Fighting tuberculosis through community based counsellors: a randomized evaluation of performance based incentives in India

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Note to readers

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Executive Summary

The tuberculosis (TB) epidemic is recognized as one of the key development challenges by the international community. Ending it by 2030 is one of the Sustainable Development Goals adopted in 2015. With 2 million people infected, India still has one of the highest incidences of TB in the world. About one thousand Indians die of TB every single day.

Cheap, widely available drugs exist to cure the vast majority of TB cases. The biggest challenge to contain the spread of the disease is to detect cases in a timely manner and ensure that patients complete the entire course of the six-month treatment. The DOTS (Directly Observed Treatment—Short course) system, which stipulates that an independent observer watch the TB patient take her pills three times a week for at least two months, has led to significant progress in the treatment of TB. Yet early detection is still hampered by stigma, lack of information, and poor outreach of the health system in remote communities. Treatment adherence is made difficult by remoteness, drug side effects, and commitment issues as symptoms of the disease disappearing after a few weeks of treatment. Fighting TB in remote communities is essentially a service delivery challenge, and health workers play a crucial role in addressing it.

This paper investigates whether financial incentives provided to health workers may encourage them to detect new tuberculosis cases and improve treatment adherence. We report experimental evidence from India on the effect of health workers' performance-based incentives on patient detection and treatment default. 75 community health workers catering to more than 2,500 patients in five Indian states—Delhi, Uttar Pradesh, Madhya Pradesh, Punjab, and Chhattisgarh—were initially hired by Operation ASHA, an NGO delegated by the Government of India to operate local TB treatment centers, and included in the first phase of the experiment. For the first six months, they were randomly assigned to receive either a fixed salary or a salary dependent on the number of patients they had detected. In the following six months, they were randomly re-assigned to either a fixed or an incentivized salary scheme, based on the number of defaults.[1]

Results point to a 24% increase of reported detections induced by the provision of detection-based incentives in the first phase (an additional 1.6 detections per center per month, significant at the 10% level, from a control mean of 6.6). The number of defaults however also increased over the same time period (an increase by 0.1, significant at the 5% level, from a control mean of 0.1). Health workers' survey answers suggest that this could be due to health workers reallocating their effort towards the rewarded task (early detection) and to the detriment of other non-rewarded activities (treatment compliance), in line with the multitasking theory. There is no detectable impact of the default-based incentives introduced in the second phase, arguably because of the perceived difficulty to prevent defaults which makes effort less rewarding. Qualitative interviews of a subset of these health workers and their peers further complement these results such as by highlighting the difficulties of default prevention relative to new patient detection. These interviews further suggest the need to be attentive towards the presence of other local competing incentive schemes that may be in place.

These findings suggest three policy conclusions. First, performance-based incentives may boost health worker performance and improve health outcomes. Second, incentives may not

[1] Note that the number of months during which each phase was carried out differs across cities, and may not be 6 months in all cases. Also during the second phase, some new CHWs who were not a part of the first phase were randomized into the experiment.

be effective in improving all outcomes. The link between effort and observable performance must be tight for health workers to respond to incentives. Third, in a multitasking environment, performance-based incentives may have undesired impacts on non-incentivized outcomes. Incentives should be carefully structured to take into account the complexity of the work expected from the workers in the public service sector.

Contents

Tables and Figures

Abbreviations

CAT I	Category 1 (DOTS treatment regimen)
CAT II	Category 2 (DOTS re-treatment regimen)
CHW	Community Health Worker
DFID	Department for Internation Development, United Kingdom
DMC	District Microscopy Center
DOTS	Directly Observed Treatment, Short-Course
IFMR	Institute for Financial Management and Research
IRB	Institutional Review Board
J-PAL	Abdul Latif Jameel Poverty Action Lab
MDR-TB	Multi Drugs Resistant-Tuberculosis
NGO	Non-Governmental Organization
Op ASHA	Operation ASHA
PI	Principal Investigator
RCT	Randomized Controlled Trial
RNTCP	Revised National Tuberculosis Control Program, India
SC	Scheduled Caste
ST	Scheduled Tribe
TB	Tuberculosis
TBHV	Tuberculosis Health Visitor
TC	Treatment Card

1) Introduction

TB epidemic is recognized as one of the key development challenges by the international community. Ending it by 2030 is one of the Sustainable Development Goals adopted in 2015. The DOTS (Directly Observed Treatment – Short course) system, which stipulates that an independent observer watch the TB-infected patient swallow his or her anti-TB pill three times a week for at least two months, is reported to have led to significant progress in the treatment of TB.[2] With 2 million people infected, India still has one of the highest incidences of TB in the world. About one thousand Indians die of TB every single day. As a comparison, as many lives are lost to TB in twelve days in India as during the entire 2014-2015 Ebola outbreak.

Cheap, widely available drugs exist to cure the vast majority of TB cases[3]. The biggest challenge to contain the spread of the disease is to detect it in a timely manner and ensure that patients complete the entire course of the six-month treatment. Early detection is hampered by stigma, lack of information and poor outreach of the health system in remote communities. Treatment adherence is made difficult by remoteness, drug side effects, and commitment issues as symptoms of the disease disappear after a few weeks of treatment. Fighting TB is essentially a service delivery challenge, and health workers may play a crucial role in addressing it.

This paper investigates whether financial incentives provided to health workers may encourage them to detect new tuberculosis cases and improve treatment adherence. A growing body of evidence documents that poor performance of health care in low and middle income countries is not only due to inadequate training or knowledge deficiencies but also due to insufficient provider effort, translating into high absenteeism rates (Chaudhury and Hammer 2004, Banerjee et al. 2004) and lack of adequation between knowledge and practice (Das and Hammer 2005; Chaudhury et al. 2006; Das and Hammer 2007). However, whether external incentives are an efficient means to improve service provider effort in the public health sector is more uncertain (Miller and Babiarz, 2013). Offering monetary incentives to workers may indeed induce unintended behavioral reactions and there are several reasons why the public health sector may be more prone to those.

First, the risk that external rewards may crowd out intrinsic motivation and have little impact on effort is higher for workers with a pro-social component to their job (Benabou and Tirole (2003), Tirole and Bénabou 2006). As suggested by the Cognitive Evaluation Theory (Deci, 1975)[4], external incentives may affect individuals' intrinsic motivation by

[2] According to the United Nations, tuberculosis prevention, diagnosis and treatment interventions saved an estimated 37 million lives between 2000 and 2013. The tuberculosis mortality rate fell by 45 per cent and the prevalence rate by 41 per cent between 1990 and 2013. The evidence however is mixed on the impact of DOTS as opposed to self-administered treatment. While Kamolratanakul et al. (1999) report a significant increase in cure and treatment rates in Thailand, Vomik (2007), Wally, Newell and Khan (2001), Zwarenstein, Schoeman, Vundule et al. (1998) find no statistically significant difference between the two types of treatment.

[3] Multi-drug resistant (MDR) strains of the disease are more expensive, and in some cases impossible to cure. However, the Global TB Report 2014 estimates that MDR-TB only represents 2.2% of new TB cases in India. It is more frequently observed (15%) in cases going for retreatment, i.e. when patients defaulted from an initial treatment. Curing non-MDR cases is therefore critical both to reduce TB mortality and to prevent the spread of MDR TB.

[4] The Cognitive Evaluation Theory states that individuals all have fundamental needs for (i) autonomy: "the urge to be a causal agent of one's own life" and (ii) competence: "the urge to master skills and control outcomes".

reducing their perceived autonomy (Frey and Goette (1999).[5] Workers with a social mission might perceive financial incentives as a signal of a "money-market" rather than a "social-market" task and reduce their effort (Heyman and Ariely, 2004) or choose their effort level based on the incentives and no longer on their intrinsic motivation: if the incentives are too low, their effort might decrease (Gneezy and Rustichini, 2000).

Second, health workers' job consists in performing several tasks, as opposed to one single repetitive task. Whether incentives work for more complex jobs or induce multitasking remains to be tested.[6] At any point of time, TB health workers are responsible for, at the least, detecting new patients, monitoring their existing patients' compliance to treatment, and giving advice to their families to prevent further spread of the disease. Incentivizing one task may prompt them to neglect the dimensions of their task that are not rewarded by incentives, or "non-contracted" outcomes (Miller and Babiarz, 2013).

Third, the impact health workers' effort has on their performance may be loose. Incentives may indeed only be as efficient as individuals are able to adjust their behavior to their goals. However, community health workers may have relatively limited bandwidth for deviating from protocols and innovating in the way they work, as opposed to managers. In addition, the performance targets used here—TB cases detection and, even more so, default prevention (i.e. adherence to treatment)—are closely linked to the patient's behavior, leaving less room for health workers' effort to translate into performance (Loevinsohn and Harding, 2005). Low marginal returns to effort may limit the impact of incentives on performance (Miller and Babiarz, 2013).

Using a field experiment conducted in urban slums of Northern India, this study examines whether financial incentives provided to social workers and agents performing multiple tasks do increase performance. Seventy-five TB health workers were randomly assigned to one of four treatment arms.[7] They either received (i) financial incentives based on patient detection for six months and incentives based on treatment adherence subsequently or (ii) financial incentives based on patient detection for six months and a fixed salary subsequently or (iii) a fixed salary for six months and incentives based on treatment adherence subsequently or (iv) a fixed salary for the whole duration of the experiment.

This design allows to evaluate the impact incentives have on a series of outcomes including (i) detection - number of patients enrolled in the DOTS system; (ii) default - number of patients leaving the DOTS system during the course of their treatment; (iii) health workers' effort / motivation and job satisfaction; (iv) patients' characteristics, satisfaction and health status. Outcomes of interest are measured by a combination of administrative data and about 5,000 comprehensive health workers and patient surveys. Our results point to a 24% increase of reported detections induced by the provision of detection-based incentives in the first phase (an additional 1.6 detections per center per month, significant at the 10% level, from a control mean of 6.6). This large increase occurs a few months after the start of the intervention. The number of defaults however also increased over the same time period, in line with the multitasking theory (an increase by

[5] However, Friedman (2013) argues that performance-based incentives, as opposed to input-based incentives, may have little impact on intrinsic motivation for they also provide information on one's competence.

[6] Multitasking has been documented mostly theoretically (Holmstrom and Milgrom 1991; Petersen et al. 2006; Mannion and Davies 2008). Empirical evidence is mostly inconclusive (Mullen et al., 2010).

[7] Even though 78 CHWs were initially randomized, 3 CHWs left Op ASHA before their baseline survey. While we use all 78 CHWs for impact on attrition, we only count 75 CHWs as being a part of our experiment in the first phase.

0.1, significant at the 5% level, from a control mean of 0.1). Evidence from health workers' surveys suggests that they reallocated their effort towards the rewarded task and to the detriment of other non-rewarded activities in response to receiving incentives. There is no detectable impact of the default-based incentives that were introduced in the second phase, perhaps due to low marginal returns to effort on the default prevention task.

Our results relate to the growing literature on performance-based incentives in the public health sector, showing mixed results. While Eichler and Levine (2009) and Gertler and Vermeersch (2013) show a positive impact of performance incentives on health outcomes, in several instances financial incentives have yielded limited effects (Miller and Babiarz, 2013), a positive effect only under certain conditions (Singh 2011; Basinga et al. 2011) or no effect at all (Hillman et al., 1998).

We also conducted semi-structured qualitative interviews of a subset of CHWs from Op ASHA in 2015, who operate under incentive scheme similar to that our experiment, some of whom were also part of the experiment. In addition, we interviewed TB patients from Operation ASHA centers where the experiment took place. These qualitative interviews complement the discussion on our quantitative results as well as add new insights on themes such as intrinsic motivation of the CHWs and interaction of institutional incentive schemes with other competing and comparable schemes.

The remainder of the paper is organized as follows. Section 2 lays out the study context. Section 3 presents the experimental design, theory of change and the study timeline. Section 4 describes data sources. Section 5 presents the population sample and balance checks. Section 6 presents the results, and cost-effectiveness is discussed in section 7. Section 8 concludes.

Appendix 1 compares the program scheme with other local schemes in place. Appendix 2 discusses the qualitative study methodology in more detail. Appendix 3 discusses the result dissemination strategy. Appendix 4 summarizes a supplementary study on Incentive that we attempted with CARE India, an NGO that caters to TB patients in rural India, which met with severe roadblocks leading to its termination[8]. Appendix 5 provides a brief description of another study that we carried out with Op ASHA, which is mentioned in the qualitative study discussions. Finally, Appendix 6 includes the full qualitative report.

[8] Please note that this paper does not use the data from the CARE experiment given the failure in implementation and the validity of the data obtained before experiment discontinuation.

2) Background

2.1) TB control in India and the challenge of reaching urban slum populations

India has one of the highest incidence rates of TB. Each year, nearly 2 million people in India develop TB and about 1,000 Indians die of TB every day, making it the leading infectious cause of death among adults in the country. Even when it is not deadly, the disease considerably weakens the patients: it is a major barrier to social and economic development.

The Indian Ministry of Health has made the eradication of TB a priority, investing considerable efforts and money through the Revised National Tuberculosis Control Programme (RNTCP): first piloted in 1993, and designed according to the DOTS strategy, it now covers the entire country. Under the RNTCP, DOTS centers are mostly run by government hospitals or by NGOs working on delegation of the State health ministries.

TB prevalence is higher in urban slums than in the rest of the country. Overcrowding increases contagion; pollution and poverty weaken the bodies; and the lack of space or drainage prevents an adequate disposal of sputum. Due to poor education, many fail to take simple preventive measures which would help contain the spread of the disease. Furthermore, the stigma that is still often associated to TB makes its detection harder.

Although the DOTS system has led to significant progress in the treatment of TB, it remains insufficient to address the challenge of curing efficiently the most remote populations. Government dispensaries which implement the DOTS model are often located far away from the slums, making it difficult and costly for TB patients there to get detected and then comply with the entire treatment. There is a blaring lack of access to health infrastructures, and of information about the detection and treatment of the disease.

The lack of interaction with health workers makes many people ignorant of the need to get detected, the process of taking a sputum test, and the possibility to get cured in a DOTS center free of cost. Detection is therefore very low. Further, even when they get detected and enrolled in the DOTS system, slum inhabitants' poor education makes them more prone to defaulting on the treatment, and therefore developing (and spreading) Multiple Drug Resistant forms of TB (MDR-TB), which require extensive and costly chemotherapy to treat and is therefore much more difficult to cure. MDR-TB is increasingly acknowledged as a looming threat on public health, especially in urban areas where those new forms of the disease could quickly get out of control.

To address these difficulties and "reach marginalized sections of the society", the RNTCP has now entered a stage of deepening. "Improving the case finding through an effective patient-centered approach to reach all patients, especially the poor" is listed first on their agenda which also highlights the need for "scaling-up of community TB care [and] creating demand through context-specific advocacy, communication and social mobilization."[9] This includes a reflection on how to better manage DOTS centers and on the use of Public-Private Partnerships (PPPs) to have a higher efficiency and deeper reach in remote places.

[9] RNTCP's webpage: www.tbcindia.org/RNTCP.asp

2.2) Operation ASHA's programs

Operation ASHA, a Delhi-based NGO and well-established actor of the fight against TB in India, specifically targets urban slums. It has established a network of more than 100 community-based DOTS centers in five states (Delhi, Uttar Pradesh, Madhya Pradesh, Punjab, and Rajasthan) run on delegation of the State health ministries. These centers are located in small shops, pharmacies, or temples. They open at convenient hours, and they each cover a small neighborhood to minimize the distance between an average patient's house and his or her center. Each center is supervised by a CHW, who delivers information to the community, engages in the detection of new patients through widespread community testing, and tracks patients enrolled in the center who have missed a pill to bring them back onto the regular course of treatment.

The CHWs play a critical role in improving the access to TB treatment in remote communities. When health workers are allocated to a center, their primary objective is to increase the detection in the area of coverage and to bring more patients onto the treatment. After the number of detections has reached a plateau, and before the center becomes too crowded to be manageable, the health workers need to focus on making sure that patients comply with the treatment and complete it. However, as in any organization working in remote areas, monitoring the health workers is a challenge. For instance, several studies have shown that attendance and commitment were often very low in the government health and education system in remote places. To circumvent this major issue, Operation ASHA, in collaboration with the research team, designed an original compensation scheme aimed at improving health workers' motivation to complete their important tasks properly and, thereby improving their efficiency.

3) Experimental Design

We evaluate the impact of an enhanced DOTS model in which health workers are offered incentives based on their performance. CHWs are offered incentives based first on the number of detections of TB infected individuals, and then on the rates of default of the patients of their centers.

3.1) Salary schemes and randomization design

Operation ASHA hires community-based health workers, who are each responsible for operating two DOTS centers. During an initial period of about 3 months, CHWs work on setting up the centers, getting to know the community and surroundings, and making the center known to the local population. During the first 3 months, CHWs all receive a fixed salary.[10]

The experiment starts after the initial three months of a center lifespan. Between months 3-9, CHWs are asked to grow their center until they have reached the optimal size (not more than 50 patients), where they are cost-effective and where patients can be effectively followed-up on. Half of the CHWs, randomly chosen, receive a fixed component and a variable amount based on their performance regarding detection of new patients (see definition in Box 1). The introduction of financial incentives explicitly linked to the outcome of their counselling work is aimed at increasing their motivation, effort, and performance, and in turn their impact on TB treatment. In order to measure impact of the salary scheme, the other half of the CHWs receives a fixed salary and serves as a comparison group.

Operational definition of a "new patient"

The following cases count as "new patients" for whom a CHW gets incentives:

1/ a person detected on the field by the CHW during counseling, referred to the DMC for a sputum test, tests positive and is then sent back to the Op. ASHA center with his treatment box and starts treatment from the center.

