IT Solutions for improved health services in Africa

University and Hospital Partnerships between African and German Institutions

UNIVERSITY & HOSPITAL PARTNERSHIPS IN AFRICA

CONTENTS

DOCUMENTATION OF THE IT SOLUTIONS

The University and Hospital Partnerships started in 2004 when the German Ministry for Economic Cooperation and Development (BMZ) joined the European ESTHER Alliance, which was initiated in 2002 by the then French Minister of Health Mr. Kushner. ESTHER stands for: Ensemble pour une Solidarité Thérapeutique Hospitalière en Réseau. (Together for Therapeutic Solidarity in a Hospital Network).

It is a network of governmental and non-governmental organisations that support and implement institutional healthcare partnerships.

The Alliance offers a platform for the exchange of knowledge gained and experiences made with international partnerships.
Initially, the objective of the network of European, African, South American and Asian institutions was to build capacity for the diagnosis and treatment of people living with Human Immune Deficiency Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS) and broadened over time to other important problems, as well as their solutions, for the healthcare systems in Low- and Middle-Income Countries (LMIC).

INSTITUTIONAL HEALTHCARE PARTNERSHIPS:

- Generate and stimulate change at the frontline
- Build on mutual trust, long-term commitment and solidarity
- Mobilise a wide range of expertise
- Complement traditional technical cooperation through the added value of personal and institutional interactions that facilitate sharing, adaptability, and learning in both directions
- Respond to local needs
- Are based on a peer-to-peer approach that inspires institutions and individuals to change the way they work, improve the quality-of-service delivery and potentially influence healthcare policy and strategies
- Enable adherence to the Paris Declaration on Aid Effectiveness principles: country ownership, alignment to national policies and systems, partnership with national authorities, etc.
- Promote a formal partnership agreement, reciprocity, joint and equal responsibility, transparency and ethics
- Support international cooperation and foster network building.

THE UNIVERSITY AND HOSPITAL PARTNERSHIPS IN AFRICA – eHEALTH

In 2019 Federal Ministry for Economic Cooperation and Development (BMZ) commissioned GIZ with the project „University and Hospital Partnerships in Africa" (HKP) with a focus on eHealth. HKP supported 16 partnership projects in 14 countries in Sub-Saharan Africa with the objective to identify, develop and implement suitable IT solutions to improve health services and patient care in line with the BMZ Digital Strategy for Africa.

The main focus was on capacity strengthening, experience sharing and knowledge exchange through professional exchange, repeated visits and training.

The heart of the partnership projects was the close collaboration of medical professionals in both partner countries, which builds a high degree of trust and acceptance. The problem was jointly identified, the activities were implemented together and always in line with national strategies, local infrastructure and needs.

In addition to medical professionals, IT experts were also involved in the partnerships, the development and implementation of suitable IT-solutions.

The partnerships worked in a variety of medical fields like the management of antimicrobial resistance, tuberculosis care and surveillance, quality management, prevention and control of non-communicable diseases, improved diagnosis and treatment of cervical and breast cancer and improved maternal and neonatal care.

16 partnership projects

14 countries in sub-Saharan Africa

28 African partner institutions

12 German partner institutions

Duration: 2019 –2021

Focus: eHealth

eHealth solutions in University and Hospital Partnerships in Africa

The use of digital solutions in order to improve health, and health care systems on a global level are increasingly important.

Healthcare professionals are able to identify and name challenges they face in managing and caring for patients, but they normally lack the expertise to develop digital solutions. They need to engage in discussions with IT specialists, who are often not familiar with healthcare systems and the challenges of patient care which need to be solved by solutions they offer.

The digital infrastructure is different in African countries and IT specialists have to consider local solutions which are suitable to the local infrastructure and system.

All German and African partners have gone through the following process:

- ✔ **the identification of a relevant challenge in health services that can be solved with digitalisation**
- ✔ **search for an IT partner to develop an IT solution**
- ✔ **joint implementation.**

To allow other stakeholders to benefit from the experiences, this process is described for 10 of the 16 partnerships.

Target audiences include other GIZ programmes, BMZ, bi- and multilateral organisations, as well as IT companies in African countries and in Germany.

The main source of information is interviews with the German and African partners and the involved IT companies. These interviews followed an interview guide, which was used equally for all interviews.

The study of partnership projects reports, data from continuous monitoring and international documents contributed as well.

How were the partnerships chosen for the case studies?

The structural challenge most often identified and in need of an IT solution is the communication between or inside different levels of the healthcare system, between:

- **healthcare professionals working at different structures in the same facility,**
- **healthcare professionals in central and rural facilities, and**
- **healthcare professionals and patients at home.**

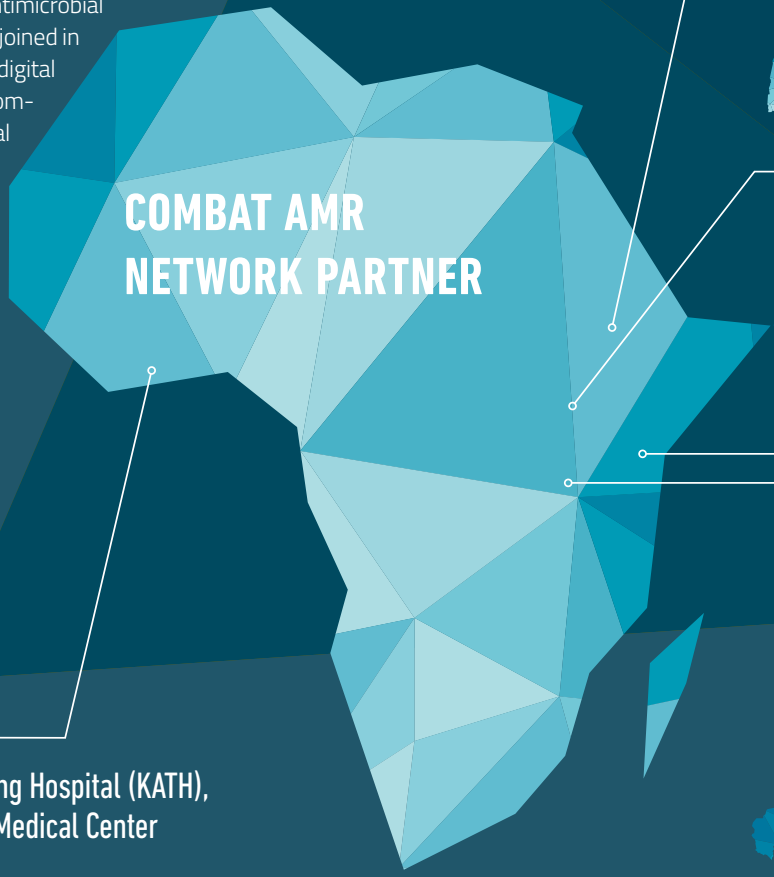
Therefore, tackling one of these communication problems was one criterion for selection.

