
Impact Assessment Study

of

CBNAAT Machines

project by

Indian Oil Corporation

on the lives of TB patients being treated in

*Thane Municipal Corporation Civic Hospitals
(TMCC)*

Report submitted by:

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Executive Summary

Tuberculosis continues to be a major public health problem in many parts of the developing world. According to USAID, India has the largest number of TB cases in the world.

India has more than a quarter of the global TB and multidrug-resistant TB (MDR-TB) cases. These patients do not respond to one or two drug regimens and they take longer time to heal thus impacting their financial status, affecting their nutrition and immunity and pushing them further into poverty adding to social stigma. Medications have improved and diagnosis needed to improve too, hence CBNAAT machines were installed in Thane Municipal Corporation (TMC) hospitals funded by IOCL to improve outcomes. This study evaluates the change in the lives of the patients and doctors and lab technicians due to CBNAAT machines being installed and compares it with before CBNAAT were installed.

It was found that CBNAAT machines provide quicker and more effective diagnosis of TB patients as compared to the way it was tested before – by using microscopy and X rays etc. With the rise in drug resistant TB cases, CBNAAT machines have been very effective in identifying the multi drug resistance in a patient. This helps the doctors to recommend the correct medications and the sooner the patients go on medications the better. The recovery of the patient is more sustainable and chances of relapse are reduced.

During personal interviews, doctors and lab technicians and other officials expressed very high levels of satisfaction with CBNAAT machines, its accuracy, the quality of its report and resulting diagnosis and better treatment outcomes. The lab members felt that the CBNAAT machines were easier to operate and they get reports within 48 hours as opposed to more than 5 days. Delay in starting medications delays the time taken by the patient to recover.

The patients and their family were happy and thankful that TMC hospitals have provided them free testing. One of the important findings was the high number of days taken for medication to start after the onset of the symptoms in the patients hence the need to increase awareness of TB. Many patients get their tests done with nearby general physicians and private clinics where they are charged between Rs. 2,500 to 3,000 per sample testing in private hospitals/ clinics. It is free at TMC CBNAAT sites. We can make a conservative estimate that the return on this investment incurred in procuring CBNAAT machines, at Rs.71.61 lacs, would be recovered in a 4-year period at between 2.7 to 3.2 times.

It has been recommended in this report that IOCL consider funding costs incurred by TMC civic hospitals in buying cartridges for say, 6 months, so that higher number samples continue to get tested with CBNAAT machines while they await state funds for the same.

IOCL may also consider providing financial assistance to some very poor families so that they continue their medications so that relapses and spread of TB is contained in that community. IOCL should continue to support the TB eradication drive by the government since the patients and their families have really benefited by the support provided.

They can consider sponsoring poor families by ration, financial assistance, livelihood support by providing hens and goats, sponsoring girl children for education and young ladies with skilling programs.

The Global TB Scenario

Tuberculosis is a potentially life-threatening, airborne bacterial infection that can be found worldwide. Tuberculosis is a major public health problem in India.

Early 2000s

New policies were introduced in India in 1993, which resulted in increased resources, improved laboratory-based diagnosis, direct observation of treatment, and use of standardized anti tuberculosis regimens and reporting methods which showed remarkable results.

In the early 2000s. Tuberculosis (TB) was estimated to be killing nearly 500,000 people in India each year. Studies conducted show that less than half of patients with TB received an accurate diagnosis, and less than half of those, received effective treatment.

By 2001, more than 200,000 health workers had been trained, and 436 million people (more than 40 percent of the entire population) had access to services. About 3.4 million patients had been evaluated for tuberculosis, and nearly 800,000 had received treatment, with a success rate greater than 80 percent. More than half of all those treated in the past 8 years were treated in the past 12 months. This showed a direct positive impact of building resources.

2015 to 2020

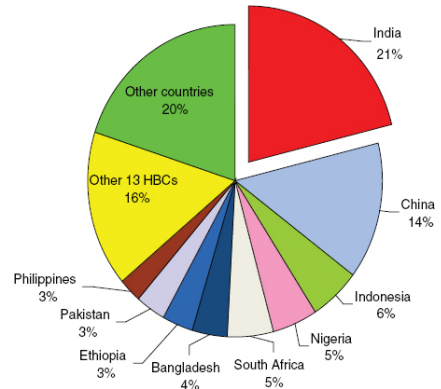
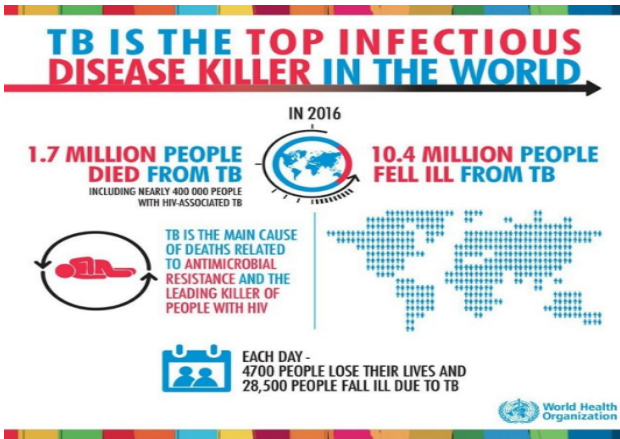
The WHO estimates that the global incidence of TB dropped by around 2% each year from 2015 to 2019. Globally, TB incidence is falling at about 2% per year and between 2015 and 2020 the cumulative reduction was 11%. This was over half way to the End TB Strategy milestone of 20% reduction between 2015 and 2020. An estimated 66 million lives were saved through TB diagnosis and treatment between 2000 and 2020.

Adding to the challenges in helping society cure itself of TB cases is that there is a shame attached to TB patients in the society. An estimated 1 in 4 people worldwide may be having a TB infection but only an estimated 5 to 15% of the people with the infection would develop symptoms in their lifetime. When someone has an infection but does not experience symptoms, they have a latent TB infection.

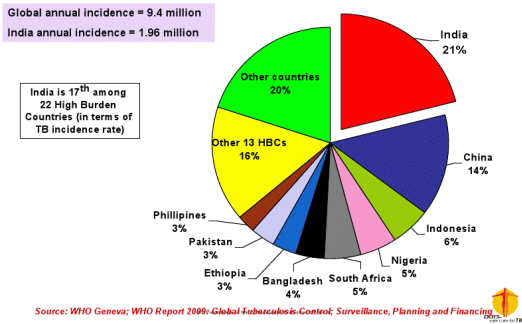
One of the biggest challenges in helping society cure itself of TB cases is that there still is a significant stigma attached to TB. According to USAID, India has the largest number of TB cases in the world - More than a quarter of the global TB and multidrug-resistant TB (MDR-TB) cases. WHO has tried to address the TB Since 2001 to 2021- as demonstrated in Annexure 1 but it does not seem to have created the requisite traction on the ground.

In 2016, according to a report by WHO, India topped the list of seven countries, accounting for 64 per cent of the 10.4 million new tuberculosis (TB) cases worldwide. As per the cases registered, India along with China and Russia accounted for almost half of the 490,000, multidrug-resistant TB (MDR-TB). India had the greatest number of new cases of MDR-TB (including rifampicin resistance), with an estimated 147,000 cases in 2016.

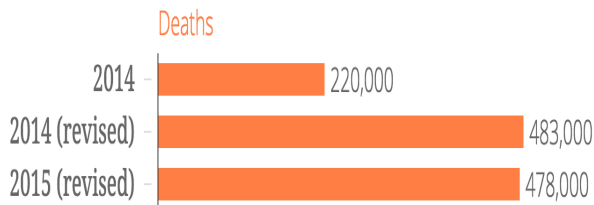
The Global TB Report 2017 released by the WHO said that India had the largest TB patients, followed by Indonesia, China, Philippines, Pakistan, Nigeria and South Africa. WHO, TB was responsible for 1.4 million global deaths in 2019.



India is the highest TB burden country accounting for more than one-fifth of the global incidence



Estimated tuberculosis deaths in India



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Data: Global Tuberculosis Report 2016

Estimates of TB Burden (WHO 2019)	Number	Rate per 100,000 Population
Incidence of TB cases (includes HIV + TB)	2.640 million	193
Incidence (HIV+TB only)	71,000	5.2
Incidence (MDR/RR-TB)	1,24,000	9.1
Mortality (deaths) (excludes HIV+TB)	4,36,000	32
Mortality (deaths) (HIV+TB only)	9,500	0.69
Proportion of TB cases with MDR/RR-TB, 2019	2.8%/14%	
New Cases/ Previously Treated Cases		

Background

RNTCP

India has released its Revised National Tuberculosis Control Programme and has laid out a National Strategic Plan (NSP) for Tuberculosis Elimination for the period 2017–2025.

It provides a framework to guide the activities of all stakeholders including the national and state governments, development partners, civil society organizations, international agencies, research institutions, private sector etc.

The NSP 2017-2025 continues with best practices from the earlier NSP, and proposes some bold and innovative steps towards TB elimination in a 3 year cost plan and a 8 year strategy document. This provides a direction for all stakeholders like important interventions or activities that the RNTCP strategic focus on Incidence, Prevalence and Mortality of TB. These strategies and interventions are in addition to the processes and activities already ongoing in the country.

The development of this NSP has been a collaborative effort between all the stakeholders including national and state governments, development partners, civil society organizations, and private sector in India which was led by the Central TB Division, Ministry of Health and Family Welfare. The NSP will guide the development of the national project implementation plan (PIP) and state PIPs, as well as district health action plans (DHAP) under the national health mission (NHM). This NSP replaces previous strategies, and will inform and guide the technical and operational guidelines refresh and associated programme tools modifications.

NSP

The NSP proposes bold strategies with commensurate resources to rapidly decline TB in the country by 2030 in line with the global End TB targets and Sustainable Development Goals to attain the vision of a TB-free India. Its vision is to free India with zero deaths, disease and poverty due to tuberculosis.

Its goal is to achieve a rapid decline in the burden of TB, morbidity and mortality while working towards elimination of TB in India by 2025.

A Strategic snapshot of the NSP is given in Annexure 2. The steps to be taken:-

- Detection
- Treatment
- Prevention of TB
- Building resources to achieve the above three.

It also lays down the four thrust areas, which include:-

- Private sector engagement
- Plugging the leak from the TB care cascade,
- Active TB case-finding among key populations (socially vulnerable and clinically high risk) and
- Specific protection for prevention from development of active TB in high-risk groups.

The Problem

Prevention of TB involves screening those at high risk, early detection, treatment and vaccination with BCG vaccine. These include household, workplace and social contacts of people with active TB. Treatment requires the use of multiple antibiotics over a long period of time. Antibiotic resistance is a growing problem with increasing rates of multiple drug resistant tuberculosis (MDR-TB).

Growth in TB cases

WHO, in its 2020 report, also mentioned that this bacterial disease killed 5 lakh people in India, a surge of 13 percent over the past few years. India alone accounted for about 34 percent of the estimated global 1.5 million tuberculosis deaths in 2020. The number of people expected to develop and die from TB during 2021 and 2022 is expected to be even higher. The latest WHO report cites model-based forecasts of how disruptions in diagnostic and treatment services in 2020 could impact future counts. The report further said that in India, 42,505 drug-resistant TB patients were started on treatment during 2020 against the estimated 124,000 patients diagnosed as drug-resistant in the country during 2019.

Multidrug-resistant TB (MDR-TB) remains a public health crisis and a health security threat. Only about one in three people with drug resistant TB accessed treatment in 2020.

Costs

Globally, close to one in two TB-affected households face treatment costs higher than 20% of their household income, according to latest national TB patient cost survey data. By 2022, US\$ 13 billion will be needed annually for TB prevention, diagnosis, treatment and care to achieve the global target agreed at the UN high level-meeting on TB in 2018.

Funding in low and middle-income countries (LMICs) that account for 98% of reported TB cases falls far short of what is needed. Spending in 2020 was US\$ 5.3 billion only (less than half (41%) of the global target). There was a decline in spending between 2019 and 2020 with TB funding in 2020 back to the level of 2016. Ending the TB epidemic by 2030 is among the health targets of the United Nations Sustainable Development Goals (SDGs) and India will have to deploy a lot more resources if it wants to do its part in helping the world eradicate TB.

Untreated TB cases

There is an estimated more than 850,000 cases of TB each year in India, that are either undetected/untreated or diagnosed/treated by private healthcare providers, with potentially substandard drugs and treatment regimens. When left untreated, TB can kill approximately one half of the patients within five years and produce significant morbidity (illness) in others. Inadequate therapy for TB can lead to drug-resistant strains of tuberculosis that are even more difficult to treat.

TB infection happens in 4 stages:

- the initial macrophage response,
- the growth stage,
- the immune control stage, and
- the lung cavitation stage

These are the four stages that a TB patient goes through over a roughly one-month period.

Stage One

The *first stage* takes place in the first week after the inhalation of the TB bacillus. After the bacillus reaches the alveoli in the lung, it gets picked up by special cells of the immune system, called macrophages which swallow the TB bacillus.

The amount of TB bacilli and the strength of the macrophage decides the extent to which the bacilli can reproduce in the macrophage, ultimately leading to the destruction of the macrophage and the extent of the infection.

Stage Two

If the macrophage cannot contain the TB bacillus, TB infection enters its *second stage* after about a week where the bacillus reproduces exponentially leading to macrophage not being able to contain the spread anymore until the third week after initial infection.

Stage Three

After the third week, the bacilli do not grow exponentially anymore, and the infection enters its *third stage* – where the body brings in more immune cells to stabilize the site, and the infection is under control. At least nine of ten patients infected with *Mycobacterium tuberculosis* stop at stage 3 and do not develop symptoms or physical signs of active disease. Often TB bacilli also infect the surrounding lymph nodes.

