OpASHA: Improving Tuberculosis Treatment and Outcomes

A social enterprise provides care and control at the last mile for tuberculosis and other diseases in India by leveraging the community, technology, and existing government infrastructure

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Contents

Summary

Tuberculosis (TB) afflicts 2.8 million citizens in India, representing more than 30 percent of the world's total burden.[1] To control TB, complete adherence to treatment is crucial—under the World Health Organization's (WHO) Directly Observed Therapy Short-course (DOTS) strategy. In this strategy, patients are required to take up to 75 doses under supervision over six months at a treatment center or in the presence of an observer.

However, the scarcity or inaccessibility of treatment centers and truthful observers in hard-to-reach areas often results in high default rates. Missing a dose or interrupting treatment is extremely dangerous, since those who default can relapse, or much worse, develop the deadlier, drug-resistant strain of TB. A continuing social stigma for those who have TB is also linked to incomplete treatment and lack of follow-up. There is poor data collection as well.

Since 2006, Operation ASHA (OpASHA) has helped deliver the "last-mile" connection to TB treatment and prevention in India by leveraging existing government infrastructure to supplement the country's own efforts. OpASHA receives free medicines, diagnostic facilities and physician services from the national TB control program. Then, it employs two delivery methods based on community empowerment:

- **Urban slums:** OpASHA sets up decentralized networks of treatment centers by strategically locating them on the premises of local entrepreneurs, such as doctors or shopkeepers. Local counselors provide detection, treatment, and education.
- **Rural communities:** OpASHA sets up mobile DOTS, whereby local community health workers (CHWs) travel to villages by motorcycle/scooter, carrying drugs and other supplies to each patient at his/her house or at a mutually convenient place, and observe the dosage.

OpASHA hires and trains community members (sometime former patients) to become CHWs to enroll and treat patients, ensure adherence to the drug regimen, follow up with defaulters and carry out educational campaigns. They also perform contact tracing and active patient seeking. The local entrepreneurs and CHWs receive incentivized compensation based on patient caseload and performance.

Through a partnership with Microsoft Research, OpASHA has pioneered a biometric technology called eCompliance for treatment. A low-cost device records both the patient's and CHW's fingerprint each time a drug is administered to confirm strict adherence with the mandated regimen. Missed doses trigger an SMS notification to managers, who assure timely counseling and follow-up visits with patients.

To date, OpASHA serves 10 million people in nine states across India, in addition to 2.2 million people in Cambodia. According to OpASHA, the TB treatment success rate increased to 87 percent, the low patient default rate is about 3 percent, and detection rates increased by 40–400 percent within 6–12 months. The cost of treatment for each TB patient is only USD 80.

Regarding sustainability and scale-up, the Indian government provides grants that cover 60–75 percent of OpASHA's costs, and the remainder comes from self-raised funding. OpASHA offers a low-cost, highly leveraged operating model that enjoys high community and partner engagement, but it needs to integrate more with other government programs and better showcase attributable results. OpASHA has expanded to Cambodia, and its model has already been replicated in Uganda, Kenya, and the Dominican Republic.

Challenge

TB is a Global Public Health Crisis

TB is one of the most deadly infectious global diseases, with close to nine million new patients and 1.4 to 1.8 million deaths each year.[2] TB is an airborne vector spread by coughing, sneezing or spitting. It primarily affects the lungs, but it can occur in any part of the body, such as the intestines, kidneys, and spine. Those with weak immune systems are the most vulnerable; 26 percent of AIDS patients die of TB.

WHO estimates that about one in three people (3.3 billion) are latent carriers of the bacteria. Every active case transmits the disease to 10–15 others throughout the course of the illness. In recent years, a multi-drug resistant strain known as MDR-TB has emerged, which is just as infectious as regular TB and almost always fatal. Treatment for MDR-TB is much more expensive and time-consuming.

TB hurts the productivity, economy, and society of countries, with a significant portion of the burden placed on impoverished and marginalized groups. Fear of the spread of disease leads to widespread stigma and neglect of TB patients.

Significant TB Prevalence in India

TB is the sixth most important cause of death and disability in India. The disease afflicts 2.8 million citizens, representing more than 30 percent of the world's total burden (Figure 1).[3] According to WHO, in 2013, the incidence of TB per 100,000 people was 171. The prevalence of TB per 100,000 people was 211.[4]

The disease is a major barrier to social and economic development. An estimated 100 million workdays are lost due to illness. For the Indian economy, there are nearly USD 23 billion in indirect costs and USD 300 million in direct costs.[5]

An estimated one million TB cases go unreported every year, each one potentially infecting 10–12 others. At the same time, it is estimated that 64,000 new MDR-TB cases emerge annually, with only 16,588 cases diagnosed.[6] India's growing urbanization intensifies the chances for the infection to spread, since TB bacteria proliferate in crowded, dank slums.

The social stigma of having TB persists in India, affecting detection and treatment and causing patients to lose their jobs and livelihood. Patients face discrimination by family, neighbors, landlords, employers, and school authorities. Approximately 300,000 children drop out of school because they or a parent has TB, and 100,000 infected women are thrown out by their families.[7]

Michael Haney, a World Bank operations advisor in India, stated: "Tuberculosis remains one of the top four causes of death among the most productive age groups, with huge economic costs, particularly for poor households. This is even more so in the case for MDR-TB patients, whose care costs more than Rs 1 lakh (USD 2,500) per year, per case, far beyond the reach of most families."

In addition, India has the largest number of hemophiliacs and diabetics in the world. It is also a center for patients suffering from hypertension and obesity-related complications. These issues, when present in TB patients, present multiple risks to effective intervention and management. For example, TB patients with diabetes take longer to respond to treatment,

Figure 1. New TB Cases 2013
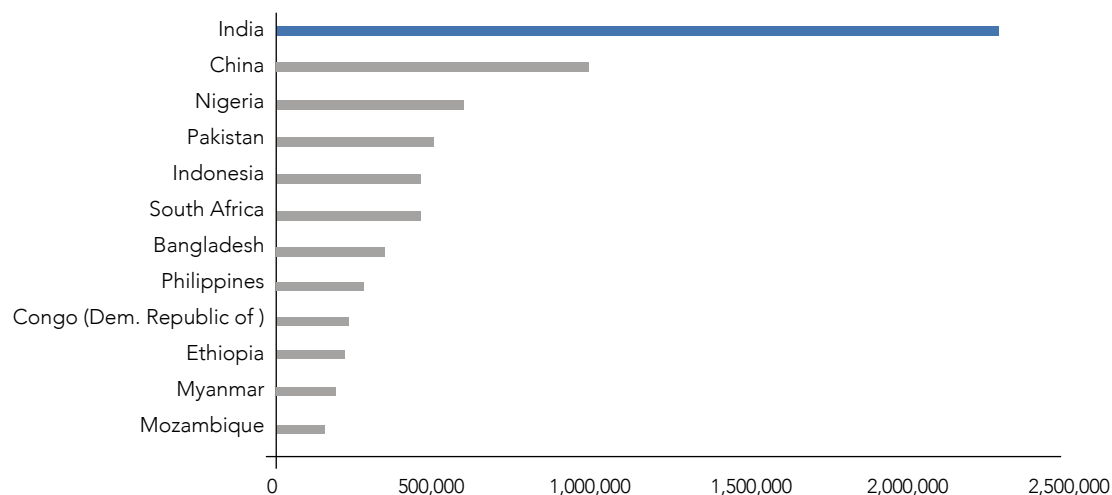
Source: The Henry J. Kaiser Family Foundation, Global Health Facts.

and diabetes can ruin the clinical course of TB. According to WHO guidelines, all TB patients should be screened for diabetes.