A second criterion was the national and international relevance of the medical problem approached.

A third criterion was the scale-up potential of the identified digital solution – also for other medical challenges and in other African countries.

COMMUNICATION BETWEEN HEALTHCARE PROFESSIONALS AT DIFFERENT STRUCTURES IN THE SAME FACILITY

Six partnerships tackled the development of antimicrobial resistance (AMR) and antibiotic stewardship. They joined in a network supporting the application of the same digital solution in all five partner institutions to improve communication between the laboratory and medical personnel at different structures or levels in a hospital. These partnership institutions were part of the network:



ETHIOPIA

- Asella Teaching and Referral Hospital & Heinrich-Heine-University Düsseldorf
- Jimma University Medical Center (JUMC) & Ludwig-Maximilians-University (LMU) Munich

UGANDA

- Kiruddu National Referral Hospital, Kampala & University Hospital Leipzig

KENYA

- Kenyatta National Hospital, University of Nairobi & Goethe University Hospital Frankfurt

RWANDA

- University Teaching Hospital of Butare & Charité — Universitätsmedizin Berlin

GHANA

- Komfo Anokye Teaching Hospital (KATH), Kumasi & University Medical Center Hamburg-Eppendorf

Bacteria and other germs adapt when they are exposed to antimicrobial treatment like antibiotics. This results in resistance to the substances used and medications lose their effectiveness. AMR can render it impossible to treat common infections, leading to substantially increased healthcare costs, prolonged treatment, disability and death.

The main causes of AMR development include the overuse of antimicrobial medicine – especially in agriculture and animal farming – and unnecessary prescriptions for patients. Inappropriate use, wrong dosage, and lack of knowledge among doctors and patients aggravate the problem. The extent of AMR in LMIC is largely unknown, mainly because data are not collected to assess it. AMR is part of the One Health approach, a focus area of the BMZ 2030 strategy.

Determining the right diagnosis and treatment depends on reliable laboratory diagnostics. Therefore, the capacity of the cooperating laboratories was continuously increased and microbiological services strengthened.

However, a common challenge involves the communication between medical doctors caring for patients and the respective laboratories performing necessary analyses. Specimen and requests for testing are paper-based and frequently get lost or delayed. The same applies for test results: These often reach the doctor delayed or never, which makes it impossible to base clinical decisions on the results.

Therefore, the partnering hospitals decided to support the development of a digitalised laboratory information system. They developed together with IT specialists an app-based communication system between the laboratory and medical doctors to ensure timely delivery of the request and test result, as well as the collection of valid data for subsequent analyses and the development of locally applicable evidence-based guidelines. The treatment guidelines and test results are available on the application and shall support medical professionals in order to treat patients correctly.

Furthermore, the data from all six sides will in future feed into a regional cloud-based surveillance system.

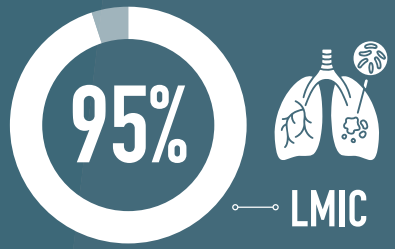
www.giz.de/de/weltweit/84939.html

COMMUNICATION

BETWEEN HEALTHCARE PROFESSIONALS IN CENTRAL AND RURAL FACILITIES

TANZANIA

1. The partnership between a Referral Hospital in a remote area of Tanzania and the Department of Infectious Diseases and Respiratory Diseases of the Charité University Medicine improves the diagnosis and treatment of patients with Tuberculosis (TB) and HIV.



Tuberculosis is still one of the top 10 causes of death worldwide. Over 95% of TB deaths occur in LMICs. Despite progress in care, HIV infections and effective treatment are still of great importance in LMICs like Tanzania.

To reduce the burden of these diseases and related deaths, early diagnosis and continuous effective treatment based on results of highly developed diagnostic tools are essential. People living with HIV and TB are often diagnosed late and treatment is interrupted.