2/ a person who is referred from the DMC with a treatment box to take medicines from the Op. ASHA center and might have self reported for testing at the DMC or been detected by an Op. ASHA CHW, or any other NGO/ Govt. worker

3/ a patient transferred from another center and starts treatment on that month from the Op.ASHA center.

The following cases should not be counted as "new patients":

1/ a person detected by the CHW on the field sent to the DMC for a sputum test, tests positive but taking medicines from the DMC or another DOTS center.

2/ a person referred from the DMC to take medicines at the Op. ASHA center but not in the first month of his treatment.

Box 1: what is a "new patient"?

After 9 months of work, CHWs are asked to focus on preventing defaults in their patient population. The CHW's compensation scheme is randomized again. Half of them receive a fixed salary for the following 6 months of their contract while the other half receive an incentivized scheme where the variable component no longer depends on the number of detections, but on the number of defaults they prevent. If the number of patients keeps growing, Operation ASHA opens a new center and the detection work is taken over by another CHW operating that newly open center.

[10] This is true for most centers, since most were newly established; however, there were some exceptions.

These incentives (for detection) or penalties (for default) come in addition to a base salary, which guarantees a minimum income and contains the amount of risk and stress for CHWs.

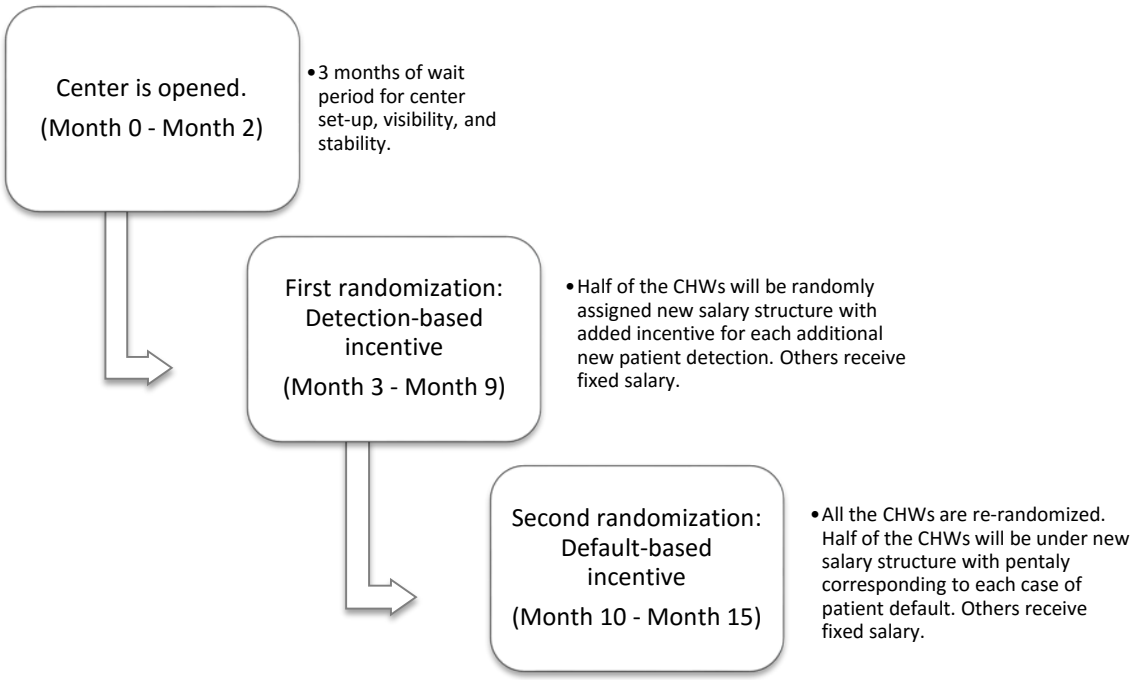

Figure 1: Randomization scheme

Figure 1 summarizes the ideal randomization scenario. However, the experiment months varied across cities and in many cases went on for longer than 6 months per phase. Also, there were cases in which some CHWs were either not a part of the first or the second experiment.

In brief, CHWs are randomly assigned to either a contract with fixed salary or a contract with a part linked to the number of detections between three and nine months, and one of the two types of contract 2 after nine months. Because they are re-randomized between the two phases, they end up being randomly allocated to one of the four groups described in Table 1 below.

Incentives in first (detection) phase?	Incentives in second (default) phase? **Yes**	**No**
Yes	**Group 1:** - Incentives for detection in phase 1 - Incentives for default in phase 2	**Group 2:** - Fixed salary in phase 1 - Incentives for default in phase 2
No	**Group 3:** - Incentives for detection in phase 1 - Fixed salary in phase 2	**Group 4 ("pure control"):** - Fixed salary in phase 1 - Fixe salary in phase 2

Table 1: Treatment arms

3.2) Design features

The structure of the incentive contracts was designed collaboratively by Op ASHA and the research team in order to minimize different possible issues.

Balancing risk and incentives. Performance incentives should ideally balance fixed and variable pay (Miller and Singer Babiarz, 2013). On one hand, the variable part must be sufficiently large to influence provider behavior (Hall and Liebman 1998), especially in health care (Hillman et al. 1998; Rosenthal and Frank 2006). On the other hand, the financial risk borne by providers increases with the variable part (Ellis and McGuire 1990). The variable part of the contract was thus limited to 25 percent of its total value.

Preventing efficiency wage effects. The computation of the variable part of contracts with incentives is done using six months of baseline data in each city to equalize, on average, incentivized salaries and fixed salaries. This is meant to isolate the effect of incentives from any income or efficiency wage effect.

- Fixed component = 75 percent of the total fixed salary
- Variable component = computed based on the baseline data so that the total salary would equal the fixed salary in expectation.

Table 2 provides the exact parameters for salary calculation in each of the cities where the experiment took place. Amounts vary across cities for two reasons: i) so as to take into account the differences in costs of living across cities; ii) so as to reflect the relative difficulties in detecting patients or preventing defaults, based on city-specific historical data.

Preventing self-selection of CHWs into treatment arms. At the time of hiring, CHWs are informed in writing that they will all get a fixed salary for three months, and will be randomly assigned one of the two salary schemes after three months - and then again after nine months. Random assignment is therefore anticipated and takes place when CHWs have been three months into the job, which prevents differential drop-outs between the control and treatment groups. Further, each CHW is told about the type of contract that he/she was randomly assigned to just before this contract is implemented, so that her performance would not be affected by the anticipation of a future contract.

			DETECTION PHASE		DEFAULT PHASE	
		Fixed	Base salary	Detection incentives	Base salary	Default incentives
UP	Moradabad	3000	2250	100 per new patient	2250	1050 if 0 default; 750 if 1 default; 450 if 2 defaults; 150 if 3 defaults; 0 if ≥ 4 defaults
Punjab	Ludhiana	4000	3000	150 per new patient	3000	1400 if 0 default; 1000 if 1 default; 600 if 2 defaults; 200 if 3 defaults; 0 if ≥ 4 defaults
Punjab	Amritsar	4000	3000	150 per new patient	3000	1400 if 0 default; 1000 if 1 default; 600 if 2 defaults; 200 if 3 defaults; 0 if ≥ 4 defaults
Punjab	Jalandhar	4000	3000	150 per new patient	3000	1400 if 0 default; 1000 if 1 default; 600 if 2 defaults; 200 if 3 defaults; 0 if ≥ 4 defaults
MP	Bhopal	3000	2250	175 per new patient	2625	1225 if 0 default; 875 if 1 default; 525 if 2 defaults; 175 if 3 defaults; 0 if ≥ 4 defaults
MP	Gwalior	3000	2250	100 per new patient	2250	1050 if 0 default; 750 if 1 default; 450 if 2 defaults; 150 if 3 defaults; 0 if ≥ 4 defaults

MP	Jabalpur	3000	2250	175 per new patient	2250	1050 if 0 default;750 if 1 default; 450 if 2 defaults; 150 if 3 defaults; 0 if ≥ 4 defaults
MP	Indore	3500	2625	219 per new patient	2625	1225 if 0 default; 875 if 1 default; 525 if 2 defaults; 175 if 3 defaults; 0 if ≥ 4 defaults
MP	Sagar	3000	2250	150 per new patient	2250	1050 if 0 default; 750 if 1 default; 450 if 2 defaults; 150 if 3 defaults; 0 if ≥ 4 defaults
Chhattisgarh	Durg/Bhilai	4000	3000	250 per new patient	3000	1400 if 0 default; 1000 if 1 default; 600 if 2 defaults; 200 if 3 defaults; 0 if ≥ 4 defaults
Chhattisgarh	Korba	3000	2625	215 per new patient	2625	1225 if 0 default; 875 if 1 default; 525 if 2 defaults; 175 if 3 defaults; 0 if ≥ 4 defaults
Chhattisgarh	Bilaspur	3000	2625	215 per new patient	2625	1225 if 0 default; 875 if 1 default; 525 if 2 defaults; 175 if 3 defaults; 0 if ≥ 4 defaults
Delhi	Delhi		N/A		2550	1190 if 0 default; 850 if 1 default; 510 if 2 defaults; 170 if 3 defaults; 0 if ≥ 4 defaults

Table 2 - Salary schemes per phase per city[11]

Dealing with the selection bias of patients. The characteristics of patients in each center may depend on the efforts made by the CHWs to go and find the ones who would not have shown up otherwise. The first incentive scheme thus lays the ground for a selection bias in the analysis of defaults. However, the cross-randomization will allow us not only to control for this possible bias, but also to estimate its importance. The data from the patient survey will provide detailed information on the characteristics of the patients detected, and we will test whether incentives enable CHWs to find patients who are usually left out of the system and are more likely to default.

Preventing contamination. The DOTS centers are located in non-overlapping and scattered areas and the CHWs are permanently assigned to their catchment areas. This limits the scope for interactions between CHWs and spill-over effects.

3.3) Theory of change

Needs **Inputs** **Outputs** **Outcomes** **Impacts**

[11] The first phase of the experiment was not carried out in Delhi, which is why there is no data for that phase.

Low CHW motivation	Introduction of financial incentives (Detection incentive/Default incentive)	Op ASHA systematically tracks the key outcomes, both incentivized and non-incentivized	Increase in CHW effort towards incentivized outcome	Increased CHW motivation and job satisfaction
Lack of CHW performance monitoring		CHWs' salaries adjusted as per the incentive scheme	Improvement in incentivized outcome (detection or default) Increase in patient-level awareness regarding TB Potential adverse effect on non-incentivized outcome (that is default during the detection phase and vice-versa)	Increased diffusion of TB related awareness in the society Lower cases of TB occurrence over the long-run

Table 3: Theory of Change

The basic assumption underlying this evaluation of performance-based incentives was that health worker motivation towards their work, in the absence of constant monitoring, is low. Based on past studies outlined below, the research team believed that if the issue of health worker motivation could be resolved, then the long-term impact on tuberculosis patients in India could be substantial. The introduction of financial incentives—the primary input provided to CHW in the treatment group—leads to higher wages for CHWs who perform better in terms of increasing detection of new tuberculosis patients and treatment compliance among existing patients.

The research team hypothesized that health workers motivated by the detection incentives input would increase the intensity of their efforts to find individuals in their communities who exhibit TB symptoms and get them enrolled in treatment if they are indeed TB patients. Alternately, those workers enrolled in the treatment group in the second phase (the default phase) would be expected to more aggressively identify and retrieve patients at risk of defaulting on their 6-month course of treatment. Regardless of the phase of the study, the CHWs would be incentivized to spread general awareness regarding TB symptoms, long-term consequences, and available treatment options within their catchment areas. A potential drawback, however, was that incentivized health workers might decrease their effort on dimensions of their work that were not directly incentivized (e.g. default prevention, when receiving detection incentives).

Patient populations in areas served by CHWs in the treatment group would be expected to have an increased awareness regarding the symptoms of TB, general facts about the disease, the process of getting diagnosed, knowledge about tuberculosis treatment, and

understanding of the consequences of treatment default. We expected that the improvement in two primary outcomes (improved detection and treatment compliance) would be achieved not only as a result of sustained prodding from a financially-motivated health worker, but also as a result of longer-term increased diffusion of TB awareness in the serviced population.
Moreover, as these incentives were explicitly linked to the result of the CHWs' counselling work, they were expected to lead to secondary outcome changes such as increase in job motivation and satisfaction on the part of the CHWs.

3.4) Timeline

The project began in December 2009 and went on until April of 2013. The project started in the cities in Punjab, and was then extended to Madhya Pradesh, Delhi, Uttar Pradesh, and Chhattisgarh. In all cities, the experiment took place for a year or more, except in Delhi where only one phase of the randomization was carried out.

Below is a visualization of the timeline for each city:

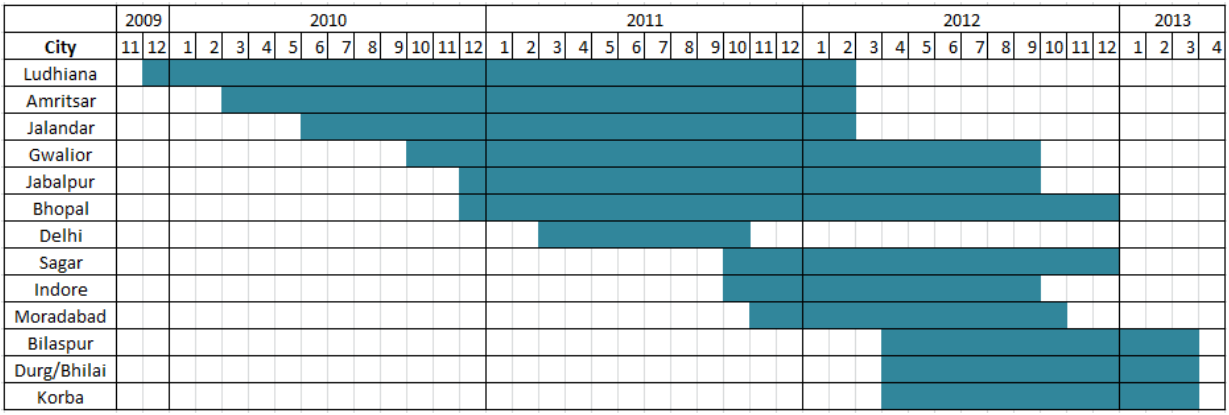

Figure 2: Timeline by city

3.5) IRB clearance

Ethics board clearances were obtained from all the institutions to which the Principal Investigators (PIs) of the study were affiliated with. Below is the list of the institutions and original approval dates:

Institution name	Original approval date (mm-dd-yyyy)
Massachusetts Institute of Technology (MIT)	03/24/2011
Institute for Financial Management and Research (IFMR)	08/08/2011
University of Cape Town (UCT)	03/29/2011

Table 4: Original IRB approvals

We regularly renewed the IRB clearances as per the protocol and requirement of each institution. The IRB clearance for the qualitative study was obtained from IFMR on 3/21/2015.

4) Data sources

4.1) Program and administrative data

Salary sheets and centerwise reports were collected monthly from Operation ASHA. They were verified and used by the research team for salary computation. They record monthly detections and defaults as well as various salary components (base, incentives, allowances, etc.) for each center and health worker.

TB registers and lab registers are kept by public health TB officers, who centralize the treatment cards generated by all centers in the area. These registers list the name and address of all enrolled patients, the dates and results of their initial and follow-up sputum tests and the outcome of the treatment. This data is not subject to forgery by the CHWs, unless they collude with senior government officials, which is unlikely. They thus provide a reliable measure of the main two outcomes of the study: detection and default.

Treatment cards are generated by Operation ASHA for each patient enrolling in a DOTS center (see Figure 3). They are a second source of information about the number and identity of newly detected patients month after month. In addition to this, they give daily information about the pills taken by the patients and their sputum tests. If CHWs who get default-related incentives are able to actually reduce the number of defaults, these data will provide additional evidence on the strategy they use to do so: do they take action to any missing pill, do they wait until 2 or 3 pills or more are missed? To this end, all treatment cards were collected and entered in a specially designed dataset.

However, the treatment cards are filled by the CHWs themselves, so they may be subject to forgery, especially by incentivized CHWs. The fact that the incentives are not directly related to the number of missed pills but to the number of final defaults reduces the risk.

