ANNUAL
IMPACT
REPORT 2022

Delft Light
backpack X-ray

www.delft.care

DELFT
IMAGING

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1 Introduction

MESSAGE FROM OUR CEO

Impact first. Always.

At Delft Imaging, what drives us is the ability to positively contribute to the healthcare systems in developing countries and make a real difference. As a social enterprise, our goal is to create a world with health equity.

The COVID-19 pandemic starkly exposed the vulnerabilities and gaps in healthcare infrastructures across the globe. Throughout 2022, we saw a tremendous increase in the need for digital X-ray systems and artificial intelligence (CAD). Installed with the aim to screen and triage for tuberculosis and COVID-19, it strengthened health systems everywhere. All through the report, you will read how, with our partners around the world, we rolled out hundreds of solutions and related services.

We are glad to share the second edition of our Annual Impact Report. It traces our journey - the milestones we crossed and the major strides we made this past year. We are proud of the impact we created, thanks to the tireless efforts of our partners worldwide. To those who assisted to finance, implement, train and utilise Delft's solutions, we are thankful for your continued trust and cooperation.

Sincerely yours,

Guido Geerts - President & CEO, Delft Imaging

Guido Geerts
President & CEO

" We are proud of the impact we created, thanks to the tireless efforts of our partners worldwide.

DELFT'S IMPACT AT A GLANCE

FY 2022

3,000,000+
People
Impacted by CAD4TB

32
Countries
Acquired Delft's solutions

100%
of Delft Portable X-rays
Powered by clean energy

500+
Health professionals
Received capacity building

950+
Professionals
Gained knowledge of AI & digital tools for TB

<1 day
Technical enquiries
Resolved on an average

TB IMPACT
(CUMULATIVE)

60+
Countries use Delft's screening solutions

1,200+
Installations at health facilities
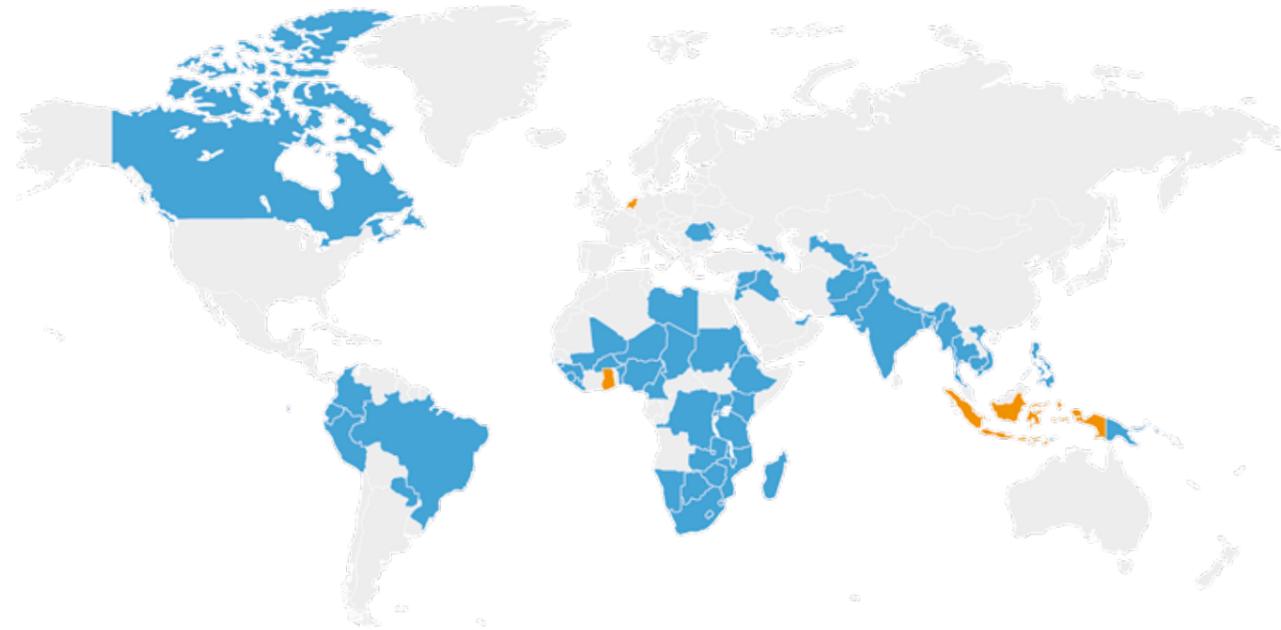
700+
Capacity building for health professionals

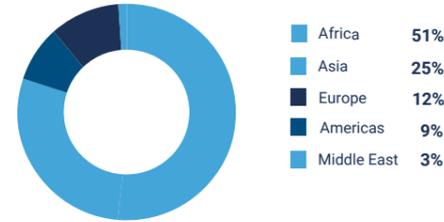**14,000,000+**
People impacted by Delft's solutions

DRIVING IMPACT

WHERE WE MADE AN IMPACT

Delft's Users by Region

■	Africa	51%
■	Asia	25%
■	Europe	12%
■	Americas	9%
■	Middle East	3%

CAD4TB

■	Africa	47%
■	Asia	27%
■	Europe	13%
■	Americas	11%
■	Middle East	3%

Digital X-rays

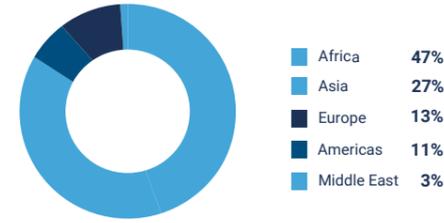|		
■	Africa	60%
■	Asia	28%
■	Europe	7%
■	Americas	5%

■ Our offices

By the end of 2022, Delft Imaging's digital solutions for TB screening are operational in over 60 countries. Our HQ in the Netherlands, along with our regional offices in Ghana and Indonesia, continuously support our clients' operations globally with on-site and web-based services to facilitate high uptime and TB programme impact.
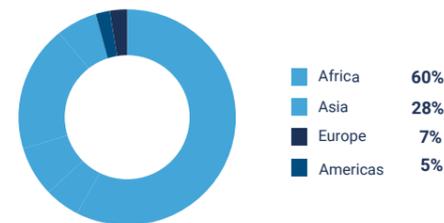
OPERATIONS SUMMARY 2022

Successful Projects Worldwide

- Implemented 40+ projects in 30+ countries globally with timely delivery.
- Expanded global reach in 8 new countries in Africa, Asia Pacific, Latin America and the Middle East.
- Supported large multiple-site projects with solar-powered multifunctional radiology systems to strengthen health systems in general and TB screening in particular.

Enhanced Performance & Services

- Released CAD4TB upgrades & updates with enhanced functionalities and a multilingual interface.
- Improved CAD4TB Platform for greater efficiency in data management.
- Expanded portfolio of digital X-ray systems.