Issues in Treatment Compliance and Monitoring

The cure for TB is both long and difficult. Complete adherence to WHO's DOTS strategy is crucial. In this strategy, patients are required to take up to 75 doses under supervision over six months or more at a treatment center or in the presence of an observer. However, the scarcity or inaccessibility of treatment centers or proper observers in hard-to-reach areas often results in high default rates, causing relapse and drug resistance.

Compete adherence is necessary for long-term treatment of TB. Low-quality drugs, inconsistent or improper treatment and poor adherence to therapy can cause TB to morph into the deadlier MDR-TB. Incomplete and erratic treatment for MDR-TB leads to worsening of resistance and then no potential for treatment. Prevention of the emergence of MDR-TB in the community is thus imperative.

Issues arise in adherence or quality of treatment for varied reasons:

- **High economic and social costs:** Patients must pay a minimum Rs 10 per day to a local nurse or health provider—these are patients who earn less than Rs 60 (one US dollar) per day. They must make several visits to the public hospital for repeated tests and consultations, which incur catastrophic expenses. Patients are also afraid of losing their jobs because of the time it takes to receive treatment and the associated stigma. They are rarely aware of the repercussions for missed treatment.
- **Painful procedure:** Daily injections for MDR-TB are painful, and tender swelling sometimes develops at the injection site. The side effects of second-line drugs include nausea, vomiting, electrolyte imbalance, thyroid disturbance, psychological problems such as depression and suicidal tendencies, and even liver and kidney problems.
- **Monitoring and data collection:** Doses are sometimes unsupervised, with a lack of patient tracking and inadequate or long waits for follow-up. Data can be falsified or misrepresented, and inaccurate record keeping occurs. Absenteeism occurs among field staff without consequence.

State and Non-Government Efforts

India spends the least among the high TB burden nations, allocating just USD 115 per case, while China, for example, spends about USD 300 per case and Brazil USD 750. Private health practitioners frequently prescribe incorrect drug treatments and expensive diagnostic tests that do not meet national standards, leading to misdiagnoses and increasing the spread of MDR-TB.[8]

The Government of India's Revised National Tuberculosis Control Program (RNTCP) supports India's National Strategic Plan for TB Control. RNTCP recognizes that implementation of a high-quality DOTS program is the first priority for TB control in the country. It aims to expand basic TB services; improve diagnosis and treatment for MDR-TB nationwide; and involve all health care providers—public, non-government and private—by scaling up approaches based on a public-private mix.

With treatment of each patient, the economy saves USD 12,235 in indirect loss. On treatment, patients earn an additional USD 13,935 through reinstated productivity in their lifetime, on average.[9]

RNTCP launched as a national program in 1997. In addition to domestic budgetary resources, RNTCP has received support from the World Bank and other partners. It has made available across India effective TB diagnosis and treatment services and has started expanding MDR-TB services. However, TB is still causing an estimated 2.2 million new cases and 270,000 deaths annually. Only two percent of patients with MDR-TB received second-line drug treatment through the RNTCP. Poor and marginalized groups remain at the highest risk.[10]

In addition to the central government's activities for TB control, there are two major consortia— World Vision-India and the Indian Coalition Against TB, a group of NGOs led by the Indian affiliate of the International Union against TB. Beyond drug purchases, most of the non-government funding for TB control goes toward capacity building of the community and case detection.

Innovation

OpASHA

In 2006, Dr. Shelly Batra and Sandeep Ahuja founded OpASHA. Dr. Batra is an advanced laparoscopy surgeon, obstetrician, and gynecologist at a renowned private hospital in New Delhi. She had been serving slum-dwellers for three decades, providing consultations and carrying out free surgeries. Mr. Ahuja was a member of the Indian Revenue Service and posted as the undersecretary of the Ministry of Finance for the Government of India. Mr. Ahuja joined Dr. Batra in 1998 and started helping her in many ways.

In 2006, Dr. Batra and Mr. Ahuja decided to focus on TB and incorporated OpASHA, with a mission to eradicate TB from India and provide health care and support services to the most disadvantaged. The founders concluded that the government infrastructure broke down at the last mile of delivery. To implement the WHO-recommended DOTS program, OpASHA would have to establish treatment centers within walking distance of patients that provide flexible, extended hours. Their vision attracted people to join from around the world, and, as a result, an advising and fundraising group grew in the United States to form OpASHA, USA.

OpASHA recognized that it is the responsibility of individual governments to reduce poverty and eliminate TB in their countries. Therefore, OpASHA sought to leverage government infrastructure to supplement countries' own TB efforts rather than duplicate existing infrastructure and facilities.

After having achieved success in TB, OpASHA expanded to treat diabetes, hypertension, and hemophilia. It also expanded its mission to provide last mile delivery for all health services to the disadvantaged at a low cost and aspires to provide services for all common diseases.
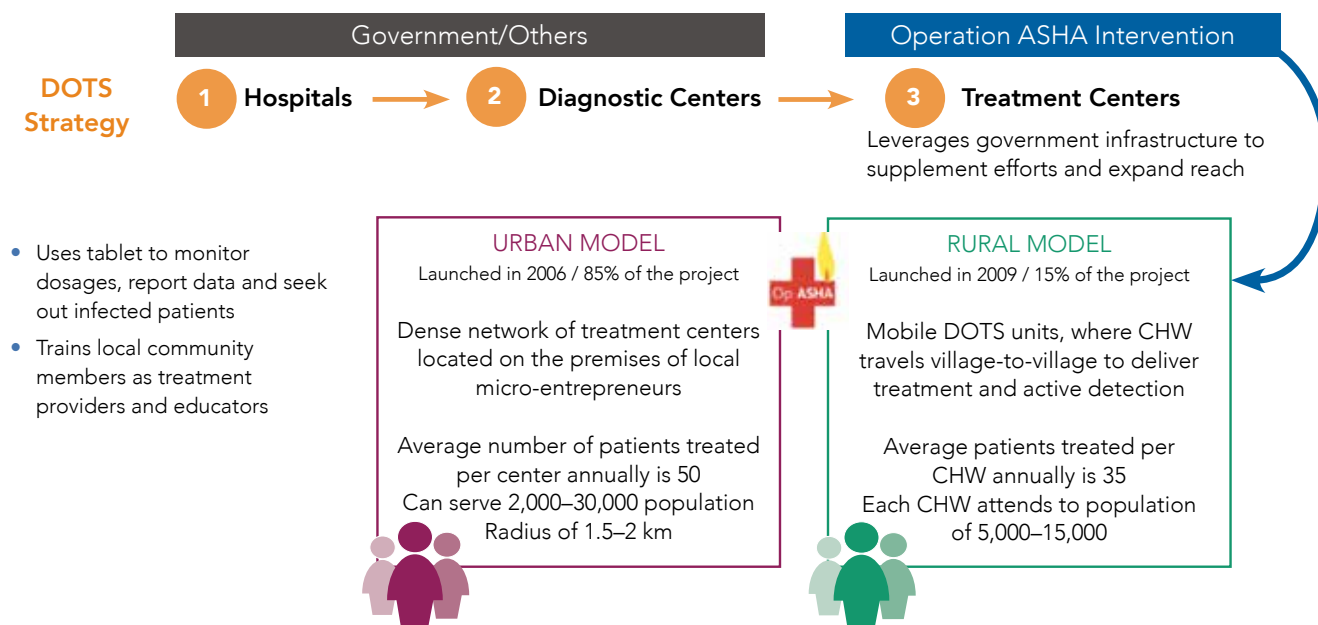
TB Detection and Treatment at the Last Mile

OpASHA receives free medicines, diagnostic facilities, and physician services from the RNTCP. It then employs two delivery models (Figure 2):

- **Urban Model:** OpASHA sets up decentralized networks of treatment centers by strategically locating them on the premises of local entrepreneurs, such as doctors or shopkeepers. The center is not publicized as a "TB center," which removes the stigma for patients. Selected local CHWs undergo a two-week training to provide patient treatment and education. The entrepreneurs and CHWs are offered incentivized compensation. CHW salaries are linked to their performance outcomes.
- **Rural Model:** OpASHA sets up mobile DOTS, whereby local CHWs travel to villages by motorcycle/scooter, carrying drugs and other supplies to each patient at his/her house or at a mutually convenient place and observe the dosage. The CHW provides education and active detection of new patients. He/she also carries test samples from patients to labs and lab results to patients. When necessary, the CHW transports patients on a scooter or motorcycle to physicians or chest experts.

