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J-PAL POLICY BRIEFCASE | JUNE 2020

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ON TRACK: HEALTH CARE, PATIENT DATA, AND PROVIDER PERFORMANCE

Biometric tracking increased the likelihood that patients adhered to recommended tuberculosis treatment, improved health worker attendance, and reduced misreporting of patient data by health workers.

Featuring an evaluation by Thomas Bossuroy, Clara Delavallade, and Vincent Pons

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Tuberculosis (TB) is the leading infectious disease killer in the world, claiming nearly 1.5 million lives annually.[1] Detecting infection early and ensuring patients complete the rigid six-month course of treatment are key to stopping its spread and to promoting patient survival. Yet, adherence to treatment is particularly challenging, as it entails consuming multiple drugs at once, over a long duration, and often in the face of strong side effects even after symptoms may have disappeared.[2]

To combat TB around the world, the World Health Organization promotes Directly Observed Therapy, Short Course (DOTS). Following DOTS, patients ingest their TB treatment under direct observation of trained providers based at local care centers. This decentralized provision of treatment requires that national TB programs have close oversight of service delivery. Delivering effective and efficient care, however, is often challenging where monitoring capacity, data quality, and internet connectivity are limited.

One potential solution to improve the delivery of social services and reliability of administrative information is biometric identification of patients and health workers to track treatment adherence and to monitor provider performance.

To test how biometric tracking affects service delivery and data quality, Thomas Bossuroy (World Bank), Clara Delavallade (World Bank), and Vincent Pons (Harvard Business School, J-PAL) randomized the placement of biometric devices in TB treatment centers in urban informal settlements across four Indian states.

KEY RESULTS:

Biometric tracking increased patient adherence to TB treatment and the World Health Organization's DOTS protocol. Patients that received treatment in a center with biometric monitoring were 1.8 percentage points (25 percent) less likely to interrupt treatment and were 13.9 percentage points (26 percent) more likely to consume medication in person.

Greater health worker effort was a major factor in increased adherence to TB treatment. Tracking of health worker performance increased the time providers spent at health centers by about 19 percent and frequency of home visits to patients by 32 percent. There was no evidence that health workers strategically avoided patients with a perceived higher risk of defaulting or reduced patient detection efforts.

Biometric devices improved the accuracy of NGO health records and official government health registers. The devices reduced overreporting of new cases by 20 percent and underreporting of treatment interruptions by 25 percent.

EVALUATIONS

India accounts for over 27 percent of global TB cases, with almost 2.7 million cases diagnosed in 2018.[1] Ninety-seven percent of all new TB cases can be effectively treated with first-line antibiotics, which in India are available at no cost to the patient. However, poor access to care, fear of social stigma, low levels of knowledge about the disease, and a stringent medication regimen make early detection and treatment adherence challenging.

The Government of India implements the World Health Organization's DOTS protocol through state- and district-level offices. It also has decentralized public-private partnerships with local NGOs. Health workers are tasked with detecting cases, directly observing patients taking their medication at DOTS centers, and rapidly following up with patients who miss a treatment dose. In India, DOTS centers employ a paper-based record system, making monitoring pill intake, treatment outcomes, and follow-up a time-consuming and error-prone process.

Researchers partnered with Operation ASHA (OpASHA) to test the impact of a biometric tracking technology on TB treatment adherence, provider monitoring, and data quality. OpASHA is the largest NGO delivering primary care to TB patients in India and operates DOTS centers in several states. Their TB providers receive an average salary of Rs 5,600 (US$90 at the time of the evaluation) per month as well as financial bonuses based on the number of new TB cases they identify.

In partnership with Microsoft Research India, OpASHA developed biometric tracking technology, eCompliance, using a tablet attached to a fingerprint scanner. The technology aimed to do the following: 1) ensure patients themselves receive medication from health workers, 2) alert providers to follow up with patients who missed an appointment, 3) enable program managers to monitor health worker performance, and 4) reduce opportunities for misreporting patient data (Figure 1). Health workers and patients identify themselves when they come to the center. Data is sent daily via SMS to OpASHA's server in Delhi, and alerts and reminders are sent to health workers when patients fail to take their doses. eCompliance is easy to use and is tailored for use in environments with limited internet connectivity.

OpASHA randomly installed biometric devices in TB treatment centers in urban informal settlements across four states in Northern India. Of 65 OpASHA catchment areas, each with one health worker and serving nearly 40,000 individuals, 34 received biometric devices. The remaining 31 catchment areas did not receive biometric devices and served as the comparison group.