Reinforces Customer Experience

- Established a regional office in Indonesia for customer support to clients in the ASEAN region.
- Our regional office in Ghana received the ISO 9001:2015 certification.
- Launched a 24/7 online helpdesk portal and eLearning platform.
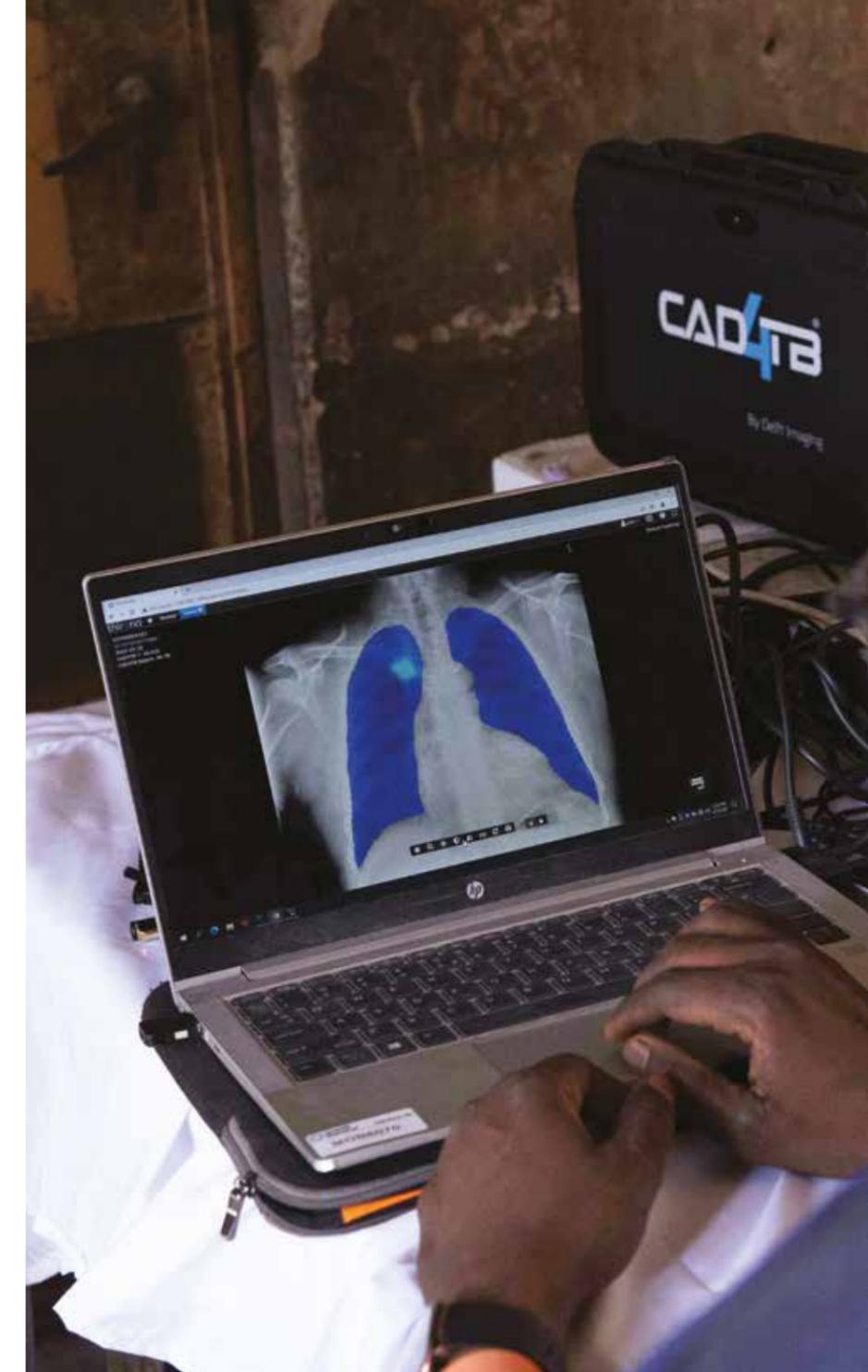
OPERATIONS SUMMARY 2022

Innovation
- Launched new AI modules for the early detection of Cardiomegaly and Silicosis in chest radiographs.

Global Recognitions
- CAD4TB endorsed by WHO.
- Awarded Best for the World 2022 on customer's impact area by the B-Corporation.

Partnership & Channels
- Continuous partnerships with the Stop TB Partnership's Global Drug Facility, Wambo/ PFSCM and The UN agencies.
- Continued to be a long-standing member of the Stop TB Partnership's Private Sector Constituency and The UNION.
- BabyChecker to join the broader VIYA, the global NGO PSI's first international sexual-wellness brand.

Florent Geerts
Business Unit Director

Mohammed Harbiye
Business Unit Director

" Ever since WHO endorsed Computer-Aided Detection for TB in combination with (portable) X-rays, we have witnessed a surge of interest in both solutions. Some global partners have long utilised these solutions in their TB screening efforts. Others are just beginning to explore its potential.

Regardless of familiarity, we are committed to delivering our solutions and emphasising on capacity building, service and support. We serve not just as a supplier, but as a trusted partner to TB programmes.

IMPACT ON TB SCREENING YIELD & EFFICIENCY

Daily screening yield
2.5 x higher
With CAD4TB in comparison to screening without

MURPHY ET AL.
NATURE SCIENTIFIC REPORTS, 2020

Cost per screen
50% lower
With CAD4TB in comparison to screening without

MURPHY ET AL.
NATURE SCIENTIFIC REPORTS, 2020

TB & Diabetes screening
High accuracy
With CAD4TB as a TB screening triage among people living with diabetes

HABIB ET AL.
NATURE SCIENTIFIC REPORTS, 2020

14 million+
TB screenings impact with CAD4TB

Our innovative TB screening solutions reduce screening costs and make TB detection more accessible, accurate and effective. Digital X-ray systems and CAD4TB facilitate rapid TB case finding in key populations.

Cases detected
22% more
With CAD4TB being used as a second CXR reader

PHILIPSEN ET AL.
IJTLD, 2019

Xpert tests used
75% saving
With CAD4TB at a sensitivity 79.7%. More than 50% saving at a sensitivity above 90%

QIN ET AL.
THE LANCET DIGITAL HEALTH, 2021

TB & HIV Added-value
CAD4TB with universal HIV screening increased timelines and completeness of HIV/TB diagnosis

MACPHERSON ET AL.
PLOS MEDICINE, 2021

PROJECT HIGHLIGHTS 2022
Introducing New Tools Project (iNTP)

iNTP is supported by USAID and the Stop TB Partnership to roll out cutting-edge innovations in diagnostics, treatments and digital health technologies to strengthen TB care in high-burden countries.

Since 2021, the project has supported the upscaling of ultra-portable X-rays and CAD in 7 countries for TB screening among hard-to-reach populations. Through the Stop TB Partnership/GDF, Delft Imaging supports Bangladesh, the Democratic Republic of the Congo, Kenya, Nigeria, the Philippines, Uganda and Vietnam with 55 Delft Light backpacks and 63 CAD4TB boxes for offline use. Delft's support includes installation, capacity building, technical support and maintenance.

For more information, please visit The Introducing New Tools Project | Stop TB Partnership and the GDF Diagnostics, Medical Devices & Other Health Products Catalogue.

> " The ultra-portable digital X-ray with CAD has significantly improved to take high-quality TB care to hard-to-reach and vulnerable/underserved populations. **– KNCV Nigeria**

Multifunctional Radiology for TB & COVID-19 Response and Strengthening Health Systems

Through the Global Fund's COVID-19 Response Mechanism (C19RM), Delft Imaging is implementing large multiple-site projects across several countries. We provide solar-powered multifunctional digital radiology systems with RIS/PACS and CAD4TB. These are designed to facilitate increased screening for TB and other respiratory diseases, as well as general X-ray examinations.

Our solutions not only support TB & COVID-19 response, but also support resilient and sustainable systems for health (RSSH). Additionally, they contribute towards achieving universal health coverage (UHC).

Our comprehensive support services include project management, installation, capacity building as well as preventative and corrective maintenance. We ensure minimal downtime of the systems, longer technical lifespans and predictable maintenance costs. These contribute to easing the total cost of ownership and maximising impact.

VOICES FROM OUR PARTNERS

Dr. Bethrand Odume
Executive Director
KNCV TB Foundation, Nigeria

" KNCV Nigeria pioneered the chest X-ray with CAD4TB in Nigeria with WoW truck since 2018 which has been a key in our targeted TB case finding as well as advocacy especially within communities and hard-to-reach locations. Moreover, we are scaling-up digital X-ray with AI for TB case finding thanks to the introduction and pilot of Delft Light Backpack. The pilot had led to what we have been able to do not only at KNCV Nigeria but also at the National Programme to help bridge the gap in TB case finding. Digital X-ray with AI has shown efficiency in TB case finding as number needed to screen and test had reduced significantly.

