BIG DATA FOR SOCIAL GOOD

Case Study :

Helping end Tuberculosis in India by 2025

The GSMA represents the interests of mobile operators worldwide, uniting more than 750 operators with over 350 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and internet companies, as well as organisations in adjacent industry sectors.

The Big Data for Social Good Initiative convenes public and private organisations to accelerate the mobile industry's impact against the UN SDGs. Infectious diseases, pollution, earthquakes, floods and other disasters are among the greatest challenges the world faces today. Each year, 15 million people die and millions more become seriously ill as a result of infectious diseases[1].

Mobile operators can provide powerful and unique insights based on anonymised, aggregated network data to help solve these complex problems. Mobility data can help public health organisations to more effectively respond to epidemics or plan targeted health interventions. It can support emergency relief agencies to more accurately and efficiently direct their resources. It can help governments better understand the impact of pollution and climate change on citizens.

Through the GSMA, mobile operators and partners across geographies have come together to accelerate and scale the opportunity for Big Data for Social Good. The GSMA offers a unique platform to establish a common framework and best practice approaches, while respecting and protecting individuals' privacy.

1. Dye, Christopher. "After 2015: Infectious Diseases in a New Era of Health and Development." Philosophical Transactions of the Royal Society B: Biological Sciences 369.1645 (2014): 20130426. PMC. Web. 23 Feb. 2017. http://rstb.royalsocietypublishing.org/content/369/1645/20130426

Summary

For the past five years, tuberculosis (TB) has been the leading global cause of death from a single infectious agent, ranking above HIV/AIDS. Worldwide, 10.4 million people contracted TB in 2016, and 1.7 million people died from it, according to estimates by the World Health Organization (WHO). India accounts for 26% of the total number of deaths from TB[2].

One of the United Nations' Sustainable Development Goals is to end the TB epidemic by 2030, while the government of India has committed to an even more ambitious target to end TB by 2025[3]. Meeting this commitment will require innovative strategies and technologies.

Bharti Airtel (Airtel) and Be He@lthy, Be Mobile (a joint initiative between WHO and the International Telecommunications Union), together with the GSMA, are seeking to understand how the big data generated by mobile networks could provide relevant insights. Together, the parties developed a proof of concept (PoC) in the Indian states of Uttar Pradesh and Gujarat, which uses mobile network data to help pinpoint geographical locations at risk of increasing TB incidence.

As TB is spread through recurring proximity, the PoC used anonymised, aggregated mobile network data showing regular population movements (such as commuting, attending education and other habitual daily journeys) provided by Airtel. The scale, granularity and immediacy of mobile data enabled the identification of areas that have low TB incidence rates, but are highly connected to areas with high TB incidence. Statistical analysis showed that regular population movement is a stronger indicator of TB incidence than location proximity between high and low TB regions[4].

Low TB areas from which people regularly travel to high TB areas are therefore at particular risk of increasing TB levels or may already be under-reporting TB cases. Understanding these patterns makes it possible to implement targeted prevention, diagnosis, and adherence measures in these areas, and to gain new insights, to better address TB.

More broadly, this PoC highlighted how the mobile industry can provide valuable insights to help address some of the greatest challenges of our time, including bringing infectious diseases such as TB to an end. For the GSMA, the key success factor in this initiative was the close collaboration between the healthcare and telecoms organisations, to ensure the approach was both relevant and actionable.

2. Global Tuberculosis Report 2017, World Health Organization
3. The National Strategic Plan for Tuberculosis Elimination https://tbcindia.gov.in
4. https://positium.com/files/Investigating_the_Potential_of_MPD-FINAL.pdf/

