility and community-based activities to bring care to hard-to-reach areas and under-served populations. The use of digital X-ray and CAD is a major step forward in the fight against TB in Uganda. These technologies are helping to ensure that more people with TB are diagnosed and treated.

As of September 2023, under the iNTP, the NTP has successfully screened over 5,500 individuals, with 962 individuals displaying abnormal CXR results. Of those who displayed abnormal CXR results, 591 individuals were diagnosed with TB.

5,500+

total individuals
successfully screened
by NTP

~17.5%

displayed abnormal
chest X-ray results

591

individuals were
diagnosed with TB

Lessons Learnt

Uganda's initial struggles with X-ray unit underutilisation in TB screening – limited workforce, staff apathy, feasibility doubts, and restricted unit access – became a springboard for crucial lessons learned. During a technical support visit in June 2022, Stop TB was able to convene stakeholders with the guidance and coordination of the NTP and USAID Mission to make more resources available. Initiatives such as implementing incentives, fostering community engagement, and facilitating peer learning from fellow iNTP implementers in Nigeria, paved the way for a revamped implementation plan, increased utilisation, and valuable learnings on early problem identification, collaborative solutions, targeted resource allocation, community ownership, and knowledge exchange – a testament to the power of proactive response and shared expertise.



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Improving Connectivity and Data Integration



Challenge

One of the greatest challenges facing TB control efforts in Uganda was that X-ray screening and CAD results were only recorded and transferred to diagnostic testing facilities by paper, leading to significant delays and potential errors in data management and analysis.



Intervention

Recognizing the need for a more efficient and streamlined process, Stop TB coordinated efforts between the Accelerated Case Finding (ACF) team with the NTLF and the National Tuberculosis Reference Laboratory (NTRL) team to integrate CAD results into LabXpert, a connectivity dashboard, also supported by the iNTP.



Process

Several measures were implemented to facilitate seamless data integration. These included the introduction of data SIM cards for secure transmission of CAD results, the implementation of a barcode printer and scanner system to efficiently link patient information from X-ray and CAD screening with their diagnostic data, and the establishment of standardised protocols for data entry and synchronisation.



Current Progress

The initiative is currently in the pilot stage, with selected health facilities testing the integration between CAD and LabXpert. This phase allows for valuable insights and adjustments to be made following any challenges and roadblocks, before scaling up implementation to include all X-ray screening sites in the country.



Intended Outcome

The ultimate goal is to achieve an end-to-end solution where presumptive information from CAD screening and diagnostic data from laboratory tests are seamlessly linked within a single platform. This integrated approach will enhance data accuracy, reduce manual errors and expedite the overall diagnostic process, leading to improved TB detection and treatment outcomes.

Uganda is leading the way in leveraging the power of connectivity and data integration. By incorporating these measures, Uganda aims to strengthen its TB control efforts and further bridge the gap in detection and treatment.

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Looking Forward

The five ultra-portable X-ray and CAD systems from the iNTP have been fully integrated into the NTLP's screening programme. Furthermore, the importance of digital X-ray and CAD is recognised as a priority in the Ugandan National Strategic Plan for TB (2020/2021-2024/2025), with the NTLP aiming to procure digital X-ray units for all hospitals and outpatient health centres in the country, that currently do not have X-ray units.

The use of digital X-ray and CAD is a major step forward in the fight against TB in Uganda. These technologies are helping to ensure that more people with TB are being promptly diagnosed and treated, which is saving lives.



Acknowledgements

Uganda National Tuberculosis and Leprosy Program,
Ministry of Health

USAID Local Partner Health Services - TB

USAID/Uganda Mission

Photos courtesy of:

Makerere University Joint AIDS Program

Sarah Zaidi of the Stop TB Partnership

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Disclaimer: The findings in this publication are those of the authors and do not necessarily represent the views of the U.S. Agency for International Development or the U.S. Government.

For more information on the introducing New Tools Project, visit:

<https://www.stoptb.org/accelerate-tb-innovations/introducing-new-tools-project>



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