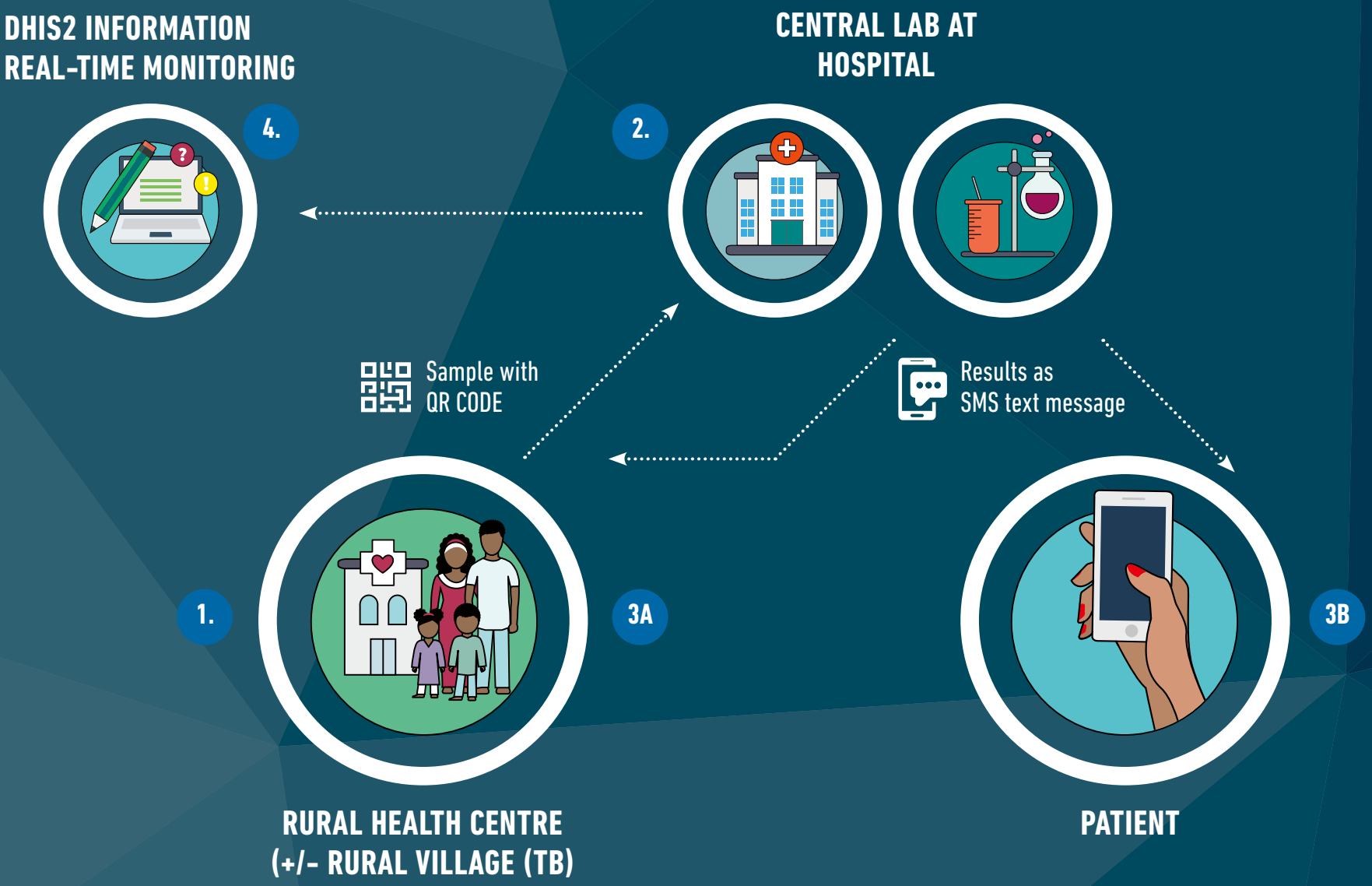
High quality diagnostic laboratory tools necessary for the diagnosis of TB and HIV and monitoring of patients under treatment are available in Tanzania, however only in laboratories of regional or referral hospitals and not in district hospitals or health centres in reach of many patients. Accessibility of these laboratories is limited because of long distances and related costs for travelling leading to patients being undiagnosed or interrupting treatment.

Therefore, the geographical partnership developed an approach to link the central laboratory with rural health centres via eHealth technology. Patients do not need to travel to the central laboratory facility: instead, registered and electronically tracked samples taken at the rural health centres will be sent with the local transport system for testing, ensuring low-cost and low-barrier access to modern, high-quality and reliable diagnostic methods. The results will be communicated back to the healthcare workers in the rural facility by text message to their smart phones or tablets. This way of communication will also be used to advise healthcare workers on how to proceed with a patient's treatment. The eHealth technology ensures that those diagnosed with TB or HIV do not fall out of the system until completion of treatment. It also allows for the monitoring new TB and HIV cases and performance of the healthcare system online in real time and to recognise and respond to delays/ problems in a timely manner.

This solution can be scaled up to all healthcare facilities in the country. The national TB and HIV programme have already shown interest.

https://health.bmz.de/stories/university-hospital-partnerships-tackle-tuberculosis-in-africa/

HEALTH TELEMATICS TO IMPROVE TB AND HIV CARE – EXAMPLE HIV CARE



MADAGASCAR

2. The partnership between the National TB Programme, the University of Toliara and a Non-Government-Organisation (NGO) in Madagascar and the Charité University Medicine improves reporting of TB-related data.

2018

61,000

Many people in Madagascar still suffer from TB. In the year 2018, it was estimated that 61,000 people fell sick with this disease despite the government's "National Tuberculosis and Leprosy Programme", which follows the recommendations of the World Health Organisation (WHO). Centres for diagnosis and treatment of TB patients are also established in rural areas and offer care for free.

One major factor contributing to the still high disease burden is the lack of reliable data for the planning of prevention, identification and care for TB patients. Regular recording and reporting of activities and patient outcome data is paper-based, which is slow, error-prone and can lead to incorrect or missing data.

Improved data collection and reporting contribute to early detection of the TB infection, identification of contacts and the reduction of spreading, more effective treatment and less TB-related death. Reliable data collection and reporting contributes to adequate availability of funding. The amount of external funding is not according to the needs, because the seriousness of the TB situation in Madagascar is not exactly known due to the lack of data. Continuous reliable data collection and reporting is especially difficult because of the remote location of healthcare facilities and TB centres.

Another problem identified is the payment of small amounts of money to healthcare facilities and healthcare workers at the peripheral TB centres for supply chain management, remuneration of healthcare workers etc. The respective cash must be transported in person from the regional level, a costly, slow and not always transparent process. To approach these problems, a digital solution has been developed, which allows for reporting data continuously and in a timely manner from the peripheral TB centres to the regional TB programme office using a mobile phone or tablet.

The digitalisation extends to the money transfer from the regional to the remote facility and ensures the availability of resources needed to run the activities of the healthcare facilities.

The data reporting system is introduced in one region of the island state. The national TB programme appreciates the importance of this system for the availability of valid data and signalled the wish for nationwide expansion.

THE eTB PROJECT IN MADAGASCAR

RURAL TB DIAGNOSTIC AND TREATMENT CENTER

Transparent transfer of funds via Mobile Money to enable continuous TB programme activities

Data supporting regional TB Surveillance

REGIONAL TB PROGRAMME OFFICE

Data supporting national TB Surveillance

NATIONAL TB PROGRAMME OFFICE

DHIS2

ETHIOPIA

3. The partnership between the School of Public Health (SPH), Addis Ababa University, Ethiopia and the Martin Luther University of Halle-Wittenberg, Germany improves the communication between central laboratories and peripheral healthcare facilities.

41 MIO † / YEAR

Non-communicable diseases (NCDs) are the major cause of death among the adult population worldwide accounting for 41 million deaths annually. 85% of these deaths occur in LMIC due to change of lifestyle and increasing risk factors. Cardiovascular diseases account for most NCD deaths (17.9 million), followed by cancers (9 million), respiratory diseases (3.9 million) and diabetes (1.6 million). Health systems of LMI countries are not well prepared for handling these diseases.