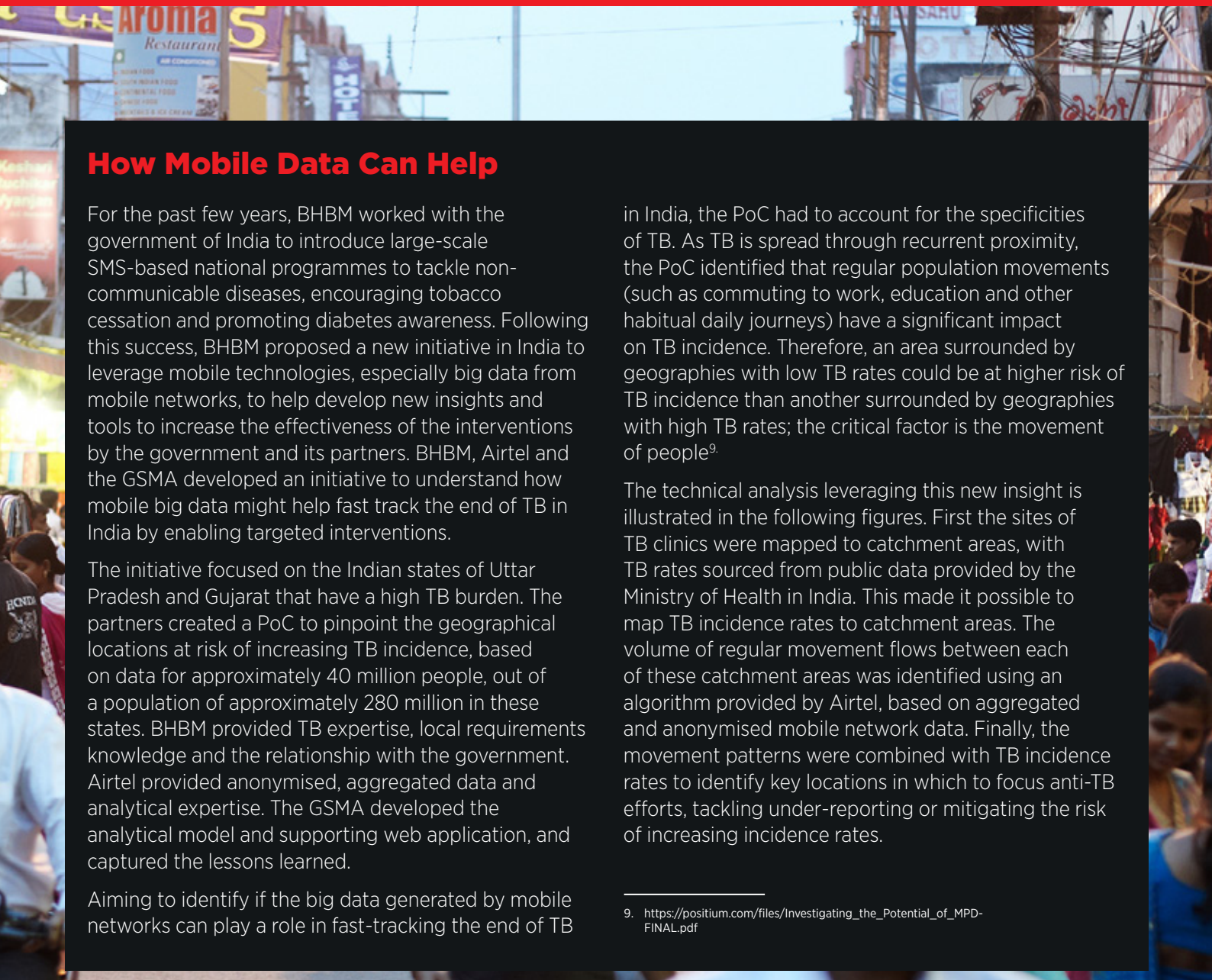
The TB Challenge in India

The WHO estimates there were 1.7 million deaths from TB globally in 2016, 95% of which occurred in low- and middle-income countries. However, cases of drug-susceptible TB can be treated through a six-month regimen of four first-line antibiotic drugs[5]. From 2000 to 2016, 53 million lives have been saved through TB diagnosis and treatment[6].

The WHO estimates 10.4 million people in 2016 contracted TB, which is carried in airborne particles[7]. These are generated when a person coughs, sneezes, shouts or sings. Transmission occurs when a person inhales these particles, and the bacteria reach the lungs. As a result, frequency and duration of exposure to an infected person are two major factors governing the transmission of TB.