Patients in this stage are not contagious, because the TB bacilli cannot enter the airways and cannot be coughed out or exhaled. If the immune system is strong, the primary complex heals and leaves nothing more but a small cavity and a scar in the tissue. This scar can later be seen on X-rays and is a sign that the person has had an infection.

Stage Four

In about 5% of cases, the primary complex does not heal and TB bacilli become re-activated after a period of 12 to 24 months after the initial infection leading to *stage four* of the infection. The reactivated TB bacilli reproduce quickly and form a cavity in the tissue, where the body's immune system cannot reach them. The TB bacilli then quickly spreads through the tissue and shows the symptoms of active TB as coughing. In this stage, the person is highly contagious because his or her sputum contains active TB bacteria.

The Challenge

- Reactivation is more likely to happen if the immune system is weakened, such as with HIV infection or malnutrition.
- It has been found through various research studies that many people have heard of TB but most don't know its symptoms.
- It is found that even the medical fraternity while diagnosing TB, sometimes find it very difficult especially when in the earlier stages.
- It is critical to arrest TB when it is in the earlier stages so as to contain its spread and to reduce fatality.
- The problem of delay in treatment of TB patients continues to plague the control of spread of TB in India.
- Relapse of TB has been found to be increasing in last few years

Controlling TB

In 2020, the Indian government made statements to eliminate TB from the country by 2025 through its National TB Elimination Program.

Goal: To achieve a rapid decline in burden of TB, morbidity and mortality while working towards elimination of TB in India by 2025.

To help control the spread of TB and to eradicate it, it is important to understand the difference between TB infection and TB disease.

TB infection and TB disease

When a person has been exposed to someone with TB disease and has breathed in the TB germs, that person may become infected with TB. In most cases, people with healthy immune systems can contain the infection at that point and not become ill with TB disease. A person with TB infection only (positive TB skin test but normal chest x-ray) is not sick and is not contagious to others. TB medicine can help kill the bacteria and prevent the development of TB disease in the future.

However, if a person with TB infection does not take preventive medicine, the bacteria may grow and cause active TB disease.

TB Symptoms

TB symptoms may include a constant cough that lasts two or more weeks, chest pain, weakness, and loss of appetite. When a person has active TB disease, the individual may be contagious and cause infection in other people, particularly those with whom they spend the most time. There are many symptoms, including:

- a bad cough that lasts weeks (TB cough dry or wet)
- chest pain
- coughing up blood
- fatigue
- weight loss
- no appetite
- chills
- fever
- night sweats

Cough lasting more than three weeks is often a first symptom of active TB. It can start as a dry irritating cough. It tends to continue for months and get worse. In time the cough produces a lot of phlegm (sputum), which may be blood stained.

Persons with active TB disease can spread TB to others. Treatment involves several drugs taken over several months in order to fully treat TB and reduce the risk of exposing others.

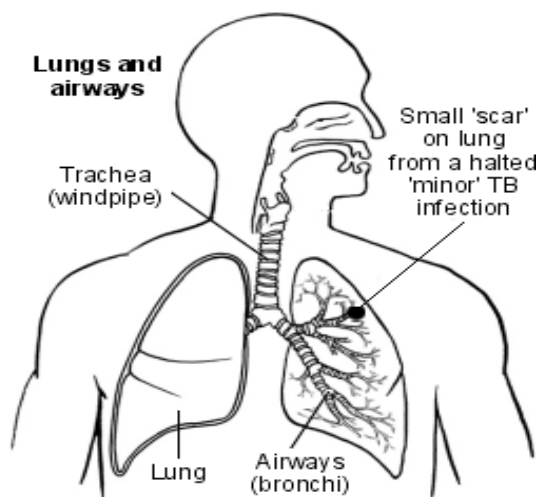
Screening and Treating TB Patients

Most of the world's TB cases occur in low-income and middle-income countries, where sputum microscopy with a conventional light microscope is the primary method for diagnosing pulmonary tuberculosis. A major shortcoming of conventional microscopy is its relatively low sensitivity compared with culture, especially in patients co-infected with HIV. In high-income countries, fluorescence microscopy rather than conventional microscopy is the standard diagnostic method. Fluorescence microscopy is credited with increased sensitivity and lower work effort, but there is concern that specificity may be lower.

Typically, TB transmission can be divided into 3 stages—

- exposure,
- latent, and
- active disease

A TB skin test or a TB blood test can also diagnose TB.



(Fig – Impact of TB on Lungs and Airways)

Challenges in Diagnosis of TB

Sometimes with TB infection, a person may have no symptoms and may not feel sick and may also not be contagious. The person may have a positive TB skin test but a negative chest x-ray. Two types of the disease don't produce a cough; Bone/joint TB and latent TB

Treatment exactly as recommended is necessary to cure the disease and prevent its spread to other people.

Vaccine for tuberculosis

Bacille Calmette-Guérin (BCG) is a vaccine for tuberculosis (TB) disease. It is often given to infants and small children in countries where TB is common. BCG does not always protect people from getting TB.

Importance of Immune System

If the body's immune system is strong, lymphocytes manage to contain the bacteria and the infection does not spread further - called asymptomatic primary TB (stages 1 to 3).

If the immune system is weak, the lymphocytes cannot contain TB bacteria and it rapidly spreads. The infected person develops symptoms (stages 1 to 3, without control over bacillus).

If the immune system is initially strong and contains the TB bacteria, but subsequently weakens and cannot control it any longer, the bacteria first go into a dormant state but then get reactivated and subsequently spread aggressively (stage 4). It can also be triggered by a new infection with TB bacteria, which leads to the reactivation of the initial infection. The standard of care for initiating treatment of TB disease is four-drug therapy.

Resistant tuberculosis

There are two main types: Multidrug-resistant tuberculosis (MDR TB) and (XDR TB).

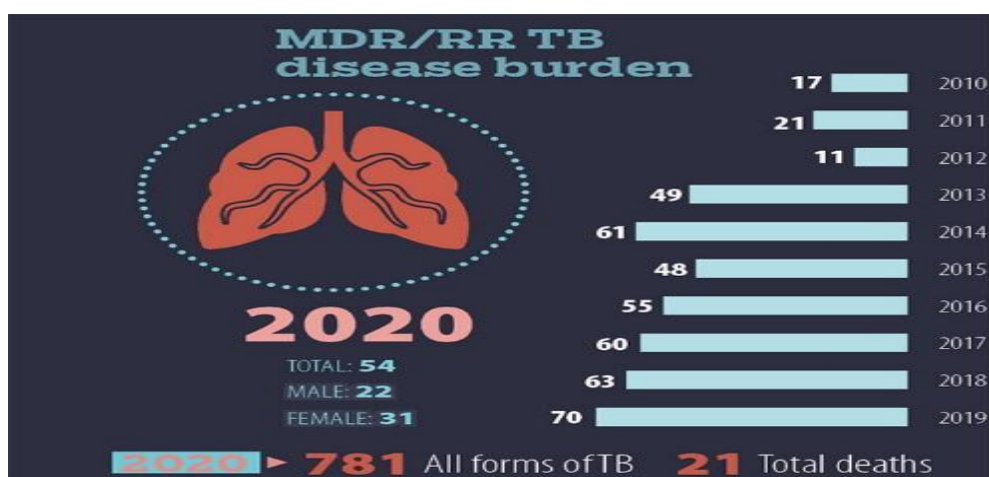
MDR TB and XDR TB, both require a longer treatment. When two or more drugs to which in vitro susceptibility has been demonstrated are given together, each helps prevent the emergence of tubercle bacilli resistant to the others. Antimicrobial resistance (AMR) can lead to some infections being harder to control and staying longer inside the body.

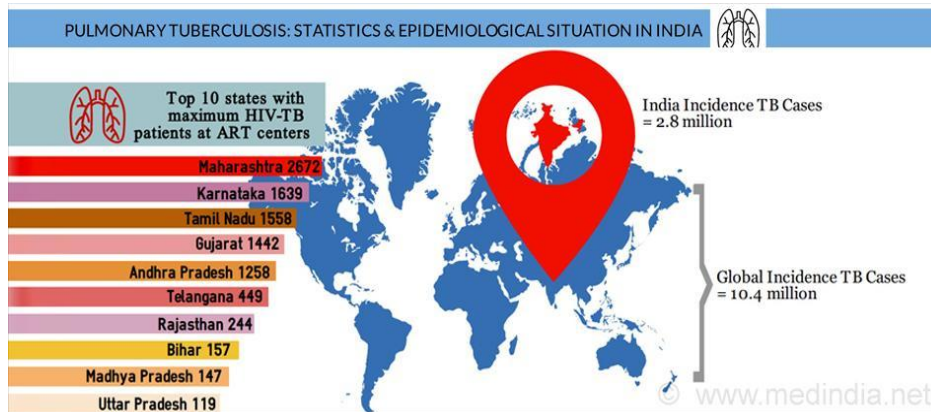
Causes of resistant TB

- People do not complete a full course of TB treatment.
- Treatment failure - Health care providers prescribe wrong dose or length of time
- Drugs for proper treatment are not available.
- Drugs are of poor quality.
- Poor adherence to treatment
- Prior treatment / Relapse
- Cavity pulmonary TB
- HIV infection and Diabetes

Globally, most MDR-TB cases occur in South America, Southern Africa, India, China, and the former Soviet Union.

The MDR / RR TB burden





Role of CBNAAT Machines in Diagnosis

The CBNAAT machines have cartridges specifically to diagnose TB. The machine can also be used to diagnose HIV (to determine the immunity to diagnose HIV) with a different form of cartridge. If the same CBNAAT machine is extended for diagnosis of TB and HIV, it will prove to be more sustainable in nature.

People who have been diagnosed with TB - or think they may have TB - need to see their doctor. In India since, many times the TB patients have less information, they don't tend to go to a doctor unless they are aware of the symptoms and they know who to go to for diagnosis.

Many times the first screening done is an X ray. TB chest x-rays can only detect active TB in the lungs so symptoms of TB in other parts of the body do not show on X ray.

Treatment of TB patients

The common treatment is for DSTB (Drug-Sensitive TB) and is for a shorter period.

TB is a treatable and curable disease. Active, drug-susceptible TB disease is treated with a standard 6-month course of 4 antimicrobial drugs that are provided with information and support to the patient by a health worker or trained volunteer.

Someone with active TB disease will need to take several TB medicines for many months in order to become well and not infect others. However, they may no longer be infectious after a few weeks of medicine and would be able, once cleared by the Health Department, to return to work and normal activities while they are completing their TB treatment.

TB disease can be treated by taking several drugs for 6 to 12 months. It is very important that people who have TB disease finish the medicine, and take the drugs exactly as prescribed. If they stop taking the drugs too soon, they can become sick again.

TB that is resistant to drugs is harder and more expensive to treat.

Challenges in treating TB

Worldwide in 2018, the treatment success rate of MDR/RR TB patients was 59%. In 2020, WHO recommended a new shorter (9-11 months) and fully-oral regimen for patients with MDR TB. Research has shown that patients find it easier to complete the regimen, compared with the longer regimens that last up to 20 months. Resistance to fluoroquinolones should be excluded prior to the initiation of treatment with this regimen.

In accordance with WHO guidelines, detection of MDR/RR TB requires bacteriological confirmation of TB and testing for drug resistance using rapid molecular tests, culture methods or sequencing technologies. Treatment requires a course of second-line drugs for at least 9 months and up to 20 months, supported by counselling and monitoring for adverse events. WHO recommends expanded access to all-oral regimens.

By the end of 2020, 65 countries started using shorter MDR-TB treatment regimens and 109 had started using bedaquiline, in an effort to improve the effectiveness of MDR-TB treatment.

Side effects of MDR-TB treatment

In patients that received standardized therapy for MDR-TB, the major adverse effects included neurologic side effects (depression, convulsions, consciousness, psychosis, suicide; 7.5%), hepatitis (5%), rash (1.3%), renal toxicity (3.8%), and auditory toxicity (14.5%).

Transmission of TB

Close contact/shaking hands/sharing bed linens, clothes, or a toilet seat is not contagious if a person is only infected with TB. This is called latent TB. If you carry the bacteria and develop the TB disease, you have active TB. Latent TB always has the potential to develop into active TB, which can be fatal if not treated. Latent TB can become active even after many years.

It can happen due to many factors which include lifestyle stresses or other illnesses, since they weaken the immune system. The US studies have shown that up to 10 % of latent TB patients get sick with TB disease eventually. The percentage of latent TB patients in India falling sick may be higher, especially if included, cases of immune-compromised patients. Hence it is important to identify and treat latent TB patients too.

Cure rate of TB

The cure rate in various cases of TB are as follows: -

Drug susceptible TB	-	95 to 97%
Persons with MDR-TB	-	50 to 60 %
Persons with XDR-TB	-	30 to 50 %

People infected with HIV, MDR-TB and XDR-TB often produce fulminant and fatal diseases. Time taken from TB exposure to death averages 2 to 7 months. Research has found that more than one-third of patients who are successfully cured of TB with antibiotics can develop

permanent lung damage which, in the worst cases, results in large holes in the lungs called cavities and widening of the airways called bronchiectasis.