CHWs are chosen from the community so that they can connect with local people and prevent patients from feeling intimidated. CHWs explain that TB is a bacterial infection that is fully curable, provided one receives the complete treatment. Once patients realize that missing doses can lead to MDR-TB, which is difficult and expensive to treat, they are much more motivated to adhere to the treatment.

Figure 2. OpASHA Delivery Model

DOTS Strategy

Government/Others | Operation ASHA Intervention

1. Hospitals → 2. Diagnostic Centers → 3. Treatment Centers

Leverages government infrastructure to supplement efforts and expand reach

- Uses tablet to monitor dosages, report data and seek out infected patients
- Trains local community members as treatment providers and educators

URBAN MODEL
Launched in 2006 / 85% of the project

Dense network of treatment centers located on the premises of local micro-entrepreneurs

Average number of patients treated per center annually is 50
Can serve 2,000–30,000 population
Radius of 1.5–2 km

RURAL MODEL
Launched in 2009 / 15% of the project

Mobile DOTS units, where CHW travels village-to-village to deliver treatment and active detection

Average patients treated per CHW annually is 35
Each CHW attends to population of 5,000–15,000

CHWs use eCompliance technology to track and report patient dosages through a biometric device and an icon-based system. The system consists of a netbook computer, a fingerprint reader, and a modem that uploads the visitation logs via SMS to a central location. Web-based medical records ensure automated data collection and reports.

For contact tracing and active case finding to identify and diagnose those potentially infected, OpASHA developed the eDetection software, a decision-based algorithm that can be downloaded on a portable tablet (see Appendix V). eDetection guides the CHW through a diagnostic process to identify suspects (such as a spouse, sibling, child, or co-worker), follow procedural next steps for testing, and put those patients testing positive on the geo map using GPS. eDetection is systematically archived and integrated with the eCompliance system.

Phases of the Model
Origin and establishment of the urban model (2006–2009)
Under the RNTCP Public-Private Mix program, OpASHA first obtained a memorandum of understanding with the government to operate treatment centers in the urban slums of Delhi. They chose to launch their initiative in Okhla in South Delhi, which has many slums with a total population of approximately 100,000. The initial search of small businesses for a possible treatment center location was unsuccessful—no one was willing to open one. Finally they recruited a Hindu priest, who was a treated patient, to open a treatment center at his temple. They hired and trained a CHW and recruited field workers to create public awareness in the community about the symptoms of TB. Finally, on September 15, 2006, OpASHA launched its first center.

Development of the rural mobile model, and expanstion to strategic areas in India and Cambodia (2009–2011)
The OpASHA team recognized the significant distances between villages and low density of population in peri-urban and rural areas. In this scenario, the fixed center model did not work as efficiently as it did in urban slums since patients would not be able to travel those distances. This led to the concept of Mobile DOTS Centers, where the CHW—and later, the

sputum collection officer as well—travels to villages for active patient seeking, sputum collection, and treatment delivery.

In 2009, OpASHA introduced Mobile DOTS Centers in India to cover patients in areas that were not within a travelable distance from the fixed centers. The CHW travels from village to village on a motorcycle/scooter, carrying strips of anti-TB drugs and other supplies. He/She collects sputum for testing and gives the medicine to patients at their homes or at a mutually convenient place and observes them swallowing the dose. Each provider attends approximately 35 patients annually. Approximately 15 percent of centers in India are mobile units. In Cambodia, which is mostly rural, all centers are mobile units.

Initially, OpASHA had an ambitious target to open as many as 1,000 treatment centers in India by 2011–12. Though many bureaucrats in the center and states, social and religious leaders, donors, and headquarters staff of the Stop TB Partnership and WHO provided support, there were many hurdles to progress placed by district and state governments, other NGOs, and vested interests, primarily over funding and fears of competition and more accountability. Yet a number of government officers and certain donors helped OpASHA to reach its current scale.

To achieve further impact and diversify risk, OpASHA shifted its focus around 2010–2011 from opening new centers in existing geographies to opening them in strategic geographies. They entered the additional states of Rajasthan, Punjab, and Maharashtra in India. For the same reasons, OpASHA also entered international geographies—in December 2010, OpASHA opened its first DOTS center in Phnom Penh, Cambodia.

Third-party replication of the OpASHA model in other countries (2012–present)

In 2012, Columbia University's Earth Institute and Millennium Villages in rural Uganda replicated the OpASHA model. In that context, patients no longer go to the clinic while on TB treatment, but rather a CHW goes to the patient's home with an eCompliance system to observe and record the patient taking the drugs.

In 2013, the NGO Clínica de Familia implemented eCompliance software in the eastern Dominican Republic. Clínica de Familia uses the fingerprint device for patients who are co-infected with HIV and TB, and are receiving both TB treatment and antiretroviral therapy at the health center. At the end of each day, center staff receive an attendance log and are able to quickly follow-up via telephone and/or home visits with any patients who have missed a dose.

Also in 2013, Jubilant Organosys adopted OpASHA technology to improve treatment for 34 villages that are served by a primary health clinic located in their sugar factory in Hapur, Uttar Pradesh. In 2015, German Leprosy and TB Relief Association took licenses of OpASHA's technology for a TB project they have been funding in Jaipur. Three multi-national pharmaceutical companies have supported adding other diseases to OpASHA's model. They have also helped to modify the technology for diabetes and hemophilia.

In 2014, Columbia University's Earth Institute and Millennium Villages replicated the model in Kenya. This is a randomized control trial that will compare the results of the OpASHA model versus the conventional model.

Financial Structure

OpASHA was initiated with funds from the founders and early fundraising initiatives were limited to the founders' friends and family. The funds generated were limited and thus restricted scale-up. In 2010, OpASHA received significant institutional funding from Sahayak Foundation, a group of Indian expatriates in the United States, and LGT Venture Philanthropy, the charitable arm of Swiss Bank, which allowed it to expand its activities.

OpASHA receives its funds mainly through grants from RNTCP. Under the RNTCP program, drugs for the complete treatment regimen are provided through the government, which takes care of about 45 percent of total annual recurring costs. All patients are tested at existing government labs and treated at government hospitals, which takes care of about 12 percent