MPH. Ngoc Anh Le Thi
Program Coordinator and Senior Researcher at the Vietnam National Lung Hospital

" With the cooperation with USAID and the StopTB Partnership, we received Delft Light ultraportable X-ray systems and CAD4TB last year and sent them to 10 provinces. During the pandemic, Vietnam experienced a significant reduction in TB notifications therefore the National TB Program of Vietnam strategise the optimised use of Gene Xpert and X-ray (2X) in detecting TB cases. Additionally, the 2X strategy has been expended to all TB health facilities besides the nationwide active case-finding at communities for high-risk groups. Thanks to CAD4TB, abnormal cases can be reviewed again by a doctor and referred to an Xpert test. Although it's still an early stage, the programme identified 102 TB cases of all forms out of screening over 6,569 people through ACF at communities and health facilities.

Dr. Daniel Gemechu
Chief of Party for USAID Eliminate TB Project, Management Sciences for Health in Ethiopia

" Ethiopia introduced Delft's mobile vans equipped with digital X-ray and CAD4TB and deployed to pastoralist communities in 4 regions to improve access to TB screening services. We found that this technology is very usable because: 1) highly sensitive screening tool is required not to miss TB cases including asymptomatic TB; 2) AI-powered CAD is very simple technology that address the gap in human resource capacity and assists reading radiological findings; and 3) mobile vans can facilitate and assist patients to easily access services whenever needed, even by mobile communities. Moreover, the technologies help generating more evidence to address the capacity gaps in health systems, human resource, infrastructure and cost as well as effectiveness in the local context. We continue advocating these technologies to increase TB case finding and quality of service while filling the gaps in infrastructure and human resource.

Dr. Nurov Rustam Majidovich
Director Republican Center for the Protection of the Population from TB of the Ministry of Health and Social Protection of the Republic of Tajikistan

" In 2022, we received Delft Light and CAD4TB for the first time thanks to our partner USAID. So far, the systems were deployed to screen over 3,000 people who live in the remote areas and have challenges to access TB services. These applications are especially efficient to use in remote, rural and mountainous areas and we have been using the system without any issue. I hope that in the future we are going to expand such a comfortable device which will be very useful to identify TB cases and contribute to the treatment of patients in Tajikistan.

Dr. Turyahabwe Stavia
Assistant Commissioner - TB / Leprosy Control Division for the Ministry of Health of the Republic of Uganda

" Despite limited access to radiology services for TB screening in Uganda, we introduced digital X-ray systems fitted with CAD in 2020. Since then, we have acquired 12 portable digital X-ray systems with CAD4TB and two mobile clinics equipped with digital X-ray, CAD and GeneXpert. We deployed them for outreaches targeting TB hotspots and high-risk populations. Additionally, for monitoring our work, we initially had paper-based systems.

However, thanks to the Delft Team, we incorporate SAM (screening-analytics-management system) to get data at the central level. With these digital technologies, TB yield is much more significant among the presumptive cases at health facilities and community screening compared to symptom screening approaches.

Incorporating the Xpert machine in the mobile clinics contributes to finding TB, DR-TB cases and clients for TPT among the high-risk priority groups for TB prevention. These TB cases would otherwise not have been identified or offered an opportunity for same-day diagnosis and treatment. These people-centred approaches were only possible because we went to these communities.

These implementations, however, have not been without lessons. We noticed that the digital mobile X-ray requires operational costs and equipment maintenance is critical for outreaches to be possible mobile clinics offer opportunities for more people-centered services but have limited power supply and operating space. The clinics also present opportunities for reducing initial loss to follow-up. Proper planning is crucial for the implementation of digital X-ray systems.

E.N.R.A.F.-DELFT.

THE NETHERLANDS X-RAY FACTORY-DELFT, HOLLAND.

Mobile Photo-Roentgen Unit 90 K.V. 30 M.Ampt.
45 K.V. 60 M.Amps.

ABOUT US

Delft Imaging, established in 2002, traces its root to the first Dutch radiology equipment factory (ENRAF) established in the early 20th century. In the decades that followed, we have accumulated extensive global expertise in medical imaging. We remain committed to providing reliable and sustainable diagnostic solutions to emerging countries, with a focus on tuberculosis (TB) and the use of AI technology.

Since our inception, we have successfully implemented projects in over 60 countries. An additional 20 countries used CAD4COVID that we provided pro-bono during the pandemic. Deployed in over 1,200 installations, our radiology equipment and software contribute to the TB impact of over 14 million people. Our state-of-the-art solutions include Computer-Aided Detection software, digital X-ray systems, OneStop mobile clinics and turn-key diagnostic centres. As an innovator, we were the first to deploy digital radiology powered by solar energy.

Delft Imaging takes pride in our collaborative partnerships with Canon Medical Systems, Oldelft Benelux and Thirona. Our headquarters is in 's-Hertogenbosch, the Netherlands. Our training and technical support offices are in Ghana and Indonesia. Additionally, we are actively engaged in public and private partnerships with international and local NGOs and knowledge institutes.

Year	Event
2022	→ **Branch office in Indonesia**
	→ **Over 14 million people impacted**
2020	→ 240+ installations with CAD4COVID AI during the pandemic
2018	→ Branch office for S. Africa in Johannesburg
2016	→ Branch office for W. & E. Africa in Accra
2012	→ Delft Imaging Systems B.V.
2012	→ Canon acquires Delft Diagnostic Imaging
2002	→ Delft Imaging Systems, Part of Delft Diagnostic Imaging
1990	→ Delft Instruments
1985	→ Oldelft
1939	→ De Oude Delft
1925	→ ENRAF (Eerste Nederlandse Röntgen Apparaten Fabriek)

2 Operating with Integrity

WE ARE A SOCIAL ENTERPRISE

At Delft Imaging, we are working towards a dream that is bigger than us, a world with health inequity. The social impact our solutions creates drives our motivation. We respond to the pressing healthcare needs worldwide, meet various international standards and actively support social initiatives.

Vision
Imagine a world with healthcare equity - where healthcare is affordable and easily accessible to all.

Mission
We empower communities in resource-constrained settings with our affordable digital imaging innovations that strengthen health systems worldwide.

Core Values
1. Improve people's quality of life by delivering innovative solutions and effective services.
2. Balance commercial activities and social impact as well as future investment for innovations and environmental sustainability.

End poverty, protect the planet and improve the lives and prospects of everyone, everywhere.

Support the 10 principles in the areas of Human Rights, Labour, Environment and Anti Corruption.

Meet the highest social and environmental standards.

Reaching new horizons of impact and improving the lives of those living on less than $5.5 a day.

SDGS & UN GLOBAL COMPACT

To create a better world by 2030, the United Nations set the 17 Sustainable Development Goals (SDGs). Delft Imaging aims to promote these SDGs with our core activities and projects. Additionally, we participate in the UN Global Compact, the world's largest corporate sustainability initiative to align ourselves with the Ten principles on human rights, labour, environment, and anti-corruption.

GOAL 1 With our integrated TB solutions, we aim to support earlier detection of TB and prevent catastrophic costs of treatment.

GOAL 3 Our innovative medical solutions, accessible to everyone worldwide, contribute to the global effort to end TB.

GOAL 7 The use of solar panels facilitate sustainable diagnostic imaging operations with clean energy.

GOAL 8 With our integrated TB screening solutions, we facilitate safer workplaces and healthier productive populations.

GOAL 9 We prioritise human well-being by providing high-quality, reliable and sustainable solutions that are affordable and accessible to all.

GOAL 10 We design our medical solutions to reach key and vulnerable populations including those in rural and remote areas in low-resource settings as well as migrant populations.

GOAL 17 We partner with public and private sectors. The Delft Foundation supports partners that promote the SDGs, particularly Goal 4 and Goal 5.

We are committed to delivering our solutions in a responsible and sustainable manner. For more information, please visit Delft Imaging Systems | UN Global Compact.

STRIVING FOR HUMAN IMPACT

Certified B Corporation

Since 2020, Delft Imaging is an officially certified B-corporation. This certification demonstrates our commitment to the highest social and environmental performance standards, public transparency, as well as legal accountability. The B Corp Certification provides legitimacy and credibility to our operation as a social enterprise while balancing purpose and profit. In our pursuit of excellence, it gives us a clear direction towards the greater good.