In 2016, India accounted for 26% of the total number of deaths from TB. During that year, nearly 2.8 million Indians were diagnosed with TB and 435,000 people died from it. According to the United States Agency for International Development (USAID), a further 850,000 cases of TB each year in India go either undetected and untreated, or are diagnosed and treated by private healthcare providers with potentially substandard drugs and treatment regimens. Such drugs and treatment regimens not only fail to fully eliminate the TB bacteria, but also contribute to an increasing incidence of drug resistant TB[8].

5. Global Tuberculosis Report 2017, World Health Organization
6. WHO Tuberculosis key Facts http://www.who.int/en/news-room/fact-sheets/detail/tuberculosis
7. Tuberculosis in India https://www.usaid.gov/what-we-do/global-health/tuberculosis/technical-areas/tuberculosis-india
8. http://www.who.int/en/news-room/fact-sheets/detail/tuberculosis



How Mobile Data Can Help

For the past few years, BHBM worked with the government of India to introduce large-scale SMS-based national programmes to tackle non-communicable diseases, encouraging tobacco cessation and promoting diabetes awareness. Following this success, BHBM proposed a new initiative in India to leverage mobile technologies, especially big data from mobile networks, to help develop new insights and tools to increase the effectiveness of the interventions by the government and its partners. BHBM, Airtel and the GSMA developed an initiative to understand how mobile big data might help fast track the end of TB in India by enabling targeted interventions.

The initiative focused on the Indian states of Uttar Pradesh and Gujarat that have a high TB burden. The partners created a PoC to pinpoint the geographical locations at risk of increasing TB incidence, based on data for approximately 40 million people, out of a population of approximately 280 million in these states. BHBM provided TB expertise, local requirements knowledge and the relationship with the government. Airtel provided anonymised, aggregated data and analytical expertise. The GSMA developed the analytical model and supporting web application, and captured the lessons learned.

Aiming to identify if the big data generated by mobile networks can play a role in fast-tracking the end of TB in India, the PoC had to account for the specificities of TB. As TB is spread through recurrent proximity, the PoC identified that regular population movements (such as commuting to work, education and other habitual daily journeys) have a significant impact on TB incidence. Therefore, an area surrounded by geographies with low TB rates could be at higher risk of TB incidence than another surrounded by geographies with high TB rates; the critical factor is the movement of people[9].

The technical analysis leveraging this new insight is illustrated in the following figures. First the sites of TB clinics were mapped to catchment areas, with TB rates sourced from public data provided by the Ministry of Health in India. This made it possible to map TB incidence rates to catchment areas. The volume of regular movement flows between each of these catchment areas was identified using an algorithm provided by Airtel, based on aggregated and anonymised mobile network data. Finally, the movement patterns were combined with TB incidence rates to identify key locations in which to focus anti-TB efforts, tackling under-reporting or mitigating the risk of increasing incidence rates.

9. https://positium.com/files/Investigating_the_Potential_of_MPD-FINAL.pdf

Figure 1

Spatial map of TB incidence rates in Uttar Pradesh

The state is divided into catchment areas based on the locations of clinics within Sub-Districts. The number of TB cases at each clinic, combined with population estimates, gives the TB incidence rate of each catchment area. Catchment areas in the figure are coloured according to the TB incidence rate in the catchment area, measured in cases per 100 thousand population per year - red for high (above 142), yellow for medium (between 44 and 142), green for low (less than 44). These limits are based on guidelines from the WHO.