Dataset Name	Description	Module	Cities
Salary sheets and centerwise reports	Operation ASHA's administrative files. Contains health worker salary for each month of the experiment, along with detection/default data as reported by OA	Salary sheets and centerwise summary sheets	ALL
Treatment Cards	Contains all patient treatment information based on pictures of Operation Asha treatment cards	N/A	**Available cities:** Bhopal, Indore, Gwalior, Sagar, Durg/Bhilai, Korba, Moradabad; **Not Available Cities:** Jabalpur, Bilaspur, Amritsar, Ludhiana, Jalandar
PII	Contains all personally identifiable information of patients in the experiment sample, including surveyed and non-surveyed patients. Is kept separate for ethical reasons.	Surveyed and Non-Surveyed Patients	ALL
Patient Surveys	Contains the following modules: Personal, Work, Inactivity-Unemployment, Family TB history, Children, Current health, Healthcare, Vaccination and past TB, Detection, Current treatment, Post-treatment, Interaction with health worker, TB knowledge, Social insertion, Optimism-happiness, Tobacco, Borrowing-saving, Assets, Wealth and sanitation, Consumption, Measures	Adult Entry, Exit, Exit+, Child Entry, Exit, Exit+	ALL

Health worker Surveys	Contains the following modules: Personal information, Family information, Health, Assets, Income generating activities, HH income, Operation ASHA centers, Detection ativities, Default activities, Expectations, Job satisfaction, Job termination	Baseline, Midline, Midline+, Endline, Endline+	ALL
Monitoring Data	Contains center and health worker monitoring data	N/A	ALL
TC Tracker	Contains a subset of patient information copied from Operation Asha treatment cards during center/health worker monitoring; data reconciled with official administrative data (TB Registers)	N/A	**All data:** All - Amritsar, Ludhiana, Jalandar, Bhopal, Jabalpur, Indore, Gwalior, Sagar, Durg/Bhilai, Bilaspur, Korba, Moradabad; **Reconciled Data:** Not available for Jabalpur, Amritsar, Ludhiana, Jalandar
Backcheck Data	Contains patient survey backcheck data of 10 percent of sample, and completion status verification of non-surveyed patients	N/A	ALL

Table 5: Source and Description of Data

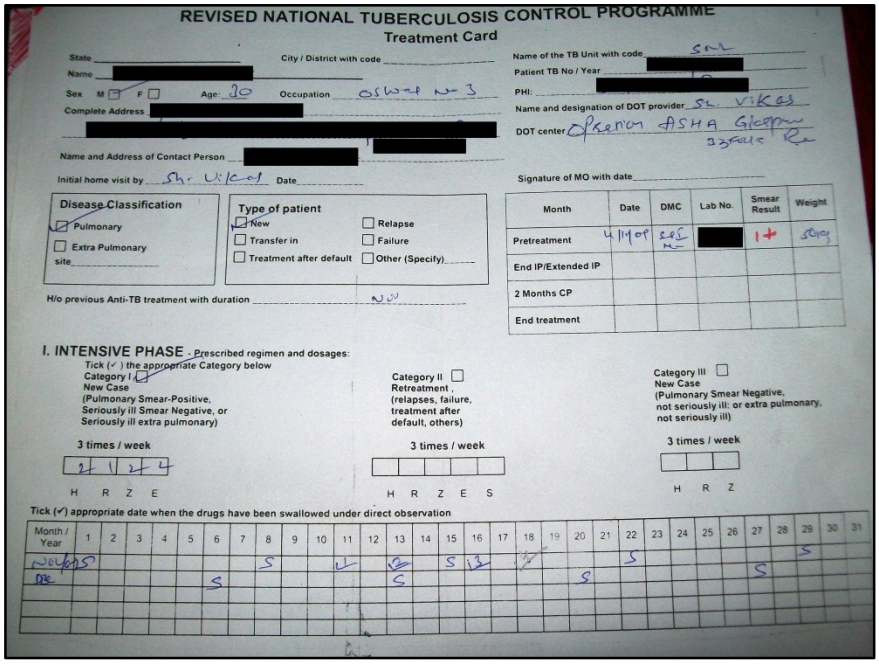

Figure 3: Example of a Treatment Card

4.2) Survey data

Health worker surveys were administered thrice, before the first salary randomization (baseline), before the second randomization (midline) and at the end of the default-based incentives period (endline). These surveys provide detailed information on the health workers' socio-economic background, their motivation when starting their job, and their work history. They also provide information on their daily work activities. We finally measure their satisfaction at work and the level of trust and cooperation they feel within the organization.

Patient surveys were collected all over the course of the three-year experiment, usually once at the beginning of their treatment and once towards the end. A total of 2791 patients were surveyed. We collect socio-economic characteristics, GPS data (to control for the distance to the center), and measure additional outcomes of the programs: health symptoms, daily activities, and awareness of hygiene behavior meant at reducing the risk of further contamination. This data provides evidence about the extent to which the intervention impacted the patients' lives and whether it improved the detection and treatment of the most remote, uneducated and deprived segments of the population.
The surveys were collected at two points for each patient: one at the start of the treatment, one after they complete the treatment. A patient who started treatment before the beginning of survey operations would be administered an augmented endline survey that includes some of the socio-economic characteristics normally collected at entry. The questionnaire, protocol and consent form were also adapted for children.
Potential respondents were identified through a sampling process which was carried out regularly (usually once every month) by a designated enumerator. At each sampling visit to an Op ASHA center, entry patients (those who had recently begun treatment) and exit patients (those who were to complete treatment in that month/ had just completed treatment/ had defaulted from treatment) were identified and assigned appropriate survey type. Patient details—such as name, address, and treatment start dates—were collected from treatment cards maintained by Operation Asha CHWs, and each patient to be interviewed was assigned a unique identification code (in the case of the patients who we were to survey for the first time).
After a sample of patients to be interviewed was determined for the next month, appointment sheets were prepared for each patient. These contained details that would help locate and identify the patients (such as names and addresses), as well as information on whether the visit was successful. Three attempts were made to locate the patient before they were declared "Not Found".

Backchecks were performed by revisiting households in our sample (both those surveyed and those reported as 'not found' or 'unable to be surveyed') to verify that they were visited by a JPAL enumerator and that they completed the survey correctly. Each city was visited approximately once a month by a designated backchecker. When re-visiting a household/patient, this person would administer a shorter version (approximately 15 questions) of the patient survey. The back-check questionnaire answers were then compared with the original survey data and inconsistencies were investigated. We backchecked about 15% of the randomly selected patients.

4.3) Monitoring data

Monitoring data were collected during visits conducted by survey staff at Operation Asha centers to observe CHW attendance, observe the number of patients visiting the center for DOTS, and to collect data from patient treatment cards. Table 6 shows the average number of visits performed per center in each city. The monitoring procedure consisted of a designated field team member visiting a pre-assigned center during a randomly selected monitoring day. This person would stay at the center from the time it opened in the morning till the CHW finished his work, around early afternoon. During his/her time there, a systematic record of the following were maintained for each visit:

- Whether the center is open and if the CHW is present
- Arrival and departure time of the CHW

- Patient name, along with administrative details such as TB number/lab number and treatment start date
- Cases where a relative picked up medicines for the patient
- Cases where the CHW was planning to visit the patient personally

State	City	Average visits per center per month[12]
Madhya Pradesh	Bhopal	0.64
	Jabalpur	0.66
	Gwalior	0.67
	Indore	0.75
	Sagar	1
Chhattisgarh	Korba	0.75
	Durg	0.92
	Bilaspur	0.86
Punjab	Amritsar	0.58
	Ludhiana	1
	Jalandhar	1
Delhi	South Delhi	0.5
Uttar Pradesh	Moradabad	1.02

Table 6: Intensity of Monitoring

The **Treatment Card Tracker** (TC Tracker) was maintained by survey staff for all the patients in the experiment. This document helped to keep track of patients who received treatment, their TB number, date of start of treatment, their test dates and the entry and exit codes that were assigned to them if they were surveyed. Most of this information was captured from the Treatment Cards maintained by the Operation ASHA CHW and was updated on a regular basis by J-PAL enumerators. The TC tracker data will be used to verify patients against the government records maintained in every city.

4.4) Qualitative interviews with CHWs

We conducted semi-structured qualitative interviews with a subset of CHWs who were part of the experiments on the effects of performance based incentives and biometric technology. In addition, we interviewed TB patients from Operation ASHA centers where the experiments took place. These qualitative interviews of a subset of surveyed CHWs and a sample of current patients were intended to:

- Contribute to survey analysis with respect to the validation of results, the interpretation of statistical relationships, and the clarification of puzzling findings,
- Identify new questions that are pressing and pertinent, which we have capability to empirically explore through the existing datasets.

In this section, we will outline the objectives and methodology utilized for the CHW interviews. A more comprehensive report on the qualitative study is included in Appendix 6.

[12] Calculated as a simple average of total visits made/(total no: of centers*total no: of months of data collection)

Objectives of CHW interviews

The CHW interviews were structured to explore the following themes:

- *Intrinsic motivation of CHWs*
  - Given the limitation in addressing highly abstract concepts such as intrinsic motivation through quantitative surveys, the study was interested in using qualitative methods to understand how exogenously introduced incentives interact with CHWs' level of intrinsic motivation.
- *Effort reallocation or multitasking*
  - The introduction of incentives can lead to a change in priorities for the CHW. The CHW may neglect dimensions of their tasks that are not rewarded by incentives. Thus the study was also interested in understanding if and how the introduction of incentives led to a change in priorities for the CHW.
- *Data misreporting*
  - When incentivized to maintain high patient compliance with the treatment regimen, CHWs might be tempted to underreport the number of pills missed by the patient. While we continue to investigate instances of forgery and data misreporting in our quantitative dataset, we were interested in also utilizing qualitative methods to explore these further.

Study Design

Methods:

Semi-structured interviews were conducted with 45 Operation ASHA CHWs and ex-CHWs. Interviews were conducted in Hindi and Odiya by a Research Associate (RA) and a senior field staff with relevant language competence and previous experiences in the project.

Based on accepted qualitative interviewing techniques and standard ethnographic practices, an interview template was designed for interviewing CHWs around previously mentioned themes of interest, paying special attention to aspects such as question order (non-threatening to risky), nature of questions ("grand-tour" questions, structured questions, hypothetical interaction questions), and inclusion of numerous prompts to probe into open-ended questions.

Interviews were transcribed and translated into English by an experienced consultant. Coding of the transcribed interviews was undertaken using Nvivo and followed the process outlined below:

Coding Process:

1) The coder reviewed 60% of the interviews and accompanying transcripts for quality and consistency.
2) A preliminary coding guide was designed using the pre-defined themes outlined in the CHW interview guide designed by the team prior to the interviews.
3) The first round of coding was done using the preliminary coding guide while keeping the process open to in-situ and open coding.
4) A second round of coding was undertaken to revisit and reorganize codes and categories from the first round. In the second round, the coder analysed the content within each conceptual/thematic node and recoded and reorganized accordingly.
5) A final round of coding and analysis was undertaken to collapse overlapping themes into 3-4 central themes.

Sampling
We sampled from all the CHWs who were part of the biometrics experiment—about half of whom were a part of the incentive experiment and the rest were also under similar incentive scheme to that of our study—and worked in the cities that Op ASHA was still working at the time of the interviews. In order to triangulate our findings from CHW interviews, we sought out and interviewed a small sample of ex-CHWs who had since quit Op ASHA. In total we interviewed 45 current and ex-Op ASHA CHWs across 7 cities.

Location	# of CHW and ex-CHW interviews
Bhubaneswar	2 CHW interviews 1 ex-CHW interview
Bhopal	11 CHW interviews
Delhi	2 CHWs interviews
Durg- Bhillai	2 ex-CHW interviews
Gwalior	9 CHW interviews 1 ex-CHW interviews
Raipur	10 CHW interviews 2 ex-CHW interviews
Sagar	2 CHWs interviews 3 ex-CHW interviews
Total	**45 CHW and ex-CHW interviews**

Table 7: City-wise distribution of CHWs and ex-CHWs interviewed

69% of the CHWs interviewed were male and 31% are female. A large percentage of the participants interviewed belonged to Bhopal, Raipur and Gwalior. 11% of the CHWs interviewed were mobile CHWs who did not operate from a fixed center. 78% of the CHWs were center based. These CHWs split their time between two fixed centers where they alternated days. Patients assigned to center based CHWs typically travel to a designated center where they are administered their medicines. 6.7% of the CHWs in the study sample were hybrid CHWs who operated out of one center and were responsible for an additional catchment area that did not have a center.
Over 94% of the interviewed CHWs were under Op ASHA's new performance based incentive. The incentive structure at the time of the interviews, while informed by the Incentive experiment, was more elaborate than the incentive structure put into place during the experiment. While the major two components of Op ASHA's new performance-pay scheme still were incentive for new patient detection and penalty for patient default, there were new minor components in the scheme that pertained to various aspects of center maintenance. Given the recall issue because of the difference of three to five years from the date of original Incentive experiment and only about half of the original Incentive CHW sample still working for Op ASHA, we did not center our questions around the original experiment and its Incentive scheme. The questions were mostly focused in the present but given the large similarity in the old and new Incentive schemes, the results should apply to the discussions on the experimental incentive schemes.

5) Sample Description and Balance Checks

5.1) Health workers

A total of 105 health workers were enrolled in the study in total across two phases, but the significant turnover rate of health workers created attrition in the experimental

sample. Only 90 stayed for at least a month, and 72 completed the full course of the experiment.

State	City	Number of Health workers enrolled for at least one month
Madhya Pradesh	Bhopal	16
	Jabalpur	18
	Gwalior	13
	Indore	9
	Sagar	4
Chattisgarh	Durg	4
	Korba	4
	Bilaspur	3
Punjab	Ludhiana	4
	Amritsar	1
	Jalandar	1
Uttar Pradesh	Moradabad	6
Delhi	South Delhi	7
TOTAL		**90**

Table 8: Geographical distribution of participating health workers

Table 8 and Figure 4 report the geographical distribution of the 90 health workers who were enrolled for at least a month.

Tables 9 and 10 present summary statistics for the community health workers. The average health worker is 32 years old. A majority (72 percent) of the health workers are males, 41 percent belong to general castes and 80 percent are Hindus. Health workers are well-educated on average: half have spent some time at the university and only 4 percent did not complete class 10. Three quarters of them have some previous work experience, for an average number of 8 years of previous work experience, and 16 percent of them have previous work experience in the social or NGO sector. Only 37 percent of the health workers live in a neighborhood where one of the centers that they operate is located. They mostly live in decent conditions: almost all of them have electricity at their place and two thirds have access to tap water. More than half own land, and 11 percent rent some apartment or house to a third party.

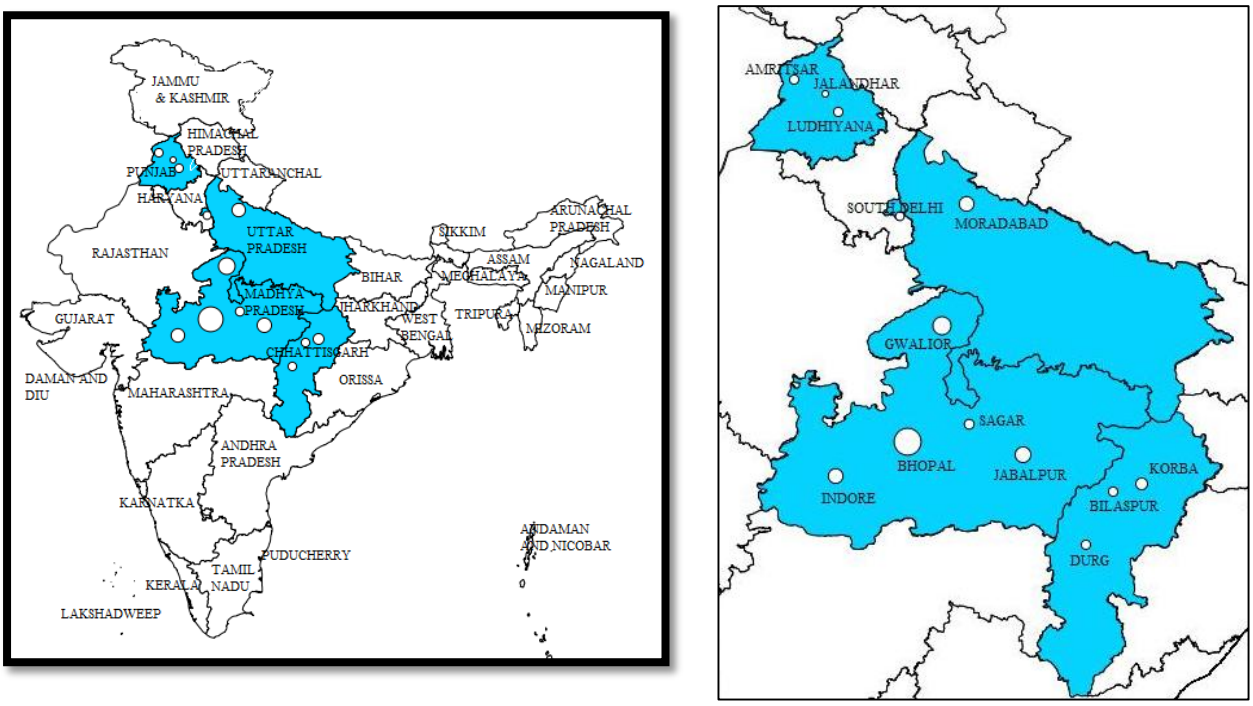

Figure 4: Map of study sites

The differences between the control and treatment groups for the first-phase randomization are significant at the 10 percent level for 4 out of these 22 variables, and they are significant at the 5 percent level for two variables (Table 9). The differences between the control and treatment groups for the second-phase randomization are significant at the 10 percent level for 1 out of these variables (Table 10). Overall, only 5 differences out of 44 are significant at the 10 percent level and 2 are significant at the 5 percent level, in line with what should be expected.

	Control group		Treatment group		*P-value* Treatment = Control	Number of obs.
	Mean	SD	Mean	SD		
Panel A. First-phase randomization						
Male	0.71	0.46	0.73	0.45	0.92	75
Age	32.5	7.4	32.3	8.0	0.92	75
General caste	0.31	0.47	0.53	0.51	0.07	75
Hindu	0.80	0.41	0.78	0.42	0.80	75
Highest education level achieved						
Below class 10	0.03	0.17	0.05	0.22	0.64	75
Class 10	0.11	0.32	0.08	0.27	0.57	75
Class 11	0.03	0.17	0.03	0.16	0.92	75
Class 12	0.29	0.46	0.33	0.47	0.72	75
Professional course	0.03	0.17	0.05	0.22	0.64	75
First year of university	0.09	0.28	0.03	0.16	0.25	75
Second year of university	0.00	0.00	0.13	0.33	0.03	75
Third year of university	0.11	0.32	0.08	0.27	0.57	75
Graduation	0.29	0.46	0.20	0.41	0.39	75
Non formal / adult education	0.03	0.17	0.00	0.00	0.29	75
Work experience						
Any previous work experience	0.74	0.44	0.78	0.42	0.75	75
Number of years of work experience	8.0	7.0	7.1	5.5	0.54	72
Any previous experience in the social / NGO sector	0.06	0.24	0.28	0.45	0.01	75
Lives in one of the areas covered by the centers	0.30	0.47	0.42	0.50	0.31	71
Assets						
Has electricty	0.94	0.24	0.98	0.16	0.49	75
Has tap water	0.77	0.43	0.58	0.50	0.08	73
Rents an apartment or house to a third party	0.11	0.32	0.10	0.30	0.84	75
Owns land	0.51	0.51	0.58	0.50	0.59	73

Notes : For each variable, we report the means and standard deviations in both the control group and the treatment group and indicate the p-value of the difference. The unit of observation is the health worker.