Reinfection of TB

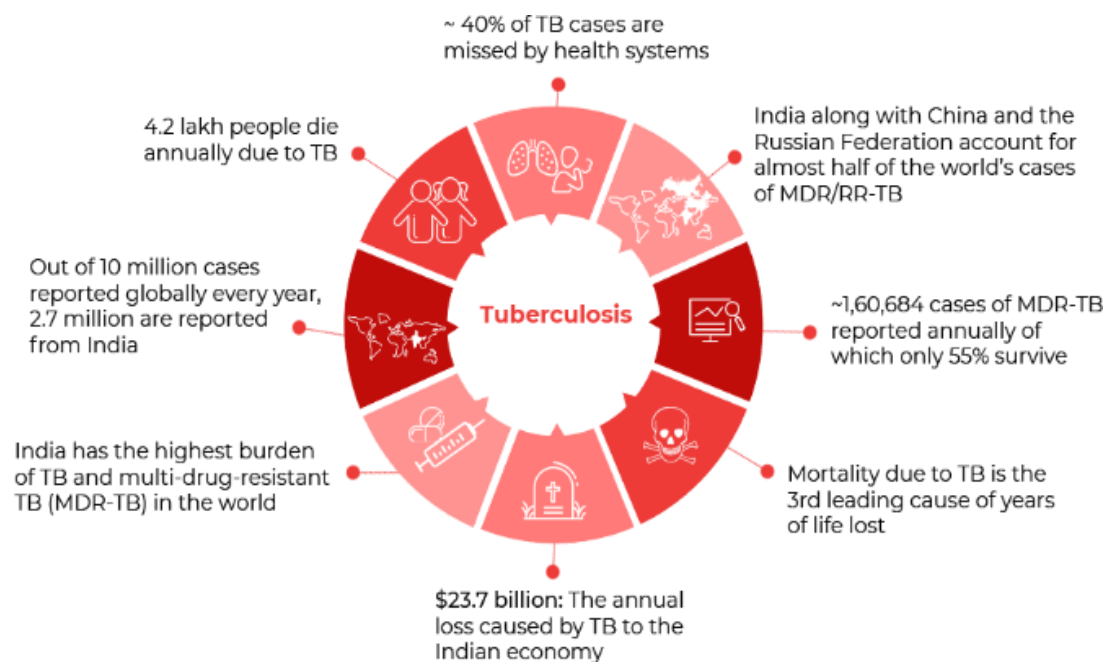
TB reinfection is becoming very common lately. Hence public health departments are under pressure to increase search drives for tracking and treating TB patients at an early stage to reduce the complications that stem from delay in treatment.

Internal Migration

Intra-country migration poses challenges to TB control and elimination programs in India. With a high prevalence of TB, the movement of patients and their families makes it difficult to trace and treat the patients. Mumbai and the Mumbai metropolitan area continue to have internal migrants which makes it more difficult to identify, treat, and monitor the TB patients.

Impact of Covid-19 on TB worldwide

Global TB targets are mostly off-track, although there are some country/regional success stories. The most obvious impact is a large global drop in the number of people newly diagnosed with TB and reported. This fell from 7.1 million in 2019 to 5.8 million in 2020, an 18% decline back to the level of 2012 and far short of the approximately 10 million people who developed TB in 2020.



India's National level Strategy and Maharashtra's State Strategy

Vaccination - One of the vaccines being tested to prevent TB of the lungs is Imuvac, which was developed to prevent leprosy. Immuvac, also known as mycobacterium indicus pranii, displays antigens similar to both the leprosy bacterium and the TB bacterium. India's strategy to eliminate TB is dependent on funding 3-4 vaccine candidates for phase I or II trials and having at least one final product co-owned by the government by 2025.

State level strategy - In 2020, Uttar Pradesh had the highest share of tuberculosis notifications in India with over 20 percent. Maharashtra and Madhya Pradesh followed with relatively lower notification rates with 8 and 7 percent, respectively.

Recovering from Covid-19 Impact - The COVID-19 pandemic has reversed years of progress in providing essential TB services and reducing TB disease burden. 16 countries accounted for 93% of this reduction, with India, Indonesia and Philippines being the worst affected. Provisional data up to June 2021 show that MDR-TB remains a public health crisis and a health security threat. Only about one third with drug resistant TB accessed treatment in 2020.

Systemic Approach - The government has created an online portal Nikshay, which keeps track of TB patients in the country and mandates all city officials to update data of patients and based on 5 parameters judged the performance of all city administration.

a) Nikshay –

The Central government has made it mandatory for all civic bodies to maintain databases of TB patients. using a web based application called Nikshay, under the National Health Mission, for ensuring electronic payment to various beneficiaries who are required to submit proof of possession of Aadhaar Authentication.

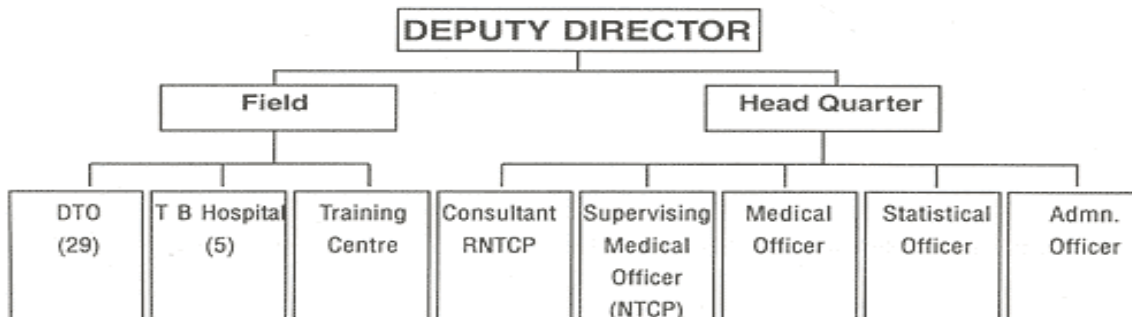
Primary public health care providers, mainly general practitioners, are responsible for pulmonary TB detection and diagnosis. Aadhar information is used for identity as well as for Direct Benefit Transfer (DBT) using Aadhaar Authentication for e-payments (using PFMS) directly into a patient's bank accounts. This is institutionalized through the National Health Mission.

b) TB elimination strategy-

- Past experience has shown that ensuring timely payment of incentives to eligible individuals in a transparent and efficient manner provides good governance in program implementation and enhances participation of private practitioners and community volunteers in public health programs.
- All cities are ranked based on 5 parameters which include reduction in the number of TB patients, notifying the government about TB patients from both public and private hospitals, conducting HIV tests of patients, providing them the Cartridge-based nucleic acid amplification test (CBNAAT) test and giving the patients financial benefit.
- Needy TB patients receive financial assistance and aid to help them complete their treatment, which is very crucial for achieving TB elimination.

Controlling TB – Maharashtra state and district levels

The National Tuberculosis Control Programme has been implemented in Maharashtra State since 1962. The programme is monitored by the Deputy Director of Health Services (T.B.B.C.G.) located in Mumbai. Thane Municipal Corporation



The District Tuberculosis Centre (DTC) is the basic unit of the control programme. There are 30 DTCs and 1995 Peripheral Health Institutions (PHI) in the State. These Centres perform following functions:

- Case finding.
- Early and regular treatment.
- Case holding.
- Management.
- Recording and Reporting.

The above activities are carried out by integration with general Health Services in Rural and Urban areas. There is facility of Indoor admission for complicated cases, for which 20 bedded wards are available at every DTC. In addition, there are 7 T.B. Hospitals / Sanatoria. The RNTCP is implemented in the State as per the guidelines of Govt. of India since 1998-99.

The Tuberculosis program staff includes public health workers, community health outreach workers, physicians, clerical support staff, counselling staff etc. Their Objectives:-

- To cure 85% newly detected sputum positive cases through Directly Observed Treatment Short course chemotherapy (DOTS)
- To detect at least 70% of estimated sputum cases

Strategy

- To Use sputum microscopy for diagnosis.
- To use Standardized treatment regimen under DOTS.
- To strengthen peripheral supervision through Sub-District Units.
- To ensure regular drug supply.
- To strengthen State level infrastructure.
- To give priority for training, IEC, Operational Research and NGO involvement.

The Research

Thane city falls under the top 10 cities in the state that provides tuberculosis (TB) care according to a quarterly report of the government's Revised National Tuberculosis Control Program (RNTCP).

Thane district has 6 Municipal corporations. It covers almost 80% urban and 20% rural area.

It has 8 TUs and 30 Public Health Centres (PHCs) and 13 Designated Microscopy Centres (DMCs). The list of 30 PHCs are in Annexure 3.

Objective of the Study

- To study the impact of CBNAAT machines installed in TMC hospitals in improving diagnosis of TB patients and in effective treatment
- To measure the extent to which doctors, lab staff in TMC and patients have been impacted by the installed CBNAAT machines and in what ways

Respondents

- TB Patients who are undergoing treatment
- Doctors, medical staff and lab technicians
- Indian Oil Corporation CSR team

Research Methodology

Type of Research

- Primary and Secondary

Mode of administering survey

- Questionnaire

Type of Questionnaire

- Open ended and Closed ended

Location

- Rajiv Gandhi Hospital (Chhatrapati Shivaji Maharaj Civic Hospital), Kalwa

Henceforth referred to as RGMC, Kalwa

Primary research

a) Questionnaire administered in person with doctors and medical team at Kalwa Hospital

b) Questionnaire administered to patients in person and over telephone

Secondary Research

- India TB reports and various Ministry of health reports from public domain

- World health organization reports

- Details of Patients from TMC records (Jan 2020 to Oc'21) were studied

Primary research – Doctors and medical team, RGMC Hospital, Kalwa

Various visits to the Chhatrapati Shivaji Maharaj Hospital at Kalwa were undertaken. The TB team was met in person and an open ended and closed ended questionnaire administered.

TMC has two CBNAAT sites

- Chhatrapati Shivaji Maharaj Hospital/RGMC Kalwa, Thane (meetings were held here)
- Wadia Hospital, Thane

Questionnaire - Discussions with doctors

Doctors undertake many functions besides diagnosing and treating TB patients, including:-

- Identify TB patients through drives,
- Diagnose through various stages,
- Help patients and their families understand the disease,
- Provide appropriate medications,
- Follow up through their treatment regime

Observations & Findings –

- i. They conduct drives in various dense clusters in the urban centres and rural places which has shown a high number of cases.
- ii. They use various tools to diagnose TB present in a patient and also trace their friends, family and other individuals the patient may have been in close contact with so that they can be checked for Tuberculosis and offered treatment.
- iii. They also assist TB patients with other needs such as referrals for check-ups, sometimes even food, especially during Covid-19, and provide linkages to other services if needed.
- iv. Besides the outpatient department, they also have a 14 bedded hospital to admit patients if needed.
- v. TB staff also consults with other physicians, private hospitals and out-reach programs through awareness programs.
- vi. They have provided access to medicines and advice through various health centres across the various urban nodes governed under Municipal Corporation.
- vii. They have a Coordinator and Records department that keeps all the information readily available to help monitor the progress of the patient and also the number of patients being treated.

a) Role of Search Missions / Drives

Thane Municipal Corporation health department periodically carries out search missions for Tuberculosis and Leprosy patients in the city. Over 400 teams have been formed for this mission, which carry out door to door checks-ups. They typically conduct 3 to 4 searches in various communities every year. During covid lockdown period search missions are reduced but have restarted again after the

covid unlocking. The number of drives / search missions undertaken between 2019 till date:-

Number of Drives undertaken in 2019	- 4
Number of Drives undertaken in 2020	- 2
Number of being undertaken Drives in 2021 since July 2021	- Target monthly drives

b) Increasing education and awareness of TB in the society with the drives

A team of 420 team members which include medical officials, ASHA workers, (JEET NGO) social workers and volunteers carry door to door check-ups living in dense clusters. Anyone noticed with symptoms related to TB, are provided with the free medical tests at Civic and government-run clinics or medical centres in Thane municipal area. After they find a TB patient, they get all the family members in the household also tested.

Due to Covid, when there was a moderation in everyday Covid cases being reported, one mission was implemented from December 1 to 16, 2020 in Thane by TMC's health department. These search drives help increase awareness in the high-density urban areas and provide information to the community. TMC health department has observed that the following clusters are emerging hotspots for TB cases:-

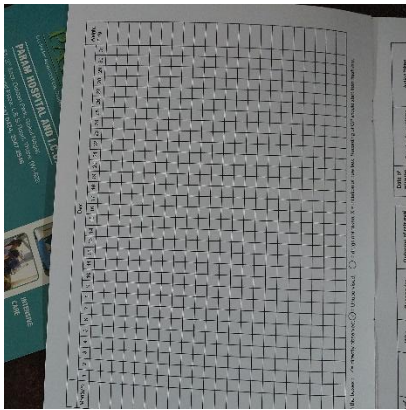
- Shivaji Nagar
- Kisan Nagar
- Manpada
- Mumbra and Kausa
- Shil

c) Increasing the reach of TMC TB health services to underserved areas

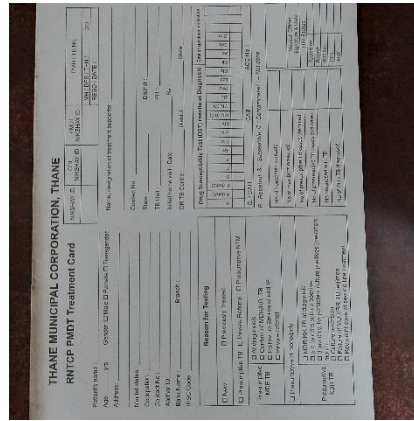
TMC TB health department has 30 PHCs and 8 TUs and facilities to test TB at 13 DMCs and 2 CBNAAT sites. Samples are collected from the network of health centres and hospitals, and sent to testing centres and CBNAAT sites for testing and the reports sent back to where the patient had given the samples.

Observations & Findings – During the visit to the Kalwa hospital, it was observed that

- The patients meet with the doctors at OPD at Kalwa or at Wadia hospital and undergo various tests for diagnosis in the OutPatient department (OPD) and on confirmation of the disease, they are given appropriate free of cost medications.
- After their mandatory visit to 2 hospitals, they collect the remaining medications from the TUs or PHCs closer to their home for follow ups.
- After their registration in the Nikshay database, and consultation with the doctor at OPD, they are given a card that helps the patients track their medications.