of costs. Of the balance remaining of annual recurring costs, approximately 17 percent is paid by the government as a cash grant, which starts about two years after establishing the OpASHA model in a city (Table 1).
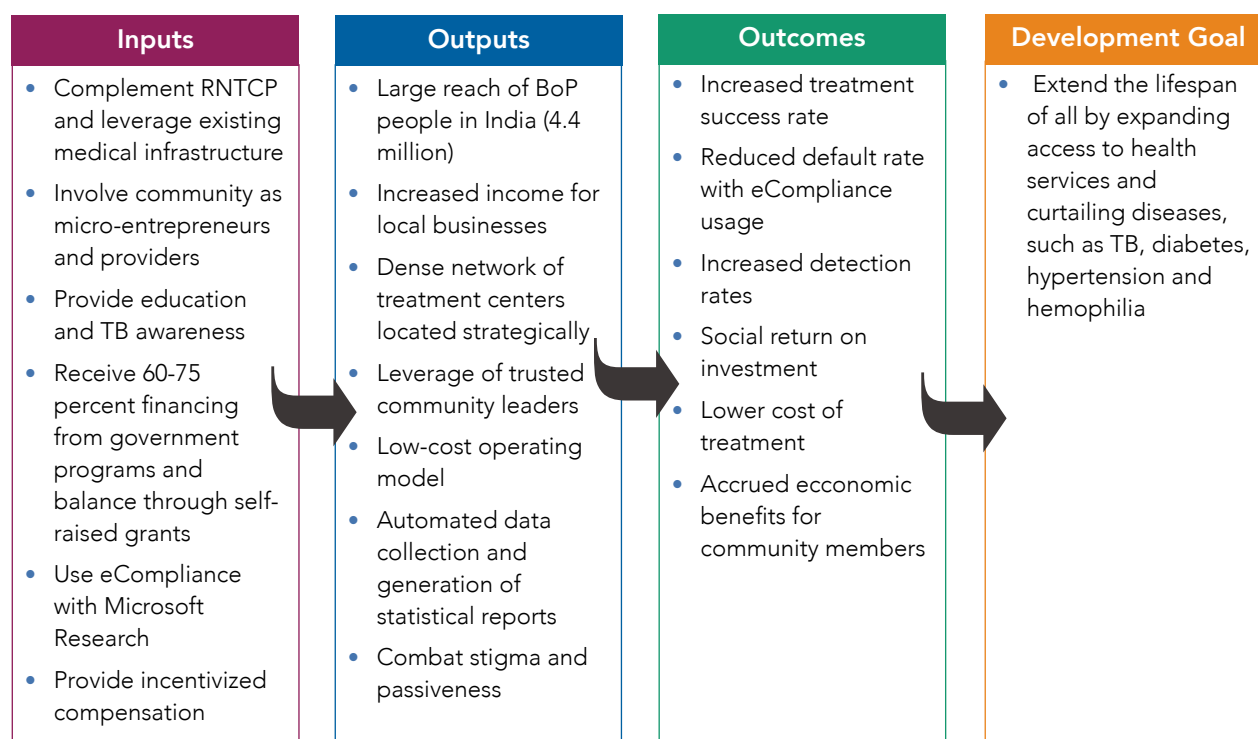
Table 1. Financial Sustainability of Variable Costs Per Patient Per Year

Costs	USD	%
Free drugs under RNTCP	74.23	45%
Free diagnostics and physician consultation	20.07	12%
OpASHA expenses reimbursed by government	28.43	17%
OpASHA expenses met through fundraising initiatives	43.48	26%
Total Cost	**167.23**	**100%**

Private donors provide the remainder of the funding. They include institutional donors—foundations, companies, bilateral and multilateral agencies—from India, United States, Europe, Hong Kong, Singapore, Australia, and New Zealand. Donor funding pays chiefly for one-time expenses, technology development and expansion to new areas. These private financial resources are leveraged to: devise context-specific models to maximize outreach across urban and rural areas; involve community members as salaried staff and incentive-based micro-entrepreneurs; conduct campaigns to de-stigmatize TB and build capacity of staff; and introduce a technology-based platform for monitoring and compliance.

To increase financial self-sufficiency, OpASHA has started licensing its technology to other companies and NGOs. Nearly 10 percent of its operating budget in 2014 was generated through such sales. OpASHA is also planning to introduce fee-based products, such as consulting or an implementation partnership, for other like-minded organizations that would want to be involved in TB control.

Figure 3. Results Chain for OpASHA Model

Inputs	Outputs	Outcomes	Development Goal
• Complement RNTCP and leverage existing medical infrastructure • Involve community as micro-entrepreneurs and providers • Provide education and TB awareness • Receive 60-75 percent financing from government programs and balance through self-raised grants • Use eCompliance with Microsoft Research • Provide incentivized compensation	• Large reach of BoP people in India (4.4 million) • Increased income for local businesses • Dense network of treatment centers located strategically • Leverage of trusted community leaders • Low-cost operating model • Automated data collection and generation of statistical reports • Combat stigma and passiveness	• Increased treatment success rate • Reduced default rate with eCompliance usage • Increased detection rates • Social return on investment • Lower cost of treatment • Accrued ecconomic benefits for community members	• Extend the lifespan of all by expanding access to health services and curtailing diseases, such as TB, diabetes, hypertension and hemophilia

Implementation

Dense Network of Treatment Centers

OpASHA establishes TB treatment centers within existing community locales, such as strategically placed shops, homes, temples, or health clinics. Under OpASHA's urban model, each center serves 2,000–30,000 people within 1.5 kilometers. The idea is that no patient should have to walk for more than 10 minutes to a center or to reach a CHW.

The treatment centers are co-located with local medical practitioners or businesses, which are open for long hours, depending on the need of the community. Thus, patients are able to procure the medicine any time, without wasting productive work hours. The center is also then not publicized solely as a TB center, which removes the stigma for patients.

The urban model is designed to help patients procure their medicines conveniently without wasting time, spending money on transport and losing wages. Many centers are located next to large bus terminals and key exits and entrances to slums and open at convenient hours. These elements drastically reduce the effort, time and money patients would otherwise invest in taking their medication. This is key to ensuring patients complete their entire course of treatment. Providers are given an incentive based on the number of patients treated.

OpASHA has operated in India mostly in urban areas, which have the advantage of a highly dense population living in slums. In rural areas, CHWs travel from village to village and deliver services. Savings on payment to micro-entrepreneurs compensates for the extra travel time and cost CHWs incur. Thus, convenience and cost of the rural model are the same as the urban model. However, the project is not cost-effective if it does not cover a population of 1,000,000 in a state and at least 200,000 in a district in a concentrated area.
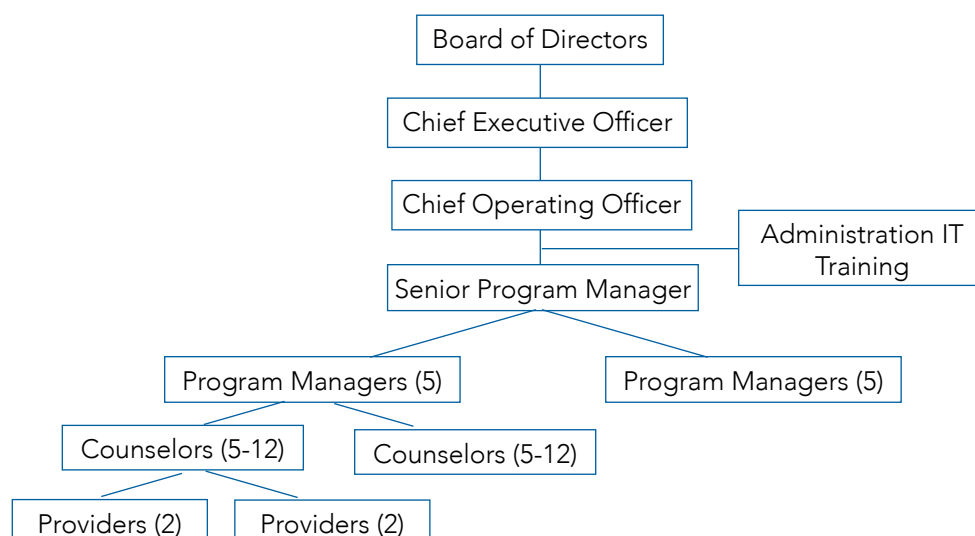
Community-Based Treatment Providers

Local providers and CHWs are at the heart of OpASHA operations (Figure 4). They are based in the community slums or villages and undergo a specific selection and training process. OpASHA spends a substantial portion of its expenses on remuneration for community workers.

