



q_ure.ai

Streamlining TB Diagnostics in a Tertiary Hospital Environment

Baran, Rajasthan



The problem

Populations across India continue to face devastation from Tuberculosis (TB)— the world’s most infectious disease. TB is highly contagious and, even in city centers, hospitals struggle to properly manage the diagnosis-to-treatment cycle in a way that can halt the continued onslaught of a disease that is curable with proper detection and invention.

Especially for resource-strapped clinicians in overcrowded urban care facilities, triaging TB in an effective manner without “missing” potentially infected patients before a proper diagnosis is rendered is a major concern for healthcare providers.

Once a suspected patient returns into his or her “micro-community” (family home, workplace, etc.) While awaiting formal illness detection, the risk of spreading infection unknowingly increases substantially, not to mention the potential or disease progression.

Lack of tools

Early TB diagnosis can save untold lives. But effective detection tools have been lacking for many years. Now, innovators in the field of automated medical imaging interpretation are emerging at the front-lines of the global battle against the world’s leading pathogen to provide support in the form of AI-enabled deep-learning technology.

A Tertiary Hospital Test Case

While TB continues to ravage communities across India, one hospital in Rajasthan in the region of Baran has a new weapon to combat what has, up until now, been an unrelenting killer. Due to its large TB patient base, Baran’s chest physician team was in dire need of assistance. Qure.ai deployed its qXR lung X-ray evaluation software in 2018. Since then, the impact and benefits of automation in radiology reads using advanced technology have been studied. The software has played a strong role in augmenting physician management of presumptive TB suspects.

Results Summary

Baran District, through a test pilot for qXR software implementation, yielded valuable results around the potential for AI-enabled software interpretation of chest radiographs for TB detection.

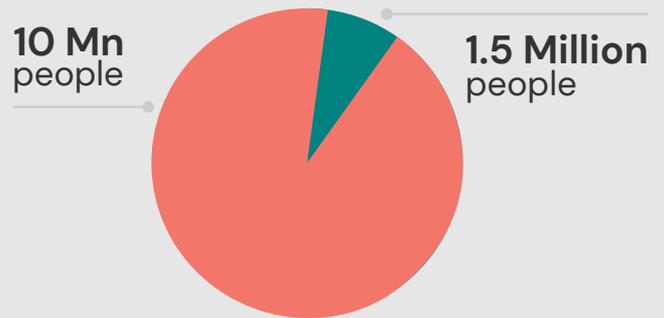
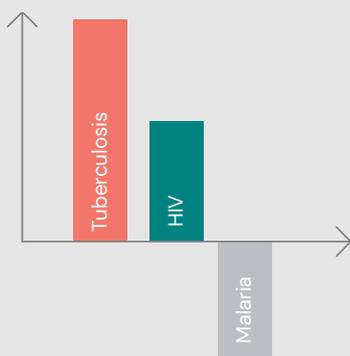
Total X-rays : 13000 | Duration: 18 months

The use case showed that the triage capabilities offered by machine automated reading streamlined early phase TB diagnoses. With the help of qXR, busy physicians received X-ray evaluation assistance—literally within minutes—to qualify suspected cases for immediate referral to the hospital’s dedicated TB Center, where patients could receive prompt conventional testing (including sputum analysis) and a faster pathway toward life-saving treatment.

Background

Facts about Tuberculosis (TB)

Tuberculosis (TB), an airborne communicable disease caused by the Mycobacterium tuberculosis, the world’s leading cause of death from a single infectious agent. (Source: Stop TB).



Mortality Rate

According to the World Health Organization (WHO)

The disease spread is still raging at epidemic proportions – with 10.6 million cases globally. In fact, this devastating illness is responsible for more fatalities worldwide than HIV and malaria combined.

Symptoms of active TB



Blood-containing
Mucus



Fever



Night Sweats



Weight Loss

(Source: WHO)

TB is spread through the air from person to person when an infected individual coughs, spits, sneezes or even speaks in close proximity to a non-infected person. Many individuals may spread the illness through human-to-human contact before they are even aware they are sick, making transmission throughout families, communities and shared places of work problematic.

TB is curable when treated promptly, but without proper diagnostics and drug treatment, the disease is often fatal.

The problem is especially exacerbated by a shortage of qualified radiologists (even in urban areas) able to administer and properly read lung X-rays—a standards means of diagnosis for TB.

Improving TB Detection Protocols at Baran District

Baran District Hospital caters to a region of 1.2 million residents. It is a tertiary care facility, equipped with a dedicated Tuberculosis Center and a series of radiology services and capabilities. The surrounding region has a total TB population of 2,900 individuals, notified from both private and public health centers, along with a migrant population from neighboring states consisting of symptomatic cases referred to Baran District for evaluation.

Based on the 2019 report, the newly identified TB cases had crossed 80% of the total notification—an increase from the previous years. Baran provided an ideal environment to benefit from Qure.ai's chest X-ray interpretive algorithms. The company teamed with the hospital starting in 2018 (and leading up through fall 2019) to begin comprehensive deployment and real time testing of its AI-powered solution.

The Objective

As Qure.ai embarked in a collaborative effort in concert with Baran District, the following objectives were pursued:

- Increase notification rates
- Improve workflow/process management
- Reduce patient dropout (stop infected individuals from aborting treatment protocols and re-integrating back into their communities without proper evaluation and/or medicine therapy)
- Reduce turnaround time
- Reduce inflated diagnostic costs

qXR Becomes “Part of the Team”

The mission of Qure.ai isn't just to focus on assisting specialists to read images faster or better. It is about improving overall healthcare outcomes—both clinical and operational. Ultimately, the solution is most effective when it embeds into the overall diagnostic care solution. In many cases, the company has deployed solutions with screening providers in low resource parts of the world who do not have access to clinical specialists. In other cases, Qure.ai is using AI to help administrators monitor reading quality or prioritize worklists.