Table 9 - Baseline characteristics of CHWs and balance checks

Results from the qualitative study question assumptions about the kinds of individuals who self-select into such front line health worker jobs. Few CHWs interviewed had any previous experience in the NGO sector or social work. Out of the 45 CHWs and ex-CHWs interviewed, only 7 CHWs had held a job in the NGO sector previous to their joining Operation ASHA. Most CHWs came from diverse professional backgrounds including teaching, private sector jobs, and self-employment.

	Control group		Treatment group		*P-value* Treatment = Control	Number of obs.
	Mean	SD	Mean	SD		
Panel B. Second-phase randomization						
Male	0.64	0.49	0.67	0.47	0.73	76
Age	32.7	6.8	33.0	9.0	0.88	76
General caste	0.33	0.48	0.33	0.47	0.94	76
Hindu	0.73	0.45	0.84	0.37	0.25	76
Highest education level achieved						
Below class 10	0.03	0.17	0.05	0.21	0.72	76
Class 10	0.18	0.39	0.07	0.26	0.14	76
Class 11	0.03	0.17	0.05	0.21	0.72	76
Class 12	0.24	0.44	0.37	0.49	0.23	76
Professional course	0.03	0.17	0.02	0.15	0.85	76
First year of university	0.09	0.29	0.05	0.21	0.45	76
Second year of university	0.06	0.24	0.07	0.26	0.88	76
Third year of university	0.09	0.29	0.07	0.26	0.74	76
Graduation	0.21	0.42	0.21	0.41	0.98	76
Non formal / adult education	0.00	0.00	0.02	0.15	0.38	76
Work experience						
Any previous work experience	0.73	0.45	0.77	0.43	0.69	76
Number of years of work experience	7.2	6.1	9.1	6.6	0.20	73
Any previous experience in the social / NGO sector	0.09	0.29	0.19	0.39	0.25	76
Lives in one of the areas covered by the centers	0.40	0.50	0.40	0.50	0.97	72
Assets						
Has electricty	0.97	0.17	0.98	0.15	0.85	76
Has tap water	0.76	0.44	0.56	0.50	0.07	76
Rents an apartment or house to a third party	0.18	0.39	0.09	0.29	0.26	76
Owns land	0.50	0.51	0.50	0.51	1.00	74

Notes : For each variable, we report the means and standard deviations in both the control group and the treatment group and indicate the p-value of the difference. The unit of observation is the health worker.

Table 10 - CHW characteristics at midline and balance checks for second randomization

At baseline, health workers mentioned three tasks as most common: identifying people potentially infected by TB and verbally telling them to get a sputum exam for detection and treatment (mentioned by 84 percent of the health workers); delivering treatment at the DOTS center (73 percent); visiting patients when they miss a pill (38 percent). Methods for detecting new patients are diverse. 30 percent of CHWs mention that they conduct door to door visits in the neighborhood and identify new patients on the basis of their symptoms. 36 percent answered that they ask neighbors about any sick people and follow their directions. A vast majority of health workers report going to the field every day for this purpose.

Default prevention is done through information sharing, direct follow-up and referrals to other healthcare providers. Half of the health workers report advising new patients about treatment adherence at the center, while one fourth report doing so at the patient's house. In addition, 28 percent of the health workers report calling patients who have missed a pill on their phone. Finally, when a patient misses pills for a period longer than a month, 29 percent of health workers report going to their house and counselling them personally while 21 percent inform public health workers and ask them to counsel them.

5.2) Health worker attrition

The experiment faced attrition during both phases of the experiment. While a total of 105 health workers were enrolled in the study, only 90 stayed for at least a month, and 72

completed the full course of the experiment. While the attrition was large, from the Panels A and B of Table 11 we see that attrition was not differential between treatment and control in either phase.

From Table 12, Panel A we see that 4 out of 15 key socio-demographic variables show significant difference between attritors and non-attritors in the Detection Phase. In Panel B however only one variable shows significant difference between attritor and non-attritor sample in the default phase. Even though we cannot conclude that the sample of attritors is random especially in Phase 1, the internal validity of the study should nonetheless be preserved given that we do not see any significant impact of either of the intervention phase on attrition.

	(1)	(2)	(3)
	CHW left the experiment during intervention		
Panel A. Impact of DETECTION incentives (1st stage)			
Treatment	-0.028	-0.019	-0.082
	(0.088)	(0.086)	(0.091)
City fixed effects		Yes	Yes
Health worker controls			Yes
Observations	78	78	73
R-squared	0.001	0.058	0.168
Mean in control group	0.194	0.194	0.194
	(4)	(5)	(6)
Panel B. Impact of DEFAULT incentives (2nd stage)			
Treatment	0.014	0.013	-0.021
	(0.093)	(0.092)	(0.088)
City fixed effects		Yes	Yes
Health worker controls			Yes
Observations	77	77	74
R-squared	0.000	0.082	0.185
Mean in control group	0.200	0.200	0.200

Note: Robust standard errors are in parenthesis. ***, **, * indicate significance at 1, 5 and 10%. We take a health worker as the unit of observation and include all health workers.

The health worker controls include the number of years of previous work experience and dummies indicating the health worker's education level, whether he has any prior work experience at all, and if so, whether it was in the social sector, and whether he lives in a neighborhood where one of the centers he operates is located.

Note that 3 CHWs in Panel A regressions and 1 CHW in Panel B did not have any baseline but were randomized and thus included in the attrition regressions.

Table 11: Impact on attrition[13]

[13] Note that the change in number of observations moving from Col 2 to Col 3 and Col 5 to Col 6 respectively is because of the missing control variables.

	Mean in non-attritor sample (SD)	Mean in attritor sample (SD)	Difference between attritor and non-attritor sample (s.e.)
Panel A: First Phase randomization (DETECTION)			
	(1)	(2)	(3)
Male	0.710	0.846	0.123
	(0.458)	(0.376)	(0.096)
Age	32.77	31.23	-2.140
	(7.571)	(8.447)	(2.137)
General caste	0.387	0.769	0.333
	(0.491)	(0.439)	(0.128)***
Hindu	0.758	0.923	0.164
	(0.432)	(0.277)	(0.061)***
Highest education level achieved			
Class 12 and below	0.548	0.308	-0.262
	(0.502)	(0.480)	(0.144)*
Some tertiary education	0.387	0.538	0.193
	(0.491)	(0.519)	(0.149)
Other diploma/prof. course	0.0645	0.154	0.069
	(0.248)	(0.376)	(0.071)
Work experience			
Any previous work experience	0.774	0.769	0.011
	(0.422)	(0.439)	(0.119)
Number of years of work experience	7.676	6.590	-1.163
	(6.314)	(6.203)	(1.904)
Any previous experience in the social/NGO sector	0.161	0.154	0.026
	(0.371)	(0.376)	(0.088)
Lives in one of the areas covered by the centers	0.387	0.231	-0.123
	(0.491)	(0.439)	(0.127)
Assets			
Has electricity	0.968	0.923	-0.062
	(0.178)	(0.277)	(0.060)
Has tap water	0.710	0.545	-0.236
	(0.458)	(0.522)	(0.138)*
Rents an apartment or house to a third party	0.0968	0.154	0.056
	(0.298)	(0.376)	(0.103)
Owns land	0.500	0.692	0.146
	(0.504)	(0.480)	(0.124)
Observations	75	75	75

Note: In col 3, we report the difference between the attritor and non-attritor sample as obtained from the OLS regression controlling for city fixed effects; robust standard errors are in parentheses.

	Mean in non-attritor sample (SD)	Mean in attritor sample (SD)	Difference between attritor and non-attritor sample (s.e.)
Panel B: Second Phase randomization (DEFAULT)			
	(1)	(2)	(3)
Male	0.633	0.750	0.158
	(0.486)	(0.447)	(0.111)

Age	33.25	31.56	-1.555
	(7.736)	(9.359)	(2.321)
General caste	0.317	0.375	0.060
	(0.469)	(0.500)	(0.136)
Hindu	0.767	0.875	0.074
	(0.427)	(0.342)	(0.074)
Highest education level achieved			
Class 12 and below	0.583	0.563	-0.069
	(0.497)	(0.512)	(0.131)
Some tertiary education	0.367	0.313	-0.039
	(0.486)	(0.479)	(0.123)
Other diploma/prof. course	0.0500	0.125	0.107
	(0.220)	(0.342)	(0.090)
Work experience			
Any previous work experience	0.767	0.688	-0.095
	(0.427)	(0.479)	(0.123)
Number of years of work experience	7.893	9.150	1.384
	(6.051)	(7.828)	(2.087)
Any previous experience in the social/NGO sector	0.150	0.125	0.007
	(0.360)	(0.342)	(0.097)
Lives in one of the areas covered by the centers	0.417	0.250	-0.136
	(0.497)	(0.447)	(0.123)
Assets			
Has electricity	0.967	1.000	0.021
	(0.181)	(0.000)	(0.022)
Has tap water	0.650	0.625	-0.034
	(0.481)	(0.500)	(0.129)
Rents an apartment or house to a third party	0.0833	0.313	0.212
	(0.279)	(0.479)	(0.114)*
Owns land	0.483	0.563	0.044
	(0.504)	(0.512)	(0.121)
Observations	76	76	76

Note: In col 3, we report the difference between the attritor and non-attritor sample as obtained from the OLS regression controlling for city fixed effects; robust standard errors are in parentheses.

Table 12: Attrition check

5.3) Patients

A total of 2760 patients were surveyed or attempted to be surveyed, representing all TB patients detected and enrolled in the areas placed by the Government under the responsibility of Operation ASHA. Table 13 provides a description of the socio-demographic characteristics of those patients. Men and women are almost equally represented, although there is a slight majority of men (57.7 percent). They belong to the most deprived castes in India: The Scheduled Castes, or Dalits (26.6 percent) and Other Backward Classes (40.2 percent). Only less than 20 percent belong to the better-off General category, which does not receive any government benefit. By comparison, 41 percent of health workers reported belonging to a caste classified under the General category. Patients are 76.1 percent Hindu.

Gender (n=2748)	%	Education (n=2723)	%
Female	42.3	No school	21.6
Male	57.7	Some primary	36.0
		Primary completed	8.6
Caste category (n=2580)	%	Secondary (completed or not)	22.4
General	19.6	Pre-university or more	11.4
OBC	40.2		
SC	26.6	**Size of household (n=2710)**	
ST	7.0	Mean	5.0
Minority	6.6	St Dev	3.4
		Median	4
Religion (n=2759)	%		
Hindu	76.1	**Migration status (n=2760)**	%
Muslim	21.7	Always lived here	59.2
		Lived here for more than 10 years	8.3
Other	2.2	Lived here for 6 to 10 years	9.1
Literacy (n=2757)	%	Lived here for 1 to 5 years	15.8
Cannot read or write	66.6	Lived here for less than a year	7.6
Can read and write	30.0		
Can read but not write	3.5		

Table 13 - Socio-demographic characteristics of patients

More than half of the sample has either never been to school or has stopped before completing primary school. Two thirds are illiterate according to their own reporting. Patients come from households of 5.5 individuals on average, although the large standard deviation and the large difference between the average and the median sizes point to the existence of a fraction of very large households in our sample. The majority of patients have been living in their community ever since they were born, but a sizable share of about a quarter (23.4 percent) are recent migrants who report living in the area for less than 5 years.

A large number of TB patients in the study sites have had early exposure to TB (see Table 14). Almost half of them (46.1 percent) report having seen at least one family member infected by TB since they were born. In 22 percent of cases, patients themselves had already had TB in the past, more than once for a small share but significant number of them (85 individuals). Three quarters of patients (73 percent) declare having received the BCG vaccine that protects them against TB, and the enumerators were indeed able to observe the mark left on their arm in a vast majority of cases.

Vaccinated against BCG (n=2437)	%	If yes, how many times (n=621)	%
No	25.1	1	86.3
Yes	73.2	2	8.5
Received unknown vaccine	1.8	3+	5.2
		Number of family members who had TB since respondent born	
If vaccinated, mark visible (n=1820)	%	**(n=2729)**	%
No	15.0	0	53.9
Yes	82.6	1	29.8
Will not show	2.4	2	9.9
		3+	6.4

Has previously had TB (n=2752)	%
No	77.3
Yes	22.7

Table 14 - Past exposure to TB

So as to understand the healthcare practices of the patients, a number of questions were asked about the last time they went to consult for a health-related problem. As Table 15 reports, about 500 patients reported seeking healthcare in the past three months. In spite of their lack of resources, they chose to consult at a private facility in two thirds of the cases – either a private doctor (more than 40 percent of consultations) or a private hospital. Only a quarter of all consultations were done using the public health system, be it a Government hospital or a Government doctor.

Have you consulted in the past 3 months? (n=2760)	%
No	81.92
Yes	18.08
What facility did you go to? (n=499)	%
Private doctor	41.88
Private hospital	23.45
Govt. referral hospital	14.23
Govt. doctor	12.02
Other	8.41
Received… (n=470)	%
Medications	92.18
An injection	39.57
A drip	17.02
Average amount spent (n=499)	Rs
Median	180
Average	595

Table 15 - Past medical consultations

In almost all cases, patients were prescribed or received medications during that consultation. In line with previous studies on healthcare in India, a large number of them also received an injection (almost 40 percent), while 17 percent were given a drip. The median amount spent on the consultation and associated treatment purchased is very large at 180 Indian rupees (seven to ten times the price of a basic meal). The average amount is even much larger, driven by a small number of extremely high expenses.

6) Results

This section discusses the main findings obtained so far. We first present the impact of the incentives on the outcome that was rewarded: the number of newly detected patients (in phase 1) and the number of defaulting patients (in phase 2). In addition, we measure the impact of the incentives on the outcome that was NOT rewarded (the number of defaulting patients in phase 1 and the number of newly detected patients in phase 2) but may also have been affected. For instance, the CHWs may have decreased their effort on alternative dimensions of their work that were not rewarded by the incentives, due to

multitasking. We then discuss possible interpretations of the impacts on detections and defaults, using additional data collected in the CHW and patient surveys. Finally, we estimate the impact of the incentives on job satisfaction in both phases.

6.1) Impact of detection-based incentives on detections (phase 1)

To estimate the impact of detection-based incentives on detections, we use the following OLS specification:

$$D_{i,t} = \alpha + \beta T_i + X_i'\lambda + \sum_c \delta_c^i + \varepsilon_{i,t}$$

where $D_{i,t}$ is the number of new detections in month t in the treatment centers operated by health worker i, T_i is a dummy equal to 1 if worker i receives phase 1 detection incentives and 0 otherwise, δ_c^i are city fixed effects (the level of stratification), and X_i is a vector of health worker characteristics. X_i includes the number of years of previous work experience and dummies indicating the health worker's education level, whether he has any prior work experience at all, and if so, whether it was in the social sector, and whether he lives in a neighborhood where one of the centers he operates is located. The key coefficient of interest is β, which estimates the differential number of detections made by health workers in the treatment group, compared to the control group. In this and all other regressions, we adjust standard errors for clustering at the health worker level since the randomization was conducted at this level. The results reported below are very similar to those using a count model, instead of the OLS model, with a Poisson regression.

The results from Equation [1] are presented in Table 16, Panel A, columns 1, 2 and 3. On average, the incentives increased the number of new detections by 1.58 each month (24.1 percent). This effect is statistically significant at the 10 percent level. It is robust to including city fixed effects and the health worker control variables: we then find an increase of the number of new detections by 2.18 (33.2 percent), significant at the 5 percent level. The magnitude of the effect is large, especially given the modest size of the incentive amount.

	(1)	(2)	(3)	(4)	(5)	(6)
	Number of detections			Number of defaults		
Panel A. Impact of DETECTION incentives (1st stage)						
Treatment	1.58	1.41	2.18	0.08	0.06	0.07
	(0.90)*	(0.79)*	(0.95)**	(0.04)**	(0.03)**	(0.04)*
City fixed effects		Yes	Yes		Yes	Yes
Health worker controls			Yes			Yes
Observations	507	507	426	476	476	439
R-squared	0.03	0.10	0.19	0.01	0.11	0.12
Mean in Control Group	6.56	6.56	6.56	0.08	0.08	0.08
Panel B. Impact of DEFAULT incentives (2nd stage)						
Treatment	-0.67	-0.51	0.61	-0.04	-0.02	-0.01
	(0.97)	(0.97)	(0.81)	(0.06)	(0.07)	(0.06)

City fixed effects		Yes	Yes		Yes	Yes
Health worker controls			Yes			Yes
Observations	181	181	157	340	340	311
R-squared	0.01	0.11	0.37	0.00	0.02	0.09
Mean in Control Group	7.56	7.56	7.56	0.21	0.21	0.21

Notes: Clustered standard errors are in parentheses. ***, **, * indicate significance at 1, 5 and 10%. We take a health worker × month as the unit of observation and include all health workers. Panel A reports the impact of detection incentives (1st stage) on the number of newly detected patients in the month and the number of defaults in the month. These two outcomes are administrative data reported on the centerwise summary sheets, month after month. Panel B reports the impact of default incentives (2nd stage) on the same two outcomes.
The health worker controls include the number of years of previous work experience and dummies indicating the health worker's education level, whether he has any prior work experience at all, and if so, whether it was in the social sector, and whether he lives in a neighborhood where one of the centers he operates is located.