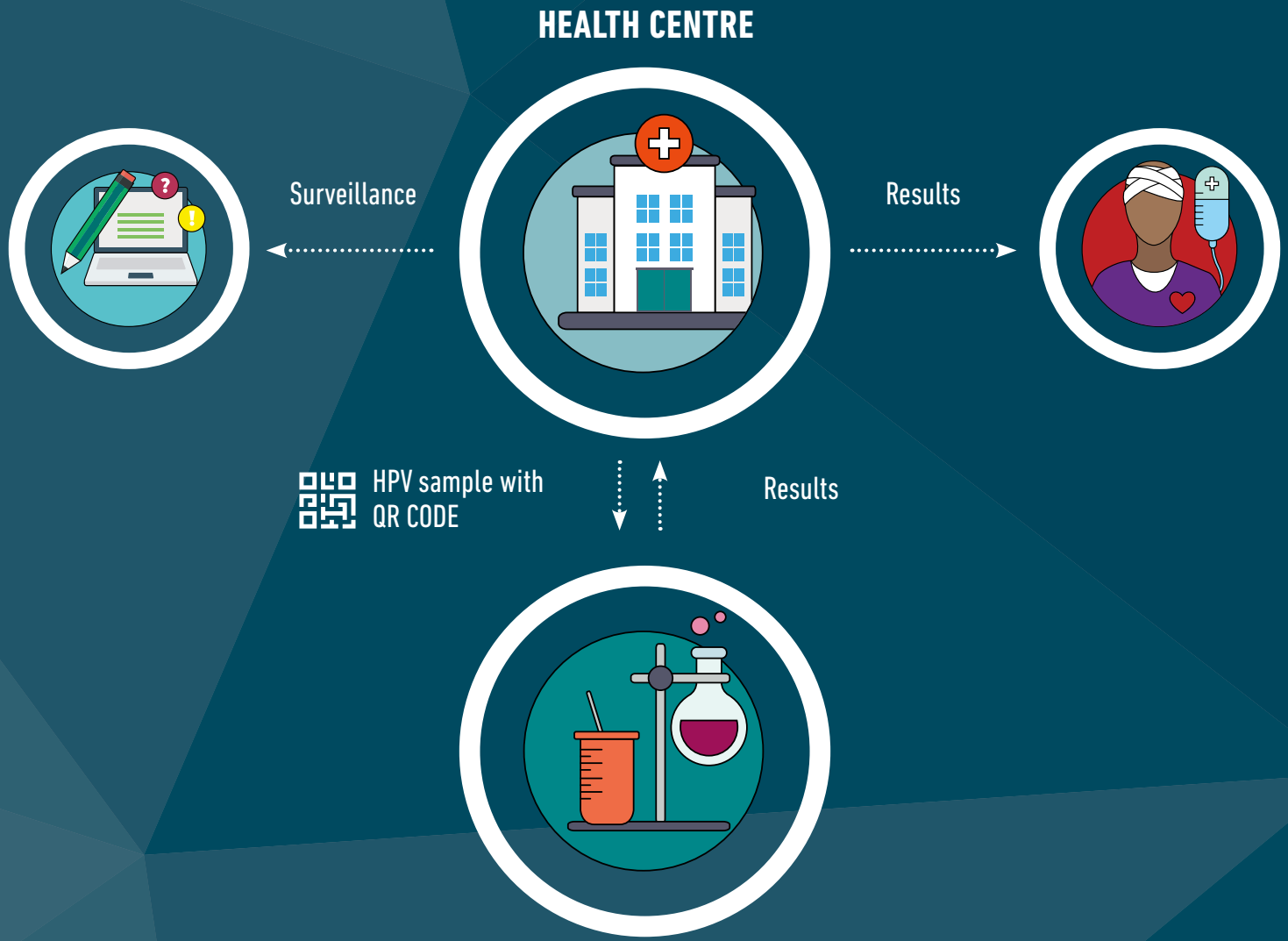
Like in other LMI countries, in Sub-Saharan Africa, NCDs have become a major public health challenge in Ethiopia and are estimated to account currently for 34% of all deaths.

Cervical cancer is one of the leading causes of morbidity and mortality among all cancers in Ethiopia.

To identify patients with the most common NCDs and risk factors, the partnership introduces comprehensive routine screening for hypertension, diabetes, breast cancer and cervical cancer in selected healthcare facilities. The screening for all diseases but for cervical cancer can be performed at the peripheral healthcare facility.

For cervical cancer, a specimen has to be taken and sent to the higher-level healthcare facility for further examination. Specimens often do not reach the higher-level facility or arrive delayed. Results may not reach the sending healthcare worker and women are not informed about the result. Therefore, the communication between the healthcare workers in selected peripheral healthcare facilities and the central laboratory is improved by the establishment of a digital communication link working via a mobile phone.

DIGITAL COMMUNICATION OF RESULTS FROM THE LABORATORY



COMMUNICATION

BETWEEN HEALTHCARE PROFESSIONALS AND PATIENTS AT HOME

GABON

11e Deauville GREEN AWARDS
FESTIVAL INTERNATIONAL DU FILM RESPONSABLE
TROPHÉE OR
The 2022 Winners
Amélioration du traitement de la tuberculose au Gabon

Watch our film:

4. The partnership between the Institute for Tropical Medicine University Tübingen, Germany, and the Centre de Recherches Médicales de Lambaréné CERMEL, Gabon, improves the treatment of patients living with TB and HIV.

TB is one of the top 10 causes of death worldwide. Over 95% of TB deaths occur in LMICs. Despite the fact that the number of new HIV infections has been reduced worldwide – even in the most affected African countries – this disease and its treatment still represents a huge challenge to the healthcare systems of affected countries.

Uninterrupted treatment is equally important for TB and HIV patients. Patients suffering from TB need to take medicine daily for at least half a year, patients living with HIV all their life. Uninterrupted treatment is the key to successful treatment. Often, patients do not return to healthcare facilities to monitor their treatment and end up stopping or interrupting the medicine.