Over 12 to 14 months, researchers collected data from surveys given to all patients enrolled in OpASHA treatment centers, administrative data (e.g., official TB registers, treatment cards, OpASHA registers), and interviews with health workers and patients. They also conducted random clinic visits to assess provider attendance and day-long observations of medication adherence.

FIGURE 1. INTEGRATING BIOMETRIC TRACKING INTO OPASHA'S TB SERVICE DELIVERY

DOTS centers with biometric tracking		Comparison DOTS centers
Patient registers fingerprint in eCompliance server at each visit	**Tracking patient visits**	Providers track patient visits on a paper treatment card
Profile and treatment history updated on server daily Alerts generated when patient misses dose	**Tracking patient adherence to treatment**	Providers cross-check patient treatment cards by hand to monitor dose intake and treatment outcomes
Providers scan fingerprints when logging in and out of system Management can view performance on server	**Tracking health worker performance**	
At 6 months, provider submits treatment card with treatment outcome to official government TB register	**Reporting patient data**	At 6 months, provider submits treatment card with treatment outcome to official government TB register

[1] *Global Tuberculosis Report*. 2019. Geneva: World Health Organization.

[2] Munro, Salla A., Simon A. Lewin, Helen J. Smith, Mark E. Engel, Atle Fretheim, and Jimmy Volmink. 2007. "Patient Adherence to Tuberculosis Treatment: A Systematic Review of Qualitative Research." *PLOS Medicine* 4(7). https://doi.org/10.1371/journal.pmed.0040238.

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RESULTS

Biometric tracking increased patient adherence to TB treatment and the World Health Organization's DOTS protocol. Patients seeking treatment in a center with biometric tracking were 1.8 percentage points (25 percent) less likely to default, defined as missing medication doses for two months or more or not completing four months of treatment, compared to 7.3 percent of patients enrolled in centers without such monitoring. Biometric tracking increased compliance with DOTS requirements: in-person pill intake increased by 13.9 percentage points (26 percent) and patients were 21.8 percentage points (60 percent) less likely to send another person to pick up medication on their behalf.

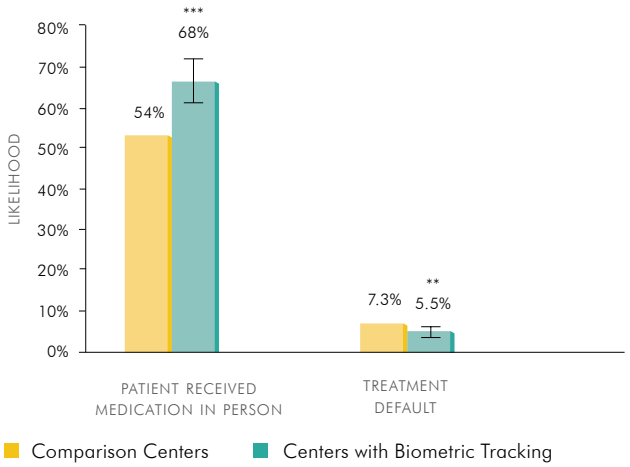
Biometric tracking did not, however, impact other dimensions of patient health. There was no difference in cure rates, symptoms, mental health, or emotional health between centers with and without biometric tracking. This lack of impact may be explained by the focus on preventing patients from defaulting. These patients accounted for a small share of patients included in this study (with default rates at 7.3 percent of the control group). Thus, average improvements in patient health would have been unlikely.

Greater health worker effort was a major factor in increased adherence to TB treatment. Provider attendance increased by up to 12 percent at centers (about 7 percentage points) and time spent at centers increased by 19 percent (about 22 minutes per day). The frequency of home visits to patients who missed their dosages increased by 32 percent (about 4 percentage points). This may be explained by more stringent oversight from OpASHA management. There was no evidence that health workers strategically avoided patients with a perceived higher risk of defaulting or reduced patient detection efforts.

Biometric devices improved the accuracy of NGO health records and official government health registers. Absent proper monitoring, health workers' compensation schemes may incentivize them to inflate the number of TB detections. The biometric tracking devices decreased overreporting of new TB cases by 20 percent. Underreporting of treatment interruptions decreased by 25 percent when comparing patients' actual probability of default to OpASHA data and government TB registers.