Table 16 - Impact of incentives on the number of detections and defaults[14]

While Table 16 estimates the overall impact of incentives, averaged over all months, Figure 5 shows the average number of newly detected patients per CHW month by month, separately for the treatment and control groups, and starting with the first month following the randomization. Interestingly, the effect of incentives on detection only manifests itself from month 4 onwards, suggesting that it takes some time for CHWs to adapt their efforts to the incentive scheme. An alternative interpretation is that the returns of efforts increasing detection only occur after a few months.

[14] The city-fixed effects control is added to all the regressions to account for the differences in base salary and incentive figures across cities.

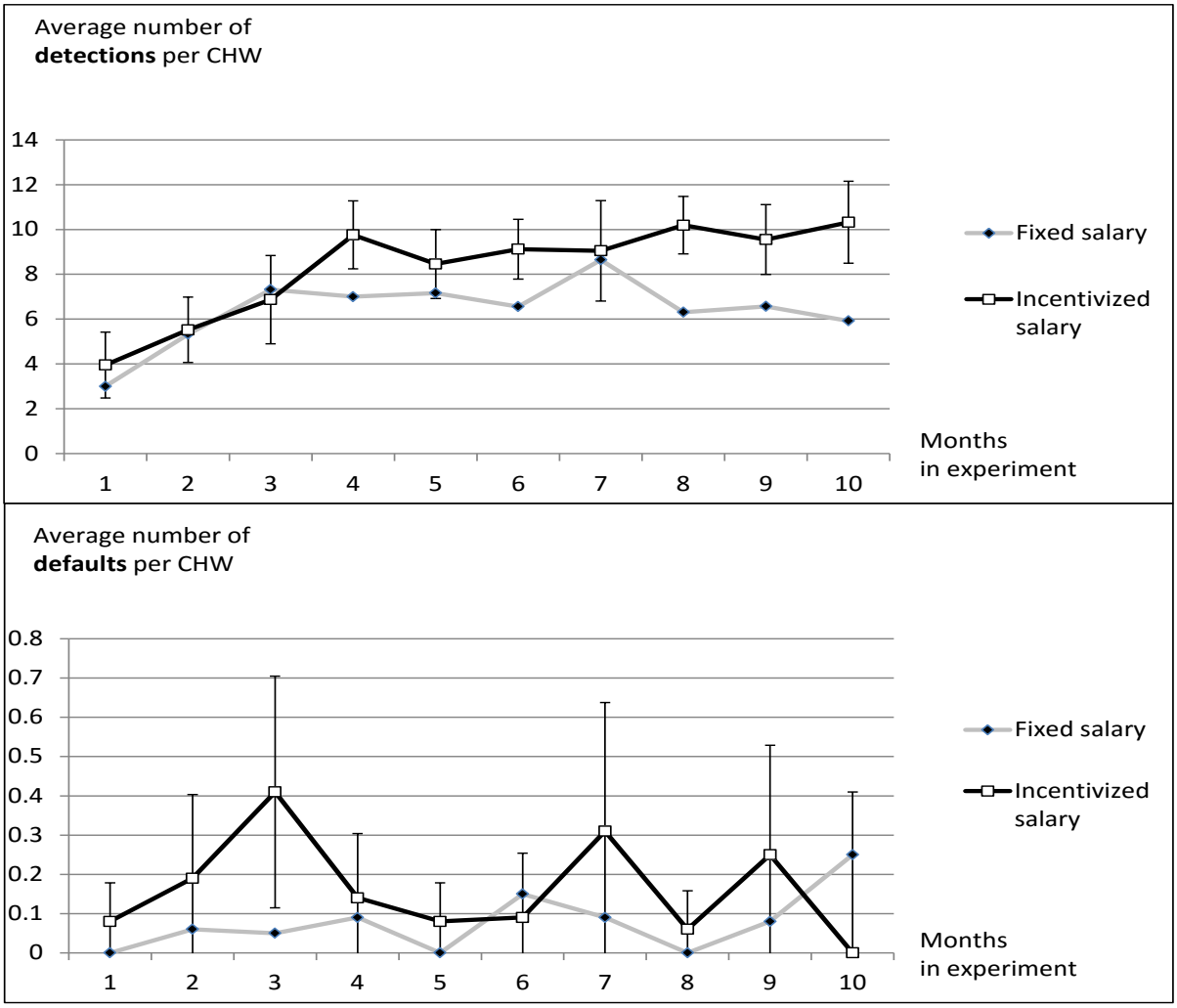

Figure 5: Average monthly number of detections and defaults

6.2) Impact of detection-based incentives on defaults (phase 1)

To estimate the impact of detection-based incentives on defaults, we estimate Equation [1], using the number of defaults as the outcome. Columns 4, 5 and 6 of Table 16, Panel A report the results. Strikingly, we find that the number of defaults was significantly larger among treated CHWs: the detection incentives led to an increase in defaults by 0.08 per month (100 percent), an effect statistically significant at the 5 percent level and robust to including city fixed effects and the health worker control variables.

As for the number of detections, Figure 5 shows the average number of defaulting patients per CHW month by month, separately for the treatment and control groups. We do not find any clear trend over time.

6.3) Impact of default-based incentives (phase 2)

Phase 2 incentives were computed based on the number of defaults that occurred in the health workers' centers within the month. For phase 2 interpretations, we estimate Equation [1], using the number of detections or defaults as the outcome, and redefining T_i as a dummy equal to 1 if i receives phase 2 default incentives and 0 otherwise. The results are shown in Table 16, Panel B. We find that phase 2 incentives affected neither

the number of detections nor the number of defaults: the estimates are small and not statistically significant at the standard levels. This result is robust to the inclusion of city fixed effects and health worker control variables.
Qualitative information points to the low returns to efforts on default prevention as a possible interpretation of this result. Most CHWs felt that default prevention required more investment of resources and that despite their efforts they had limited control over patient's behavior. A CHW expressed the disproportionate effort required to keep patients in treatment: "Default, missed doses, we have to work harder. (…) If a patient does not come in the morning, then we have to go to his home in the afternoon and if he is still not available, then we have to go back in the evening, 3-4 trips for one patient". Another CHW illustrates the same point: "Missed dose, default, death… how is that our fault? Is that our fault? Patient does not eat the medicine regularly, on top of that if the patient indulges in other harmful behavior like drinking alcohol, 'nasha pati'… it's unfair to penalize us for this".
The quantitative and qualitative results suggest that incentives in the second phase were based on an outcome that was either unaffected by CHWs' effort level, or perceived to be so. This may explain why the default-based incentives did not translate into any significant change in outcomes.

6.4) Interpretation of the detection-based incentives' impact

We now discuss three possible interpretations for the fact that detection-based incentives increased defaults at the same time as they increased detection: multi-tasking, patient selection, and forgery.

Multi-tasking

In the first phase, the salary of incentivized health workers was computed solely based on the number of detections they made: the number of defaulting patients in their centers was not taken into account. To the extent that the incentives encouraged the health workers to increase their effort and time spent detecting new patients, they may have conversely reduced their efforts to ensure treatment compliance, explaining the increased number of defaulting patients. This interpretation is in line with predictions from principal-agent models in a work environment characterized by multitasking.
To provide more direct evidence on health workers' efforts, we built five indices on their self-reported activities, using their answers to our midline and endline surveys. Table 17 defines these indices and Table 18 shows the results.

Effort on detection	
Quantitative: • number of sputum samples of TB suspects sent to the lab, • number of days spent detecting new patients	Qualitative: • diversity of methods used to detect new patients, • diversity of actions undertaken with a TB suspect, etc.
Effort on default	
Quantitative: • number of days spent visiting ongoing patients	Qualitative: • extra-medicine provided to weak patients

	• diversity of cases in which visits the patient at home, etc.
Overall effort: • Time spent working on a daily basis	

Table 17 - Indices of multitasking

From Table 18, we can see that there is some suggestive evidence of multitasking in response to default incentives but not to detection, which provides partial support to our hypothesis.

Qualitative interviews with CHWs indicated that they use a mix of strategies for patient detection which include not just door to door detection but also referrals from current or past patients, referrals from the District Microscopy Center (DMC), and patients coming to get tested on their own accord. While most CHWs identified door to door detection during 'field visits' or 'counseling visits' as their primary method, most relied on more than one avenue for new detections. For CHWs who were more established in the communities in which they were working, referrals from past or current patients often resulted in new referrals. For established CHWs, patients also often came on their own to the center to get tested. Such CHWs reported having invested time upfront in establishing themselves as DOTS providers in their catchment areas so that they didn't need to "work very hard" at finding new patients. Given that most CHWs relied on a diversity of methods to find new patients, some of which do not require as much effort on their end, lends support to quantitative findings that show lack of evidence for multitasking in response to detection incentives.

	(1) Overall effort	(2) Effort toward detection, quantitative	(3) Effort toward detection, qualitative	(4) Effort toward default, quantitative	(5) Effort toward default, qualitative
Panel A. Impact of DETECTION incentives					
Treatment	-0.18	-0.10	0.01	-0.09	0.06
	(0.14)	(0.21)	(0.10)	(0.21)	(0.09)
City fixed effects	Yes	Yes	Yes	Yes	Yes
Obs	78	78	78	78	78
R-squared	0.41	0.41	0.42	0.19	0.37
Panel B. Impact of DEFAULT incentives					
Treatment	0.29	-0.33	0.13	0.09	0.16
	(0.12)**	(0.19)*	(-0.12)	(-0.15)	(0.10)*
City fixed effects	Yes	Yes	Yes	Yes	Yes
Obs	77	77	77	77	77
R-squared	0.53	0.46	0.22	0.60	0.40

Table 18 - Impact of 1st phase Incentives on multitasking

In qualitative interviews, CHWs often spoke about their complex interactions with other health workers as well as the larger RNTCP district level hierarchy within which they are embedded. Some CHWs spoke of difficult interactions with TBHVs (government DOTS workers) who represent greater competition for patient referrals from the DMC. CHW interactions with other frontline health workers, DMC staff and TBHVs highlight that

detection and default prevention activities are not undertaken in isolation from the larger RNTCP structure and its operational politics. Furthermore, while CHW interactions with these actors varied both in terms of frequency and intensity, they bring attention to the need to further investigate the dynamics between overlapping front line health workers (public, private and NGO) as well as across the RNTCP hierarchy and how these dynamics shift with the introduction of incentives.

Patients' selection

An alternative interpretation for the impact of detection-based incentives on defaults is that the additional patients recruited by the health workers who received incentives may have been different. To the extent that incentivized health workers put more effort into detection, they may have been able to reach out to marginalized patients that were less likely to get detected on their own, but also more likely to default once they had started the treatment. As an indirect test for this hypothesis, we estimate a selection equation to compare the characteristics of patients detected by incentivized and non-incentivized CHWs. The results are shown in Table 19.

	SC	ST	No school	Distance from patient's home to center	Hindu	Has lived here > 10 years	Patient and CHW have same religion	Patient and CHW speak hindi at home
CHW gets detection-based incentives	-0.065	0.01	0.043	-0.084	0.228***	0.076*	-0.082	-0.008
	(0.06)	(0.02)	(0.03)	(1.08)	(0.06)	(0.03)	(0.09)	(0.08)
CHW controls, city fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
Observations	1095	1095	926	903	1088	1095	1088	1095
R-squared	0.061	0.083	0.094	0.102	0.243	0.166	0.264	0.147
Mean in Control Group	0.26	0.08	0.22	21.42	0.76	0.06	0.75	0.41

Table 19 - Impact on patient selection

We do not find any empirical support for this interpretation: patients detected by CHWs who received detection incentives do not seem more marginalized or vulnerable: they are not more likely to live far away from the treatment centers and they are not more likely to belong to scheduled casts or scheduled tribes. If anything, they are more likely to be Hindus and, thus, to belong to the religious majority. When asked about their detection strategies during qualitative interviews, none of the CHWs indicated targeting specifically vulnerable communities (such as Scheduled Caste/Tribes communities) for detection even though they highlighted a range of detection strategies such as door-to-door outreach and contact-tracing.

Forgery

A last possible interpretation is that incentivized health workers made up fake patients to increase their salaries, and that these made-up patients were later reported as defaulters, as they never showed up to take initial and follow-up sputum tests in the public hospitals. Ongoing analysis will test this interpretation by comparing data reported by the NGO to data from public TB registers.

We also sought to explore this hypothesis qualitatively in interviews with current and ex CHWs. While most CHWs provided perfunctory responses to questions on data forgery and misreporting, some (mostly ex-CHWs) did elaborate on specific instances. They cited

the pressure to meet targets for detection coupled with the collusion between DMC staff and his colleagues. For one ex-CHW, the performance based pay structure created unattainable expectation from management and opportunities for collusion that adversely affected his motivation to "help people" and ultimately his desire to continue working at Op ASHA. Two other ex-CHWs also elaborated on instances of patient data falsification in collusion with DMC staff.

While some of the testimonies may suggest that incentivising patient detection created an incentive for CHWs to trick the system (registering fake patients, colluding with DMC staff, submitting someone else's sputum for lab tests), the evidence is not conclusive given the sensitive nature of the topic and the unwillingness of most CHWs to elaborate on this topic. Given that only few CHWs spoke about data forgery and misreporting (and those who did were largely vague about citing specific instances), it is difficult to assess the magnitude of these issues from the available qualitative data. Furthermore, since the ex-CHWs were more open about this line of investigation, it is plausible that CHWs may have feared negative repercussion of divulging information related to data misreporting or forgery.

6.5) Impact on job satisfaction

We finally estimate the impact of incentives on job satisfaction in both phases. Job satisfaction is defined as a standardized index aggregating CHWs' answers to multiple survey questions, each of which directly or indirectly indicated the CHW's satisfaction with some crucial part of her work. The indicators, which were equally weighted in the index, were: CHW's overall satisfaction with job, whether the CHW believes that she is being sufficiently compensated for work, her overall satisfaction with the salary scheme, preference for an alternate salary scheme over the current one, whether the CHW recommended the job to anyone in the past six months, whether she believes that her detection efforts are effective, and whether she believes that her default efforts are effective (only used in 2nd phase). As shown in Table 20, the incentives decreased health workers' satisfaction by about 0.25 standard deviations in both phases. Our estimates are significant at the 5 or 10 percent level, depending on the specification.

	(1)	(2)	(3)
	Job satisfaction index		
Panel A. Impact of DETECTION incentives			
Treatment	-0.24	-0.25	-0.27
	(0.11)**	(0.11)**	(0.14)*
City fixed effects		Yes	Yes
Health worker controls			Yes
Observations	78	78	68
R-squared	0.06	0.23	0.41
Panel B. Impact of DEFAULT incentives			
Treatment	-0.17	-0.20	-0.28
	(0.12)	(0.11)*	(0.14)*
City fixed effects		Yes	Yes
Health worker controls			Yes
Observations	77	77	69
R-squared	0.03	0.26	0.38

Table 20 - Impact on health workers' satisfaction

Qualitative interviews with CHWs lend further support to these findings as most CHWs expressed preference for a fixed salary structure rather than one based on incentives. However, their dissatisfaction with the incentivized pay structure was directed largely at 'default' based incentives rather than 'detection' based incentives. While the amount of base salary and detection incentives did play a role in the level of satisfaction CHWs felt at work, most were dissatisfied with their salaries being linked to default prevention because they had little control over patient's behavior, leaving less room for their efforts to translate into performance.

Aside from incentives, CHW job satisfaction was also tied to their level of satisfaction with program management, the topic that the CHWs repeatedly brought up during the qualitative interviews. Many CHWs identified pressure from program managers to meet targets for detection as their primary grievance. In many cases the pressure to detect new patients was tied to threats (real or perceived) of job loss. Some CHWs also voiced grievances against program staff management for making ad hoc deductions on their salary. Grievances regarding reimbursable job inputs such as travel conveyance and mobile allowances emerged as another key point of discontent. As one CHW put it, "sometimes we spend more than we earn on the patients." Many CHWs reported spending money out of their own pockets for patients not just in the detection phase where they would "give money for HIV test, blood test, sugar test" but also in the treatment phase where they would "spend much more than [the designated mobile allowance of Rs. 200] on patients to keep calling them to make sure that they come and take their medicine."

One aspect that emerges from the CHW testimonies on job satisfactions pertains to the emotional labour that they felt was being undercompensated. As one CHW put it: "there should be a focus on the CHW as he is coordinating with the patient. Sometimes they have problems in the field...like a patient not willing to take medicines, or even wanting to die and the CHW deals with that, so he should be provided with some kind of support. Salary given to ground workers is so less that even if they want to do something for the patient, they cannot with such less salary". Another CHW, while taking a less optimistic view on

the CHW-patient relationship, echoes similar sentiments when stating that "at one point they (the patient) just becomes dependent on us and says now you (the CHW) will have to take me…you take us to the doctor, you get us checked…they start depending on us a lot and they trouble us till the end".
It appears that the negative impact of performance-based incentives on job satisfaction may reflect the difficulty in preventing defaults, but also the added pressure in a job that most already perceive as emotionally draining and financially undercompensated.