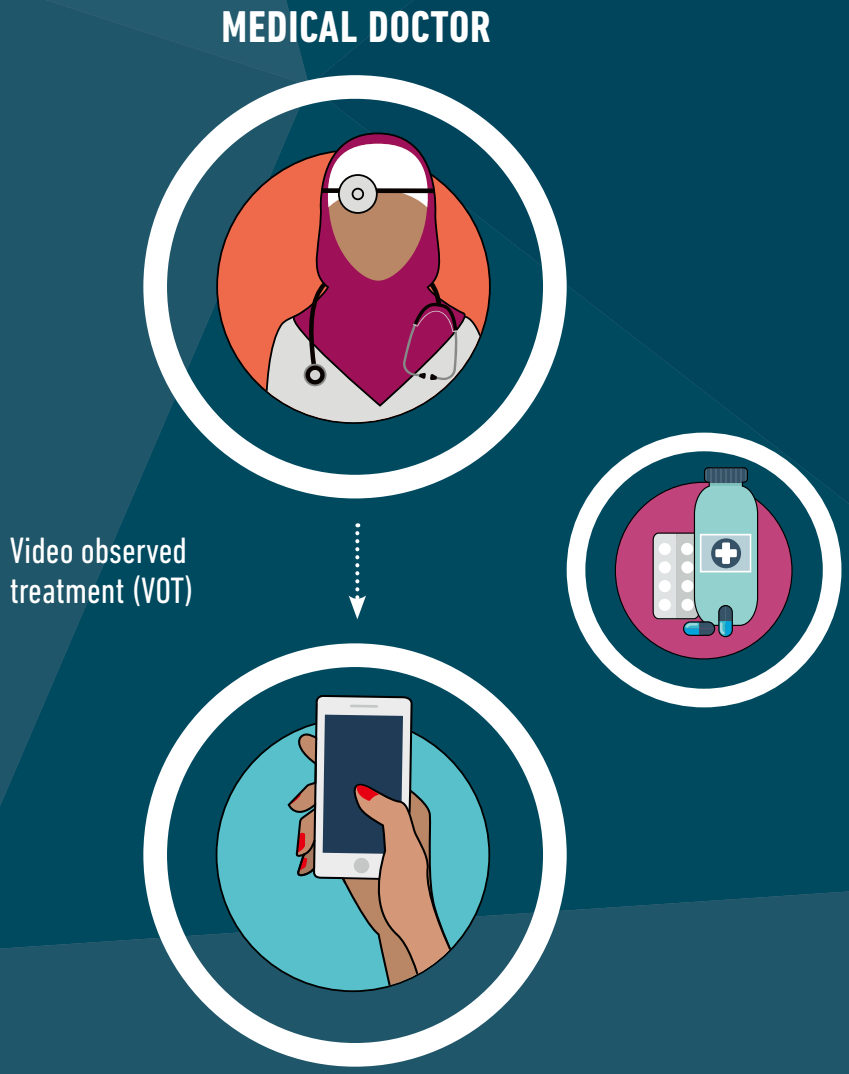
Many years ago, countries introduced the so called "directly observed treatment strategy" (DOTS), which did not work according to expectations. In Gabon, the number of new TB infections was 529/100,000 in the year 2017 and 147/100,000 died. In Gabon, 56,000 people are infected with HIV. Many of them are infected with HIV and TB at the same time. Ensuring long-term, regular and uninterrupted treatment for both infections is a major hurdle, but it is the only path to a healthy and symptom-free life. In Gabon, 44% of TB patients do not complete their treatment.

To improve this situation, "video observed treatment" (VOT) has been introduced as a direct line of communication between the healthcare worker and the patient at home.

Patients use their mobile phones and an app to produce a video when taking their daily treatment and send the video to the health-care worker caring for them. She/he can have a look and see whether the treatment has been taken properly. If no video arrives or treatment has not been taken properly, the healthcare worker will contact the patient via phone to find out why the video was not sent or/and advise him/her how to take the medication. Patients can also communicate unpleasant side effects of the medication to the healthcare worker and be advised accordingly.

This is a promising approach for reducing the lack of follow up with patients under TB and antiretroviral treatment and can be used not only in Gabon, but also in other African countries facing the same problem or suffering from other chronic diseases.

VIDEO SURVEILLANCE SYSTEM FOR TB AND HIV TREATMENT



DATA COLLECTION, ANALYSIS & SURVEILLANCE

Relevance of valid data availability and surveillance

The availability of valid data is the basis for policy and strategy development by the Ministry of Health (MoH) of every country and for planning and budgeting by regional and district authorities and healthcare facilities. Most IT solutions in healthcare support the collection and availability of necessary data directly or indirectly. Monthly data analysis offers management teams an overview of morbidity, mortality and disease-specific information as well as the functioning of the healthcare system at the respective level.

For mobilising external funding, valid data showing the extent of the problem are also important.

Here, "surveillance" comprises a national and regional data collection approach for continuous disease monitoring, epidemic preparedness and control. It aids responsible authorities beyond healthcare facilities as source of information for decisionmaking at national level

The above-described partnership with Madagascar facilitated the collection of valid TB-related data, which is entered into the national TB database and as such supported improvement to the national TB surveillance system.

Another area for surveillance is the development of antimicrobial resistance. The partnerships of the AMR network will feed data collected in a large hospital about antimicrobial resistance into a regional database beyond national borders. This database will help to monitor the resistance building process in a whole African region and can lead to the creation of information and advice for adequate antibiotics to be used.

Most of the countries in Sub-Saharan Africa have established a digital Health Management Information System (DHMIS) and platform, which contains all data collected in the country and is accessible for healthcare managers.

All partners of the AMR network, the partners in Madagascar and in Ethiopia, use the DHIS2 Platform to report the data they collect making it available to other relevant parties in the healthcare system.

EXPERIENCES

MADE WITH THE DEVELOPMENT AND IMPLEMENTATION OF THE IT SOLUTION

Development

Are German and African medical doctors ready to move into the IT world?

The digitalisation of healthcare system processes is, as of yet, not far advanced in Germany and countries in Sub-Saharan Africa. Therefore, medical personnel are not very accustomed to IT solutions, their complexity and the huge opportunities they offer.

By entering into a partnership to solve healthcare system issues with IT, the African and German partners demonstrated their interest and readiness to face new challenges and to think in an unfamiliar way in an area where they lack qualification.

These challenges started with clearly defining a problem that could be solved with digitalisation, followed by the development and implementation of a suitable IT solution.