TB Health CHWs

- *Duties:* CHWs work for OpASHA for five hours a day and are key players of the entire operations. They detect, enroll and treat patients; ensure their adherence to the drug regimen; retrieve defaulters to ensure completion of treatment; and perform awareness campaigns. On average there is one CHW for every two DOTS providers.
- *Selection/Training:* The CHW is a local person who may not be living in the exact vicinity of the slum, but comes from a neighboring comparable area and background. CHWs undergo a rigorous two-week training at the OpASHA training center in Delhi. There are 4–10 people per training batch. The training covers the technical and administrative details of the project, RNTCP guidelines and details of the disease, and associated health issues. Soft skills, such as communication and helping skills, are also addressed.
- *Compensation:* CHW salaries are mostly based on performance on the basis of detection and treatment completion rates (2/3:1/3). Qualitative aspects such as behavior with patients are also incentivized. For the first three months after a new treatment center is

Figure 4. OpASHA Organizational Structure

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                    │  Board of Directors │
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                    │ Chief Executive     │
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open, the CHW base salary is USD 90 per month. During the first 3–6 months, the incentive structure is based on detection; the CHW earns USD 2 per new patient detection. After six months the incentive structure becomes a sliding scale, offering rewards for compliance or patient treatment defaults (measured as one month of continuously missed dosage under RNTCP guidelines). Less than an 82 percent treatment success rate of patients in three consecutive months results in termination. Good performers have scope for promotion and acknowledgement.

Program Managers
- *Duties:* Program managers set up new treatment centers and recruit and monitor CHWs. Between 5–12 CHWs report to one program manager and send daily reports. Program managers evaluate CHW performance and discuss any gaps to suggest remedial action. Program managers also manage accounts and finances for all CHWs and centers under their supervision, including CHW incentive payments.
- *Training:* Program managers undergo a two-week training at the OpASHA training center in Delhi, or a mobile training at city offices. Middle management attend a three-day course, and senior management attend a one-day orientation.
- *Compensation:* Program managers are salaried and earn about USD 170 per month.

DOTs Providers
- *Duties:* The number of DOTS providers in a community is based on the community's estimated disease burden. OpASHA estimates a DOTS provider could manage a patient load of maximum 75 patients per year. The provider's space, located in a high-traffic area of a community and ideally within 10-minute walking distance for a patient, becomes a treatment center. The center is open for extended hours (typically from 6 a.m. to 10 p.m.), to enable patients to access treatment before or after their regular work schedules.
- *Selection:* The first step to establish an urban center is to find a community DOTS provider within the slum. The CHW and program manager identify the provider through repeated visits to the slum. The most important piece of criteria for a community DOTS provider is inclination to serve the community. Ideal candidates include social workers, shop-keepers, doctors, chemists, and patients who have successfully completed treatment.

- *Compensation:* DOTS providers are remunerated based on the number of patients they serve in the center, a monthly amount that varies from USD 6–12. In some areas, such as in Delhi, it is necessary to be flexible, and a flat amount of USD 18 is given irrespective of the patient caseload.
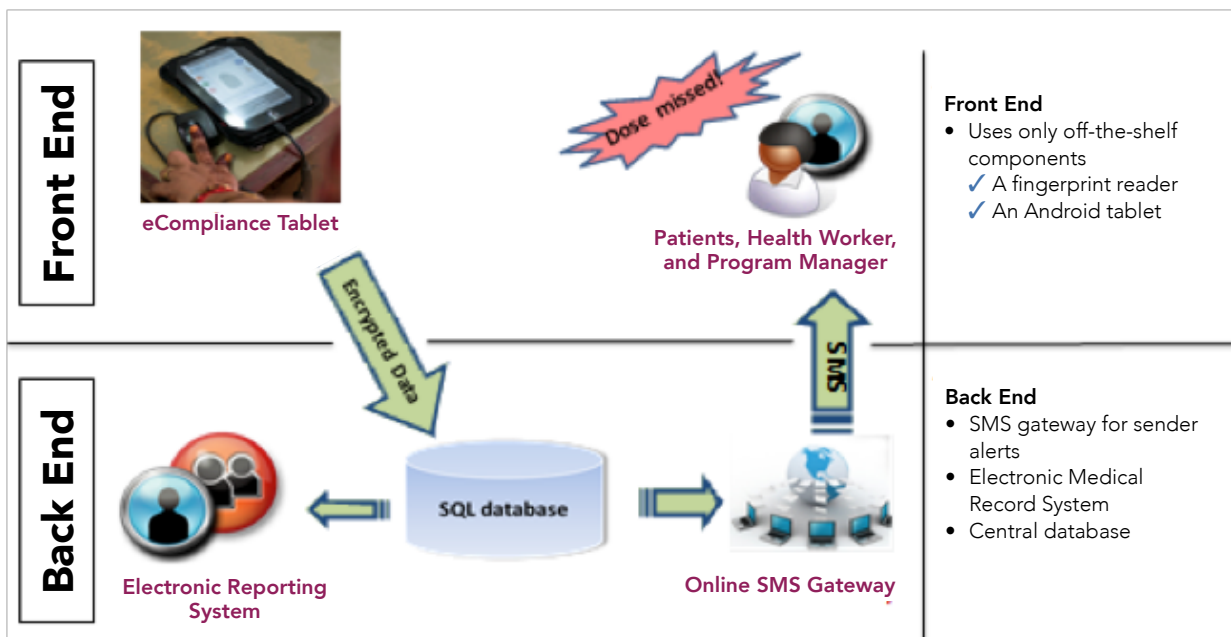
Compliance, Monitoring, and Quality Control

Because of the rising threat of MDR-TB, OpASHA launched eCompliance, a biometric initiative in collaboration with Microsoft Research, which uses fingerprint scanners to track patient visits. The system consisted of three parts: a netbook computer, a USB fingerprint reader from Digital Persona, and a GSM modem that uploads the visitation logs via SMS to a central location (Figure 5). In 2013, OpASHA replaced the netbook computer and GSM modem with a tablet (similar to a mini iPad). OpASHA developed a new software independently for this (it is OpASHA intellectual property).

Patients scan their finger every time they take medication, and these logs are visualized in the central office to monitor medication delivery. Missed doses trigger an SMS notification to managers, who ensure timely supervision or counseling to the patients and health workers involved. The health worker is then required to make a follow-up visit within 48 hours to deliver the medicines and supplementary health education. These home visits are also confirmed by biometrics.

According to OpASHA, the cost of hardware, installation, Internet connection, and maintenance for each eCompliance unit for the life of a tablet (18 months) is USD 245. Based on patient caseload in OpASHA, the cost of treating each patient for normal TB is thus estimated at only USD 13, a fraction of the cost incurred by most organizations in treating a TB patient, which is estimated at USD 2,458.[11]

The measures put in place to minimize dropouts and non-compliance are the following: no patient receives medication without prior counseling; by the end of each day, patients who missed that day's dose are identified; and within the next two days, the CHW will make a home visit and administer the medicine. The CHW follows-up with the sputum testing laboratory so that no sputum positive patient is missed (Figure 6).

Figure 5. How eCompliance works

Front End

eCompliance Tablet

Dose missed!