We received the Best for the World 2022 award for our exceptional positive impact on Customers' Impact area. This award places us in the top 5% of 4,000+ certified B Corporations worldwide, which have successfully set the high bar for customer satisfaction.

For more information, please visit:
www.bcorporation.net

Million Lives Collective

The Million Lives Collective recognises and raises awareness of innovative social entrepreneurs who are successfully tackling global development challenges. Supported by leading bilateral agencies, multilateral organisations and foundations, the initiative celebrates pioneers reaching new horizons of impact and improving the lives of those living on less than $5.5 a day.

Since 2020, Delft Imaging is a Vanguard member of the Million Lives Collective for our CAD4TB, which has directly impacted over 6 million people.

For more information, please visit:
www.millionlives.co

QUALITY MANAGEMENT

Quality

Our headquarters in the Netherlands holds ISO 13485:2016 Medical Devices certification and our Ghana office holds the ISO 9001:2015 Quality Management System certification. These certifications ensure that our clients receive exceptional performance standards from us. Despite the challenges posed by the global supply chain post 2020, we have maintained an on-time delivery rate.

88%

On-time delivery

Trust in Data Protection

We understand that safeguarding data, privacy and security is of utmost importance to our clients and stakeholders. Based in the Netherlands, we comply with the strict EU regulations on data privacy and security, including the General Data Protection Regulation (GDPR). Our transparency allows our clients and donors to trust us with their data protection and security at all times.

Data ownership   Restricted data use   Data processing   Confidential   Data anonymisation

EMPOWERING OUR USERS

Capacity Building

Capacity building ensures the safe and efficient use of Delft Imaging's solutions, and hence the impact of our users. To this end, we offer specialised training on equipment and software to medical and support personnel. We empower them with the practical knowledge and skills necessary to handle the equipment properly. Additionally, our eLearning platform provides a flexible solution for refresher trainings and staff onboardings.

Through these capacity building services, we strive to support healthcare professionals to achieve the best possible outcomes.

500+
Capacity building for health professionals

20
Countries received

91%
Exellent/Very Good/ Good rate for training

Support & Service

Delft Imaging's primary objective is to ensure that clients experience uninterrupted operations with maximum uptime and efficiency. We have regional offices in Ghana and Indonesia that handle technical enquiries and provide the necessary assistance.

Our qualified teams of experts offer training, seamless installation as well as reliable services and maintenance, including a 24/7 helpdesk. Our local service partners assure swift and efficient support. They combine in-person, web-based technical assistance for a more streamlined customer experience, for rapid response and problem solving.

<1 day
To resolve technical enquiries on an average

<8.6 hrs
To resolve IT issues on an average

4.8/5
Customer satisfaction with helpdesk support

COMMUNITY ENGAGEMENT

Delft Community

Fostering collaboration and knowledge-sharing among health professionals is pivotal to TB programs. To this end, we organise the Delft Community and Live Webinars, bringing together our clients and stakeholders at the forefront of the fight against TB. During the webinars, our partners share their best practices and engage participants in meaningful dialogues.

We provide different channels that enable participants to engage actively with their peers and exchange practical experiences.

130+
TB professionals
Joined the Delft Community

950+
TB professionals
Gained knowledge on AI & digital tools for TB screening

Delft Foundation

In 2022, we supported the iCog Anyone Can Code (ACC) in Ethiopia, which develops and offers programming courses to students and youth. Through the free-of-charge platform, students can learn basic programming to acquire technical knowledge, which can support their learning and future careers.

This contribution enables over 3,500 students and youth across Ethiopia to access the DigiTruck Ethiopia programme.

3,500+
students
Gained access to programming courses

3 Case Study

Delft's Impact Worldwide

# OUR SOLUTIONS FOR TB PROGRAMMES

Ever since the WHO updates on the TB screening guidelines, the global effort to scale up and implement portable digital X-ray systems and CAD has been tremendous. The inclusion of Delft Light and CAD4TB in the Diagnostics Catalogue of the Stop TB Partnership's Global Drug Facility and Wambo/PFSCM has furthered the accessibility and deployment of these new tools worldwide.

We support our partners with cutting-edge solutions, like ultra-portable X-ray systems and CAD4TB, to perform rapid and accurate screening for TB.

1. Delft Ultra

2. Delft Light

3. EasyDR

4. OneStopTB Clinic

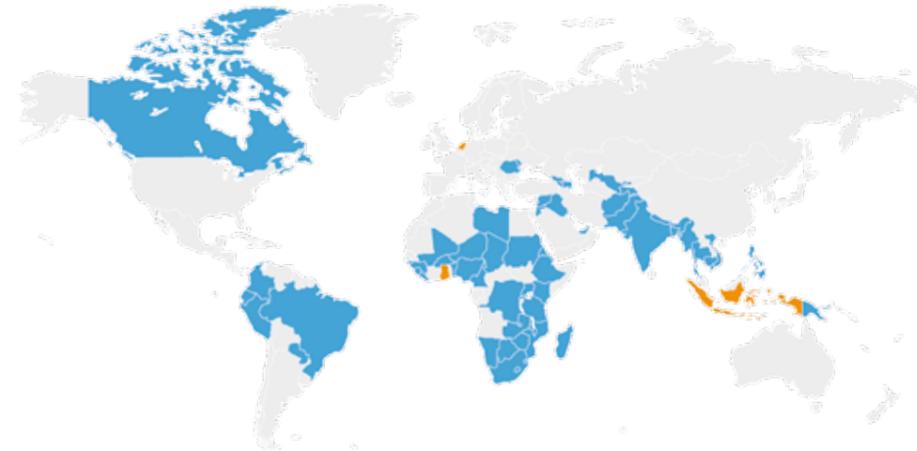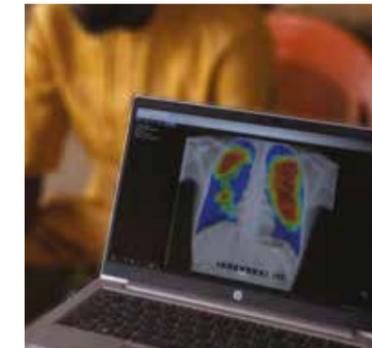**5.** CAD4TB AI Software

1.
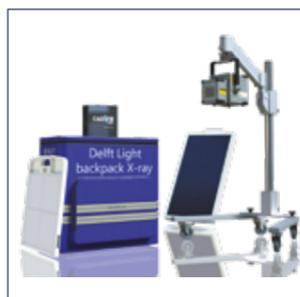
2.

3.

4.

5.

ACTIVE CASE FINDING

Find missing TB cases with Delft Light & CAD4TB

- Delft Light and CAD4TB were distributed to eight high TB burden states with many hard-to-reach areas.
- A parallel screening algorithm using the WHO four-symptom screen (W4SS) and CXR with CAD4TB (threshold score at 50) guided screening and identification of presumptive TB.
- From December 2021 to June 2022, 57,732 people were screened.
- Of these, 6,961 (17%) presumptive TB were identified and 1,472 were diagnosed with TB. Among those, 867 (59%) were clinically diagnosed with TB.
- To diagnose a TB case, the Number Needed to Screen was 39 (Female: 50, Male: 34) and the Number Needed to Test was 5 (F: 6, M: 4), which is highly efficient.
- **The ultraportable digital X-ray with CAD has significantly improved to take high-quality TB care to hard-to-reach and vulnerable/underserved populations.**
- The interventions have been particularly effective in targeting and finding more men with TB in the community.

REFERENCE A.Ihesie et al. (2022, November 8-11). Scaling up ultra-portable digital X-ray with computer-aided TB detection in Nigeria. The Union World Conference on Lung Health 2022.