The IT literacy of the African and German partners involved varied from no exposure to digital instruments to the availability and involvement of a good IT team. Most of the African and German partners are highly qualified clinical experts, but lack knowledge about the complexity of IT processes and what to consider for successful implementation.

In all documented partnerships, African and German partners were involved to the same extent in the development of ideas for IT solutions and discussions with an IT company selected for the development of the respective software. The degree of digital knowledge influenced the degree of involvement in the cooperation with the IT company. It also determined the awareness of already available IT solutions and their usefulness for solving the identified problem.

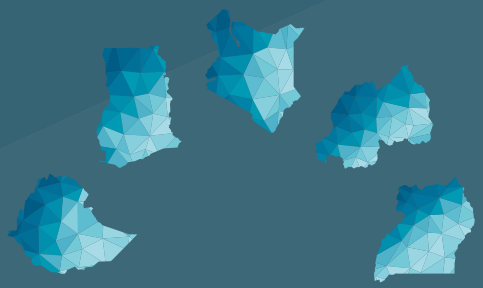
All partners considered the conceptualisation and development of an IT solution to be a very interesting and enriching learning process that will improve healthcare services.

“PRIOR TO THE DIGITAL INTERVENTION, THE LABORATORY TECHNICIANS WERE COMPLAINING THAT ‘WE ARE NOT DOING ENOUGH CULTURES’ TO ASSESS FOR ANTIBIOTIC RESISTANCE. ”

Professor Esayas Gudina, Jimma University

Identification of an important challenge and the IT Solution

All partners were able to define an important challenge that hindered effective patient care and that could be improved with a digital solution.



ETHIOPIA, GHANA, KENYA, RWANDA, UGANDA

The six members of the **AMR network** had made great efforts to strengthen the capacity of laboratory personnel. However, despite the fact that patient care was improved through capacity strengthening, the improvement was limited, because the paper-based communication between laboratory and medical personnel in other hospital departments did not work well.

The partners in all five countries realised and agreed that only digitalisation could help.

The team of the University in Munich contacted another group in the University called "Informatic Health Solutions". One of its members, who is also a medical doctor, supported the process of finding a suitable solution. This search was a continuous process involving the African and German partners alike, and they all learnt as part of the process. The African partners clarified what is possible and not possible under the conditions in their countries. They found out that a solution already existed which exactly met the requirements of the AMR group and countries. This was offered by an Indian non-governmental organisation called Society for Health Information Systems Programmes" (HISP India) who are already involved working in African countries.

Making this platform, which is used in all partner countries, part of the IT solution will result in addition to the establishment of a surveillance system for AMR and guarantees sustainability.

However, due to different existing IT Systems in the involved institutions and countries adjustments to the IT solution were necessary. Working with an IT company familiar with the situation in African countries was therefore a huge advantage and reduced the risk of failure.

GABON

The partner universities in **Gabon and Tübingen** were even further advanced with regard to identifying a problem in need of an IT solution. A study carried out in 2016 showed that less than 50% of TB patients under treatment take their medication regularly. This is an unacceptable situation, which can only be improved by establishing continuous communication with the patient. WhatsApp was considered as an option.

A member of the team from Tübingen is permanently stationed in Gabon and saw early on the importance of having an IT team at hand, which he established with five experts in Gabon. The existence of this team allowed to think of possible solutions for the problem identified.

The development of the IT solution was still a learning process for them, especially in regard to data security and respective regulations.

The responsible German clinician was not extensively exposed to IT processes, yet learnt a lot during the IT-related discussions und continues to learn. She mentioned that she is now in a better position to assess eHealth projects.

Together with an African-based IT company, they developed their idea further. This company won the tender and will develop the final product for video-based observation (VOT) of medication intake.

Being more familiar with data security led to the decision to look for another messenger than WhatsApp.

TANZANIA

The experts involved in the partnership between the **Ifakara Hospital in Tanzania** and the **Charité Berlin** are all involved as a team in all processes for finding an IT solution.

The German partner had already gathered quite some experience and knowledge in the field of IT and worked in Tanzania with an open-source software called Open Data Kit (ODK) to collect data for study purposes. Why not use this software for solving problems related to TB and HIV? It showed that the software used did not allow for two-way communication and the collection of more data points for one person. Therefore, another solution needed to be found.

During the match-making workshop organised by GIZ to bring university partners and IT companies in Germany into contact, the partners talked with an IT company familiar with the situation in Africa and realised that they offer exactly the product needed for the work in Tanzania, which needed of course adaptation for the very specific requirements.

The discussions and negotiations helped to learn how to engage with an IT company in order to find a suitable solution together.

The Tanzanian team was involved in all discussions and every single step for the concept development. It proved of great importance that the hired company was familiar with all aspects of setting up an IT solution in an African country and also accepted that not all requirements can be defined at the beginning.

MADAGASCAR

The team of the partnership between **Madagascar and the Charité Berlin** identified the problem and the suitable IT solution. They needed the IT company to translate the idea into an IT solution.

The team in Madagascar had already gained some experience with the development of a platform. This was very helpful for the development of the new platform, which is built on the existing one. However, no product was available but developed together by the project team and the IT company.

The German clinician was not yet exposed to work related to IT. In an iterative process, the team developed the solution together with the IT company. This was a new experience for the company as well. The biggest challenge was to match the new technology with the less advanced IT environment in Africa.

The team contacted and talked with several IT companies, which also increased their knowledge about processes, possibilities and new technologies.

ETHIOPIA

While the German clinician in **Halle** had already gained some experience with the development of an IT solution, the **Ethiopian partner** was less experienced. The Ethiopian team was exposed to the use, but not to the development of IT software. Data management was the main area of experience.

The selected Ethiopian-based IT company did not offer an existing solution; it had to develop a specific solution for the problem identified by the partnership team. The solution needed to align with the national DHMIS.

A big challenge was the development of tender documents. It would have been advantageous to involve the administration of the Ethiopian institution from the beginning in order to know their requirements and regulations.

Implementation followed with challenges to be overcome

The development and implementation of the digital tool at all sites of the **AMR network** presented its own challenges, because the starting situation in the partner hospitals varied. Therefore, the implementation progress at different AMR sites also varies. While the digital tool is well established and used in the two partner hospitals in Ethiopia and it is nearly completed in Ruanda, the process has come to a hold in Uganda and Kenya, and it is delayed in Ghana due to different reasons.