Patients, Health Worker, and Program Manager

Front End
- Uses only off-the-shelf components
  ✓ A fingerprint reader
  ✓ An Android tablet

Encrypted Data

SMS

Back End

Electronic Reporting System

SQL database

Online SMS Gateway

Back End
- SMS gateway for sender alerts
- Electronic Medical Record System
- Central database

Figure 6. How eCompliance solves treatment follow-up and data collection challenges

Problem	Solution	Benefits
• Unsupervised doses being given • Missed doses and default by patients • Inaccurate data and record keeping • Patients not tracked • Inadequate or time lag for follow-up • Absenteeism among field staff	• Taking a fingerprint every time confirms a TB patient's presence, which creates indisputable evidence. • Missed doses trigger an SMS notification to both counselors and managers, to ensure timely supervision or counseling. • CHWs must make a follow-up visit within 48 hours. • Home visits are also confirmed by CHWs at the beginning of the day, end of the day and every 30 minutes in between. This ensures total attendance. Staff can also be tracked in real time on GPS or Google maps to see their actual location.	**FIELD STAFF LEVEL** • Ensures integrity of DOTS: eliminates unsupervised doses • Eliminates human error • Improves skills • Makes counseling easy, that is, easier to convince patients • Ensures accurate reporting • Saves time that would be otherwise spent in going through paper records • Targets counseling to patients who miss doses frequently • Substantial increase in productivity **PATIENT AND COMMUNITY LEVEL** • Positive impact on the psyche • Improves motivation • Seen as dedication toward quality treatment • Prevention of drug-resistant strains of TB

In late 2014, OpASHA developed a new software application, SMS Lab Alert, which mimics the manual lab register in government and other labs that are not automated. Those who need testing are registered in the tablet instead of the manual register. The moment a result is entered in this tablet, an alert is sent to all concerned, including the patient and CHW, to take next steps, including enrolling for treatment. If a patient is not enrolled for a week, alerts are issued automatically to the CHW and his supervisor. According to OpASHA, the SMS Lab Alert has reduced the time to enrollment after detection by 60 percent and helped stop the loss of patients before enrollment. This application is being used in India and Cambodia.

OpASHA management information systems include continuous monitoring and rigorous reporting. Quality assurance starts from defining the inputs appropriately and accurately. If the performance of a CHW shows less than 82 percent treatment success rate in three consecutive months, he/she is terminated. The success of the project rests largely on how well the CHWs deliver. The biometric device for dose tracking and other technology applications has been introduced to minimize human errors.

Quality control is carried out at two levels. The first level is regular staff, such as program managers, senior program managers, and the Chief Operations Officer. The second level is quality auditors, who visit every center at random and report directly to the Chief Operations Officer so they cannot be influenced by line staff.

Partnerships

OpASHA believes in developing and maintaining partnerships, and not setting up parallel systems. Therefore it has established those partnerships that can result in a collective impact against TB.

Implementation Partners

RNTCP in India is the key partner in facilitating the OpASHA program. OpASHA leverages the government infrastructure and relationships to enable access to government diagnostics and medicines free of charge to the patient. This includes a full course of medicine, diagnostic facilities, physician access, and other consumables required throughout the course of treatment. Furthermore, the Indian government employs various grant-in-aid schemes providing cash to partners in the private sectors such as NGOs engaged in TB care and control.

Similarly, the National TB Program in Cambodia is a key partner, which provides similar facilities.

Another dimension of the partnership with the Government of India is at the levels of the Ministry, State Department, and Office of District TB Officer. The Central TB Division, Directorate General of Health Services, Ministry of Health and Family Affairs, provides funds through the State Departments. The main executor of the program on the government side is the District TB Officer. He ultimately signs the contract, though he is not the approving authority.[12]

To get a project approved, OpASHA follows a multi-step process:
- OpASHA contacts the Department of Health and Family Welfare in a State with a proposal.
- The State approves the plan of action and agrees on the areas and districts where OpASHA will operate.
- OpASHA approaches each district to sign the agreement and identify the exact areas for intervention.

At the operational level, the partnership with the government is critical. The Senior Technical Supervisor (STS) of the DOTS program is the point of regular contact for the CHWs. The STS informs them of changes in guidelines and advises on technical problems. The government-approved microscopic centers (usually in government hospitals) are the sputum testing centers, which detect and register patients and entitles them to the DOTS regimen. OpASHA is required to collect drugs from stipulated government stores. This operational management lies largely with the program managers. Most of the centers visited in Delhi reported a useful relationship with the STS, who serve as the first point of contact for CHWs and program managers for any issues or problems.

OpASHA has faced resistance from the lower levels of bureaucracy, resulting in district health officials delaying the start of OpASHA operations in their territories. OpASHA learned that if a State Health Secretary showed enthusiasm, the organization could build into its proposal operations in multiple districts to reach as many slums as possible. Buy-in from the State Health Secretary created a push from the top to district officials to cooperate with OpASHA. Therefore, OpASHA shifted to a top-down approach in its implementation. According to the OpASHA team, they have witnessed a perceptible acceptance of their program in many districts.

Other implementation partners are Microsoft Research and Innovators in International Health, a nonprofit based out of Boston, USA. They have been involved with the coding of technology.

OpASHA benefits from software development and perfecting biometric tracking for treating TB. In addition, Poverty Action Lab, an affiliate of MIT, is partnering with OpASHA to perform an independent evaluation of OpASHA's model, including cost-effectiveness, benefits to patients, and eCompliance technology.

Finally, community micro-entrepreneurs also play a key role in the OpASHA model. It is on their premises in urban areas that the DOTS treatment centers are housed.

Private Financial Partners

Funds from USAID, Eli Lily, and International Finance Corporation (IFC) have been raised by OpASHA India directly. OpASHA, USA also raises some funds from various donors (Table 2).

Table 2. How Stakeholders and Partners Help Achieve Results

Partner	Effect
Community entrepreneurs	Increase awareness and acceptance of TB, de-stigmatize the disease
Government	RNTCP offers free drugs, diagnostics, physicians and cash grants
Individual and institutional donors	Offers financial sufficiency
Providers (selected from community)	Offer last mile connectivity
Technical support: Microsoft	Develop the eCompliance system
JPAL	Toward maximizing impact
Institutional donors: USAID, IFC, World Bank, etc.	Offer financial sufficiency at scale
Other non-state providers (Prajnopaya Foundation and Jubilant Organosys in Uttar Pradesh, German Leprosy and TB Relief Association in Rajasthan, Millennium Villages and Columbia University in Kenya and Uganda, Clinica de Familia in the Dominican Republic)	Replicate project through partners

Impact

According to OpASHA, as of May 2015, OpASHA has successfully treated 50,000 patients in India (and Cambodia), serving more than 3,000 disadvantaged communities, including urban slums and villages. OpASHA claims an 85 percent cure rate, and one in three symptomatics identified is sputum positive. The annual detection rate increased after the OpASHA intervention (Figure 7).[13]

Figure 7. Annual Detection Rate of New Sputum-Positive Cases (South Delhi)

Source: Anupindi and Hermelin 2014
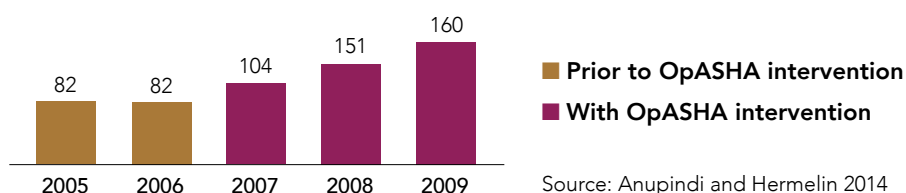
Community Empowerment and Income

OpASHA educates patients and the community to de-stigmatize TB, provides diagnostic and treatment facilities, and monitors complete delivery of treatment. They leverage community members and leaders to spread key messages to the communities. According to OpASHA, to date, their model has provided:
- Vocational training to 24 female TB patients to prevent them from being abandoned by families
- Work to 190 disadvantaged persons
- Added income to178 micro-entrepreneurs in disadvantaged locations who work as partners with OpASHA
- Dignified jobs for 154 semi-literate youth

Additional Service Delivery

OpASHA's model has turned into a delivery pipeline for other health services and products for the disadvantaged. OpASHA also distributes analgesics, antacids, antiemetics, iron and calcium tablets, condoms, oral rehydration salt, protein supplements, food, and blankets. OpASHA now provides detection, counseling, and treatment for diabetes, hypertension, hemophilia, and depression. Through partnerships, OpASHA also provides high-quality drinking water, reading glasses, micro-accident insurance, and financial services at affordable prices to many communities.