Health worker and patient satisfaction did not decrease despite biometric technology imposing additional constraints. More accurate recordkeeping reduced bonuses for new detections and resulted in a 7 percent decline (Rs 429 or US$7) in health worker income. Still, biometric monitoring did not reduce job satisfaction and remained in use in over 75 percent of the centers five months after introduction. The devices reduced concerns of excessive workload by half (10.5 percentage points) by saving health workers time cross-checking patient records to gather data on treatment adherence and outcomes. Despite having to go to the center more frequently to scan their fingerprints to receive medication, as opposed to sending a relative on their behalf, patients did not report lower levels of satisfaction with their treatment.

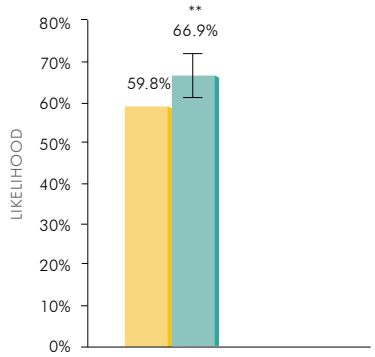
FIGURE 2. BIOMETRIC TRACKING INCREASED PATIENT ADHERENCE TO MEDICATION



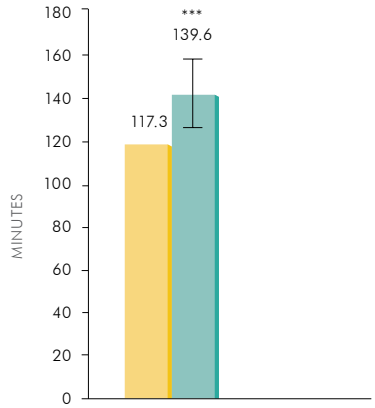
Note: Error bars represent 95% confidence intervals. Statistically significant difference relative to the comparison group is noted at the 1% (***), 5% (**), or 10% (*) level.

FIGURE 3. GREATER HEALTH WORKER EFFORT CONTRIBUTED TO INCREASES IN PATIENT ADHERENCE TO TB TREATMENT

3A. ATTENDANCE AT HEALTH CENTER (RANDOM SPOT CHECKS)



3B. TIME SPENT AT HEALTH CENTER



Note: Error bars represent 95% confidence intervals. Statistically significant difference relative to the comparison group is noted at the 1% (***), 5% (**), or 10% (*) level.

POLICY LESSONS

Real-time tracking of service providers and users can simplify service delivery and improve provider effort. Additional evaluations from India show that technology-based attendance monitoring improved teacher and health care provider performance.[3,4,5] However, these monitoring systems can be undermined over time if there is not broader organizational support for them.[3,5] In this evaluation, monitoring devices were not met with strong resistance, most likely because they reduced provider workloads by facilitating patient tracking.

Improving provider job performance can be a viable strategy to boost medication adherence. Many interventions have tested behavioral nudges for patients to promote pill intake, for instance via SMS reminders or tailored information on pill packaging.[6,7,8] Improving health worker performance can also increase medication adherence by reducing supply-side constraints such as access to quality care.

Biometric identification improves recordkeeping and quality of administrative data. Evaluations in Indonesia and India suggest that top-down monitoring systems can reduce the misreporting of data and corruption.[9,10,11] Notably, this biometric tracking system enables monitoring of service delivery and measurement of program outputs via a tablet linked to a fingerprint scanner instead of by in-person government or third-party auditors, leaving little room for misreporting.

OPEN QUESTIONS

As a next step, researchers are interested in exploring the impact of biometric data systems on service delivery and state capacity beyond TB treatment.

Featured Evaluations: Bossuroy, Thomas, Clara Delavallade, and Vincent Pons. "Biometric Tracking, Healthcare Provision, and Data quality: Experimental Evidence from Tuberculosis Control." NBER Working Paper No. 26388, October 2019.

Briefcase Author: Sarah Baum | **Editor:** Caroline Tangoren

Suggested Citation: J-PAL Policy Briefcase. 2020. "On Track: Health Care, Patient Data, and Provider Performance." Cambridge, MA: Abdul Latif Jameel Poverty Action Lab.

This research was made possible by:

Fieldwork: J-PAL South Asia

Partners: Operation ASHA, Microsoft Research India

Funders: USAID, AusAid, and the Health Results Innovations Trust Fund administered by the World Bank

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