Key

High TB rate | Medium TB rate | Low TB rate

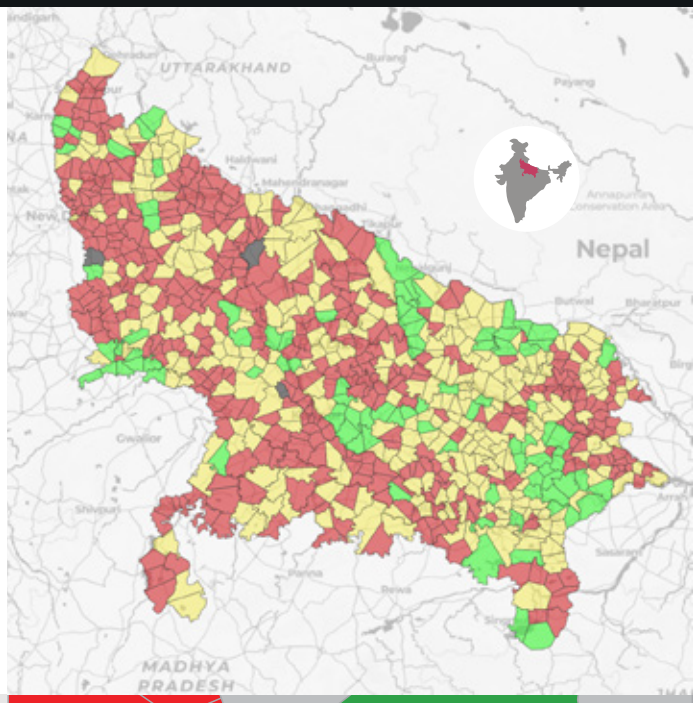


Figure 2

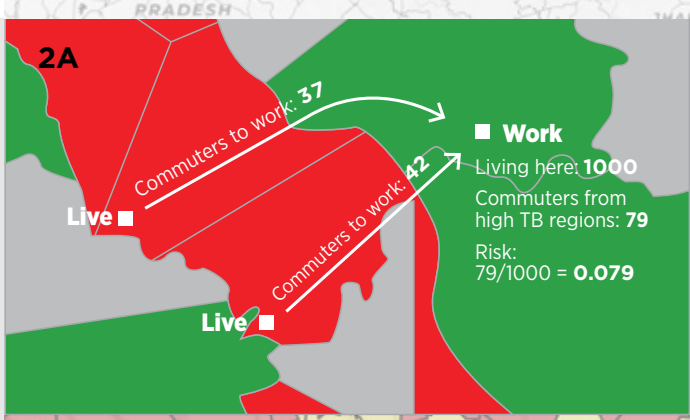
Habitual movement patterns between catchment areas

The mobile data provided by Airtel shows the volumes of habitual movements between locations across the whole state. These locations were aggregated across the catchment areas defined from the TB clinic locations. From this, commuter figures from one area to another can be separated according to the TB rate, so that the movement between areas of different TB levels can be quantified. In the lower figure, commuter flows to and from a focal district are shown by curved lines, where the thickness of the line represents the volume of the flow and the colour shows the TB level of the other district.

Key

High TB rate | Medium TB rate | Low TB rate

Note: thickness of the line = volume of regular movements to and from other areas