Community Active Case finding with Delft Light & CAD4TB

- A study compared the use of chest X-ray (CXR) with AI-powered CAD and the WHO four-symptom screen (W4SS) to evaluate the added value and efficiency for community active TB case finding in Kano state.
- Among those screened, 943 presumptive TB were found on CXR with CAD4TB (score >60) and 116 (12%) were diagnosed with TB. For symptom screening, 4,272 presumptive TB cases were identified and 115 (3%) were diagnosed with TB.
- The difference in presumptive TB and case yield from both arms was statistically significant. The number needed to test (NNT) was 5 using the CXR screen and 39 using W4SS.
- CXR screening with CAD4TB performs better than W4SS correlating with bacteriologic positive TB results. A lowered NNT bears the advantage of cost saving with more efficient use of sputum cups and Xpert cartridges.
- **Bringing to scale AI-aided CXR screening would be a cost-efficient way for early TB detection in similar settings.**

REFERENCE M. Bajehson et al. (2022, November 8-11). The use of artificial intelligence software aided chest Xray screening for community active case finding in Kano, Nigeria. The UNION World Conference on Lung Health 2022.

ACTIVE CASE FINDING

ACF in remote areas with **Delft Light & CAD4TB**

- Received Delft Light and CAD4TB for the first time in 2022 to conduct TB screening in remote and mountainous areas in Tajikistan, among key and vulnerable populations.
- So far, over 3,000 people have been screened using Delft Light and CAD4TB, 146 presumptive TB cases were identified that further undertook Xpert test or clinical examination, and 45 are diagnosed with TB. All of them initiated TB treatment.
- In Sogd province, 2,286 people from the risk group were screened, 121 presumptive TB were identified and 43 were confirmed with active TB. Additionally, 360 TB contact persons were examined across the province, 18 presumptive TB cases were identified. 10 patients were diagnosed with TB and started treatment.
- In the Asht region, 480 teachers and students were screened. Among them, 22 presumptive TB were identified. Further clinical examination and Xpert testing were performed. Treatment was initiated for the 3 TB cases identified.
- Upon request of the Ministry of Defense, Delft Light and CAD4TB were deployed to conduct TB screening among military personnel in remote areas. As active case finding, 687 people were screened, 46 presumptive TB were identified. Treatment followed for the 30 that were diagnosed with TB.
- TB screening was also conducted among mine workers and key & vulnerable populations.

REFERENCE N. Madjidovich (2022, August 31). Practical application of portable digital X-ray systems in tuberculosis service of Republic of Tajikistan. New tools for TB detection: How to implement portable X-ray, CAD & AI technology, Delft Imaging webinar.

HIGH TB CASE YIELD

High-yielding TB case-finding with **Delft Light, CAD4TB and OneStopTB Clinic**

- The study compares the impact of the "WoW truck," equipped with a digital X-ray machine, and the Delft Light Backpack ("DLB"), a portable digital X-ray that was transported via motorcycle to hard-to-reach areas.
- The WoW and pilot DLB interventions under the USAID-funded TB LON project were deployed for active case finding in the same local government area (LGA) after one umbrella advocacy and community mobilisation visit.
- From January 2022 to March 2022, TB ACF was carried out in 3 LGAs in Northern Cross River State. Of the 10,488 clients screened, 915 presumptive TB were identified, 911 were evaluated and 158 cases were diagnosed with TB. 156 were placed on treatment and notified to NTP.
- The WoW truck contributed to 75% of screens, 69% of presumptive and 73% of TB cases diagnosed. Achievement across all indicators in the cascade for WoW exceeds those for DLB. Communities received similar information before outreaches, but client patronage was higher for WoW trucks.
- **The WoW truck is very conspicuous and self-announcing to people in the community hence the high level of patronage following advocacy visits to key community leaders.**

REFERENCE E. Chukwu et al. (2022, November 8-11). Using Wellness on Wheels trucks for community TB active case-finding in Northern Cross River, Nigeria. The UNION World Conference on Lung Health 2022.

KEY POPULATIONS

TB screening in pastoralist communities with **OneStopTB Clinic**

- Ethiopia introduced Delft's mobile vans equipped with digital X-ray and CAD4TB and deployed these to pastoralist communities in 4 regions to improve access to TB screening services.
- In six months (July to December 2021), over 5,400 people were reached. Of the 3,749 screened using digital X-ray and CAD4TB, 1,016 presumptive TB cases were tested by Xpert, 119 (11.7%) were bacteriologically confirmed with TB and 46 (27%) were clinically diagnosed with TB. All of them initiated TB care.
- The results raise the interest in Ethiopia to increase the use of such new technologies nationwide, including in urban areas, to improve TB screening and TB elimination studies.

REFERENCE D. Gemechu (2022, August 31). Introduction of CAD4TB in Ethiopian NTLP. New tools for TB detection: How to implement portable X-ray, CAD & AI technology, Delft Imaging webinar.

Active TB case-finding with **OneStopTB Clinic**

- Seven mobile diagnostic units equipped with EasyDR digital X-ray machines with CAD4TB software and GeneXpert have been deployed to urban cities to screen high-risk and vulnerable populations in Malawi.
- Between March 2018 and December 2021, 395,279 individuals from high-risk groups were screened for TB. This includes 220,194 males (56%) and 175,085 females (44%). 53,638 presumptive TB cases were identified (14%). A total of 3,775 TB cases were diagnosed through the mobile TB screening unit.
- Representing a yield of 955 per 100,000 (NNS:105). The yield is significant.
- Active TB case finding of Systematic screening remains a priority area that needs more resources to find the missing TB cases. **The use of CAD4TB best fits screening for large numbers of people and quicker identification of TB presumptive cases.**

REFERENCE I. Dambe (2022, April 7). Targeted Active TB case finding using mobile TB diagnostic units. New tools for TB detection, Delft Imaging webinar.

KEY POPULATIONS

TB screening among PLHIV with **Delft Light & CAD4TB**

- Supported five health facilities in conducting TB screening among people living with HIV using digital X-rays and CAD in Uganda.
- Patients with CAD4TB score >60 were presumed for TB and referred for Xpert MTB/RIF test, and those confirmed with TB initiated TB treatment.
- From July 2020 to Nov 2021, 4,463 individuals were screened with X-rays. 691 (15.5%) had abnormal CXR, and 368 (53.3%) had their sputum samples tested with Xpert MTB/RIF, of which 48 (13%) were confirmed with TB.
- Among those screened, 22.7% were PLHIV, 165 (16.3%) had abnormal CXR, and 20 PLHIV (21.5%) were confirmed with TB.
- **TB screening with CXR improved TB case detection with higher yield among PLHIV and contacts compared to other groups.**
- Using digital X-rays and CAD for routine screening of TB among PLHIV in care should be prioritised for early TB diagnosis, treatment initiation, and improved outcomes.

REFERENCE B. Aldo et al. (2022, November 8-11. Intensified TB case-finding using digital X-ray and CAD4TB among people living with HIV receiving care at health facilities in Uganda. The Union World Conference on Lung Health 2022.

Community level screening with **OneStopTB Clinic**

- Targeted TB screening hotspots and high-risk communities mapped using programme data and disease burden.
- Conducted screening using X-rays to identify presumptive TB patients confirmatory laboratory testing.
- From May 2022 to September 2022, 11,435 people were reached with mobile TB clinic services, and 630 (6%) had abnormal CXR. 249 TB cases were diagnosed (TB yield was 3.0%), and 84% promptly started TB treatment.
- 151 people (51%) had bacteriological confirmation by GeneXpert, 28% (1,038/3,752) pending GX results. The five rifampicin-resistant TB cases were notified from the community.
- Presumptive patients are tested using GeneXpert for same-day diagnosis and initiation of treatment.

REFERENCE T. Stavia (2022, November 2). Expanding access to new Tools for TB screening and diagnosis: Experience digital X-rays and CAD4TB in Uganda. Applied AI for TB and beyond: scaling up the utilisation of X-ray and CAD, Delft Imaging webinar.

