TB SCREENING IN MOUNTAIN AND ISLAND VILLAGES IN VIET NAM USING ARTIFICIAL INTELLIGENCE AND ULTRA-PORTABLE X-RAY
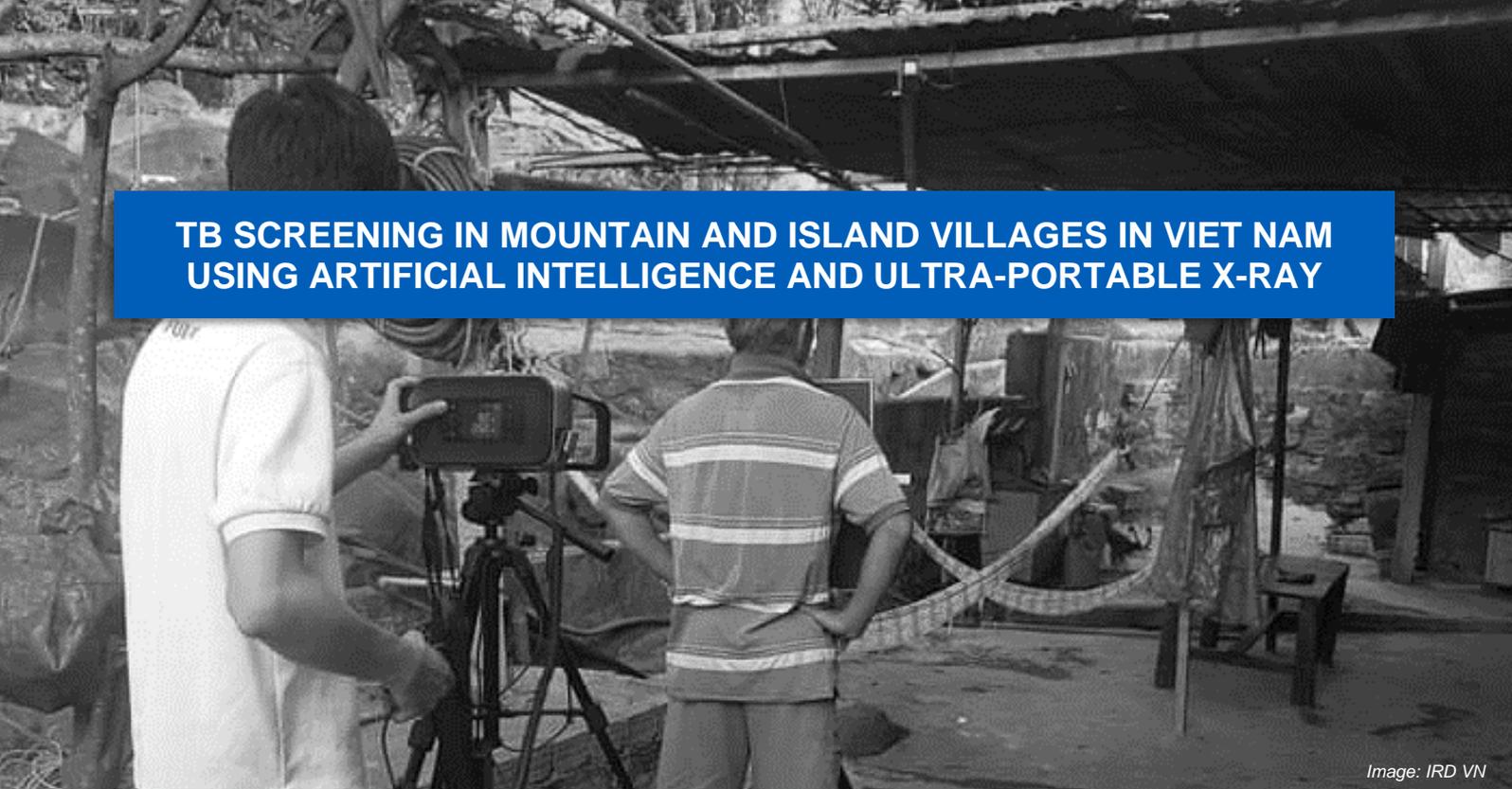
Image: IRD VN

PROJECT OVERVIEW

📍 **Phuoc Son and Cu Lao Cham, Quang Nam, Viet Nam**	🕐 **March–April 2021**	🧠 **Lunit INSIGHT CXR (Lunit)**	🤝 **NTP, IRD VIET NAM, FIT & local partners**

AI INTERVENTION

In 2020, there were an estimated 172,000 people with tuberculosis (TB) in Viet Nam.[1] Although the country was one of the few globally to reduce TB deaths by 35% by 2020, as laid out in the End TB Strategy, many people with the disease remain underserved.[2] Around **70,000 people with TB in Viet Nam were not diagnosed or reported** in 2020 – one of the highest numbers worldwide.[2] To accelerate the identification of people with TB who are missed by existing government health services, TB REACH, the Embassy of Japan in Viet Nam and Expertise France supported the National TB Programme (NTP), Interactive Research & Development Viet Nam (IRD-VN), Friends for International Tuberculosis Relief (FIT) and local partners to use artificial intelligence (AI) software (Lunit INSIGHT CXR) and a lightweight, ultra-portable X-ray system (CALNEO Xair, Fujifilm) to rapidly screen for TB.

These cutting-edge tools meant that the project could organize screening campaigns in hard-to-reach communities where larger X-ray trucks could not easily travel. TB screening was offered in the heart of communities – in pagodas, schools, and cultural houses, as well as in primary care facilities with no access to X-ray equipment.