6.6) Qualitative insights on CHW intrinsic motivation

Over 77% of the CHWs identified the desire to do social service as one of the reasons behind their decision to take up the job at Operation ASHA during baseline. Most CHWs initially identified the social service aspect of the job as the reason for taking up or continuing working for Op ASHA during the qualitative interviews as well. However, upon following up, for many of these CHWs the desire to engage in social service was also tied to the convenience it afforded them to work in their own communities. One CHW explained that her decision to join Operation ASHA was motivated by the fact that she could get paid to administer treatment to TB patients, something that she was already doing for a distant relative suffering from TB. She was informed by a TBHV that "there is an NGO that will pay for the same work" that would allow her to "keep doing her daily chores and the patients would come and take their medicines".
For most CHWs, the motivation to work as TB CHWs seemed to stem from more practical considerations. This information stood in contrast to the quantitative survey where only 29% of mentioned taking job at Op ASHA for regular income, 9% mentioned the "convenience" aspect of the job, and only 2% mentioned taking this job because it was well-paid. For one CHW who was working in the evenings at his family owned business, the decision to work at Operation ASHA was driven by the need to supplement his income. Similarly, for another CHW who was completing his studies concurrently, the decision to work was motivated by the need to "gain some experience". He added that he would continue working at Operation ASHA if he gets a better position upon graduating otherwise he would be compelled to look for another job. Many other CHWs highlighted reasons centered around convenience—such as geographical proximity to their spouse/family and lack of better work opportunities—that led to their decision to work at Operation ASHA.
Once the CHWs dispensed the socially desirable answers regarding their motivation for work, with minor probing most opened up with practical reasons on their taking up and continuation in this line of work. The qualitative finding that in most cases the supposed "intrinsic" motivation was coupled with other practical considerations suggests that the idea of intrinsic motivation is rather complex in a resource-limited setting and requires more sophisticated investigation.

7) Cost Effectiveness of the Incentive Schemes

The incentives scheme is a performance-based payment linked to final outcomes. The cost per additional detection corresponds to the amount of monetary incentive provided to the health worker, as reported in Table 2. The management costs for administering this scheme are negligible since the implementing agency tracks the number of patients detected and the number of defaults, which is now further facilitated by the introduction

of biometric technology called "e-Compliance" at most of the Op ASHA field sites. Given that we observed a significant positive impact of the detection based incentive, the design of the scheme would have made the cost-effectiveness of the intervention straightforward had we not also observed a significant simultaneous increase in default. However, given this double-edged impact, the cost effectiveness of the scheme is uncertain overall. Measuring the relative costs of each detection and default is beyond the scope of the study. We thus cannot conclude on the overall cost-effectiveness of the intervention.

8) Summary of the main results and policy implications

8.1) External validity

The study provides insights into the effectiveness and structure of monetary incentives in improving health sector outcomes. Given that our study covered multiple states and cities across Northern India and included CHWs of varied types (such as fixed center-based workers as well as mobile workers), we expect the study to have high scope. Few limitations of the scope of the study are:

1. The study only covered urban slums in Northern India.
2. The CHWs were only responsible for TB treatment under DOTS.

While the precise results may not entirely hold under different contexts, we do not have any strong reason to question the general external validity of the study.

8.2) Key results

Results from the experiment point to a significant increase of reported detections induced by the provision of detection-based incentives in the first phase. However, the number of defaults also increased over the same time period. Health workers' survey answers suggest that this could be due to health workers reallocating their effort towards the rewarded task (early detection) and to the detriment of other non-rewarded activities (treatment compliance), in line with the multitasking theory. There is no detectable impact of the default-based incentives introduced in the second phase.

8.3) Policy implications

Findings point to the following policy implications:

1: Performance-based incentives may be an efficient tool for boosting key health worker performance indicators and improving health outcome. Introducing detection-based incentives led to a considerable jump in the number of new cases detected, with immediate impacts on the lives of patients and their families and communities. This was achieved at a minimal cost since payment is only made against results.

2: Performance-based incentives may not be effective in improving all outcomes. While introducing performance-based incentives increased the number of new patient detections in the first phase, it did not have a detectable impact in reducing the number of defaults in the second phase. Since, treatment defaults are among the major challenges to TB eradication and lead to drug resistant forms of the disease, effective ways to motivate and incentivize the health workers should be investigated in further detail.

3: Performance-based incentives may have undesired impacts on other outcomes. While introducing performance-based incentives increased the number of new patient detections in the first phase, it simultaneously increased the number of defaults. Health

workers appear to have reallocated their effort towards the incentivized activity, to the detriment of other important tasks. Incentives should be structured accordingly.
Furthermore, an additional insight that we gathered from the qualitative interviews may also be of importance to policy makers:

Performance-based incentive should be designed keeping in mind competing and comparable schemes. During the qualitative interviews, we found that there were new government incentive schemes that interacted with the institutional incentive put in place by Op ASHA (post the Incentive experiment). In 2014, RNTCP introduced an incentive scheme for DOTS providers under which a provider could claim Rs. 1000 flat incentive for each patient treatment completion for new patients (CAT I) and Rs.1500 in the case of relapse patients (CAT II). CHWs, especially from Bhopal, were acutely aware of this incentive structure, which created them to question the institutional incentive (which was a fraction of the government incentive, even though Op ASHA also provided base salary and other benefits that the government DOTS providers were not entitled to). From an implementation perspective, this is an important finding since incentive schemes are often thought of as operating in isolation with little attention given to how they interact with other competing and comparable schemes and how information about competing incentive schemes can impact CHWs' overall motivation and job satisfaction.

While incentive schemes that reward a clearly measurable aspect of a health worker's task can be an effective way to boost performance in that particular aspect, one also needs to understand its impact on behavioral responses of workers who have multiple tasks and a great amount of control over their effort allocation and performance reporting.

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Appendix 1: Comparison with Local Incentives Schemes

Various incentive schemes have come into existence in the recent years in India, which focus on mainly two aspects to tuberculosis treatment: new case finding and patient treatment adherence. Some of these schemes are summarized below, most of which are in place to incentivize the health provider.

Overview of different incentive schemes:

Incentive for the DOTS providers under RNTCP[15]

Until 2014, RNTCP had a provision of a flat cash incentive of Rs.250 for DOTS providers for each patient treatment completion. This incentive sum was recently revised so that under the new scheme a DOTS provider could claim Rs.1000 flat incentive for each patient treatment completion for new patients (CAT I) and Rs.1500 in the case of relapse patients (CAT II). In the case of MDR patients, while previously the DOTS provider could claim a bulk sum of Rs.2500 per treatment completion, now the provider can claim Rs.2000 at the end of Intensive phase and Rs.3000 additional at the end of Continuation Phase.

Incentive for patients under RNTCP[16]

To encourage treatment adherence in tribal population, RNTCP has a special provision for tribal areas where a patient can claim a flat incentive of Rs.250 after satisfactory treatment completion under DOTS.

Incentive for the private health care providers under an RNTCP supported program[17]

RNTCP in collaboration with multiple NGOs in Mumbai ran a program in which private providers were encouraged and incentivized to take up the DOTS provider role in their community. However, the incentives were non-cash and included access to continuing medical education free of charge, access to free sputum microscopy and free drugs for referred patients. Since the private providers (PPs) charge consultation fee in either case, provision of free government drugs and services would allow the PPs to retain the patients. The collaboration led to a 40% increase in case detection, without adversely affecting key post-detection outcomes such as treatment success rate.

Incentives for ASHA (Accredited Social Health Activist) volunteers[18]

ASHA volunteers under the Government of India's flagship National Rural Health Mission are incentivized to provide a range of services in their community, ranging from immunization of children to referrals of leprosy and treatment of TB cases under DOTS. For each patient who completes DOTS schedule under the volunteer's supervision, the volunteer is eligible for a cash incentive of Rs.250. However, a recent report on incentives for ASHA workers notes chronic delays in payment coupled by lack of clarity over incentivized tasks and the amount of incentives.

Experimental study that linked patients to already existing welfare schemes[19]

One study was carried out in West Bengal that investigated whether linking TB patients to government welfare schemes already in place was associated with treatment adherence and reduction in death rate and default rate. The treatment group in the study had a modest increase in Treatment Success Rate as compared to the comparison group. Besides being essentially non-cash in nature, the scheme is unique in that the incentive

[15] Source URL: http://goo.gl/VFVedG
[16] Source URL: http://tbassnindia.org/APRIL-2014-issue.pdf
[17] Source URL: http://goo.gl/VFVedG
[18] Source URL: http://goo.gl/8thhcm
[19] Source URL: http://medical.adrpublications.com/index.php/JoARM/article/view/31

in this case is not continual since the patients in the treatment group can choose to discontinue the treatment and yet continue to receive welfare benefits.

A randomized trial that incentivizes peer to peer referrals[20]

JPAL-SA is collaborating with Operation ASHA in another randomized trial in which current patients receive various types of cash incentives to make suspect referrals. The project aims to test whether the use of incentives to leverage social networks of current patients outside of their immediate family is a cost-effective strategy to increase testing and detection of TB patients. The project is different from all other incentive schemes in place in that increase in detection will be caused by the activities of patient (referrals) rather than the activities of the health workers. The project is currently in the implementation phase.

The uniqueness of the study's scheme as compared to other schemes:

Two features separate the incentive scheme under study from the other cash incentive schemes for the health workers outlined above:

Balancing risk and incentives: The variable part of the health worker's salary was limited to 25 of the total value, while the fixed part remained 75 percent. The computation of the variable part was performed based on the baseline data. The health workers received the sum ranging from Rs.100 to Rs.220 per patient, the incentive amount varying based on the city they were working. Unlike the flat incentive of RNTCP or ASHA workers, the sophistication of this incentive structure ensured a balance between fixed and variable pay, such that the total salary equalled the fixed salary in expectation if the number of detections or defaults were to remain the same as baseline.

Incentive to prevent default: The 2nd phase of our experiment focused on default prevention, in which the health workers were incentivized to keep default to the minimum. The health worker would receive the full incentive amount only if there were no default, each additional default causing a decrease in the variable component of the salary, thus introducing a component of loss aversion that is not present in the other incentive schemes discussed above.

[20]Source URL: http://goo.gl/nvJzI6

Appendix 2: Qualitative study

Purpose of the Qualitative Study

We conducted semi-structured qualitative interviews with a subset of community health workers who were part of the experiment on the effects of performance based incentives. In addition, we interviewed TB patients from Operation ASHA centers where the experiment took place. These qualitative interviews of a subset of surveyed health workers and a sample of current patients not only increases our analytical confidence in various inferences we make, but also provides more depth to the overall study. Two of the primary objectives of the qualitative study are as follows:

- To contribute to survey analysis with respect to the validation of results, the interpretation of statistical relationships, and the clarification of puzzling findings,
- To identify new questions that are pressing and pertinent, which we have capability to empirically explore through the existing datasets.

Scope

Qualitative interviews were structured around certain themes of interest which were meant to inform open-ended questions. Since one aim of the study was also to gain fresh insights into field issues that might not be apparent through the quantitative surveys, the themes and pre-planned questions were not taken as exhaustive. New questions emerged from initial rounds of fieldwork which informed subsequent rounds of interviews.

Location	# of CHW and ex-CHW interviews	# of patient interviews
Bhubaneswar	2 CHW interviews 1 ex-CHW interview	6 patient interviews
Bhopal	11 CHWs interviews	11 patient interviews
Delhi	2 CHWs interviews	3 patient interviews
Durg- Bhillai	2 ex-CHWs interviews	1 patient interview
Gwalior	9 CHWs interviews 1 ex-CHW interviews	11 patient interviews
Raipur	10 CHW interviews 2 ex-CHW interviews	9 patient interviews
Sagar	2 CHWs interviews 3 ex-CHWs interviews	6 patient interviews
Total	**45 CHW and ex-CHW interviews**	**47 Patient interviews**

Health worker Interviews

Some themes that we explored in the semi-structured interviews of health workers are:

- **Intrinsic motivation**

Given the limitation in addressing the highly abstract concept of intrinsic motivation through survey questionnaires, qualitative questioning would provide further insight into the presence and level of intrinsic motivation and its interaction with exogenously introduced incentives. Since the concept of intrinsic motivation has rarely been tackled in the public service sector of developing countries, this would potentially add novel ideas to the larger discussion on this topic.

- **Data misreporting**

We were aware that monetary incentivizing patient detection might lead to the misreporting of data from the health workers' part. When incentivized to maintain high patient compliance with the treatment regimen, health workers might be tempted to underreport the number of pills missed by patients and when required to systematically report missed pills information on biometric devices, they might tend to over-report the number. While we continued to investigate any such systematic discrepancies in our quantitative datasets, we pursued the topic with more attention in qualitative interviews.

- **Multitasking / Effort reallocation**

The introduction of incentives or biometric devices can lead to a change in priorities for the health worker. Health workers may tend to neglect the dimensions of their task that are not rewarded by incentives. Similarly, in the case of biometric devices usage, they might focus less on finding new patients and increase focus on intermediary processes of patient compliance such as prevention of missed pills. We tried to qualitatively gauge how these interventions changed health workers' effort reallocation.

Patient Interviews

As with the health workers, we expected the qualitative data on patients to provide a richer understanding about the knowledge, perceptions, attitudes, and behaviors of TB patients. Carrying out patient interviews simultaneously with health worker interviews have also shed some light on the subtleties of patient-health worker interactions.
Some of the themes that we explored in these interviews are as follws:

- patient's precise pathway to diagnosis and treatment,
- level of TB knowledge and understanding of its social and health effects,
- understanding of OA and its work,
- interaction with private and public health sector,
- patient treatment compliance and factors that affect compliance,
- patients' interaction with biometric devices, and
- patients' experience with stigma around TB.

The conversations were focused on patient's personal stories and experiences so as to get more individualized perspective into the issues of concern. Given the semi-structured nature of the interview, interview templates were designed to serve as guiding tools.

Methodology

Conducting and processing interviews

We conducted open-ended interviews with a subset of Operation ASHA health workers, ex-health workers, and their direct supervisors (program managers) in addition to current and past TB patients at OA centers. Interviews were conducted primarily in Hindi by a pair of staff, a Research Associate (RA) and a senior field staff with relevant language competence and previous experiences in the project. The presence of a local field staff, who already had extensive interactions with similar health workers and patients, helped facilitate communication. The Research Associate, with the assistance of the field staff, conducted the interviews in a less-formal, conversational setting.
Based on accepted qualitative interviewing techniques and standard ethnographic practices, we designed interview templates for health workers and patients around previously mentioned themes of interest, paying special attention to aspects such as

question order, nature of questions ("grand-tour" questions, structured questions, hypothetical interaction questions), and inclusion of numerous prompts to probe into open-ended questions.
Interviews were recorded only after obtaining written and/or verbal consent from the interviewees. Recordings were translated into English by an experienced consultant under the close supervision of the RA. Post the translation, the data was duly coded, which involved organizing the raw transcriptions around pre-defined and emergent themes and sub-themes. The processed information was then used to complement the discussion on quantitative results.

Sampling
We sampled in all the health workers who were a part of either of the experiments (Incentive or Biometric) and were working at Operation Asha at the time of the interviews. We also interviewed some health workers who quit Op ASHA subject upon their willingness to be interviewed and geographical accessibility.
For patients, we sampled one or two patients from the registers of each of the health workers that we interviewed. We would select two patients at random from the register by systematically selecting the third patient listed under two months ranging from February 2015 to June 2015. This protocol ensured that the health worker did not have influence over our sampling. We rejected the patient thus sampled only if the patient happened to be under 14 years of age, or was an MDR patient.
Management of Personally Identifiable Information
Audio recordings and raw transcriptions of the interviews will not be made public. Transcriptions will be encrypted before being transmitted over the internet. The processed data and the results will be anonymized before being made available outside the research team.

Results

While key results have been integrated in the previous sections of the report, a stand-alone set of results is available in the 25-page note attached to this report. Note: Some of the findings relate to another experiment carried out with Op ASHA on effectiveness of biometric devices in increasing patient treatment compliance and CHW attendance.

Appendix 3: Results Dissemination Strategy

Operation ASHA

The results of our study have been shared with Operation ASHA, which currently operates 194 DOTS centers throughout India, serving a population of 4.37 million people, and also operates 51 centers in Cambodia serving a population of 1.08 million people. Performance based incentive is now a part of Op ASHA's salary structure for all its health workers. As a member of the global "Stop TB Partnership" coordinating board, OA is also well placed to disseminate knowledge about performance based incentives in health care setting to other major partners involved in improving healthcare services and delivery.

Donor Organizations

This study has been supported by several prominent donor entities, and they will be able to publish final results of the study on their own platforms and spread awareness regarding study findings through their networks. We have already previously presented on our research at conferences organized by large donors in the public health space, including 3ie, Australian Agency for International Development, and DFID. The broad reach of such organizations can help ensure that our study results reach a wide audience.

Academic Papers and Conferences

The principal investigators and research staff are currently producing an academic paper describing the results of the study. We aim to publish the paper in top international development economics journals. We have started presenting the results at prestigious institutions such as Harvard University and at conferences such as NEUDC conference (North East Universities Development Consortium). We expect to present our findings at numerous academic conferences both in India and abroad, in the hope of spurring further research into related areas of study from other prominent economists.

Direct outreach to stakeholders

Under the 12th five-year plan of the Revised National Tuberculosis Control Programme (RNTCP), the central TB commission of India has placed increase focus on results obtained from rigorous impact evaluation studies, such as the one that we have conducted. The team has previously engaged with members of the Central TB division in India and the Indian Ministry of Health, including Dr.Kuldeep Singh Sachdeva, the Deputy Director General of the Central TB Division. These policy makers have been highly receptive to our work, and we are excited to update them with the final study results, which can then be used to influence tuberculosis policy in India at the national and state levels. Additionally, one of the Principal Investigators on the project, Thomas Bossuroy, has joined the World Bank team tasked with advising India's central TB division and Ministry of Health on the future course of the RNTCP. In this capacity, he will be able to make a maximum policy impact by spreading results of the study to Indian health ministry officials at the highest level.

Media outreach

The research team will work closely with Operation ASHA and the JPAL South Asia policy team to maximize coverage of the study results in Indian media and to produce outreach materials that present the results in a highly accessible manner. Once the results are finalized, the policy team may produce a "policy briefcase", which explains the context of the study and highlights the main findings. Both JPAL and Operation ASHA use such advocacy materials to present the study to interested national and state government officials, journalists, and others.