1



2

Pic 1 Treatment card back page which gives 2 year period medication calendar

Pic 2 -Treatment card having patient details.

d) The support system at Chhatrapati Shivaji civic hospital, Kalwa

During the visits at Kalwa hospital, the following medical team was met with a questionnaire administered.

Senior team

- CTO- TMC – Dr. Prasad Patil
- DOT & Supervisor – Mr. Sanjay Pawar
- Medical Officer - Dr. Kate

Designation and Responsibility of team members:-

- PPM Coordinator and NGOs (Jeet) - Responsible for Private practitioners and NGOs
- STS (Sr Treatment Supervisor) - Responsible for Treatment and supervision
- Senior Technician Lab Supervisor - Mr. Dubele, heads the lab team
- TBHV (TB Health Visitor) - Visiting homes of patients/ getting additional information
- LT (Lab technician) - Asmi
- DEO - Data entry Operators
- Statistical Assistant - Record keeping
- Counsellors and family - Counsels Patients and their care givers
- Clerks - Administration

Observations & Findings –



3



4

Figure 3 and 4 – (Doctors consulting room for out patients at Chhatrapati Shivaji Maharaj Hospital, Thane - Belapur Road, Kalwa)



5



6

Pic 5 and 6– Patients inside the OPD room number 20 on tuesdays and wednesdays



7



8

Pic 7- Patients outside the OPD room number 20 on tuesdays and wednesdays

Pic 8 - DOTs medicine provided in this room



Pic 9 and 10 – Registration for Nikshay done and a unique number given to patients



11



12

Pic 11 – Statistic department where Record keeping is kept

Pic 12 – Medical officer for MDR / XDR cases (drug resistance cases)

Impact on TB control:

Covid restrictions have potentially increased TB spread since many did not get tested and hence the increase in drives are expected to bring more patients under treatment.

It was observed that all patients have to undergo Covid scanning before they undergo any entry into the system. After they have registered the patients and their family members are also provided with Counselling so that they understand the dos and don'ts. It also helps the family feel assured that they are in good care. Some patients who need hospitalisation, are also given the option of hospital stay in the dedicated 13 bed TB patient ward at Kalwa.

f) Impact of CBNAAT machines – before and after

Before the CBNAAT machines were installed in TMC civic hospitals, the patients were tested via sputum samples through microscopy at TMC hospitals. When tested positive for sputum, the patients were sent to J J Hospital, Mumbai for CBNAAT testing.

Observations & Findings – After the CBNAAT machines were installed in TMC hospitals, the patients sputum is tested through microscopy and if positive, they

would be tested through CBNAAT machines at Kalwa and Wadia hospitals, the 2 CBNAAT sites under TMC.

YEAR	CAT 1 and Cat 2	Resistance cases	Grand total
2016	1604	487	2091
2017	1813	494	2307
2018	3096	644	3740
2019	4708	777	5485
(Total cases - Pre CBNAAT) 2016 - 2019	11221	2402	13623
2020	2380	858	3238
(Jan - Oct) '21	2173	646	2819
(Total cases - Post CBNAAT) Jan 2020 - Oct 2021	4553	1504	6057

a) The doctors mentioned that they need CBNAAT machines reports during early stages of TB symptoms detection. They usually get a report within 48 hours and even earlier sometimes, which is very helpful in putting the patient on a correct treatment regiment.

b) They usually have around 30 to 50 patients every Tuesday and Wednesday (OPD at RGMC) through various references or walk-ins or from other departments. About 15 to 20 % of the patients are now seen to be drug resistant, which used to be 10 % before.

c) Total number of tests conducted between both the civic hospitals for the period Jan 2020 - Oct 2021 was 6057. The total number of people who had CBNAAT tests conducted at the RGMC Kalwa and Wadia facilities were approximately 1,800, which works out to about 30% of all TB cases reported since January 2020 till October 2021.

d) The medical team shared that due to lack of availability of cartridges required for testing through CBNAAT, only approximately 30% of all the tests could be conducted from the period when the CBNAAT machines were made available till October 2021.

e) They use the services of JEET NGO in their search drives

f) After the RNTCP, under the guidelines provided by the Central TB Division, Ministry of Health and Family Welfare and the State TB Training and Demonstration Center, all the TMC hospitals have been directed to conduct 100 % tests of all TB patients using CBNAAT machines and to discontinue using Microscopy machines. Hence from now on, more CBNAAT tests will be conducted. Request has been made to the state government, requesting for cartridges to enable 100 % compliance, going forward.



g) When the doctors were asked how happy they were with the CBNAAT machines, they all said that they were very pleased by the report they got. They ranked it 90 % plus satisfaction.

h) The factors that the doctors consider most important in CBNAAT machines is a) prompt diagnosis and b) information like drug resistance and c) ease of handling the machines. This gives them the right information they seek, to recommend the right medications, which improves the recovery of the patients and also reduces the chances of relapse.

Secondary Research, Findings and Analysis – TMC Data

The list of 116 patients in the year 2019 – 2020 who are undergoing treatment in various stages drawn from 30 PHCs were analysed and following are the findings and analysis.

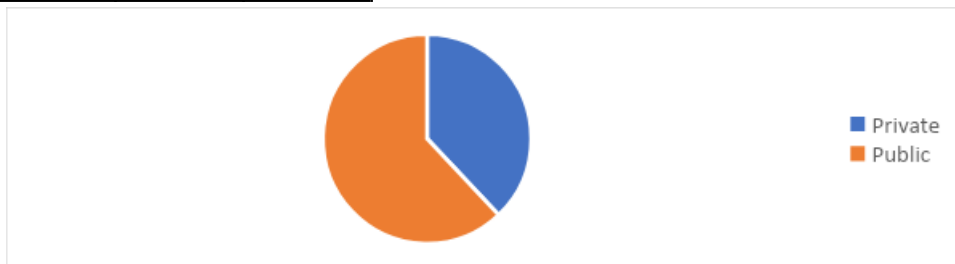
Observations & Findings

RGMC	Wadia	Total
41	75	116



About a one third of the patients were from RGMC and two thirds from Wadia

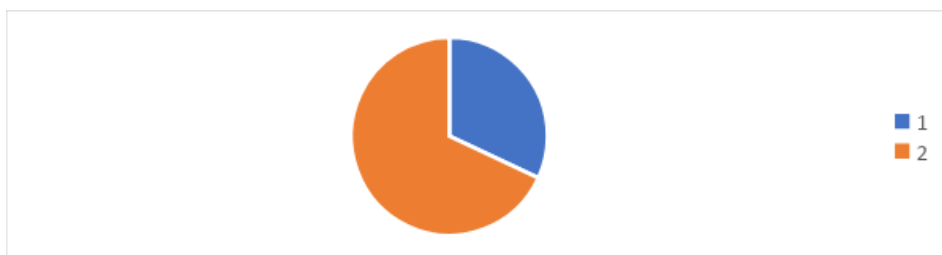
Private	Public	Total
44	72	116



One third of the patients were from Private and two thirds were from Public hospitals

Gender		
Male	Female	Total
37	79	116

32% of the patients were Male with 68% heavily tilted over females

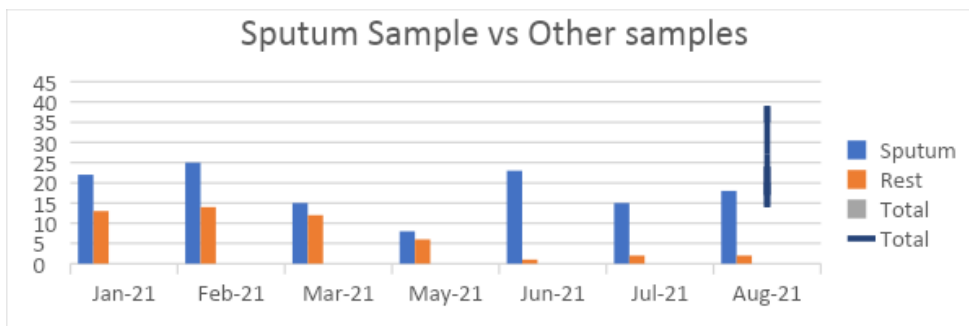


Date of Testing		
2020	2021	Total
39	77	116

One third were tested in 2020 and two thirds in 2021



Type of sample collected in 2021 till August '21	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Total
Sputum	22	25	15	9	8	23	15	18	135
Rest	13	14	12	2	6	1	2	2	52
Total	35	39	27	11	14	24	17	20	187

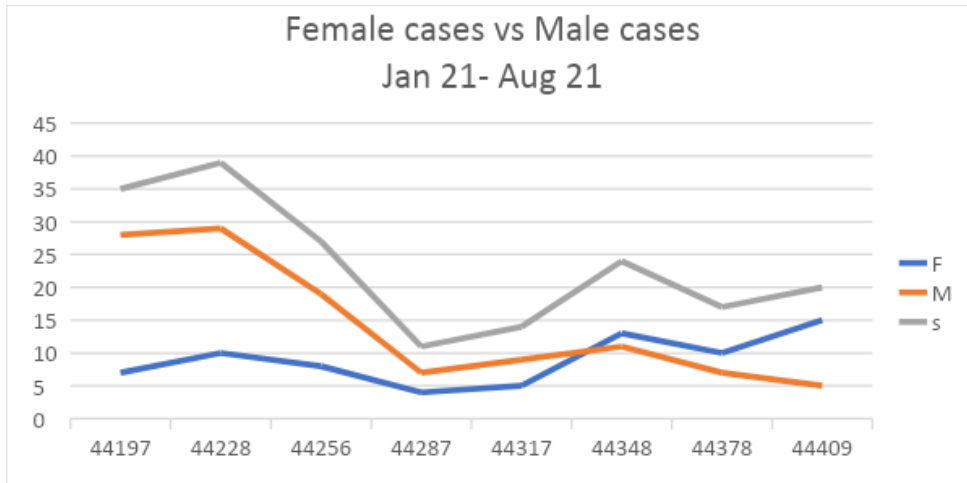


Besides the above , another list of TB patients being treated by TMC health department for the period between January 2021 and August 2021 were analysed.

- Out of the total 187 patients being treated in 2021 (up to Aug 21) 28% were diagnosed by using samples other than sputum. 72% of the samples collected were Sputum. (Also refer Annexure 4)
- The Number of cases have been inconsistent every month, probably because of the drives conducted and the restrictions due to Covid.
- One patient has been admitted to a hospital every month. Totally 2 patients have died in this period which is a 1% fatality rate for this period for the given sample.

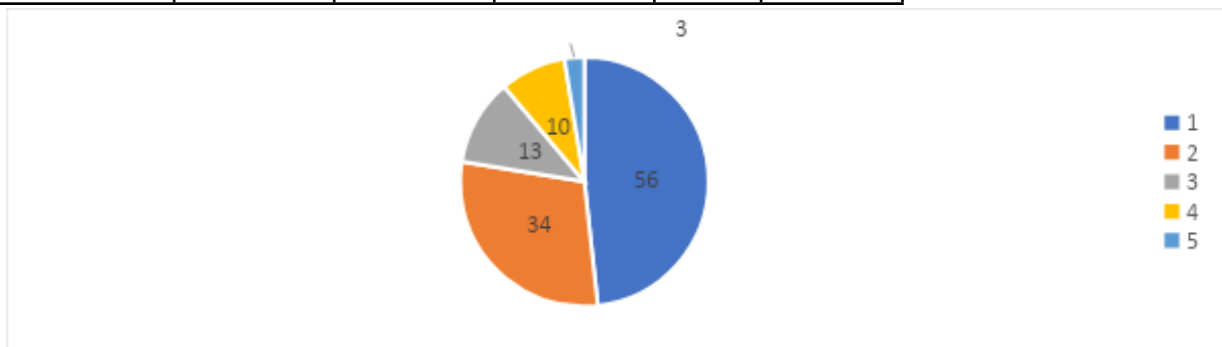
The break-up of Female vs Male TB patients in TMC in the period Jan-21 to Aug-21

Gender Breakup	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21
Female	7	10	8	4	5	13	10	15
Male	28	29	19	7	9	11	7	5
Total cases	35	39	27	11	14	24	17	20



The number of female cases per month have increased over male cases per month starting June 2021. This could be because more female patients have been tested in that period or there is a higher occurrence of female cases since they stayed indoors a lot more due to Covid. This needs to be studied more.

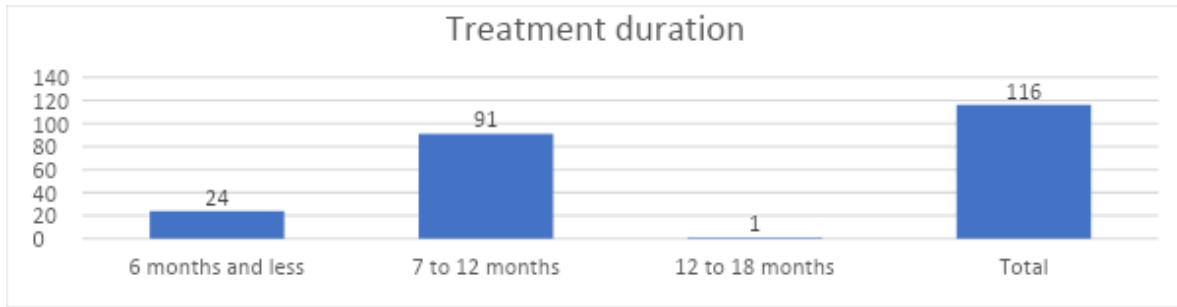
Age group break up					
12 – 19	20-35	36-49	51-65	65+	Total
56	34	13	10	3	116



77% of the sample observed are below 34 years of age. It shows a very high number of young people being affected by the TB virus and also makes a statement on nutrition and immunity levels in this age group.