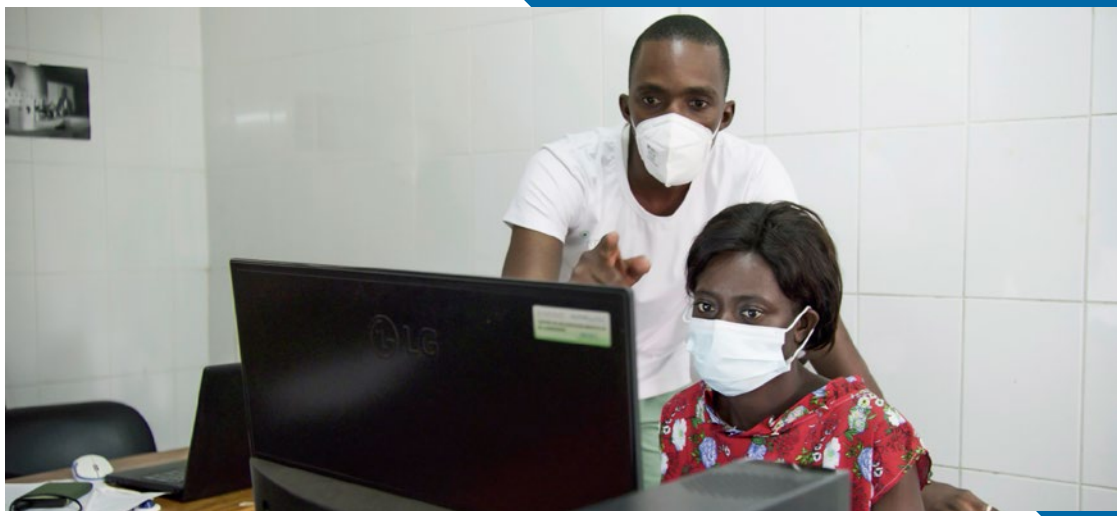
The implementation process is therefore described for the partnership of the University of Munich with the Jimma University of Ethiopia, which is the coordinating and leading partnership for this process.

A huge advantage was that, in most African countries of the AMR network, the contracted IT non-governmental organisation (NGO) "Society for Health Information Systems Programmes" (HISP India) was already working with local teams related to the national DHIS-2 and has gained experience working in an African context.

The implementation of the mobile application at Jimma has started, after the underlying DHIS-2 eHealth platform requirement assessment and implementation have been finalised. By June 2021, a prototype version of the AMR data collection & surveillance system was ready including a mobile app version that was validated by August 2021. A test implementation phase started in September 2021, revealing functional deficiencies in the mobile app, e.g. no user-friendly lay outs tailored for clinicians, no possibilities for clinicians to provide feedback on clinical outcomes and antibiotic prescriptions. After HISP India improved the system, all systems were in place for using the app in January 2022. Patients have been continuously registered ever since.

Laboratory personnel and clinicians were trained by the employees of HISP Ethiopia and experts of the national DHIS-2. The routine morning meeting of the different departments were used for the training, ensuring that the care of patients was not interrupted.

After the use of the system started, challenges were faced again as expected. For problem solving, the experts of HISP Ethiopia, the DHIS-2 and the IT department of the university could be approached and issues were solved, guaranteeing a smooth implementation.



Challenges included a weekly collapse of the system, substandard functioning of the interface for clinicians, a substandard functioning dashboard and analysis of the resistances.

The request for the analysis sent by the clinician to the laboratory is still paper-based, but will soon only be digital. The report of the analysis from the laboratory to the clinician is now digital. The report can be printed for use in the patients' files, which are still paper-based.

As the data are stored on the DHIS-2 platform, data safety is not an issue. The regularly required software update is easily done because the DHIS-2-system is already in use.

The NGO HISP India had to work with different sites and different systems. Working for a regional network of hospitals comes with special challenges. The countries are not only hesitant with regard to the development of digital systems but also with regard to dealing with governmental requirements, frameworks and regulations. HISP India started to have discussions jointly with all sites to find out the requirements followed by individual discussions with all partners. As the clinicians are not IT specialists and are not used to presenting the requirement in a form well understood by IT experts, it took them some time to find out what was requested and made repeated adjustments as necessary over time. Adjustments at the pilot site Jimma could be replicated for all sites, which was an advantage.

During the phase of developing the tool, HISP India was also in contact with WHO to take into consideration international standards in regard to AMR and develop coding accordingly.

The training of healthcare workers for the use of the app was carried out remotely, and so was the continuous follow up. Face-to-face discussions would have made the process easier and led to an understanding in a shorter period of time. The presence of a local IT-Team was very helpful.

IMPORTANT LESSONS LEARNT:

- **It is important to know the IT capacity of the country and the local structures in place. Therefore, the process should start with an assessment of these conditions.**
- **It is an advantage to work with a knowledgeable IT person from the country, who knows how to link the new system with existing systems.**
- **Contracting an IT company that knows the situation in Africa related to IT systems is very helpful and recommended.**
- **The communication between IT experts and clinicians can be a challenge. Clinicians have to listen and be ready to learn.**
- **Contributions of clinicians have to be taken care of when developing the app.**

The development of the digital system for the partnership **Gabun and Tübingen** was an iterative process and involved the IT team of the partner hospital in Gabun, an IT company of Gabun and a German IT company. The first version did not look as expected, because the clinicians did not know how to phrase a request for an IT expert. And the IT experts did not know the medical facts and needed time to understand what they were asked for.

The involved experts followed different tasks. While the German IT expert looked at regulatory requests and data security and documented the system, the local expert carried out the programming. For the implementation, a team of five, including two medical doctors, one nurse and two field workers, were trained and in contact with the recruited patients.

Not all patients owned a smart phone and were therefore given one with credit. It was necessary to train them on the use of a smart phone as well as for the use of the VOT app. Respective training modules still need to be developed to enable scaling up.

The use of the VOT tool is easy for the patient as well as for the medical personnel. With one click, they find out if the patient has sent the daily video to prove that the medication was taken. Another click allows the follow up of the patient in case a video was not received.

The system has the potential for being scaled up for use with other chronic diseases needing lifelong treatment.