Event/ meeting description	Date	Location	Presenting team member	Audience

Northeast Universities Development Consortium (NEUDC) at Boston University	Nov 2014	Boston, USA	Thomas Bossuroy	About 50 researchers in development economics
CREST economics seminar	Nov 2014	Paris, France	Vincent Pons	About 15 researchers at ENSAE/CREST
Development Faculty Retreat at Harvard University	Dec 2014	Cambridge, USA	Vincent Pons	About 10 members of the Harvard faculty
Meeting with the Central TB Division (Government of India) for results sharing	Dec 2014	Delhi, India	Thomas Bossuroy	Dr Kuldeep Sachdeva, Deputy Director, CTD; Dr Patrick Mullen, Lead Health Specialist, The World Bank, 2 WHO consultants
Meeting with Operation Asha for results sharing	Dec 2014	Delhi, India	Thomas Bossuroy	Dr Shelly Batra, President of Op ASHA; Sandeep Ahuja, CEO of Op ASHA; and Op ASHA staff.
Meeting with Bill & Melinda Gates Foundation(BMGF) for results sharing	Dec 2014	Delhi, India	Thomas Bossuroy	Dr. Puneet Dewan, Senior Program Officer (TB), BMGF
Results presentation at workshop on quality of health care organized by BMGF and Duke University	Jul 2015	Rajasthan, India	Clara Delavallade	About 60 leading policymakers from Government and donor institutions, and researchers in public health from the World Bank, Duke University, McGill University among many others.

Appendix 4: The CARE Study

Overview of Implementation

In November 2012, JPAL entered into a partnership with CARE India to study the effect of performance-based salary incentives on the performance of CARE's tuberculosis health workers in rural areas across 3 states of North India (Chhattisgarh, Jharkhand, and Madhya Pradesh). According to the terms of the study, these health care workers, also known as Field Extension Workers (FEWs), would be randomly selected to receive either fixed salaries or incentive-based salaries which vary based on new-patient detection rates and patient treatment default rates in the FEWs' respective catchment areas.

JPAL's collaboration with CARE was complementing a similar experiment that JPAL conducted between 2010 and 2012 in urban slums with Operation Asha. By extending this study to CARE, the JPAL team hoped to increase the sample size of healthcare workers and patients in the study, and also to increase the external validity of the study by including results from the rural context.

As shown in the Table below, we enrolled a total of twenty-five FEWs and their respective thirty-eight DMCs in our study. The four CHWs in East Singhbhum district were in the study for only three months. Those in Khargone, Bharwani, Jashpur, Koriya, and Sarguja were in the study for 6 months. FEWs in Kanker and Dhamteri were in the experiment for eighteen months. All the FEWs were randomized only for the first phase (detection incentives) of the study.

State	District	Number of FEWs	Number of DMCs
Chhattisgarh	Kanker	3	5
	Dhamteri	2	3
	Sarguja	4	8
	Koriya	3	6
	Jashpur	3	6
Madhya Pradesh	Khargone	3	3
	Bharwani	3	3
Jharkhand	East Singhbhum	4	4
	Total	**25**	**38**

Survey Operations

Patient surveys began at the end of July, 2013 and were administered to patients who were in the initial stage of their treatment (between 2 weeks to 2 months) as well as patients who have completed their treatment (between 6 to 7 months). Overall, more than 1,900 patients were conducted surveys in Chhattisgarh, as shown below. We were unable to conduct patient surveys in Madhya Pradesh and Jharkhand (please refer to the challenges section for a more detailed discussion).

State	District	Entry	Exit	Exit plus	Num of Surveys
Chhattisgarh	Kanker	287	172	99	558
	Dhamteri	580	358	193	1131

	Sarguja	37	0	67	104
	Koriya	52	0	50	102
	Jashpur	15	0	27	42
	Khargone	NA	NA	NA	NA
Madhya Pradesh	Bharwani	NA	NA	NA	NA
Jharkhand	East Singhbhum	NA	NA	NA	NA
	Total	**971**	**530**	**436**	**1937**

Detections and Treatment Outcomes

The Table below shows the number of detections that occurred in treatment and control DMCs in each district. The total number of detections is greater for the control group since we had no treatment DMCs in Dhamteri. However, given the imperfect implementation of the incentive scheme (please refer to the challenges section below for a more detailed discussion), we cannot confidently assess an impact of our incentive scheme.

State	District	Treatment	Control
Chhattisgarh	Sarguja	88	30
	Koriya	38	7
	Jashpur	59	13
	Dhamteri		184
	Kanker	138	157
Madhya Pradesh	Bharwani	4	16
	Khargone	29	15
Jharkhand	East Singhbhum	24	17
	Total	**380**	**439**

Patient treatment outcomes are reported below for two districts in Chhattisgarh. We were unable to get data from the remaining districts in Chhattisgarh, as the government TB registers were not updated before we ended operations.

Treatment Outcome	Kanker		Dhamteri		
	Treatment	Control	Treatment	Control	Total
Cured	26	68	5	12	111
Default	1	1	0	0	2
Died	3	11	5	11	30
Failure	3	3	0	0	6
Transfer	0	0	1	0	1
Treatment Complete	16	32	2	16	66
Data Not Yet Available	129	138	68	263	598
Total	**178**	**253**	**81**	**302**	**814**

Intervention Costs

In total, the treatment group was paid about 7% (Rs. 16,860) more than the control group in salary and incentives. Since we did not launch the default phase, no FEW incurred monetary penalties. Payments in Kanker and Dhamteri are higher since the experiment ran the longest in these districts. The figures below do not reflect any changes in operation costs incurred by CARE.

District	FEW	Monthly Base Salary	Total Incentives	Total Salary (including incentives)
Kanker	FEW 1	2,475/3,300	17,875	55,000
	FEW 2	3,300/4,400	0	49,500
	FEW 3	2,475/3,300	12,375	49,500
Dhamteri	FEW 1	3,300/4,400	0	49,500
	FEW 2	3,300/4,400	0	49,500
Sarguja	FEW 1	3,600	15,200	26,000
	FEW 2	3,600	2,450	14,310
	FEW 3	4,400	0	13,200
	FEW 4	4,400	0	13,200
Koriya	FEW 1	3,600	3,200	14,000
	FEW 2	3,600	6,000	16,800
	FEW 3	4,400	0	13,200
Jashpur	FEW 1	4,400	2,340	19,940
	FEW 2	3,600	0	14,400
	FEW 3	4,400	7,200	24,800
Bharwani	FEW 1	3,600	1,600	13,900
	FEW 2	4,400	0	15,600
	FEW 3	4,400	0	15,000
Khargone	FEW 1	4,400	0	15,900
	FEW 2	3,600	2,530	15,810
	FEW 3	3,600	3,200	15,800

Challenges

Unfortunately, the study could not continue the partnership with CARE as serious threats to the study began to emerge during the implementation of the incentive scheme. The most important issues are outlined below:

1) Severe delays in CARE salary payments to Field Extension Workers

Continuous delays with FEW salary payments posed a major threat to the study. The reasons behind the delay, at one end, was because of the delay CARE faced in receiving funds from their donors, World Vision and at the other end, due to the contractual requirement CARE has with its NGO sub-partners. Despite our best efforts to resolve the issue, we were unable get a timeframe for when a delay, lasting five months in 2014,

would be resolved and no assurances were given that such problems would not emerge in the future.

These delays predictably had a severe effect on the job motivation of CARE FEWs and compromised the core intervention of the study. Our field team was informed that FEWs were "barely working" for several months due to salary delays and had taken up other jobs.

Under these circumstances, we could not believe that the salary-based intervention undergirding the study could be implemented faithfully.

2) Validity of CARE reported detection data

For the duration of the experiment, CARE was self-reporting detection data. This detection figure – the basis for salary calculations and a primary outcome variable of the study – was supposed to equal the number of positive TB detections (through sputum tests) recorded in the lab registers of a FEW's catchment area during the salary month. Moreover, to prevent forgery, this figure was supposed to be verified by CARE Program Officers (POs) before being released to the study team. However, we could not be confident that this critical protocol was actually been followed, particularly during periods of salary delays.

At the beginning of the study, it was decided that CARE POs would send the study team written documentation signed by the lab officials at local District Microscopy Centers (DMCs). However, CARE Program Officers did not observe this protocol, despite repeated requests from the JPAL team.

Due to the geographical spread of the DMCs, it was impossible for the study team to regularly monitor all data. Yet, in order to verify accuracy of CARE's reported data, we made an effort to confirm that the detection data provided is accurate. To this end, the study team attempted to verify the data reported by CARE during certain months using detection data collected directly from DMC-level lab registers.

For study DMCs in these months, we found that the lab statistics often differ substantially from CARE's reported figures and they were both under and over reported. This discovery led us to be concerned about the accuracy of all the detection data reported by CARE over the course of the study.

3) Failure to secure necessary governmental permissions

Finally, the study faced significant delays in terms of intervention implementation and survey operations because of difficulties with securing official permission to access patient data from government registers in both Madhya Pradesh and Jharkhand.

Appendix 5: Background on Biometric study

Biometric identification has seen a rapid growth in the past decade and has now been used as a mechanism for delivering public policy in more than 80 developing countries, with applications ranging from financial services to social transfers, civil service reforms or health. However, evidence on the impact of biometric identification for beneficiaries is encouraging but still scarce.

In an attempt to examine the benefits of leveraging the technological advances for TB control in India, we conducted an RCT with Op ASHA to evaluate the impact of biometric monitoring of CHWs on their performance, commitment and job satisfaction, the quality and scope of service delivery, CHW and patient attendance, patient satisfaction, and patient health outcomes. The biometric devices were used to perform three main functions: identifying new patients and enrolling them in the record system with minimal room for errors in reporting; accelerating follow-up by health workers by generating alerts when patients fail to take their pills; creating a real-time tool for program managers to monitor attendance and performance of health workers.

The research team partnered with Op ASHA to randomize the roll-out of biometric devices across 130 catchment areas (including fixed DOTS centers and mobile catchment areas) in four states in Northern India: Madhya Pradesh, Delhi, Chhattisgarh and Odisha. The randomized experiment allows to estimate the impact of using digital technology in DOTS centers on a series of outcomes: (i) patient detection and compliance – pills intake, missed doses and defaults; (ii) health worker and patient attendance at the DOTS center; (iii) patient and health worker satisfaction. The intervention took place from 18 March 2013 till 15 May 2014 in the state of Madhya Pradesh (MP), from 15 April 2013 till 15 May 2014 in the states of Delhi and Chhattisgarh, and from 10 September 2013 till 10 Sept 2014 in Orissa. We are currently in the process of finalizing results of the experiment.

Appendix 6: Full Qualitative Report

Background on the qualitative study

In order to investigate the intermediary processes via which performance-based incentives and biometric devices interact with counselors' job performance as well as probe deeper into patients' lived experiences with the disease and the DOTS system, we designed and conducted a set of qualitative interviews with Op ASHA counselors and patients.

The overall objectives of the qualitative study were to:

- Contribute to survey analysis with respect to the validation of results, the interpretation of statistical relationships, and the clarification of puzzling findings.
- Identify new questions that are pressing and pertinent, which we have capability to empirically explore through the existing datasets.

As such, we do not use the qualitative interviews to make any statistical inferences, but rather, to complement and add depth to the findings from the quantitative study.

This research report presents findings from semi-structured qualitative interviews with 45 current and ex-counselors and 47 patients. The report presents the objectives, study design, analysis methods, and findings from the counselor interviews followed by the patient interviews.

Summary of findings

Counselor interviews:

- For most counselors, the motivation to work as TB counselors stemmed from more practical considerations and conveniences rather than any intrinsic motivation to improve the lives of TB patients.
- For counselors, job satisfaction was tied to their level of satisfaction with program management as well as the salary. Many counselors felt that their salaries were not commensurate with the amount of risk and effort they undertook on a daily basis. These grievances were also tied to the lack of a protection they felt in their jobs.
- Counselors who received the biometric device expressed mixed feelings about the utility of the device and its ability to make their job easier. Most felt that while the device itself was useful, it increased the time they had to spend either at the centre or in the field collecting finger prints.
- While some of the counselor testimonies suggest that incentivising patient detection created an incentive for counselors to trick the system (registering fake patients, colluding with DMC staff, submitting someone else's sputum for lab tests) it is difficult to suggest that conclusively given the sensitive nature of the topic and the unwillingness of most counselors to speak openly on this topic. Furthermore, given that few counselors spoke about data forgery and misreporting, (and those who did were largely vague about citing specific instances) it is difficult to assess the magnitude of these issues from the available qualitative data. Given that ex-

counselors were more open about this line of investigation, it may be safe to say that counselors may have feared negative repercussion of divulging information related to data misreporting or forgery.

Patient interviews:

- Most patients lacked knowledge about TB symptoms and treatment leading to low disease recognition and treatment seeking behaviour. Patients did not suspect that they had TB at their first consultation with a health provider and many continued to cycle through different private and government doctors without suspecting TB.
- Counselors mentioned that patients tend to put less trust in government services, indicating a preference for private care which was deemed not only more trustworthy but also more effective. This observation is not well reflected in the patient interviews where most patients responded being satisfied with the quality of government care for TB.

Objectives and study design

Objectives of the counselor interviews:

The counselor interviews were structured to explore the following themes:

- *Intrinsic motivation* of counselors
  - Given the limitation in addressing highly abstract concepts such as intrinsic motivation through quantitative surveys, the study was interested in using qualitative methods to understand how exogenously introduced incentives interact with counselors' level of intrinsic motivation.
- *Effort reallocation or multitasking*
  - The introduction of incentives or biometric devices can lead to a change in priorities for the counselor. The counselor may neglect dimensions of their tasks that are not rewarded by incentives. Similarly, for biometric device users, they might shift their focus towards tasks that are monitored by the device. Thus the study was also interested in understanding if and how the introduction of incentives or biometric devices led to a change in priorities for the counselor.
- *Data misreporting*
  - When incentivized to maintain high patient compliance with the treatment regimen, counselors might be tempted to underreport the number of pills missed by the patient and when required to systematically report missed pills information on biometric device, they might tend to over-report the number. We were interested in utilizing qualitative methods to investigate instances of forgery and data misreporting.

Objectives of the patient interviews:

As with the counselor interviews, qualitative interviews with patients were done with the aim to provide a richer understanding about the knowledge, perceptions, attitudes, and

behaviours of TB patients and to shed light on the subtleties of patient-health worker interactions.
The patient interviews centred on exploring the following dimensions:

- Patients' pathways to diagnosis
- Sources of knowledge on Tuberculosis
- Understanding of the disease
- TB prevalence from patients' perspective
- Understanding of Operation ASHA and its work
- Interaction with private and public health sector
- Experience with treatment compliance
- Patients' interaction with biometric devices
- Patients' experience with stigma around Tuberculosis.

Study Design:

Methods:

Semi-structured interviews were conducted with 45 Operation ASHA counselors and ex-counselors and 47 Operation ASHA patients. Interviews were conducted primarily in Hindi by a pair of staff, a Research Associate (RA) and a senior field staff with relevant language competence and previous experiences in the project.
Based on accepted qualitative interviewing techniques and standard ethnographic practices, an interview template was designed for interviewing counselors around previously mentioned themes of interest, paying special attention to aspects such as question order (non-threatening to risky), nature of questions ("grand-tour" questions, structured questions, hypothetical interaction questions), and inclusion of numerous prompts to probe into open-ended questions.

Interviews were transcribed and translated into English by an experienced consultant. Coding of the transcribed interviews was undertaken using Nvivo and followed the process outlined below:

Coding Process:

6) The coder reviewed 60% of the interviews and accompanying transcripts for quality and consistency.
7) A preliminary coding guide was designed using the pre-defined themes outlined in the counselor interview guide.
8) The first round of coding was done using the preliminary coding guide while keeping the process open to in-situ and open coding.
9) A second round of coding was undertaken to revisit and reorganize codes and categories from the first round. In the second round, the coder analysed the content within each conceptual/thematic node and recoded and reorganized accordingly.
10) A final round of coding and analysis was undertaken to collapse overlapping themes into 3-4 central themes.

The same coding process was followed by patient interviews. Codebooks developed for during the analysis of counselor interviews and the currently ongoing analysis of patient interviews have been included in the appendix.

Sampling

We sampled from all the counselors who were part of biometrics experiment and are currently working at Op ASHA in the cities that Op ASHA was still working at the time of

the interviews. In order to triangulate our findings from counselor interviews, we sought out and interviewed a small sample of ex-counselors who have since quit Op ASHA. In total we interviewed 45 current and ex Op ASHA counselors across 7 cities.