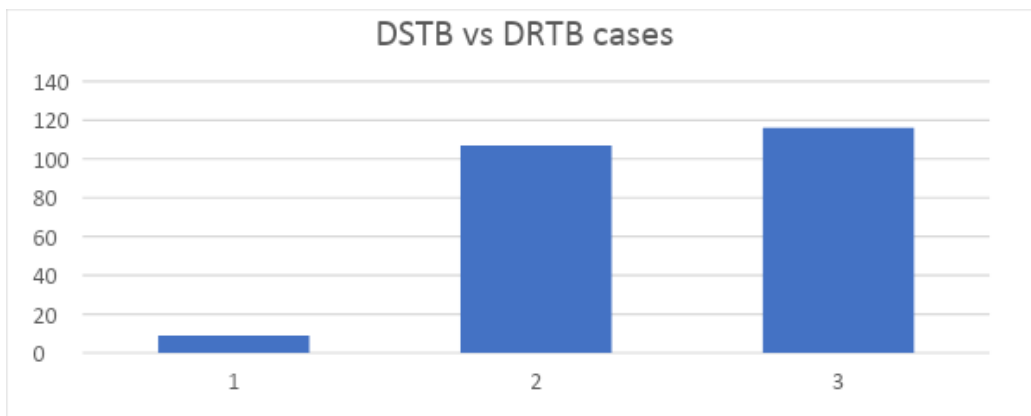
Treatment duration of patients (Jan 21 to Aug 21)			
6 months and less	7 to 12 months	12 to 18 months	Total
24	91	1	116

79% of the patients are being treated for more than 6 months. One can deduce that either the cases weren't identified soon enough or that patients weren't showing enough signs of the symptoms which has also been observed in the primary research when spoken to the patients.



Some of the patients who may be on 6 months sometimes end up going for 1-year treatment regime or longer since they do not respond well to the early medications, and hence would go into 12 to 24 months treatment regime and into relapse and Drug resistant categories.

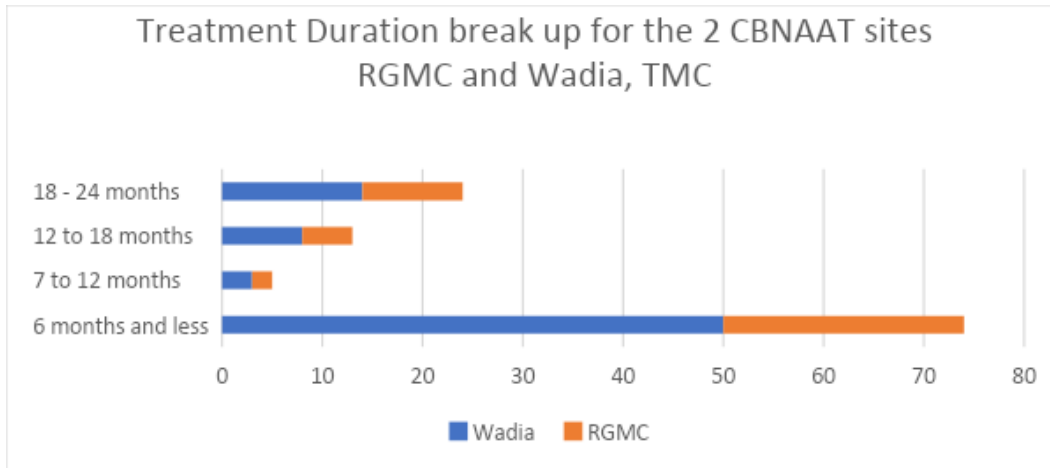
TB reports		
DRTB (Drug Resistant TB cases)	DSTB (drug sensitive TB cases)	Total
9	107	116



Less than 10% of the cases in the year 2020 are drug resistant.

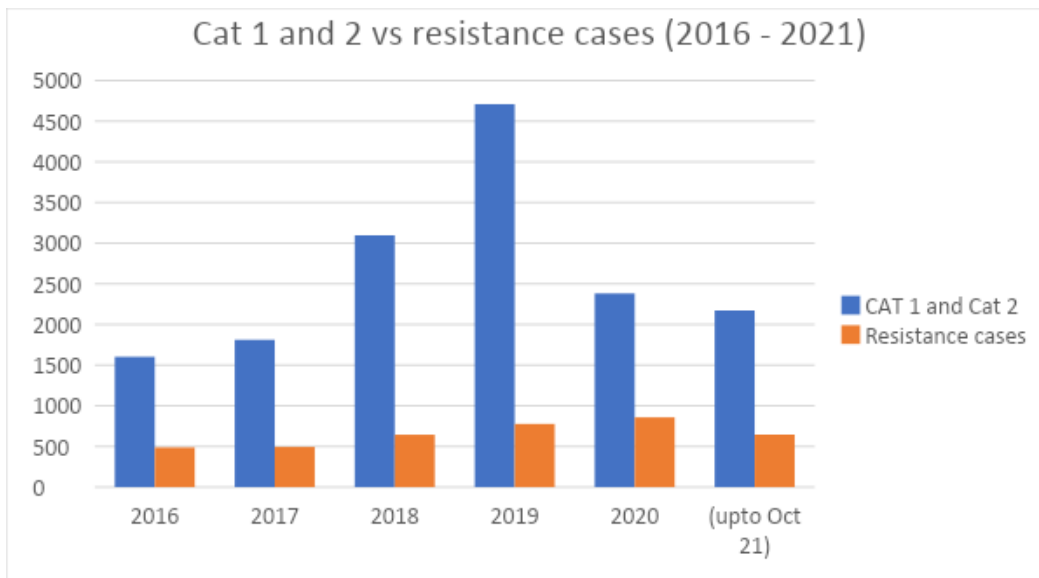
Treatment duration for Wadia and RGMC, Kalwa					
CBNAAT centre	6 months and less	7 to 12 months	12 to 18 months	18 - 24 months	Total
Wadia	50	3	8	14	75
RGMC	24	2	5	10	41
Total	74	5	13	24	116

Between both the CBNAAT sites, one can see that the percent of the patients across the different treatment duration is consistent across both the sites, which means that the 2 sites are not showing dissimilar kinds of patient profile.



Following is the data of Category 1 & Category 2 of TB patients and how they are stacked up against the Drug resistant cases over the past 5 years from 2016 till October 2021:-

YEAR	CAT 1 and Cat 2	Resistance cases	Grand total
2016	1604	487	2091
2017	1813	494	2307
2018	3096	644	3740
2019	4708	777	5485
2020	2380	858	3238
(Jan to Oct 21)	2173	646	2819
TOTAL	15774	3906	19680

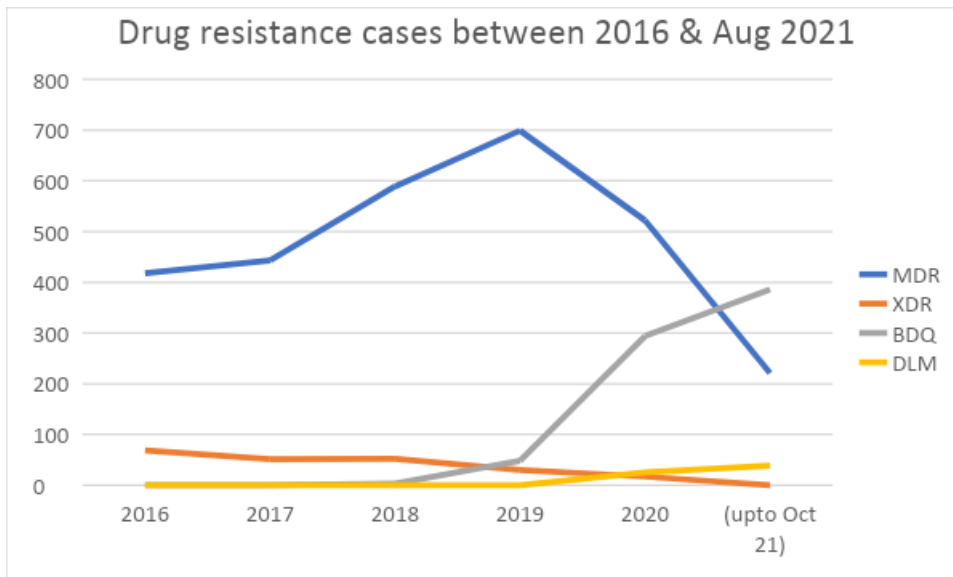


It is evident from the data and the graph, that the Cat 1 and 2 has spiked between 2017 and 2019, before coming down very sharply in 2020, which was due to the lockdown and reduction in drives undertaken to identify TB cases in high density residential clusters and the cases in 2021 is only till August 2021.

Hence, as the drives restarted, the trend line would show an increase over those in 2019.

It would be pertinent to see the corresponding numbers for both Cat 1 and 2 and Drug resistant cases for the year ending 2021 and in 2022.

YEAR	MDR	XDR	BDQ	DLM
2016	418	69	0	0
2017	443	51	0	0
2018	589	52	3	0
2019	699	30	48	0
2020	522	17	294	25
(upto Oct 21)	221	0	386	39
TOTAL	2892	219	731	64



This data and graph shows the relative number of Drug resistant cases over the past 5 years from 2016 till 2021 (up to Aug 21)

While MDR has shown a growth and reduction post 2019, possibly due to low cases having been identified due to lockdown, BDQ has shown an alarming increase post 2019 in spite of a low number of overall TB cases identified.

There is an urgent need to increase awareness and to conduct more drives in high density clusters of population and specially the hot spot areas identified from past trends.

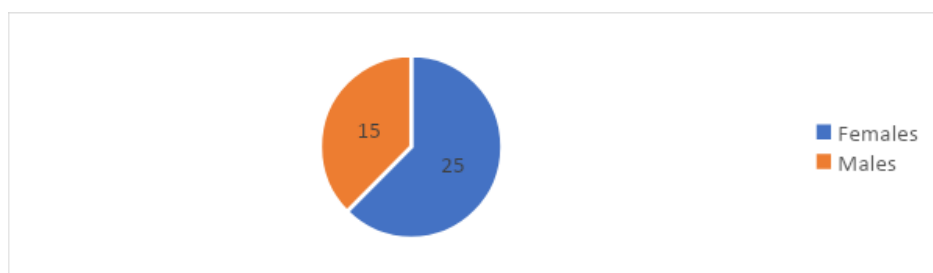
Primary Research, Findings and Inferences - Patients

Open ended (descriptive) and Close ended (pointed) questions were asked to the respondents to encourage them to share their overall experience. Due to shame and judgement attached to TB in the society, most of them were not admitting to being a TB patient and they also were not enthused in sharing about their experience in the hospital.

They tended to share their emotional experience and expressed thankfulness that they were able to get the diagnosis and medication for no cost. Hence, they would not critically evaluate their experience so as to not jeopardize their future treatment at the Civic hospital.

Following is the demographic profiles of respondents interviewed in person and over phone:-

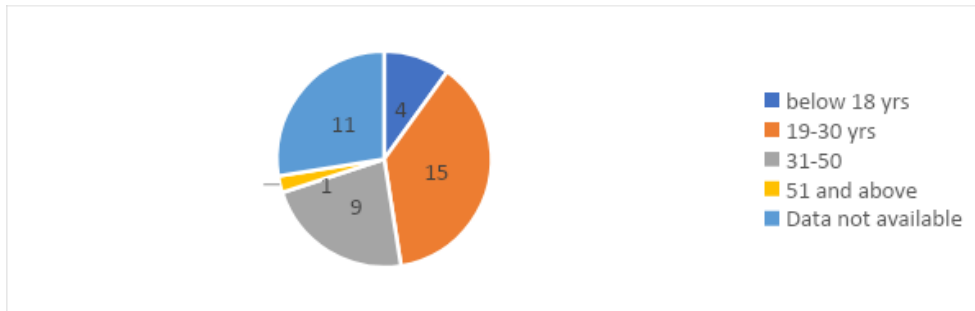
Gender of Respondents Interviewed		Percentage
Females	25	63%
Males	15	37%
Total	40	100%



Females are almost twice the number of the male patients and further analysis needs to be done to ascertain why.

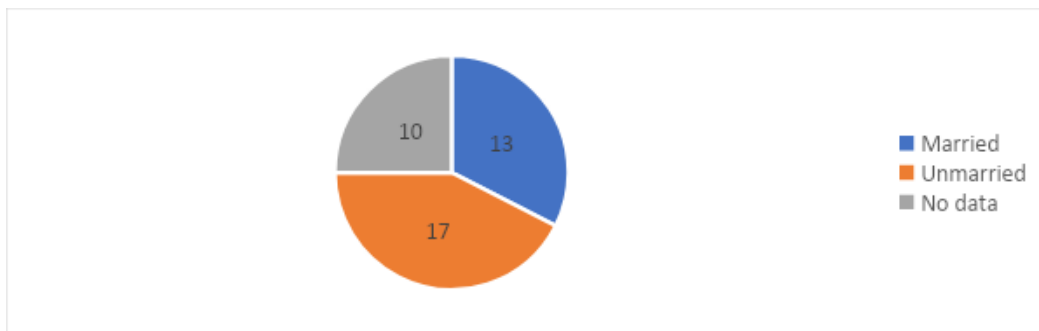
Age of Respondents Interviewed		Percentage
below 18 yrs	4	10%
19-30 yrs	15	38%
31-50	9	23%
51 and above	6	14%
Data not available	7	17%
Total	40	100%

61% of the respondents are between 19 and 50 years of age and this the productive age. Many of these are college going boys and girls and their education and ability to join the workforce gets affected. Their marriages also get affected and with the sense of shame associated with the disease, some of these young patients may lower their chances to get married of their choice and delay their starting of family life.