The system is proving effective. All 20 recruited patients take their medication as requested and are able to handle the application properly.

The development of the digital tool for the partnership between **Madagascar and Charité Berlin** involved local and German IT experts. In addition to the advantage of having local experts with knowledge of the local digital situation, their involvement allows for continuous work without long travel to visit remote centres.

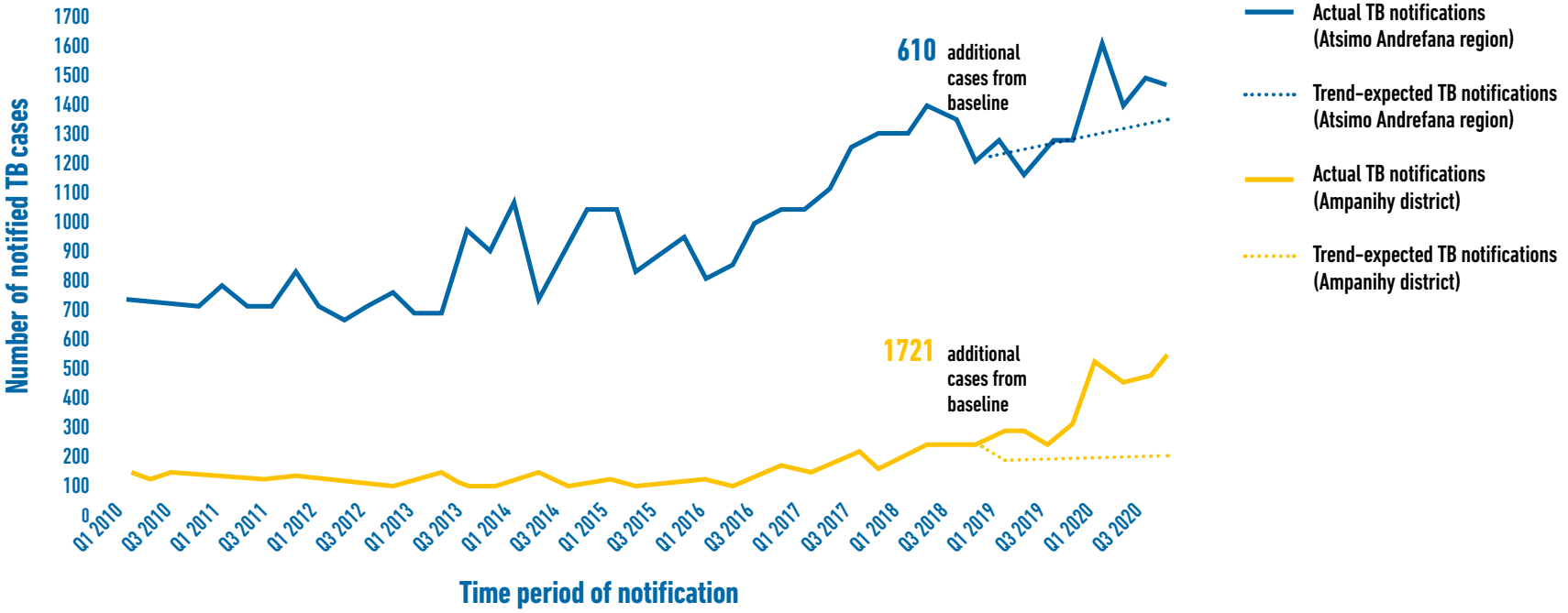
The tool was continuously adjusted after the implementation started. This was necessary, because not all requirements were foreseen, and a changed situation asked for additional data to be included. As an example, Body Mass Index (BMI) was not included as a variable at first, but it was later considered important. Therefore, the IT tool must allow for adjustments, it should be user friendly, and not too complex.

Since the local internet connection is not stable, it must be possible to enter data offline for later upload.

Instead of organising centralised training for all TB centres, the medical personnel of each TB centre were separately trained. Each centre nominated a focal person, who could contact the chief technical officer at the established help desk in case an issue occurs. The help desk is accessible during working hours. The chief technical officer visits each centre once per month.

The new approach has already led to a great improvement in the notification of TB patients.

Data collection in Madagascar: addional cases since the implementation of the IT solution



IMPORTANT LESSONS LEARNT:

- The design of the systems must allow for modifications and adjustments.
- The application should have interfaces to connect to other existing or new important systems.
- The involvement of a local IT expert, who knows the digital situation of the country, is a great advantage.
- It must be possible to enter data offline.
- The system must be user friendly and not too complex.

The partnership of the **Ifakara Referral Hospital in Tanzania** and the Charité University Hospital in Germany prepared a roll-out plan for implementation. They tested the software at one site and tackled the problems occurring. These were related to the amount of patient data to be entered, the design of the fields for data entry, the language used and the data transmission. After the tool had been improved, healthcare workers have been trained in its use and the use of the tablets provided. The training was followed by a step-wise scaling up to two main sites and dispensaries in its catchment areas. The German IT company was continuously involved during the whole implementation process and supported the adjustments.

Increasingly more patients could be treated after the implementation of the IT-Tool.

Entering all the data on the tablets was an additional task for the healthcare workers, requiring the introduction of a payment as an incentive and involvement of more personnel for data entry.

Data storage follows European Union (EU) rules to guarantee data safety. Additionally, a sub-project is implemented for data security and will produce a document, which explains data security aspects to be taken care of and how.

TB data are entered into the national DHIS-2. Discussions with the national TB programme are on the way to allow for entering the additional data collected in Ifakara on this platform as well.

An evaluation is planned and will include social and economic data, which will also show the costs for the continuous use of the tool.

IMPORTANT LESSONS LEARNT:

- **Working with an IT company familiar the local conditions supports communication and understanding and the development of an adequate tool.**
- **The introduction of a new tool has an advantage but also a disadvantage, because it increases the workload of the healthcare workers involved. Therefore, it might be necessary to introduce an incentive.**

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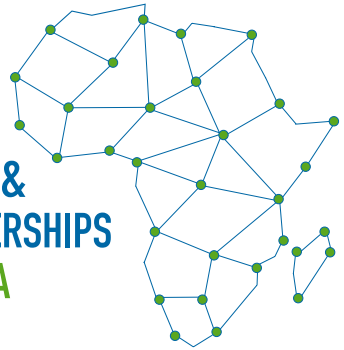

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