Table 3. Summary of Impact from OpASHA initiatives
An assessment of the OpASHA business model based on an analytical framework.

CRITERIA	EVIDENCE
Reach/Access	• Availability: 224 centers in 16 districts in 9 states in India (as of 2015) • Access: Serving more than 3,000 disadvantaged communities, including urban slums and villages, with 4.4 million poor people reached in India (by 2015) • Affordability: Free treatment for poor population
Effectiveness	• In South Delhi alone, detections increased by 100%: from 82 per 100,000 people in 2005 before OpASHA was founded, to 160 cases per 100,000 in 2009, while maintaining a default rate of just 3% percent[14] • According to OpASHA, treatment success rate is 87% versus 32% by the government program (2011 data) • OpASHA increases detection rate of TB by 50–400% within 6–18 months of starting work in any area
Accountability	• Quality assurance through performance-based remuneration of CHWs, feedback loop and eCompliance biometric devices
Cost-effectiveness	• OpASHA's cost to treat one TB patient = USD 80 versus Population Service International, India, cost to treat one TB patient = USD 567 • OpASHA's cost of detection = USD 27 per patient versus programs funded by TB-REACH cost of detection = USD 852 • Savings in cost of detecting 3 million undetected patients = USD 2.5 billion (OpASHA's model vs. TB-REACH funded programs) • OpASHA also serves as a pipeline for NGOs and the government to reach the disadvantaged, whether to deliver food and nutrition supplements, contraceptives, or disease screenings • eCompliance runs on commercially available, off-the-shelf components, with minimal initial and operating costs
Impact on Development Outcomes	• Number of patients cured: 49,870 • Increased treatment success rate: 87% • Decreased death rate: from 5.1% to 2.1% • Employment for semi-literate youth who work as providers • Increased income for entrepreneurs who house DOTS centers
Potential for Sustainability	• 60–75% of cost from government • 10% through consultancy and licensing of technology • Balance through self-raised grants
Potential for Scalability	• Embedded in government service delivery systems • Model has been replicated in India, Cambodia, Uganda, Kenya, and the Dominican Republic • Technology has been replicated in Peru

Source: OpASHA

Sustainability and Scale-Up

Several factors need to be considered as OpASHA plans to increase its financial sustainability and expand its activities in the coming years.

Technical Issues

- **Franchise-like operation for easy replication:** OpASHA's model is designed to be highly scalable, leveraging a simple organizational structure and formalized training and operating manuals. Biometric devices deliver a digital, automated way to ensure patient compliance and provide a reliable means of CHW performance tracking.
- **Lack of convergence with other government programs:** Currently, there is little or no alignment with other government programs relevant for the success of the treatment, such as those for provision of proper diet for drugs to be effective. There could be better integration of services to increase favorable outcomes.
- **Lack of tracking processes for migratory population:** For treatment to be successful the tracking of migrants is essential. Currently there are no processes to address this issue of patients falling off the radar when they enroll in another center. However, this is not always possible because of the significant paperwork at government levels. Once the eCompliance system expands to larger geographies and the entire country, it will automatically provide this feature.
- **Leveraging the delivery model to provide other services:** OpASHA centers serve as a low-cost, efficient, and accessible pipeline penetrating deep into the slums where others failed to reach. The TB Association of Delhi and other organizations use these centers to distribute food rations, blankets, educational material, and nutritional supplements to the slums. OpASHA is exploring leveraging this channel to deliver other services to ensure a flow of funds to OpASHA. It will also ensure that frontline OpASHA workers earn more income, based on additional incentives that are expected to come with additional schemes.

Financial Sustainability

- **Low-cost, highly leveraged operating model:** OpASHA employs a low-cost, highly leveraged operating model based on hiring community resources and working through local providers. Full treatment costs of only USD 80 per patient, of which 75 percent is spent on the core program, will allow OpASHA to become financially sustainable with their centers in India within two years.
- **Shift from implementation agency to strategic consultancy partner:** To achieve scale and become financially self-sustainable, OpASHA is looking to provide knowledge and expertise to similar organizations that are willing to become the implementation agency for OpASHA.

Research and Advocacy

- **Need to showcase impact attributable to OpASHA:** It remains difficult to discern OpASHA's specific impact on TB detection, which raises questions about OpASHA's incremental contribution to the prevention of new infections. In addition, while the

Indian government records TB data in districts, OpASHA is not able to indicate its level of impact because its activities are fragmented throughout the district/State. The numbers then amount to a very small percentage of the district/State. Hence, OpASHA is looking for an opportunity to be able to adopt districts and undertake district-wide interventions (as it has done in Cambodia) to achieve positive movement in TB management indicators for that district. The hope is that this attributable impact will create a more positive disposition among the government, funding agencies, and community.

Behavioral

- **Approach combats stigma and passiveness:** OpASHA employs a variety of approaches to combat stigma and passiveness, including:
  - Corps of highly trained, well-compensated CHWs (equipped with motorcycles, as required), to ensure compliance and treat TB fully to prevent MDR-TB and also treat MDR-TB.
  - Provision of over-the-counter drugs to treat the side effects of TB drugs for greater compliance and to provide camouflage against social judgment and stigma.
  - Rapid response testing and education of the identified patients and their immediate circle for increased suspect identification.
  - Highly effective performance-based remuneration focusing on suspect identification and active case detection within the community through frequent, private "house calls."

Lessons Learned

Engage the Community to Facilitate Treatment
Efforts at OpASHA are community-driven—community members are not merely beneficiaries but also agents of the initiative. The model trains local people to provide education and treatment at the patients' doorstep. Patients feel more comfortable and are more likely to approach fellow community members for treatment.

Collaborate with National Programs to Access Funds and Public Networks
OpASHA receives all of its anti-TB drugs, diagnostic and physicians' services and hospital care from the government. In addition, the government provides a grant covering the recurring expenses for treatment centers in India after two years of operation. The government provides the resources, and OpASHA increases their capacity in distributing TB treatment in India's most inaccessible slums and villages.

Automate Patient Attendance and Treatment to Improve Efficiency and Data Accuracy
OpASHA's most effective innovation is using SMS and biometric technology to alert CHWs and program managers about patients' treatment. This system alerts CHWs when a patient misses a dose, ensures a follow-up visit to the patient within 48 hours, generates all reports automatically, eliminates human error, improves transparency and reliability, increases productivity, and reduces recurring costs.

Customize Service Delivery Models
OpASHA tailors its model for rural and urban areas to reach the poor population at scale. Different socio-economic conditions require different models of delivery. A singular model approach will create inefficiencies. Therefore, an organization should remain flexible and evolve models based on the target audience. For example, OpASHA's network of treatment centers are located in strategically selected areas and offer extended operating hours based on specific community needs.

Offer Free Services to Beneficiaries
Providing other services through the OpASHA delivery model—such as antacids, iron and calcium tablets, condoms, protein supplements, food, and blankets—engenders trust and motivation and offsets patients' expenses. These added services could help increase patients' willingness to adhere to long-term TB treatment.

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[12] One World South Asia. 2012. OpASHA: a partnership project to eradicate tuberculosis worldwide. Unpublished memo.

[13] Anupindi and Hermelin 2014.

[14] Anupindi and Hermelin 2014.

This case study was developed through an analysis of qualitative and quantitative studies, desk review, organizational-level data analysis, and local consultations.

OpASHA Background and Services

OpASHA is a registered NGO in India and has tax exemption, and it is also a 501(c)3 nonprofit in the United States. OpASHA, USA serves as fiscal sponsor for the Indian organization.