KEY POPULATIONS

ACF targeting most-at-risk and hard-to-reach populations with **Delft Light & CAD4TB**

- All clients were screened using a parallel screening algorithm, including the WHO four-symptom screening and CXR with CAD4TB (threshold ≥ 50). All identified presumptive TB cases were evaluated with GeneXpert, Truenat, or TB LAMP. Bacteriological negative results had their X-ray images and symptoms sent to radiologists for review.
- From Dec 2021 to March 2022, 17,261 (Male: 12,350, Female: 4,911) were screened for TB, 2,764 (M: 1,893, F: 871) presumptive TB were identified, and 2,639 (M: 1,819, F: 820) were evaluated. All 437 (M: 337, F: 100) TB cases diagnosed were enrolled in treatment.
- **The Delft Light with CAD4TB helped to improve access to TB screening among hard-to-reach and most at-risk populations, including men.**
- The intervention was found very efficient in identifying missing TB cases among these populations and is recommended for scale-up to more states in Nigeria.

  REFERENCE B. Odume et al. (2022, November 8-11). Delft Light Backpack (DLB) portable digital X-ray for pre-diagnostic TB screening: results from a scale-up intervention in Nigeria. The Union World Conference on Lung Health 2022.
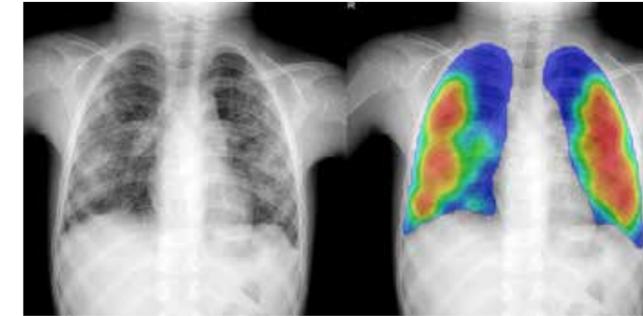

TB screening among inmates with **Delft Light & CAD4TB**

- Delft Light Backpack Portable Digital X-ray (DLB) and CAD4TB were procured and deployed under the USAID-supported New Tools project.
- From December 2021 to February 2022, three 2-person teams, each equipped with the DLB and CAD4TB, were deployed to screen all inmates in 16 prisons across the states. Persons with a CAD4TB score >50 had sputum samples collected for Xpert MTB/RIF ultra-assay and further clinical evaluation.
- Across all prisons, 4,920 inmates were screened. 87% are within the 5 Medium Security Custodial Centres (MSCC) with a mean inmate population of 857. Presumptive TB yield from MSCC and Satellite custodial centres (SCC) was 9.4% and 6.9%, respectively. A total of 72 cases were diagnosed, of which 67 (93%) were from MSCC. TB yield amongst screened inmates in MSCCs was twice.
- The Nigerian correctional service and relevant health authorities should institute measures to decongest the bigger centres that are overcrowded to halt the spread of infectious diseases such as Tuberculosis within those congregate settings.

  REFERENCE M. Tukur et al. (2022, November 8-11). Early experience from the Portable Digital X-ray implementation in special populations in Kano and Katsina states, Nigeria; lessons learnt and recommendations for scale up. The Union World Conference on Lung Health 2022.

TB SCREENING IN CHILDREN

Active TB case-finding among school children with **Delft Light & CAD4TB**

- The study compared the yield from the WHO four-symptom screen (W4SS) and mass mobile X-ray screening with CAD in similar groups of schoolchildren (ages 6 to 15) during an active case-finding activity in Lagos.
- Presumptive TB cases were identified, and sputum samples were taken to be analysed using the GeneXpert MTB/RIF. The presumptive TB cases who couldn't produce samples or returned negative from GeneXpert had their chest X-ray films reviewed and then sent for a clinical assessment.
- Over 6 months, a total of 13,384 schoolchildren were screened. In the W4SS group, 11,097 were administered by the W4SS checklist, 1,143 presumptive TB were identified, and 70 active TB cases were found. In the X-ray with CAD group, 2,287 were screened, 129 presumptive were identified, and 15 TB cases were found.
- With W4SS, the Number Needed to Screen (NNS) was 158 and the Number Needed to Test (NNT) was 16. With CXR intervention, NNS was 152 and NNT was 9.
- **Active case-finding based on CXR was preferable as the yield was better than the W4SS. Therefore, fewer cases would be missed and it would be worthwhile to invest more in the mobile CXR.**

  REFERENCE A. Alege et al. (2022, November 8-11). Comparison of yield from symptomatic W4SS screening and mass mobile X-ray in schoolchildren in Lagos, Nigeria. The Union World Conference on Lung Health 2022.

4 Policy & Scientific
Evaluation

ADVANCING TB SCREENING WITH CAD4TB
Evidence-based WHO-recommended Tool for TB Screening and Triage

Delft Imaging is the pioneer of Computer-Aided Detection (CAD) for TB, and has strong partnerships with the Diagnostic Image Analysis Group (DIAG) of Radboud University Medical Centre and our sister company, Thirona. Initial research started in 1996, with the prototype projects commencing in 2007. This led to the first field implementation in South Africa and Zambia in 2011.

CAD4TB was the first CAD software to obtain CE-certification back in 2015. Its performance, effectiveness and reliability are confirmed in multiple scientific publications, and adopted by TB programmes as well as bilateral agencies and multilateral organisations.In 2021, the WHO released updated guidelines, including the recommendation for using CAD for systematic TB screening. CAD4TB has been endorsed by the WHO as the scientifically proven CAD for digital chest radiography, positioning Delft Imaging as a leading partner for TB programmes worldwide.
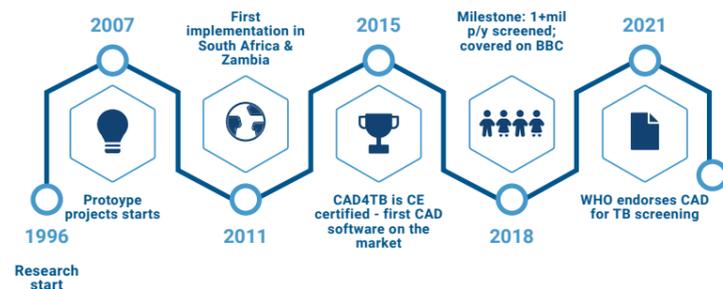
Evidence on CAD4TB performance

- Endorsed by the WHO: WHO consolidated guidelines on TB and Global Tuberculosis Report 2022
- Performs on par/better than expert/trained human readers
- Meets WHO's TPP (Target Product Profile)
- Performance validated in 60+ scientific publications
- Operational in 60+ countries for active case-finding, prevalence surveys, as well as community and facility-based screening programmes
- Impacted over 14 million people for rapid TB screening

" ...among individuals aged 15 years and older in populations in which TB screening is recommended, CAD software programmes may be used in place of human readers for interpreting digital chest X-rays for screening and triage for TB disease.

– WHO guidelines for systematic TB screening

2007 — **First implementation in South Africa & Zambia** — **2015** — **Milestone: 1+mil p/y screened; covered on BBC** — **2021**

Protoype projects starts — **CAD4TB is CE certified – first CAD software on the market** — **WHO endorses CAD for TB screening**

1996 — **2011** — **2018**

Research start

OPTIMISING TB SCREENING WITH X-RAY & CAD
Scaling-up Systematic TB Screening to Maximise Early TB Detection

Chest X-ray (CXR) plays a crucial role in the early detection of TB and is fundamental to achieving the targets outlined in the WHO End TB Strategy. The Global Fund Strategy (2023-2028) and TB Information Note highlight the role of digital X-rays in early and accurate TB diagnosis, with an emphasis on finding the missing people with TB and prioritising screening interventions. The latest plan includes scaling-up and improving systematic screening for TB with more sensitive CXRs and CAD software.

The Stop TB Partnership's Global Plan to End TB 2023-2030 highlights the importance of leveraging modern technologies. Solutions such as CXRs with CAD enhance the rapid detection of TB and expand early diagnosis, including at sub-clinical stages. The Plan underlines the excellent value of digital CXRs for pulmonary TB screening in combination with confirmatory tests, especially in populations with high TB rates.

The USAID's Global TB Strategy 2023-2030 aims to maximise TB detection in individuals of all ages by increasing access to new technologies such as portable digital X-rays with AI. Our wide range of digital X-ray systems, including ultra-portable, mobile and multifunctional stationary systems, are designed for TB screening in different settings. All systems are compatible with CAD software. Moreover, our X-ray systems can be solar-powered and come with a power pack option.