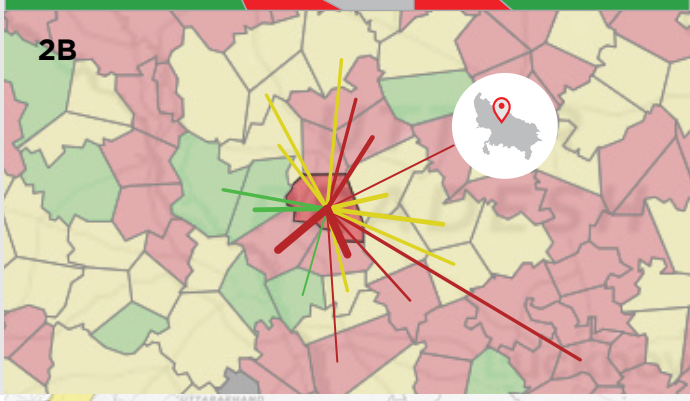


Figure 3

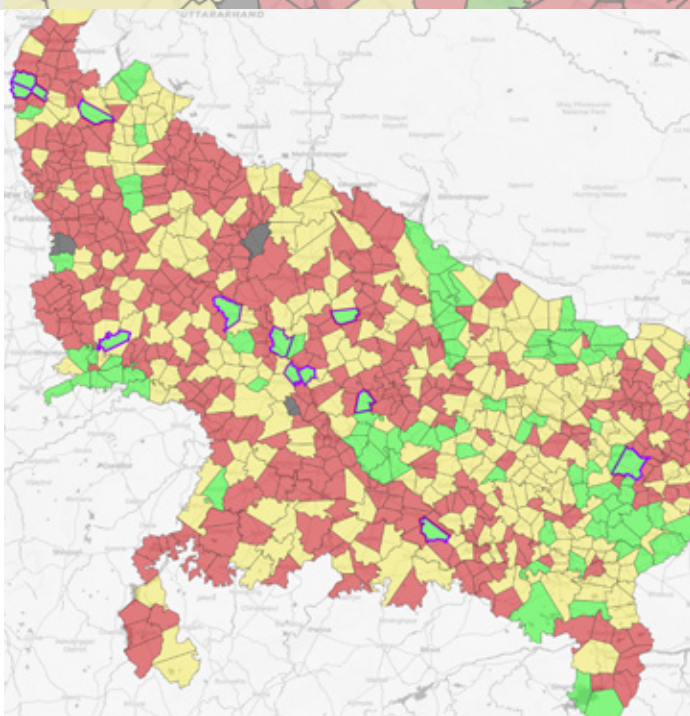
TB hotspots in Uttar Pradesh

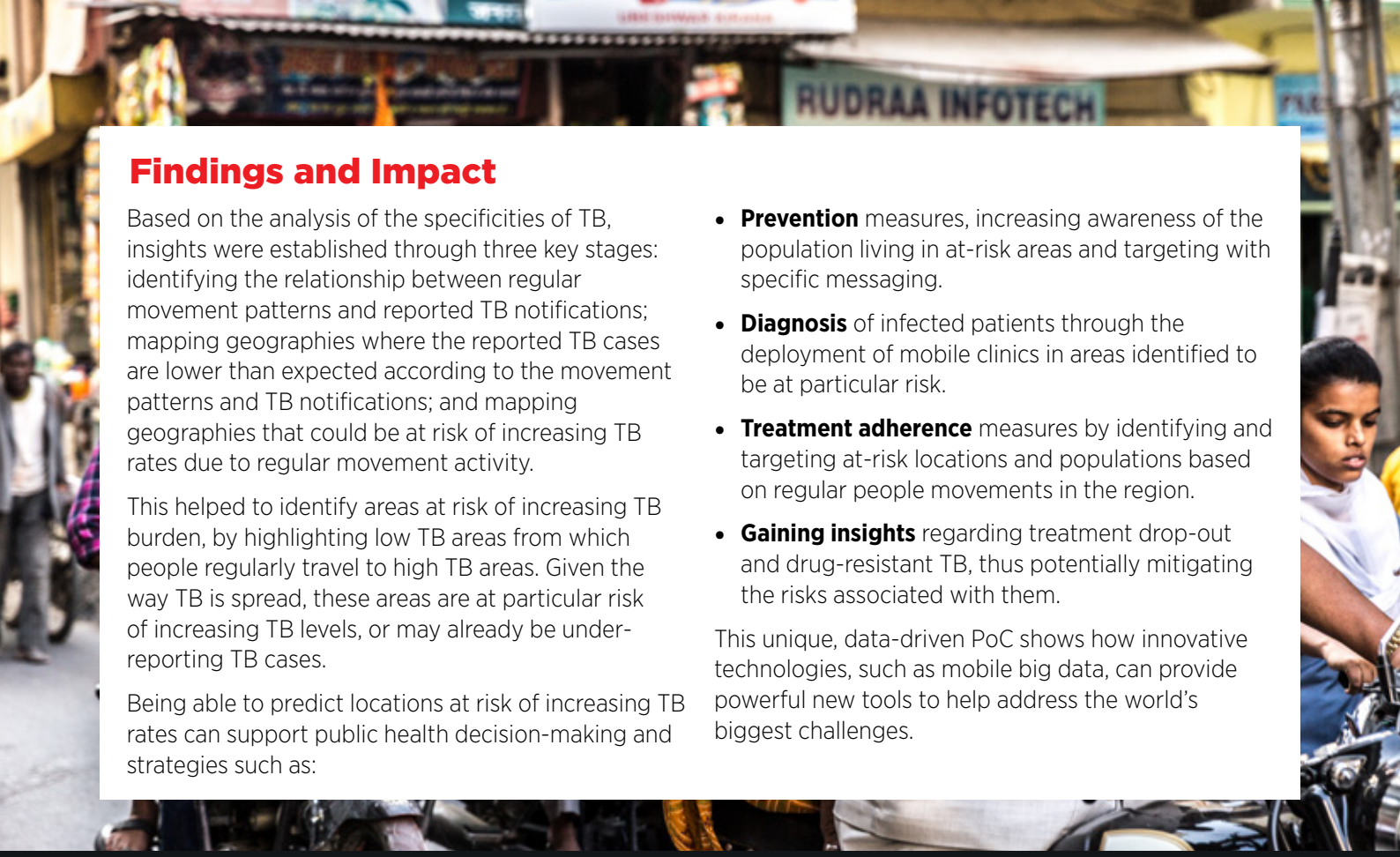
Quantifying the proportions of commuters in each catchment area that travel between high, medium and low TB regions reveals catchment areas that currently report low numbers of TB cases, but share a relatively large, regular flow of people with areas where TB incidence rate is high. Such areas could be TB transmission hotspots at risk of increasing their TB incidence rate, or could have large numbers of missing, unreported or undiagnosed cases.