Improving TB Detection Protocols at Baran District radiograph interpretation are slower, the risk that the hospital will “lose” the potentially infected patient back into the community is very high. In this scenario, not only does this threaten personal health outcomes (because treatment is not rendered within a timely fashion), but risk of further spreading the disease to others within the community (while treatment is delayed) is greatly increased.

In the case of Baran district hospital, Qure.ai's qXR tool integrates into the hospital's workflow system to enhance the flow of patient triage and referral—two key areas that have maximum impact on the patient's ability to be properly diagnosed and receive prompt drug treatment.

When used for TB point-of-care screening, followed by immediate bacteriological/NAAT confirmation, Qure.ai significantly enhances the on-site physician's ability to treat the patient while he or she is still at the clinic. When turnaround times for radiograph interpretation are slower, the risk that the hospital will “lose” the potentially infected patient back into the community is very high. In this scenario, not only does this threaten personal health outcomes (because treatment is not rendered within a timely fashion), but risk of further spreading the disease to others within the community (while treatment is delayed) is greatly increased.

Faster, Most Accurate Diagnosis

Qure.ai's integration into the diagnostic workflow at Baran District positively impacted clinical efficiencies in several key areas:

Using the qXR tools, technicians are alerted to any sign of TB infection within minutes, thus eliminating an extended waiting period for patients.

For those individuals where TB is potentially detected, they are sent to the TB Center care facility immediately, where they can meet with a TB specialist and commence an appropriate treatment protocol.

This timetable vastly decreases the patient drop-out rate, as both clinicians and patients themselves are now on alert for a possible abnormality.

qXR enables an automated referral system and reduces the workload of the physician team at Baran, where practitioners are already overloaded and stretched due to too many cases.

By referring suspected patients to the specialized TB care center, the entire diagnosis-to-treatment cycle is shortened and streamlined—and physicians are free to attend to other medical care needs and cases, without compromising the priority of TB treatment.

Moreover, the qXR software tool reads ALL X-rays (TB symptomatic or asymptomatic), thus detecting additional cases that would have been missed otherwise (the so-called "missing TB cases" that are often overlooked within a crowded healthcare system that is sorely lacking more manpower and diagnostic resources).

Impact

The results of the Baran District use case analysis show that qXR software deployed in addition to the standard of care workflow positively impacts faster, more prompt disease identification. qXR analyzes all chest X-rays without introducing a bias for symptoms, identifying newer cases that would have been missed otherwise. Since test results using the software are available within minutes (rather than hours or days) at the diagnostic center itself, the technicians and healthcare workers are empowered to navigate the presumptive cases for confirmatory tests, while they wait for their X-ray films the next day. Individuals who have traveled to the hospital from remote areas are promptly seen—greatly reducing their inclination to “drop out” and return home untreated.



While qXR offers a parallel diagnostic protocol (i.e. final diagnosis of TB is made by automated interpretation as well as conventional sputum testing and analysis), it is invaluable in a triage capacity—enabling physicians to manage more patients and handle a variety of ailments while still keeping a dedicated focus on TB detection and intervention.

Within 2 months of deploying qXR software at Baran District TB center, the TB notification rates increased from 67.8 to 90.14

As qXR refers all asymptomatic cases too for confirmation, which would have been otherwise missed, qXR could influence the increment in the percentage of new cases. In 1.4 years, we saw significant increase in new TB patients enrolment from **62% to 85%**.

The turn-around time of Chest X-ray analysis by qXR is less than 2 minutes at Baran District Hospital. A comparative analysis of the treatment enrolment time before and after the software was deployed showed a 2.5 day reduction in treatment enrolment time, from 5.7 days to 3.2 days after the introduction of qXR.

Results

Increase in average monthly notification rate:

When comparing the notification rates and their patterns before and after qXR is deployed, ie, before July 2018 and after August 2018, the average monthly notification rate at Baran District TB Center (Baran DTC) increased from 67.8 to 90.14

Decrease in drop-out:

There was also a decreasing trend in the drop-out of presumptive cases to the TB Unit from 72% to 53% from October 2019 to December 2019.

21% cases predicted as presumptive:

An analysis of data for yield on case detection-notification from qXR software collected between October 2019 to December 2019 showed that out of 2,070 chest X-rays analysed during this period, qXR predicted 21% cases as presumptive with signs of TB from X-rays, which were automatically referred to the TB center for sputum collection immediately. A minimum yield of 2.3% has been achieved with the software referrals.

Increment in percentage of new cases:

Percentage of new cases enrolled at Baran DTC has significantly increased during the period August 2018 to Dec 2019, from 62% to 85%. As qXR refers all asymptomatic cases too for confirmation, which would have been otherwise missed, qXR could have an effect on the increment in the percentage of new cases.

Significant reduction in treatment enrolment time:

The turn-around time of Chest X-ray analysis by qXR is less than 2 minutes at Baran District Hospital. A comparative analysis of the treatment enrolment time before the software is deployed [prior to July 2018] and after qXR is deployed and streamlined [post July 2018] showed a 2.5 days reduction in treatment enrolment time, from 5.7 days prior to qXR to 3.2 days with qXR.