Marital Profile of the respondents		Percentage
Married	17	43%
Unmarried	17	43%
No data	6	15%
Total	40	100%

The break up of the Married to the unmarried among the respondents who answered is almost 40% to 60%



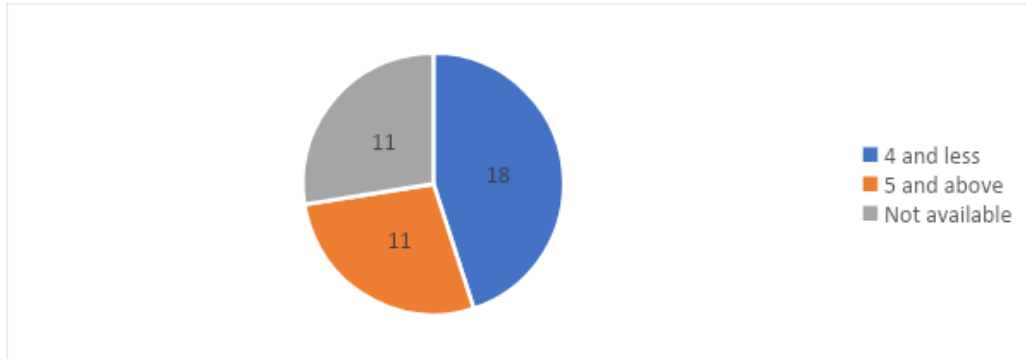
Family Size		Percentage
4 and less	22	55%
5 and above	11	28%
Not available	7	17%
Total	40	100%

The percent of respondents who belonged to small and nuclear families seem to be one and a half times higher than the ones with larger families, among the ones who answered the question.

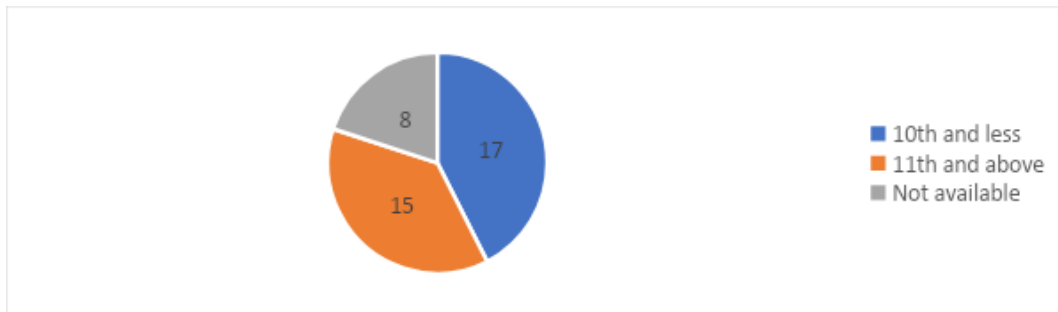
It may be inferred that many of the undetected cases in the larger families could be latent TB cases and may eventually show up if they develop symptoms later.

Since TMC civic hospitals have mostly urban populations visiting them, there is a higher number of nuclear families. TB cases tend to be a lot more in larger families as a proportion of the overall population as is evident from findings. It is observed that the earning member

in most of the responding families tends to be one person and that can be a big financial burden on them if the earning member is suffering. 3 out of the 40 respondents, asked me if I would be able to help them with the Rs. 500 per month help that the government is committed to.



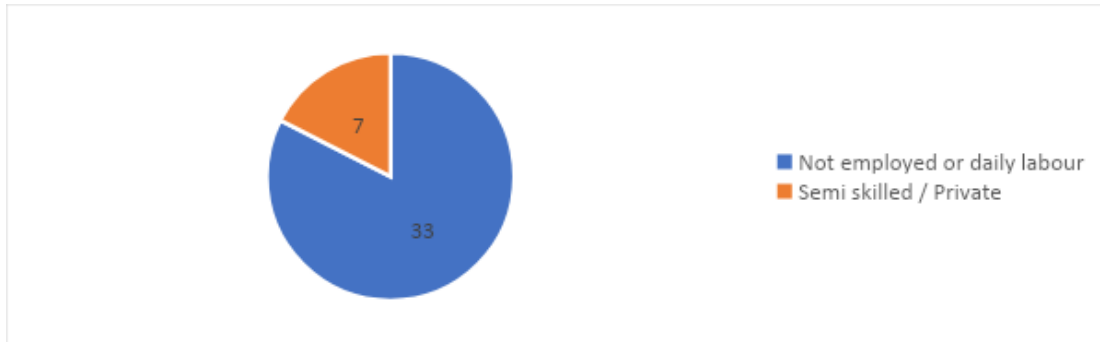
Education Profile		Percentage
10th and less	19	48%
11th and above	17	42%
Not available	4	10%
Total	40	100%



During the interview it was observed that quite a few of the respondents could speak broken English words and about 2 of the 40 respondents lived in apartments and had decent financial backgrounds. Many of the respondents had delayed diagnosis and thereby it can be inferred that education does not necessarily have a higher chance of taking the right decisions when testing for TB. Awareness is key.

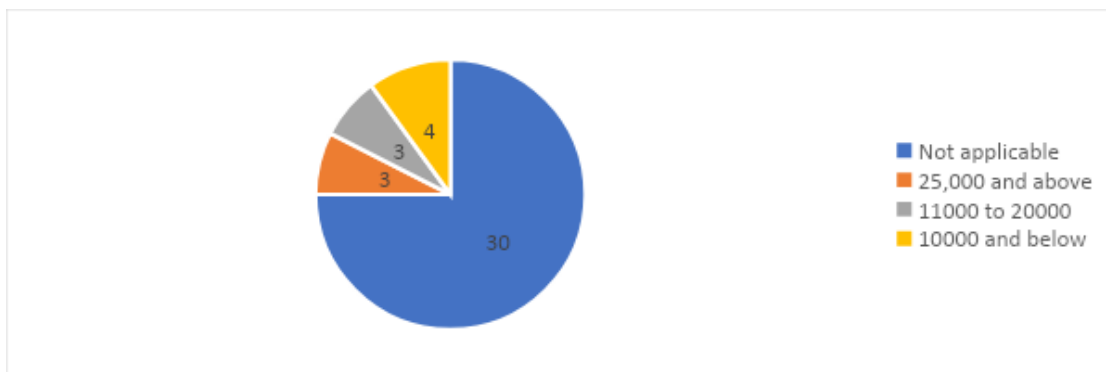
Occupation profile of Respondents		Percentage
Not employed or daily labour	33	83%
Semi skilled / Private	7	17%
Total	40	100%

Most of the respondents were young college going and teenagers (not working) and many of them did odd jobs like daily labour, wiremen, salon workers, auto rickshaw drivers etc.



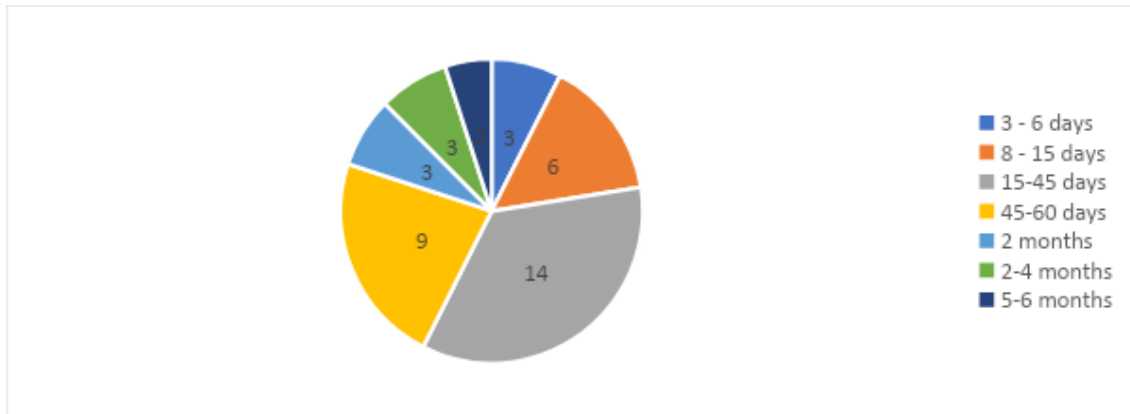
Household income of respondents		Percentage
Not applicable	30	75%
25,000 and above	3	8%
11000 to 20000	3	8%
10000 and below	4	10%
Total	40	100%

Only 15% of the respondents had a monthly household income of Rs. 10,000 and above.

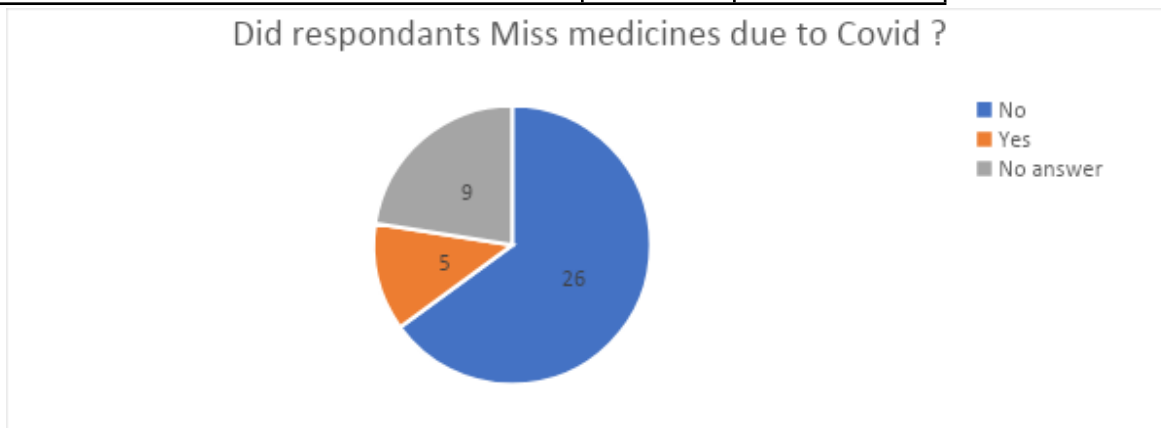


Time taken for medication to start after the onset of the symptoms		Percentage
3 - 6 days	3	8%
8 - 15 days	6	15%
15-45 days	14	35%
45-60 days	9	23%
2 months	3	8%
2-4 months	3	8%
5-6 months	2	5%
Total	40	100%

It is very disheartening that Almost 85% of the respondents got their diagnosis or confirmation of the report 15 days after the onset of the symptoms. Some of them probably started medicines based on the physical symptoms on the body or on the basis of X ray while other reports were awaited. This could at times also mean judgement calls by doctors. There is a need to improve diagnosis for the treatment of TB going forward.



Did Respondents miss TB medications due to Covid		Percentage
No	30	75%
Yes	5	13%
No answer	5	12%
Total	40	100%

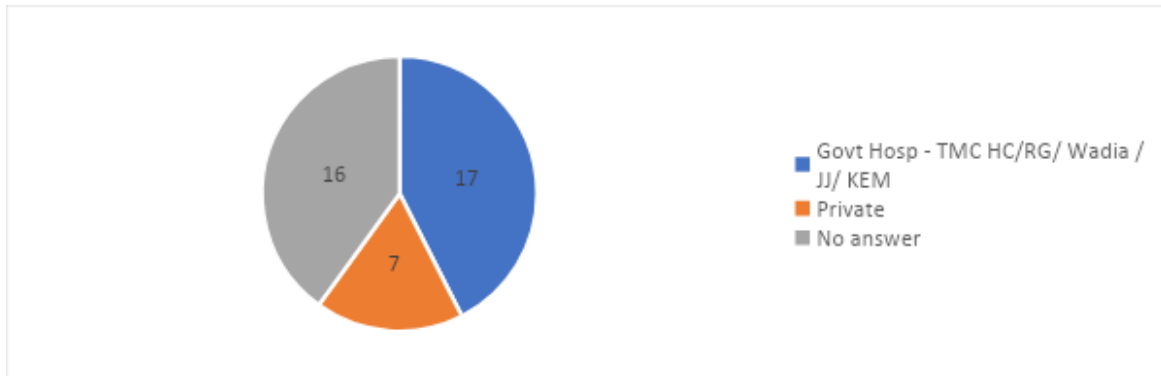


Most of the respondents have not missed medication even during Covid is an encouraging sign although quite a few people admitted that they had difficulty getting some of their medicines because they were out of stock for some time.

TB Tests were done at		Percentage
Govt Hosp - TMC HC/RG/ Wadia / JJ/ KEM	18	45%
Private	10	25%

No answer/ 3 rd party	1 2	30%
Total	4 0	100%

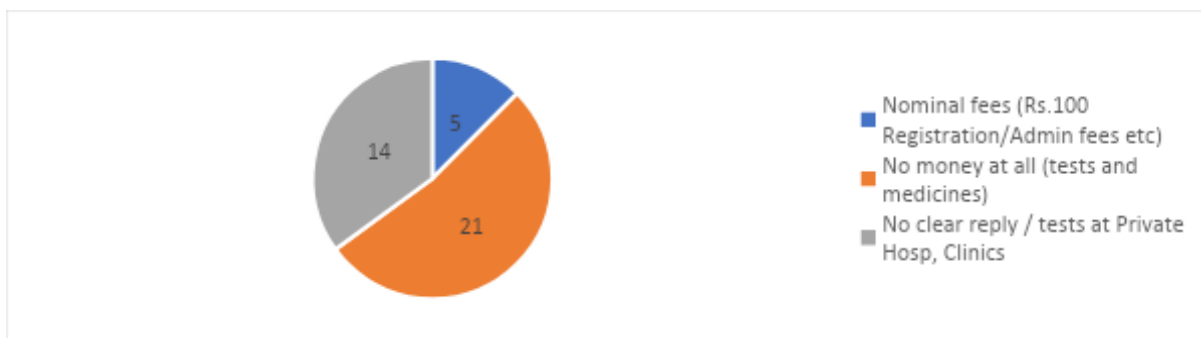
Lot of the tests for TB were done by 3rd party vendors and many had their test reports taken by their neighbourhood/family doctors and they came to TMC civic hospitals only for confirmation of diagnosis or for medications since they are not available outside or they are very expensive so they can't afford the treatment in private.