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People attending screening sites had chest X-rays taken with the ultra-portable system and read by radiologists. AI analyzed some of the X-rays to **ensure the quality of the radiologist's interpretation during high-volume campaigns.** If the X-ray was suggestive of TB, it was printed on the spot and the participant was referred for an immediate consultation with an on-site pulmonologist. Highly sensitive molecular diagnostic tests (Xpert MTB/RIF Ultra) were used to confirm whether the person had TB.

First, the project piloted the new tools in a mountainous district, Phuoc Son, near the Vietnamese border with the Lao People's Democratic Republic. Following the success of this eight-day campaign, screening began in Cu Lao Cham, a small island 8 miles off the coast of Hoi An in central Viet Nam. The island is home to around 2,000 people who can struggle to access essential health care services located on the mainland. In 2019 and 2020, an X-ray truck was transported to the island by ferry for screening campaigns, but on this occasion, rough seas made this too risky to repeat.

X-ray screening in Phuoc Son. Image: IRD VN

" *AI AND ULTRA-PORTABLE X-RAY IS VERY USEFUL FOR USE IN ISOLATED AND RURAL POPULATIONS LIKE OURS, BUT IF YOU MOBILIZE A LOT OF PEOPLE IN ONE PLACE, THEN THE BATTERY LIFE CAN BE A LIMITING FACTOR.* "

**– THUY DONG,
ASSOCIATE DIRECTOR**

On average **338 people were screened per day** with X-ray. Due to the high numbers of people screened, an additional power source was required to recharge the X-ray's battery throughout the day. The ultra-portable systems added value in their potential to be used in communities without specialized X-ray facilities. This was confirmed by the Viet Nam National Lung Hospital, which approved the use of the X-ray system in outdoor and improvised spaces after verifying that the system emits less radiation than other types of X-ray. Due to this improved set-up, screening was more efficient, as there was no need to manoeuvre around a cramped X-ray truck. As a result of this campaign, Fujifilm upgraded its ultra-portable X-ray system to enable it to continue charging while in operation, fixing the battery life challenges.

PROJECT IMPACT

- ✓ **4,394** people screened for TB using X-ray in **5** villages
- ✓ **33** people diagnosed with TB
- ✓ **2.9x** higher detection rate than TB prevalence rate[3], indicating **mobilization of at-risk populations**
- ✓ **32** people with TB linked to appropriate treatment

WATCH A VIDEO OF THE PROJECT HERE

Currently, Viet Nam's national strategy – the "Double X Strategy" – places X-ray at the core of efforts to eliminate TB in the country, accompanied by GeneXpert diagnostic testing. Undeniably, AI software and ultra-portable X-ray have the potential to be an **invaluable supplement to this strategy**. The NTP, IRD-VN, FIT and local partners continue to lead on the use of these tools in Viet Nam. In 2020 and 2021, they implemented several campaigns in mountainous and island populations. Using the programmatic data generated from these screening campaigns, a multi-platform AI software evaluation was conducted to assess AI software performance against local radiologists. Additional AI software used to assist with TB care and prevention efforts in Viet Nam include: CAD4TB (Delft Imaging), qXR (Qure.ai) and Genki (DeepTek). This initiative helped to lay the foundation for the decision to **scale up the use of AI software and ultra-portable X-ray systems for TB screening** in Viet Nam.

" *OUR WORK HERE HAS SHOWN THAT THERE ARE A FEW AI SOFTWARE THAT ARE REALLY GOOD IN OUR SETTING AND PERFORM ON PAR WITH READERS THAT HAVE OVER 35 YEARS OF EXPERIENCE. I'M HOPING WE CAN SYSTEMATICALLY INTEGRATE AI SOFTWARE AS A DECISION SUPPORT TOOL FOR RADIOLOGISTS IN FUTURE TB SCREENING CAMPAIGNS.* "

ANDREW CODLIN
M&E AND RESEARCH DIRECTOR

FURTHER READING

Independent Evaluation of 12 Artificial Intelligence Solutions for the Detection of Tuberculosis

Early Evaluation of an Ultra-Portable X-ray System for Tuberculosis Active Case Finding

REFERENCES

1. WHO TB profile Viet Nam. Geneva: World Health Organization; 2022 (https://worldhealthorg.shinyapps.io/tb_profiles/?_inputs_&entity_type=%22country%22&lan=%22EN%22&iso2=%22VN%22, accessed 2 February 2022).

2. Global tuberculosis report 2021. Geneva: World Health Organization; 2021 (https://www.who.int/teams/global-tuberculosis-programme/tb-reports/global-tuberculosis-report-2021, accessed 5 November 2021).

3. Nguyen HV, Tiemersma EW, Nguyen HB, et al. The second national tuberculosis prevalence survey in Vietnam. PLoS One. 2020;15:e0232142. doi:10.1371/journal.pone.0232142.

ABOUT THIS DOCUMENT

This document is one of a series spotlighting the experiences of these early implementers when using artificial intelligence (AI) / computer-aided detection (CAD), to highlight the added value of CAD for TB programmes and inspire prospective implementers to innovate. Funding of this project was provided by the Stop TB Partnership's TB REACH initiative, launched in 2010 by Global Affairs Canada. In 2012, TB REACH first worked with implementing partners to pilot CAD software. Since then, it has implemented 3 different CAD products in 13 different countries in Sub-Saharan Africa, Latin America, Eastern Europe, and South and South-East Asia.