States and cities served in India
- Madhya Pradesh: Bhopal, Gwalior, Gwalior tribal belt, Sagar, Mandla
- Uttar Pradesh: Moradabad
- Rajasthan: Jaipur
- Chattisgarh: Raipur, Durg&Bhilai, Korba
- Delhi NCR: East Delhi, West Delhi, South Delhi
- Orissa: Bhubaneswar
- Maharashtra: Bhiwandi,
- Karnataka: Hubli
- Haryana: Gurgaon,

States and cities served in Cambodia
- Phnom Penh: West OD and Sensok OD
- Takeo: Bati, Prey Kabas, Daunkeo, Ang Roka, Kirivong ODs
- Kampot: Chhouk, Kg Trach, Kampot ODs
- Preah Sihanouk: Preah Sihanouk OD
- Kep: Kep OD
- Kg Speu: Oudong OD

Services Provided

1. Health Services
   a. Detection, treatment, and prevention of TB (both normal/DST and MDR, XDR, XXDR)
   b. Over-the-counter medicines and supplements to treat side effects of TB drugs, including nausea, vomiting, weight loss, headache, and joint pain
   c. Detection and treatment/management of diabetes
   d. Detection and treatment/management of heart disease
   e. Detection of mental health problems
   f. Contraceptives
   g. Vaccination
   h. Iron supplements to pregnant women
   i. Oral rehydration salt to prevent deaths of children from diarrhea and dehydration
   j. Nutritional supplements and non-perishable food for the malnourished

2. Financial Services
   a. National Pension Scheme–Lite: a pension scheme for the poor that is subsidized by the government of India, which matches beneficiaries' contributions 100 percent. The government of Delhi also provides an identical subsidy to residents of Delhi. OpASHA provides this service in collaboration with a sister social business.
   b. Micro-accident insurance

APPENDIX III

OpASHA Organizational Overview

OpASHA works through a well planned organizational structure, both at the central and field level. The Head Office is divided into key functional areas of Project Management, Training, Operations, and Communications along with support functions for Human Resources and Finance.

In 2010–2011, as the scale expanded, OpASHA leadership realized the need to set up a layer between the top management and the feet-on-the-street layer of employees to achieve better results. Therefore, a layer of "Middle Management" was incorporated around 2010–2011. This change infused the organization with fresh talent at a strategic level and helped the organization conduct its scaled up operations to its current level of impact.

SENIOR MANAGEMENT TEAM
- Maharshi Vaishnav, General Manager, Development and Communications
- Dr. Neelam Raisinghani, Senior Manager, Government Liaison
- Parvez Kotadia, General Manager, Finance and IT
- Senoo Rawat, Senior Manager, Operations
- Suresh Subramanian, Chief Operating Officer
- Zeeshan Sumrani, Senior Manager, Program

OpASHA Revenue and Expense Sheet

ANIL AYUSH & ASSOCIATES
Chartered Accountants

OPERATION ASHA
G-26, 1st Floor, Kalkaji, Delhi 110019
INCOME & EXPENDITURE FOR THE YEAR ENDED ON 31.03.2014

EXPENDITURE	AMOUNT Rs.	INCOME	AMOUNT Rs.
To Postage	16,924.00	By Membership, Grant & Donation	31,944,556.96
To Misc Exp.	58,263.23	By Govt Grant & Donation	7,073,977.00
To Repair & Maintenance Exp.	130,638.63	By FDR Interest	391,233.22
To Office Exp.	179,951.00	By Bank Interest	186,884.00
To Conveyance	34,722.00	By Misc Receipt	12,765.34
To Power & Fuel	195,950.00	By Excess of Exp.over Income	
To Bank Charges	8,246.38	Trf. to General Fund	3,092,398.93
To Printing & Stationery	58,650.00		
To Grant Paid	5,132,200.00		
To T. B. Project Exp.	35,796,578.21		
To Depreciation	1,059,692.00		
To Audit Fees	30,000.00		
	42,701,815.45		42,701,815.45

Notes to the Accounts As Per Schedule 'B'

AUDITORS' REPORT
As Per Our Audit Report of Even Date Attached
for **ANIL AYUSH & ASSOCIATES**
FIRM REGN NO 018118N
CHARTERED ACCOUNTANTS

for **OPERATION ASHA**

Place : New Delhi
Dated : .19th September 2014
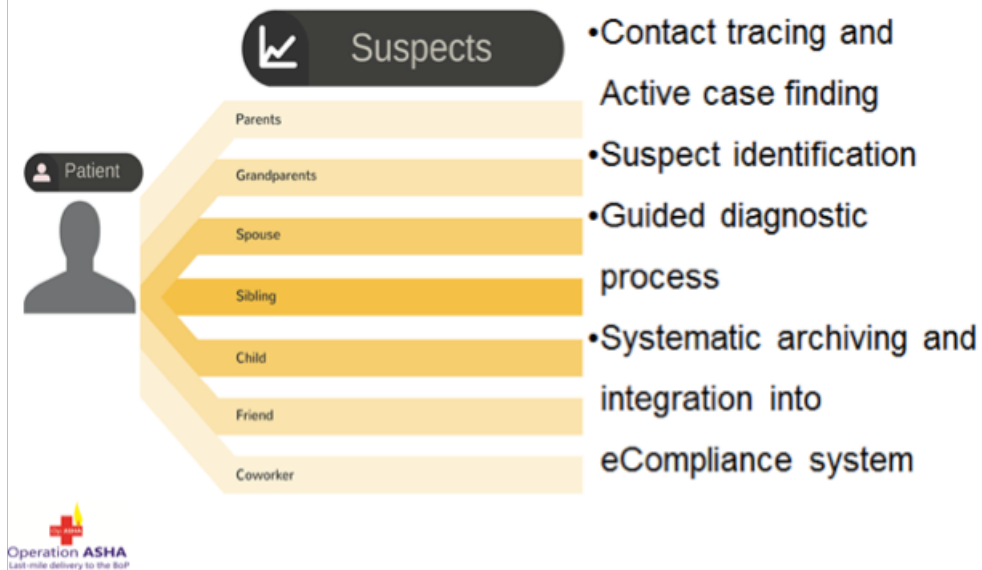
ANIL KUMAR AGRAWAL
M NO 094001
PROPRIETOR

PRESIDENT   SECRETARY

OpASHA eDetection Information Sheet

eDetection

- Contact tracing and Active case finding
- Suspect identification
- Guided diagnostic process
- Systematic archiving and integration into eCompliance system

Operation ASHA
Last-mile delivery to the BoP

Advantages

- Easily downloaded and accessed using 2/3G connection
- Housed on portable tablet
- Uses a decision-based algorithm
- Analyses the answers to decide next steps i.e. hospital visit, test
- Puts positive patients on the geo map using GPS
- Locates hotspots

Operation ASHA
Last-mile delivery to the BoP

Tuberculosis afflicts 2.8 million citizens in India, representing more than 30 percent of the world's total burden. To control tuberculosis, complete adherence to treatment is crucial. However, the scarcity or inaccessibility of treatment centers in hard-to-reach areas often results in high default rates, and there is poor monitoring and data collection and continuing social stigma for those afflicted.

Operation ASHA (OpASHA) delivers the "last-mile" connection to tuberculosis treatment for the bottom-of-the-pyramid in India. It employs a network of urban treatment centers and rural mobile units for convenient access. Trained corps of incentivized local community health workers provide improved detection and prevention and use biometric devices and web-based records for better compliance and monitoring.

As a result of OpASHA's efforts to date, the tuberculosis treatment success rate has increased to 87 percent, the low patient default rate is about 3 percent, and detection rates increased by 40–400 percent within 6–12 months. OpASHA offers a low-cost, highly leveraged operating model that enjoys high community and partner engagement.