Amount paid for TB Screening tests & Meds		Percentage
Nominal fees (Rs.100 Registration/Admin fees etc)	5	13%
No money at all (tests and medicines)	2 5	62%
No clear reply / tests at Private Hosp, Clinics	1 0	25%
Total	4 0	100%

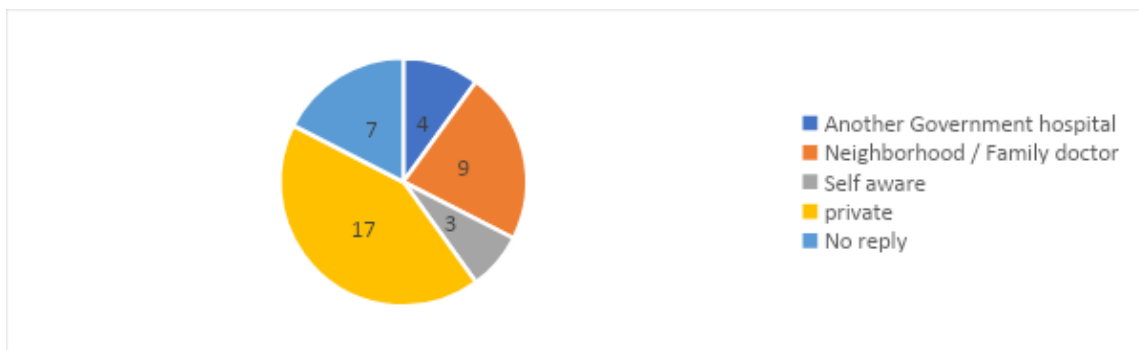
None of the respondents have not paid money for testing at TMC hospitals and many of them had paid money during their diagnosis in private clinics.

The patients who had got their tests done from outside had paid between Rs,2,500 to Rs.3,000 for a comparable test done from a private laboratory or private hospital.



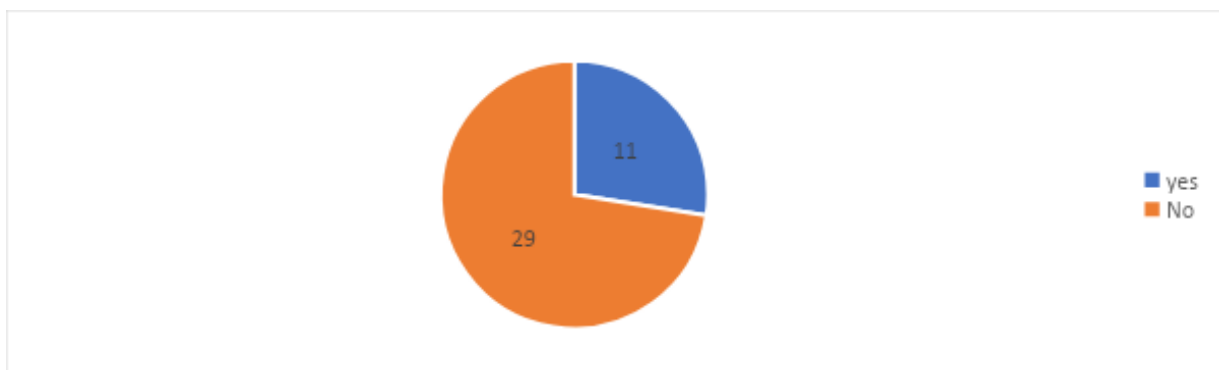
Who recommended the TMC TB hospital?		Percentage
Another Government hospital	6	15%
Neighbourhood / Family doctor	11	27%
Self aware	3	8%
Private	17	43%
No reply	3	7%
Total	40	100%

Some patients were diagnosed while suffering from other diseases or had visited other Civic Hospitals like JJ, Sion etc before being transferred to TMC civic hospitals, since they resided in Thane district. Some respondents were even admitted in other civic hospitals for a few days since they were either too weak or the medicines didn't suit them well. Only 3 of the 40 respondents were aware of the TMC civic hospitals and these 3 have shown better treatment results. Some had visited doctors but didn't show symptoms early enough and had to struggle with a misdiagnosis and even delayed treatment since symptoms didn't show up until later.



Has anyone in the family have TB before?		Percentage
Yes	12	30%
No	28	70%
Total	40	100%

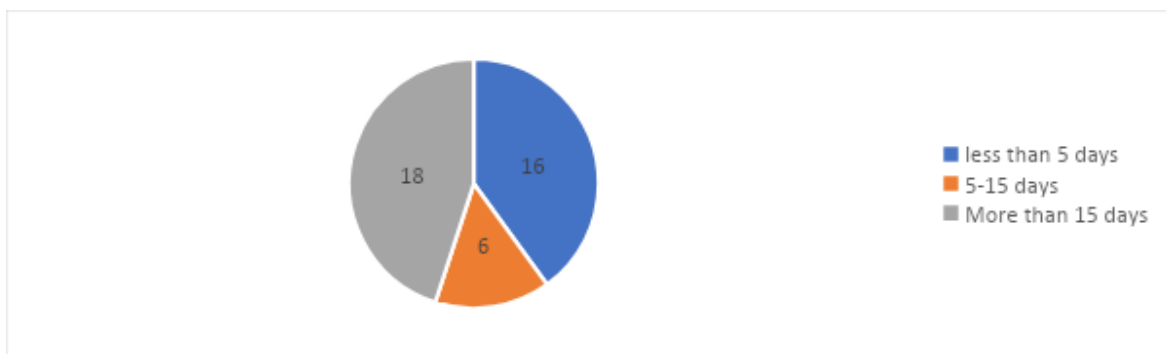
About 30 % of the respondents have had someone else in the family who has had TB before. 2 of the 40 respondents were a case of relapse. There is a need to further counsel the families and the patient so that internal family transmission and relapse can be reduced. 2 of the families have lost one of their parents.



Time taken to give TB confirmation report	Percentage
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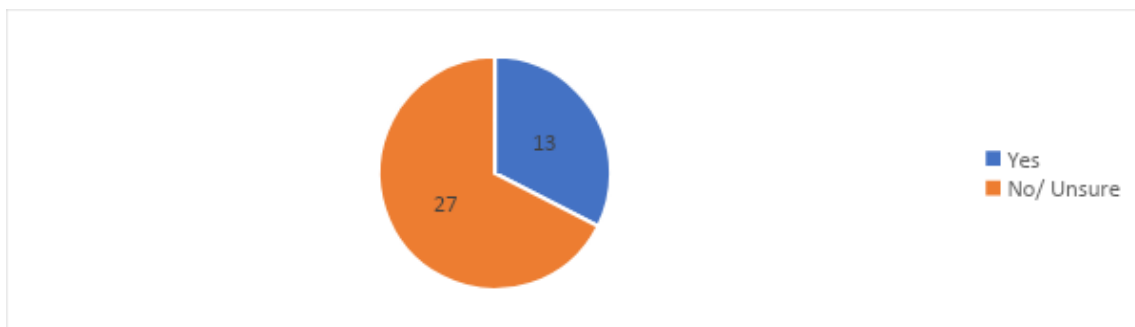
less than 5 days	18	45%
5-15 days	6	15%
More than 15 days	16	40%
Total	40	100%

Of the 40 respondents, 40% got the confirmation of their TB report more than 15 days after they had submitted their samples. This surely needs to improve so that more timely medical intervention can be done. If 100% of the samples in the future would be tested using CBNAAT machines would dramatically reduce the number of days. It was found that 11 of the 40 patients sampled got a report within 48 hours which were all tests conducted by the CBNAAT machines.



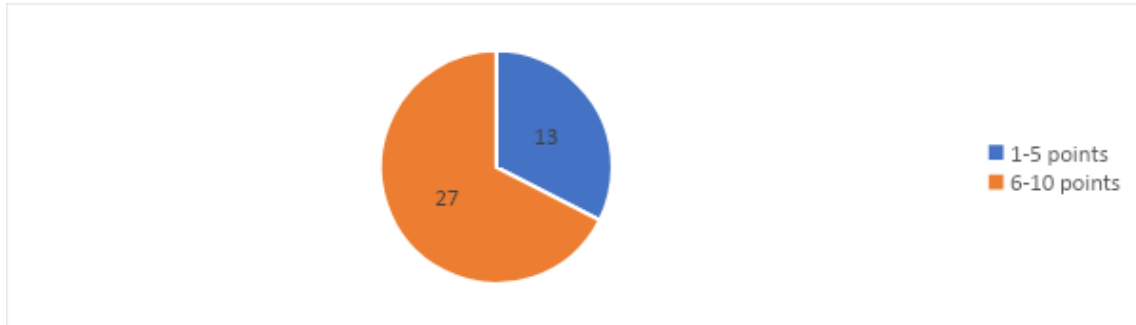
Was the Technical staff supportive & knowledgeable?		Percentage
Yes	13	33%
No/ Unsure	27	68%
Total	40	100%

Two thirds of the respondents were not very happy with their experience during submitting their samples.

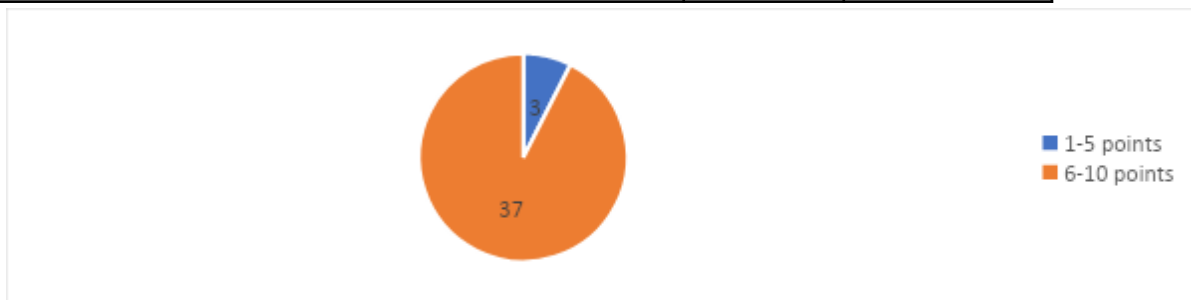


Rating Testing/ Diagnosis Experience from 1 to 10		Percentage
1-5 points	13	33%
6-10 points	27	68%
Total	40	100%

Most respondents experienced a lot of delay in their diagnosis and yet they seemed to understand that it takes time. Only 33 % of the respondents were admittedly unhappy with their diagnosis. Some others may have been kinder in their evaluation since they were happy to get good and free medication thereafter.



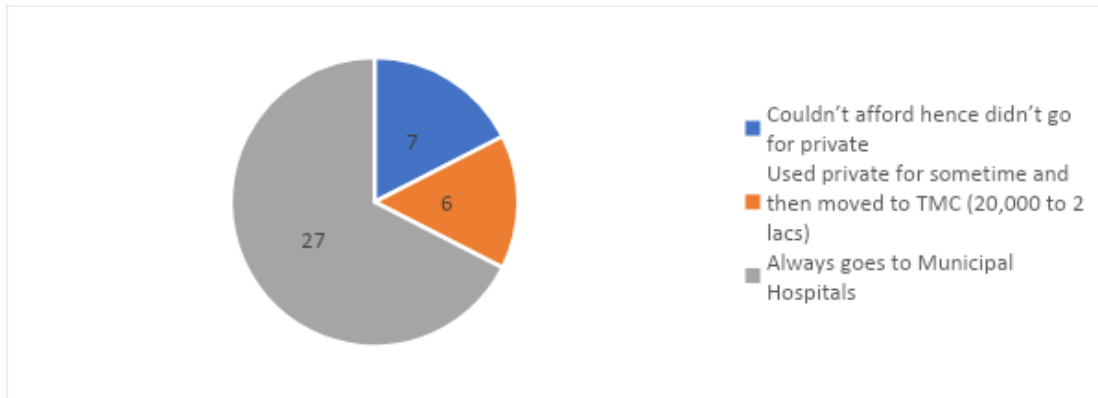
Rating Doctor / Medical team Experience from 1 to 10		Percentage
1-5 points	3	8%
6-10 points	37	93%
Total	40	100%



Most of the respondents were very happy with the efforts undertaken by the team of doctors and their team probably because they were thankful that the medicines are now working and the patients are improving and the team follows up with the patients to ensure that timely medications are taken by the patients.

Money spent for TB cure at Private hospital		Percentage
Couldn't afford hence didn't go for private	7	18%
Used private for some time (spending Rs. 20,000 to 2 lacs) and then moved to TMC hospital	8	20%
Always goes to Municipal Hospitals	25	62%
Total	40	100%

Some respondents had started medications and even hospitalisation in private hospitals and when the bills shot up (one family out of the 40 respondents had spent Rs. 2 lacs for hospitalisation charges) eventually they had to come to the civic hospitals for free medications.



Financial return of Spent on CBNAAT machines

TMC had two CBNAAT machines operational between January 2020 and October 2021, when it conducted TB tests on CBNAAT for about 1,800 patients at no cost to the patient. The patients said that the cost of the test in a private facility ranged between Rs.2,500 to Rs.3,000.

	Time period	Total Number of tests conducted by TMC	Number of tests done with CBNAAT	CBNAAT capacity utilisation	Cost of one CBNAAT test at private hospital / clinic Amount (Rs)	Total cost incurred by testing in private hospital Amount in Range (Rs in lacs)
Tests conducted	Jan 2020-Oct 2021	6,000	1800	30%	2,500 to 3,000	45 to 54
Estimated tests in TMC CBNAAT machines	Jan 2022-Dec 2023	6000 (assumed)	4500	75%	2,500 to 3,000	150 to 180
Total tests Estimated	Jan 2020 - Dec 2023	12,000 (assumed)	6300	53%	2,500 to 3,000	195 to 234
Cost incurred for 2 CBNAAT machines						71.61
Financial Return on financial investment made (times)						2.72 to 3.27 times

We can make a conservative estimate that the return on this investment incurred in procuring CBNAAT machines, at Rs.71.61 lacs, would be recovered in a 4-year period at between 2.7 to 3.2 times.