" CXR was found to be a sensitive screening tool that has an important role in the early detection of TB in children and adults who are at higher risk of TB, as well as potential to reduce the population burden of TB diseases when combined with early treatment.

STRENGTHEN TB SURVEILLANCE WITH DATA
CAD4TB Platform for Digitised TB Management & Integration

Moving from paper-based to digitised data-driven TB management and decision-making enhances real-time, digital case-based TB disease surveillance.

The CAD4TB Platform (formerly known as SAM) provides modules for patient registration, customisable symptom screening, CAD4TB AI algorithm for CXR analysis and confirmatory test results. Additionally, it produces individual reporting and programmes insights for TB management.

Furthermore, the CAD4TB Platform enables seamless data integration among multiple locations, serving as the primary data entry point for health workers at the community level. It facilitates data access from multiple locations, enabling National TB Programmes at the central level to access and monitor information on dashboards.

> " Initially, we had the paper-based system, but thanks to the Delft Imaging team, we are incorporating SAM in our implementation to see how the TB programmes can get the data at the central level.

– TB/Leprosy Control Division for the Ministry of Health of Uganda
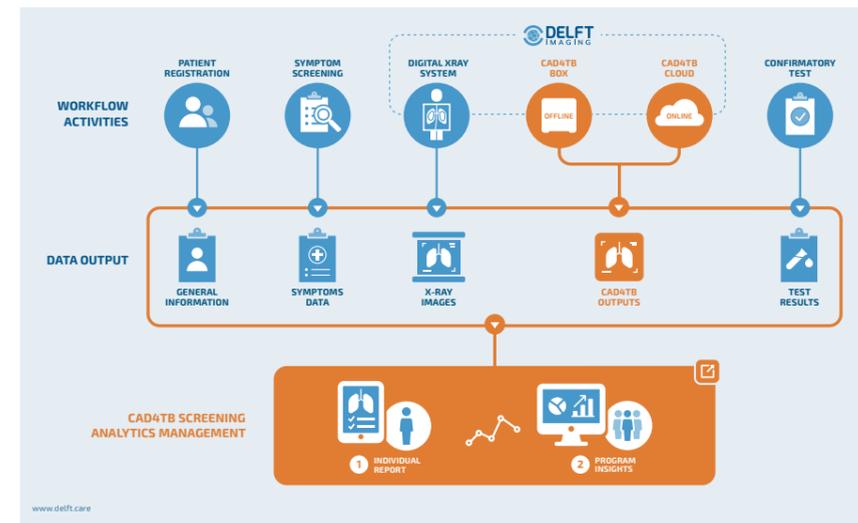
CAD4TB & X-RAY SCIENTIFIC VALIDATION
An Overview of 2022 Scientific Publications featuring Delft's Solutions
CAD4TB has been validated in over 60 scientific publications in highly respected journals.

In 2022, the following publications feature Delft's CAD solutions.

CAD4TB Performance
> " CAD4TB 7 significantly outperformed CAD4TB 6, performed better than human readers and met WHO TPP values. CAD4TB 7 shows a steep initial increase of GeneXpert tests saving which suggests greater numbers of GeneXpert tests to be saved.

Qin, Z. et al. Plos Digital Health, 2022

CAD for mass TB screening in prisons – Brazil
> " Automated interpretations of X-rays by CAD achieved high sensitivity and specificity. The study suggests that X-ray screening with CAD could reduce the number of confirmatory tests.

Soares, T. et al. The Lancet Regional Health, 2022

CAD for TB active case finding – Kiribati
> " CAD4TB to be used for CXR interpretation for the population-wide active case finding and prevention for TB and leprosy elimination in Kiribati.

Coleman, M. et al. BMJ Journals, 2022

CAD for TB & COVID-19 screening - Peru
> " The integrated screening using X-ray and CAD4TB and CAD4COVID provided an efficient way to screen for both TB & COVID-19 and showed the potential to increase the uptake of TB active case finding activities·

Tovar, M.A. et al. Public Health Action, 2022

Efficiency of Ultra-Portable X-ray with CAD - Nigeria
> " TB screening using Delft Light Backpack X-ray during community-based ACF in otherwise inaccessible Niger Delta communities of Nigeria showed a high TB prevalence among participants. Nationwide deployment of the instrument in hard-to-reach areas is recommended.

Odume, B. et al. Public Health Action, 2022

Silicosis Detection - South Africa
> " CAD4TB and CAD4Silicosis detected silicosis and/or TB with high AUCs (>0.85) against both readers and specificity (>70%), suggesting a high potential to come close to expert readers in the identification of TB and/or Silicosis among ex-miners.

Ehrlich, R. et al. Int J Environ Res Public Health, 2022

CAD performance in persons with previous TB – Zambia
> " The performance of CAD software as a TB triage tool is decreased among patients previously treated for TB.

Kagujje, M. et al. Clinical Infectious Diseases, 2022

5 Innovations & Co-Creation

APPLIED AI FOR TB & BEYOND

CAD4TB Upgrades & Updates for Enhanced TB Screening and Data Management

In 2022, Delft Imaging released CAD4TB upgrades and updates to enhance the performance and usability of the software.

The release includes:
- Synchronisation of data from CAD4TBbox to CAD4TBcloud
- Expansion of M&E insights
- Customisable screening workflow
- Radiographer feedback
- Multi-lingual support (French/Spanish/Russian/Portuguese)

NEW: Cableless CAD4TB Case

Delft Imaging pre-launched a new plug & play CAD4TB which comes all-in-one in a compact case. Our all-in-one CAD4TB case contains a CAD4TBbox for offline use, with all necessary cables already connected. This configuration expediates the installation and connection of CAD4TB and digital X-ray machines, minimising the cumbersome cable connections. The case protects the device during transportation and in challenging weather conditions.

NEW: AI Modules for Early Detection of Cardiomegaly and Silicosis

We launched new AI-powered CAD modules that automatically detect possible early signs of heart failure and occupational lung disease. The modules further increase the diagnostic value of CXR in TB screening and supporting the people-centred approach.
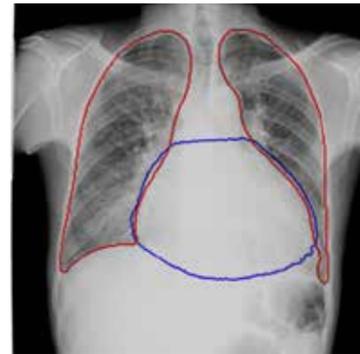
Cardiomegaly (an enlarged heart) affects a wide range of age groups and can be identified on CXR. This condition is incidentally or occasionally found during TB prevalence surveys or community-level screenings.

Silicosis is a form of occupational lung disease notable among miners. Since Silicosis is one of the underlying drivers of TB, addressing both Silicosis and TB, especially for the mining population, is critical.

Our cardiomegaly module produces lung segmentation and cardiothoracic ratio (%), while CAD4Silicosis generates an abnormality score (0-100) and a heatmap.

AI-powered CAD for Cardiomegaly and Silicosis is especially valuable when the availability of human expert readers is limited. These innovations contribute to the incidental finding of heart failure and silicosis during TB screening.

CO-CREATION FOR FUTURE INNOVATIONS

The COVID-19 pandemic posed severe disruptions to TB services. This significantly reduced TB case notifications in many high TB burden countries. To achieve key milestones of the End TB Strategy, TB programmes urgently need additional resources and innovative approaches in order to recover and catch-up.

Delft Imaging is committed to providing cutting-edge solutions and services to support TB programmes. Your views matter to us in our ongoing pursuit to provide demand-driven innovations. To end TB and achieve health equity for all, we want an open dialogue on how to co-create next-generation digital screening solutions and strengthen data-driven TB programmes. To share your thoughts and ideas, please feel free to contact us at info@delft.care.