Key

High TB rate | Medium TB rate | Low TB rate

TB transmission hotspots





Findings and Impact

Based on the analysis of the specificities of TB, insights were established through three key stages: identifying the relationship between regular movement patterns and reported TB notifications; mapping geographies where the reported TB cases are lower than expected according to the movement patterns and TB notifications; and mapping geographies that could be at risk of increasing TB rates due to regular movement activity.

This helped to identify areas at risk of increasing TB burden, by highlighting low TB areas from which people regularly travel to high TB areas. Given the way TB is spread, these areas are at particular risk of increasing TB levels, or may already be under-reporting TB cases.

Being able to predict locations at risk of increasing TB rates can support public health decision-making and strategies such as:

- **Prevention** measures, increasing awareness of the population living in at-risk areas and targeting with specific messaging.
- **Diagnosis** of infected patients through the deployment of mobile clinics in areas identified to be at particular risk.
- **Treatment adherence** measures by identifying and targeting at-risk locations and populations based on regular people movements in the region.
- **Gaining insights** regarding treatment drop-out and drug-resistant TB, thus potentially mitigating the risks associated with them.

This unique, data-driven PoC shows how innovative technologies, such as mobile big data, can provide powerful new tools to help address the world's biggest challenges.

Key Lesson Learned

For the GSMA, the key success factor in this initiative was the close collaboration between the healthcare and telecom organisations, to ensure the approach was relevant and actionable.

Such a collaboration requires the involvement of a demand-side agency that can provide expertise, local requirements, knowledge and relationships with the relevant players across the ecosystem. This expertise includes a deep understanding of the reality of a disease, its key challenges and its specificities; including the way it is spread, the patient journey and the potential interventions. These capabilities enable the ecosystem to efficiently orient the analysis.

Through joint learning, iterations, and digital skills development, the mobile industry can provide relevant insights to support efforts to eradicate infectious diseases such as TB.

Going forward

Airtel and the GSMA have identified a series of potential next steps:

Potential next steps include the evolution of the PoC into a working model for the Ministry of Health in India. This could be done by complementing the mobile data with other data sources, scaling up the analysis to other Indian states, strengthening the algorithm and expanding the number of partners from both the demand and supply side.

With SDG 3 (Good Health and Wellbeing) and eradicating TB as our shared goal, there is a significant opportunity to integrate the findings of the initiative into active treatment programmes for the benefit of people and communities.

Watch our video, learn about the initiative and contact us for more information: **bd4sg@gsma.com**

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