Consistent Data

Due to covid, meeting with patients for in person interviews was not possible and hence TMC was requested to share some data of patients, some of which were spoken to over phone. After Covid unlock, respondents were met in person to conduct a primary survey.

The demographic profile of the data provided by TMC (for the period 2020 and 2021) was consistent with the sampled data of patients who were interviewed in person and spoken to over phone.

Thus, the sample of 40 respondents spoken to were quite representative of the overall sample of the data given by TMC.

Recommendations

National Health Accounts estimates for India has reported that the share of the government's health expenditure in the total GDP has increased from 1.15% in 2013-2014 to 1.35% in 2017-2018 and is expected to increase further in future.

- b. IOCL should continue its CSR spend in public health in line with the expected increase in Government of India spent in public health. A Social return on investment study can be considered at the end of Dec 2023, to capture the impact of CBNAAT machines over 4 years on the society to focus on social impact.
- c. The doctors and technical staff are very happy with the CBNAAT machines and they wish to increase the percentage of tests done with CBNAAT machines, but due to unavailability of cartridges used for testing samples in CBNAAT machines, they can't. They have a backlog of about 170 patients who need to be tested. IOCL could consider financing cartridges for the hospitals to test this lot while they await state funds.
- d. Some patients approached saying they had not been receiving the government support of Rs. 500. Due to covid, many of these marginalised families have been severely impacted. IOCL could consider finance or ration assistance to a few families for a one year period so that they continue medications.
- e. IOCL may consider sponsoring education of one girl child in say, 100 affected families, till she finishes school.
- f. Young ladies could be sponsored for in semi-skilled training like nursing or tailoring programs. About 60% of the patients are females.
- g. It was observed during the study that higher awareness levels about TB among patients have resulted in timely visits to the hospital and sooner testing and medications. IOCL could consider contributing to the awareness campaigns by installing banners at the IOC petrol pumps in hot spots identified in the TMC area.
- h. IOCL could consider making and distributing Pamphlets in Hindi and Marathi using Most asked Question and Answers format giving vulnerable communities information on Dos and Dents to understand more about TB.
- i. The TB Disease Burden on India is telling (Refer Annexure 5) If the ground level CSR team identifies and works with SHG in helping TB affected families in high TB incidence area like Shivaji Nagar, Kisan Nagar, Manpada, Mumbra, Kausa and Shil etc and maybe finance hens and goats for marginalised families.

References

Ministry of Health. National health indicators.

http://www.moh.gov.om/nv_menu.php?fNm=stat/NationalHI.php&SP=1

Ministry of National Economy. Statistical yearbook 2008.

<http://www.moneoman.gov.om/book/syb2008/syb2008.htm>

Ministry of Health, Development of Health Services and Health Care.

http://www.moh.gov.om/nv_menu.php?fNm=reports/devofhelt.htm

India TB report 2019

India TB report 2020

World health organization reports 2002 2015 2016 2017 2020

<https://pubmed.ncbi.nlm.nih.gov/>

Annexures

Annexure 1

World TB Day 2020: It's Time
World TB Day 2019: It's Time
2018: Wanted: Leaders for a TB – free World You can make history – End TB
2017: Unite to End TB
2016: Unite to End TB
2015: Gear up to end TB
2014: Reach the 3 million
2013: STOP TB: in my lifetime
2012: STOP TB: in my lifetime
2011: On The Move Against TB: Transforming the fight towards elimination
2010: On the move against tuberculosis: Innovate to accelerate action
2009: I am stopping TB: Fighting TB is the responsibility of every citizen
2008: I am stopping TB: Fighting TB is the responsibility of every citizen
2007: TB anywhere is TB everywhere
2006: Actions for life: towards a world free of tuberculosis



2005: Frontline TB Care providers: heroes in the fight against tuberculosis
2004: Every breath counts – Stop TB now
2003: DOTS cured me – it will cure you too
2002: Stop TB, fight poverty
2001: DOTS: TB Cure for all
2000: Forging new partnerships to Stop TB

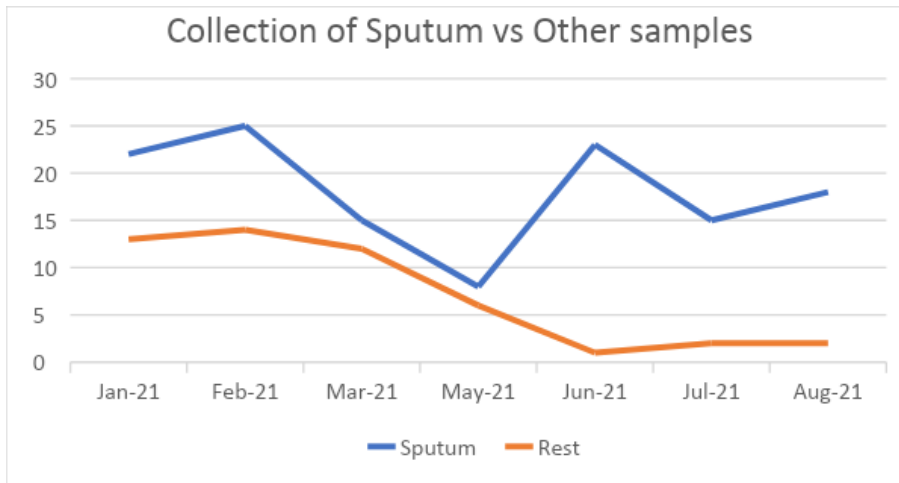
Annexure 2 - Strategic snapshot of the National Strategic Plan for TB

Detect	How
Find all DS-TB and DRTB cases with an emphasis on reaching TB patients seeking care from private providers and undiagnosed TB in high-risk populations	<p>Scale-up free, high sensitivity diagnostic tests and algorithms</p> <ul style="list-style-type: none"> • Scale-up effective private provider engagement approaches • Universal testing for drug-resistant TB • Systematic screening of high risk populations
Treat	How
Initiate and sustain all patients on appropriate anti-TB treatment wherever they seek care, with patient friendly systems and social support.	<p>Prevent the loss of TB cases in the cascade of care with support systems</p> <ul style="list-style-type: none"> • Free TB drugs for all TB cases • Universal daily regimen for TB cases and rapid scale-up of short-course regimens for drug-resistant TB and DST guided treatment approaches. • Patient-friendly adherence monitoring and social support to sustain TB treatment • Elimination of catastrophic costs by linkages of eligible TB patients w
Prevention	How
Prevent the emergence of TB in susceptible populations	<ul style="list-style-type: none"> • Scale up air-borne infection control measures at health care facilities • Treatment for latent TB infection in contacts of bacteriologically-confirmed cases • Address social determinants of TB through intersectoral approach
Build	How
Build and strengthen enabling policies, empowered institutions and human resources with enhanced capacities.	<p>Translate political commitment through supportive policy and institutional structures:</p> <ul style="list-style-type: none"> •National TB Elimination Board with 4 divisions instead of current administrative set up - TB Elimination implementation on a "Mission mode" •National TB Policy and Act • Restructure RNTCP management structure and institutional arrangement: •HR reforms to include state level contractual supervisory cadre and dedicated staff for TB surveillance network • Build supportive structures for surveillance, research and innovations, and a cafeteria approach of interventions •Reforming STDCs and expanding the role of the Medical Colleges to include surveillance and as centers of excellence (COEs) •Redefining role of National institutes (NTI, NRTI, to support policy advice • Scale up Technical Assistance at national and state levels. • Align and harmonize partners' activities with programme needs to prevent duplication

Annexure 3 – List of 30 Health Centres


Sr	TMC Health Centres
1	AATKONESHWAR HC
2	ANAND NAGAR HC
3	AYURVEDIC HC
4	AZAD NAGAR
5	BALKUM HEALTH
6	C.R. WADIA HC
7	DHOKALI HC
8	DIVA HC
9	GANDHI NAGAR
10	KAJUWADI HC
11	KALWA HC
12	KAUSA HC
13	KHAREGAON HC
14	KISAN NAGAR HC
15	KOPRI HC
16	LAXMI CHIRAG NAGAR
17	LTN HOSPITAL KORES
18	MAJIWADA HC
19	MANORAMA NAGAR
20	MANPADA HC
21	MENTAL HOSP. HC
22	MUMBRA HC
23	NAUPADA HC
24	ROSA GARDANIA H C
25	SAVARKAR NAGAR
26	SHIL HC
27	SHIVAJI NAGAR HC
28	UTHALSAR HC
29	VARTAK NAGAR HC
30	WAGLE ESTATE HC

Annexure 4



Annexure 5

DISEASE BURDEN IN THE COUNTRY

<ul style="list-style-type: none"> > India accounts for about a quarter of the global TB burden 	 <p>COVID & TB</p> <ul style="list-style-type: none"> > Detection of new TB cases halved in Maharashtra in first few months of Covid outbreak > While 20,000 cases are reported on an average every month in Maha, the number dropped to 6,918 in July 2020
<ul style="list-style-type: none"> > In 2018, the estimated TB incidence was 27 lakh 	
<ul style="list-style-type: none"> > This translates into a rate of 199 patients per 1 lakh population 	
<ul style="list-style-type: none"> > Worldwide, India is the country with the highest burden of both TB and drug-resistant TB 	
<ul style="list-style-type: none"> > The estimated incidence of people with multidrug- and rifampicin-resistant TB in India is 1.3 lakh 	

Questionnaires

(A)

Stakeholder – End Beneficiary / Patient

Date - ___ / ___ / ___ Location:- Chhatrapati Shivaji Maharaj Hospital/ RGMC, Kalwa

Name of patient – _____

Gender – M / F Age - _____ yrs

Married - Yes / No Number of people in household - _____

Number of dependants - _____ Highest Education - _____

Profession of Household head- _____ Household income per month - _____

What were the first Symptoms? - _____

Month & year When symptoms first noticed _____

DDMMYYYY when Medication started - _____

Calculate - Total Time taken _____ days from start of symptoms to starting medication

How many days / weeks / months did you miss medications during Covid? Yes / No

Where did you get your CBNAAT test done? _____

How much did you pay for your CBNAAT scan? _____

1.) Who referred you to this hospital to get your diagnostic report? Tick on all applicable options

a) Doctor recommended – If yes, Name - _____, designation _____

b) This Hospital is located near to you

c) A person who known to you recommended ?– Relationship - _____

d) Any other person _____

2.) Which hospital were you visiting before you came to TMC for CBNAAT diagnosis?
_____ hospital _____ location

3.) Has anyone in your family tested for TB before? Yes / No. When? _____

4.) Have you been tested by any other diagnostic machines before using the current CBNAAT machines? Yes / No / Not sure

5.) If tested by other than CBNAAT machine,

A) How long did you wait for the results from the earlier diagnostic machine? _____ hours /days

B) If yes, how much money did you pay when using the earlier diagnostic machine?
Rs. _____



C) How long did you wait for results from the TMC Hospital diagnostic machine?
_____ hours /days

6.) How much money did you pay when using the TMC diagnostic machine? Rs. _____

7.) Did the technical staff know the workings of the Diagnostic machine and did he/she explain to you with patience and listened to your issues well? Yes / No / Not sure

8.) Can you share how was your overall experience with the Diagnostic machine at the TMC hospital and how was it different from the one you used with other hospitals you tested?

9.) On a scale of 1 to 10 , rate the quality of Overall Experience you had with the technical staff in the TMC Hospital CAT scan?

Lowest 1 2 3 4 5 6 7 8 9 10 Highest

10.) On a scale of 1 to 10 , rate the quality of your experience during diagnosis

Lowest 1 2 3 4 5 6 7 8 9 10 Highest

Questionnaire (B)

Stakeholder - Relatives / caregiver of the End Beneficiaries (additional questions in addition to the Patient questionnaire)

- 1) How did you find out about TMC Hospital?
- 2) How much did the Diagnostic test cost in the earlier hospitals vis a vis the TMC hospital?
Earlier hospital name - _____
Cost of the test - _____
Cost of the test at TMC- _____

Questionnaire (C)

Stakeholder - Doctors/Technical staff at TMC

- 1) At what stage of the treatment of the disease do you need the patients to get the CBNAAT Scan done?
- 2) How many patients undertake the test (Approx) in your hospital every day since new CBNAAT machines and the average number per day before ? New machine _____
Earlier _____
- 3) On an average how many patients are in-house from TMC hospitals per day / month? _____
- 4) How many patients on an average are drug resistant TB per day / month? _____
- 5) How many patients are referred by private hospitals per day / month? _____
- 6) How much more is it compared to the earlier machines for the corresponding period?
In-house _____ numbers % increase _____
From outside _____ numbers % increase _____
- 7) On a scale of 1 to 10 , rate the quality of diagnostic report the CBNAAT machine has giving
Lowest 1 2 3 4 5 6 7 8 9 10 Highest
- 8) On a scale of 1 to 10 kindly rate to what extent, has the CBNAAT machine results been accurate in diagnosis and eventual quality of treatment of the disease
Very Accurate 1 2 3 4 5 6 7 8 9 10 Not Acc



9) Kindly mention and rank the features of the CBNAAT machine starting with highest importance to lowest the CBNAAT in serving your diagnostic needs

- A) _____ Met your objectives _____ %
- B) _____ Met your objectives _____ %
- C) _____ Met your objectives _____ %

- D) _____ Met your objectives _____ %

10) How satisfied are you with the maintenance and servicing of the machines by the brand

Very Satisfied 1 2 3 4 5 6 7 8 9 10 Not at all

11) What are your expectations from the Donors of the CBNAAT machines?