" After we came up with the concept, Delft Imaging developed the design of what we call Wellness of Keke (WoK). We looked at the cost considerations and were motivated to create it using local content. We contacted a local Nigerian car manufacturing company to produce, WoK. To ensure same-day diagnosis, each WoK is coupled with a portable digital X-ray with AI and TB LAMP or Truenat. We also integrated COVID vaccination and other health service provisions like chronic disease screening - hypertension and diabetes. WoKs drive our community health services and are deployed to remote locations and hard to reach communities. As such they not only help screen people for TB and chronic diseases but have been majorly helpful in providing covid vaccination.

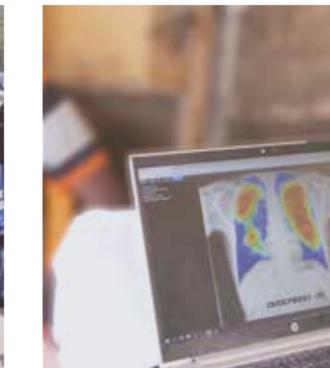**- Dr. Bethrand Odume, Executive Director of KNCV TB Foundation Nigeria**

Solar panel use	Backpack X-ray	CAD for Tuberculosis	Digitised screening	Innovative ways to screen

BABYCHECKER

BabyChecker is a smartphone-based ultrasound that uses Artificial Intelligence to identify risky pregnancies and improve timely referrals from primary health care facilities.

" Having an ultrasound at the community level may encourage women to seek care at an earlier in their pregnancy, especially among younger women with first-time pregnancies. I believe that the provision of timely check-ups will contribute to safer pregnancies.

- **Fatmata, Maternal & Child Health Aide**

Antenatal Care

Every two minutes, a woman dies during pregnancy or childbirth, according to the latest estimates released in a report by United Nations agencies in February 2023. Women die due to complications during and following pregnancy and childbirth. Most of these complications develop during pregnancy and most are preventable or treatable.

An imaging ultrasound scan is widely used to estimate gestational age, investigate suspected pregnancy complications and monitor complicated pregnancies when they occur. However, across sub-Saharan Africa for example, ultrasound devices are not well known. This is especially true for women living in rural areas, who make up about 58% of the total area.

Progress

With resource efficiency at the forefront of our innovation, BabyChecker is designed for any community health worker with no prior experience with ultrasound. Since introducing BabyChecker at community health centres in Sierra Leone, BabyChecker has evolved together with its users, which is a process that has provided us with unique insights on usability, product development and innovating in resource-constrained settings.

Onsite with BabyChecker

Through research projects and collaborations, BabyChecker has been used in various healthcare settings around Africa. NGOs and health centres in Ethiopia, Ghana, Sierra Leone and Tanzania are leading the way in these exciting developments.

Sierra Leone

In September 2021, we began our project at community health centres around Lion Heart Medical Centre (LHMC). In October 2022, we extended the project to 3 additional health centres and introduced BabyChecker at the Jericho Road Community Health Centre. In total, over 60 users working in primary healthcare are using BabyChecker to each scan over 30 pregnant women every week. We continue to explore the usability of BabyChecker and how it can be improved as a point-of-care screening tool.

Tanzania

BabyChecker was used at various health facilities in Karatu District, in the Arusha Region of Northern Tanzania. In only four days, over 100 women were already scanned and 20 users, including clinical officers, midwives and nurses, got familiar with BabyChecker. We thank Misingi and the district for their shared vision of improving maternal and antenatal care.

Margreth & Happyness are nurses at Karatu Lutheran Hospital, Tanzania

They never used ultrasound before. Within 1-hour, they were scanning with BabyChecker: a smartphone-based ultrasound to identify risky pregnancies.
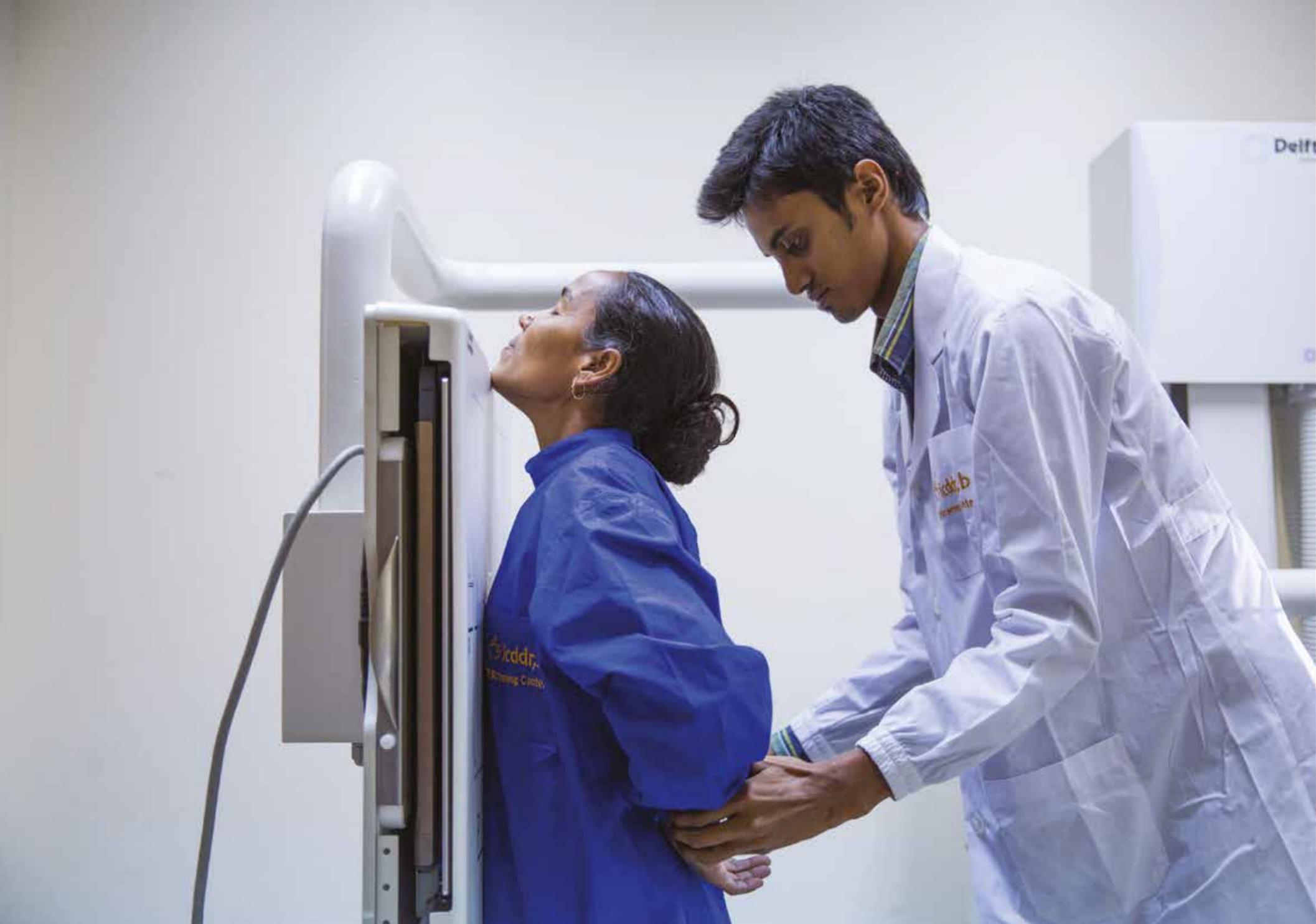
6 Working as One

THE TEAM

Towards the end of 2022, Elsie Appeadu joined Delft Imaging as the Managing Director of the Ghana office. She succeeded Maurits Verhagen after seven years of building and growing our presence in Accra and Africa. We are grateful for his services and efforts.

Delft Imaging fosters a space where everyone belongs.

Our team members' diverse backgrounds and multicultural experiences spark creativity, collaborative ethos and broader perspectives.

We're working towards an inclusive society – within our organisation and through our solutions.

We are happy to communicate with you in:
Afrikaans, Akan, Arabic, Bahasa Indonesia, Dutch, English, French, Greek, Hindi, Japanese, Portuguese, Spanish, Turkish and Urdu.

ACKNOWLEDGEMENTS

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