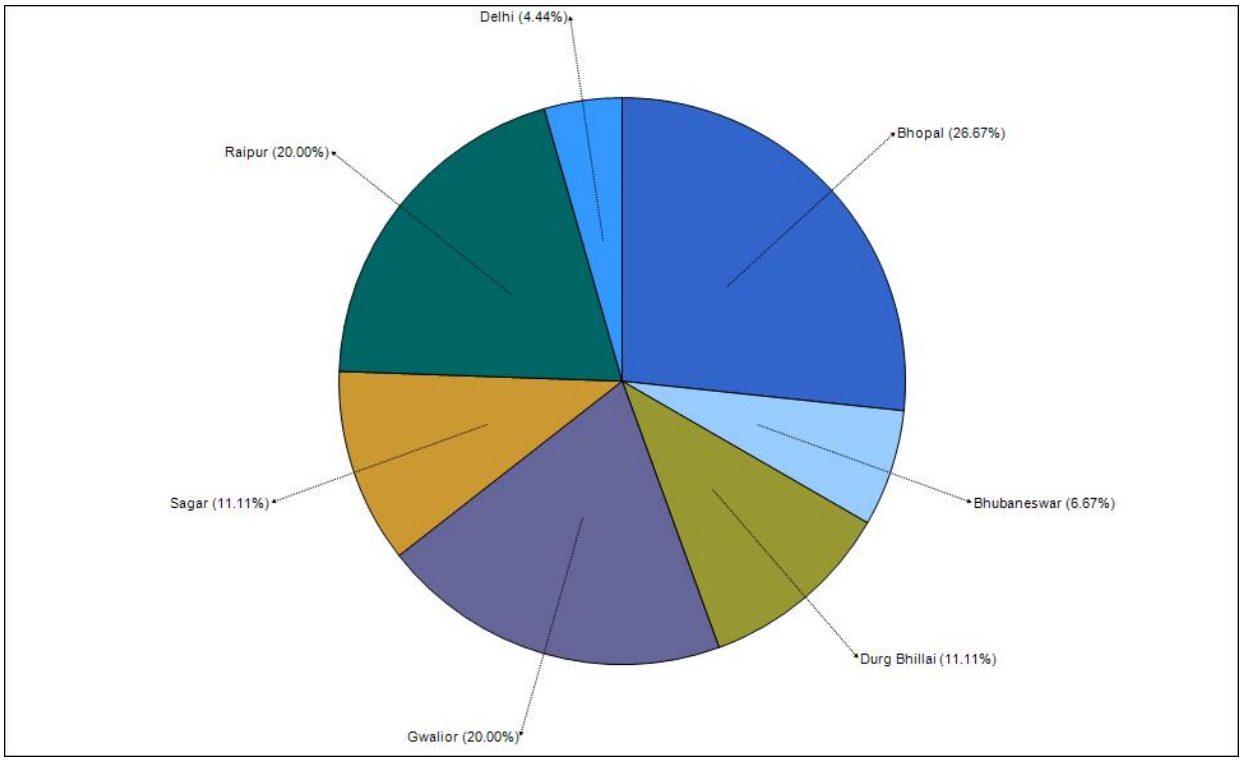
Location	# of counselor and ex-counselor interviews	# of patient interviews
Bhubaneswar	2 counselor interviews 1 ex-counselor interview	6 patient interviews
Bhopal	11 counselors interviews	11 patient interviews
Delhi	2 counselors interviews	3 patient interviews
Durg- Bhillai	2 ex-counselors interviews	1 patient interview
Gwalior	9 counselors interviews 1 ex-counselor interviews	11 patient interviews
Raipur	10 counselor interviews 2 ex-counselor interviews	9 patient interviews
Sagar	2 counselors interviews 3 ex-counselors interviews	6 patient interviews
Total	**45 counselor and ex-counselor interviews**	**47 Patient interviews**

Ethics considerations:
The study was reviewed and approved from the ethics committee of the Institute for Financial Management and Research, India. Informed written consent was obtained from each participant. Interviews were recorded only after obtaining written consent from the interviewees. In order to ensure non-disclosure of individual information, audio recordings and raw transcripts were stored in a password protected folders and encrypted before being transmitted over the internet. The processed data and the results will be anonymized before being made available outside the research team.

Counselor Interviews – findings

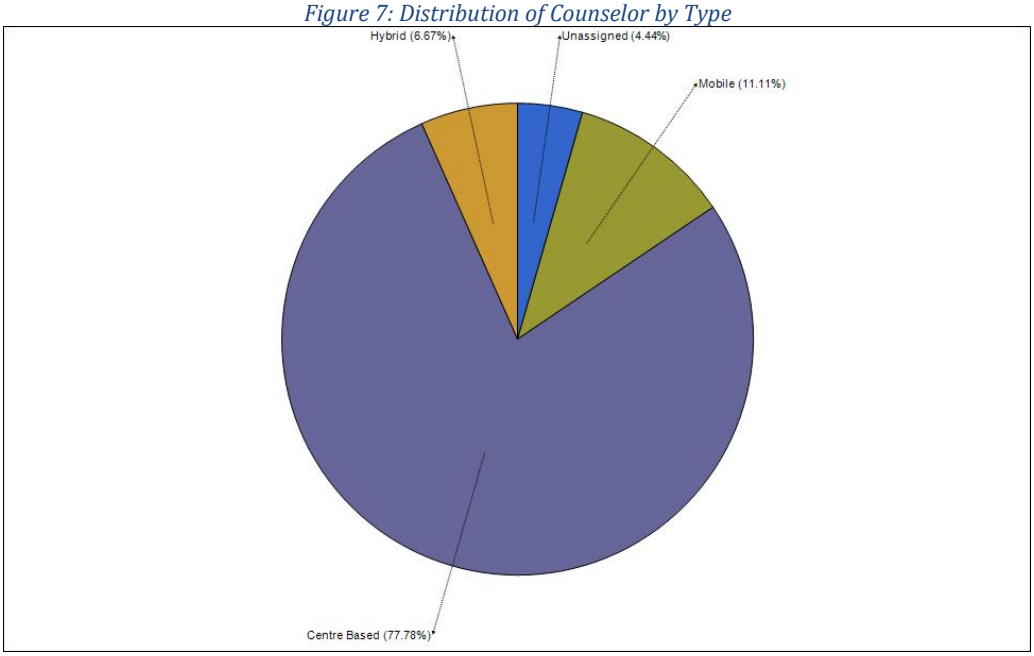
Descriptive statistics on counselors interviewed:
69% of the counselors interviewed are male and 31% are female. A large percentage of the participants interviewed belong to Bhopal, Raipur and Gwalior.

Figure 6: Distribution of counselors by location



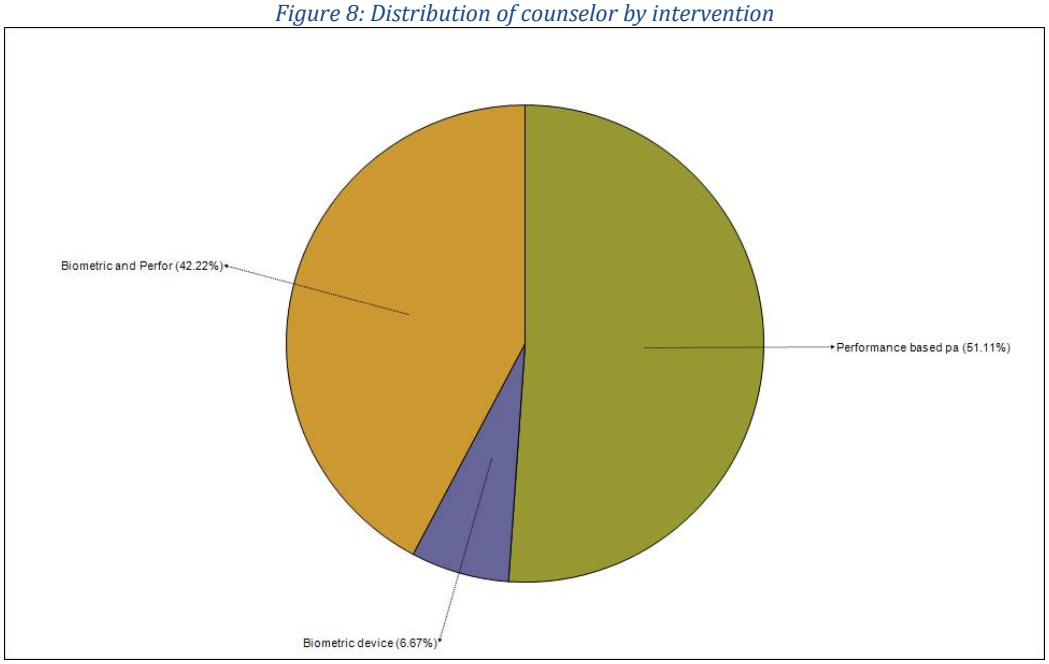
11% of the counselors interviewed were mobile counselors who did not operate from a fixed centre. These mobile counselors either deliver medicines to the patients at their houses or at a pre-determined location. 78% of the counselors were centre based. These counselors split their time between two fixed centers where they alternated days. Patients assigned to centre based counselors typically travel to a designated centre where they are administered their medicines. 6.7% of the counselors in the study sample were hybrid counselors who operated out of one centre and were responsible for an additional catchment area that did not have a centre.

Figure 7: Distribution of Counselor by Type



Over half the counselors interviewed had received the performance based incentive intervention. 42% of the counselors received both the performance based incentives and the biometric device.

Figure 8: Distribution of counselor by intervention



Findings:

Theme 1: Intrinsic motivation of counselors

Pathway to Operation ASHA

- Most counselors had friends and/or family working at Operation ASHA who alerted them to vacancies or had heard of Operation ASHA through their social networks. Some counselors came to Operation ASHA through the Designated Microscopy Centre (DMC). These counselors had earlier exposure to front line counselors such as TBHVs, through whom they were made aware of opportunities at Operation ASHA. One counselor was acquainted to the DMC through a family member who was suffering from TB. Two counselors were acquainted with Tuberculosis Health Visitors (TBHV) and another was working in frontline HIV testing through which he was acquainted to the DMC. 6 counselors had been recruited directly by Operation ASHA program managers.
- Only 7 counselors had held a job in the NGO sector previous to their joining Operation ASHA. Most counselors came from diverse professional backgrounds including teaching, private sector jobs, and self-employment. Since the interviews did not attempt to trace employment histories, we cannot say with certainty whether these counselors had no previous experience in the NGO sector. 4 counselors held no previous professional experience.

Motivation to work at Operation ASHA

- The desire to do social service was identified by many counselors as the reason behind their decision to take up or continue working at Operation ASHA. However for many of these counselors the desire to engage in social service was also tied to the convenience it afforded them to work in their own communities. One counselor responded that her decision to join Operation ASHA was motivated by the fact that she could get paid to administer treatment to TB patients, something

that she was already doing for a distant relative suffering from TB. She was informed by a Tuberculosis Health Visitor that "there is an NGO that will pay for the same work" that would allow her to "keep doing her daily chores and the patients would come and take their medicines". For one ex-counselor, while he was "inclined towards social jobs" monetary considerations compelled him to look for work elsewhere. Working as a frontline health care provider gave him "a platform to connect to people" but he could "not do up and down in a cycle anymore and the salary was also very less".

- For most counselors, however, the motivation to work as TB counselors stemmed from more practical considerations. For one counselor who was working evenings at his family owned business, the decision to work at Operation ASHA was driven by the need to supplement his income since according to him "it's so expensive these days that one source of income is not sufficient until you have a government job". Similarly another counselor who was completing his studies concurrently, the decision to work was motivated by the need to "gain some experience". He added that he would continue working at Operation ASHA if he gets a better position upon graduating otherwise he would be compelled to look for another job.
- For other counselors, the decision to work at Operation ASHA was driven by convenience: One counselor had the following to say about his decision to join Operation ASHA: "I had a promotion (in my previous job) and was posted in Lucknow but due to family issues I could not go. They asked me to resign since I did not want to go to Lucknow and I did. Then I was searching for jobs and my friend informed me about Op ASHA. He said the work is good and I thought that since I was not getting any job I will work here until I get one. And now it has been four and half years. Actually I didn't have any job for three months after resigning so I had to no other choice as situation at home deteriorated". One female counselor joined Operation ASHA in an effort to remain with her husband who had also applied and been accepted to receive training in Delhi.

Job satisfaction:

- For counselors, job satisfaction was tied to their level of satisfaction with program management as well as the salary. Many counselors identified pressure from program managers to meet targets for detection as their primary grievance. In many cases the pressure to detect new patients was tied to threats (real or perceived) of job loss. As one counselor put it: "they (program managers) don't care about problems, if you don't get 10 patients, you get notice…he (the counselor) does not leave on his own, there is a problem, and they give order…only then he (the counselor) leaves." Some counselors also voiced grievances against program staff management for making ad hoc deductions. One counselor complained that "he [program manager] deducted salary when [she] took leave". Another complained that "he [the program manager] would often visit the centres…and if he found any mistake, then he would cut our salary on his own…and then he would party… for example he would come to my centre and if he finds a mistake he would cut Rs. 200 from my salary."
- Grievances regarding reimbursable job inputs such as travel conveyance and mobile allowances emerged as another key point of discontent. As one counselor put it, "sometimes we spend more than we earn on the patients." Many counselors reported spending money out of their own pockets for patients not just in the

detection phase where they would "give money for HIV test, blood test, sugar test" but also in the treatment phase when they would "spend much more than [the designated mobile allowance of Rs. 200] on patients to keep calling them to make sure that they come and take their medicine".

- Salary was a key point of contention for most counselors who complained either that their salary was too low or not on par with the amount of risks they undertook. Most counselors who complained of low salaries expressed the concern that their salary had not increased incrementally over the years. One ex-counselor stated that he was asked to leave the job because he asked for an increment. "During our training" he stated "we were informed that every year they will increase our salary. But that never happened. Rs. 5000 is very less for anyone to survive. We spend that much in petrol. And when I asked for an increment then they did not like that. If increment happened once in 2-3 years, that too just Rs. 140, what will happen with that?" Another counselor echoed these sentiments: "We risk our lives when we deal with patients, considering that, we should be given some increment but hardly Rs. 200 was increased. Everything is so expensive today, so we are bound to think if we should continue or leave the job. That's why some counselors leave the job".
- Many counselors felt that their salaries were not commensurate with the amount of risk and effort they undertook on a daily basis. These grievances were also tied to the lack of a protection they felt in their jobs. The following excerpt from a counselor interview illustrates these interwoven concerns: "Op ASHA says if our counselor has TB, then he/she can come and join work after 6 months, but they won't give us our salary in those months. If something happens to us, our family, kids will get affected. Our life will be destroyed. Most important thing, our salary never comes on time. We counselors had asked for aprons, our bags are torn. They didn't give us. We have to buy bags now. Where is our profit? We have been working here for past 3 years, Op ASHA should do something for us. We have spoken to [program manager], but nothing happened. If something happens to the laptop then we will have to pay. The CDP doctor also tells us that we don't get paid according to the amount of effort we put into our work. As far as we know, the counselors in Delhi don't even have to go to find patients, we have to go and find patients. We do everything ourselves".
- One aspect that emerges from counselor testimonies on job satisfactions pertains to the emotional labour that they felt was being undercompensated. As one counselor put it: "there should be a focus on the counselor as he is coordinating with the patient. Sometimes they have problems in the field...like a patient not willing to take medicines, or even wanting to die and the counselor deals with that, so he should be provided with some kind of support. Salary given to ground workers is so less that even if they want to do something for the patient, they cannot with such less salary". Another counselor, while taking a less optimistic view on the counselor-patient relationship, echoes the same sentiments when he says that "at one point they (the patient) just becomes dependent on us and says now you (the counselor) will have to take me…you take us to the doctor, you get us checked…they start depending on us a lot and they trouble us till the end".

Takeaways:

- Very few counselors indicated previous experience in the NGO sector or social work. Qualitative interviews suggest lack of pro-social tendencies impacting

counselor's decision to join Operation ASHA. For some counselors, while the decision to join Operation ASHA was not driven by any sort of intrinsic motivation, their experience of working with TB patients did provide a sense of contribution to their communities, of having done 'social service' and of earning 'respect'.

- This draws attention to assumptions about the kinds of individuals who self-select into such front line health worker jobs and the difficulty in ascertaining their level of intrinsic motivation both quantitatively as well as qualitatively. In their evaluation of incentive strategies aimed at recruiting community health workers (CHWs), Ashraf, Bandiera and Lee (2015) found that career incentives attracted CHWs that were more qualified and had the same level of pro-social preferences, as CHWs recruited by making social incentives salient. They argue that "estimates on the effects of incentives on performance obtained by strengthening incentives for a given set of agents might understate their true impact, because they measure the response of agents who have self-selected into jobs with low-powered incentives, and hence might be less responsive to incentives in the first place" (22)[21]. The qualitative interviews draw attention to this self-selection.

<u>Theme 2: Effort Allocation of incentivized counselors</u>

Effort on detection: Diversity of methods used to detect new patients

- Counselors referred to four main avenues through which they get new patients: door to door detection, receiving patients from the DMC, referral from current or past patients, and patients coming on their own.
- While most counselors relied on more than one avenue for getting new patients; door to door detection during "field visits" or "counselling visits" was identified as the primary method.
- Most counselors refrained from mentioning TB or Operation ASHA in their initial interactions with 'suspects'. They often inquired after general health matters in the household followed by TB specific symptoms: "I ask them if there is anyone in the household who is not well…they refuse at times, then we ask even more (specific)...is there someone who has been coughing for a long time…now a days people are smart, they know and understand...also there are many (surveyors) who moves around now a days…some let us sit…some don't…if someone says yes there is someone who is not well in my family then I ask them since how long they have been sick, and if they have cough, is it dry cough or with mucus".
- Most counselors also received some patients from the DMC however this did not occur with regularity and was often subject to the kind of relationship they shared with the DMC and the TBHV staff. For one counselor who gets patients from the DMC, "earlier the TBHV people were not very cooperative" and "doubted" Operation ASHA counselors. Often the patients they received from the DMC were extremely unwell and prone to default.
- Referrals from past or current patients also resulted in new patients, especially for counselors who reported having worked in the same communities for a few consecutive years. For such counselors whom "people have started recognizing", field visits often centered on targeted detection rather than door to door detection: "Today I went for visit and I met a former patient who was cured. We

[21] Ashraf, Nava, Oriana Bandiera and Scott S. Lee. "Do-Gooders and Go-Getters: Career Incentives, Selection, and Performance in Public Service Delivery." Working Paper, February 2015.

spoke for some time and he informed me that his neighbour, an old lady, has been coughing for some time. So we immediately went to her and he introduced me to her and then I made a referral slip and I gave it to her".

- For established counselors, patients often came on their own to the centre to get tested. Such counselors reported having invested time upfront in establishing themselves as DOTS providers in their catchment areas so that they didn't need to "work very hard" at finding new patients. However, none of the counselors (aside from Delhi based counselors who did not go for active detection) reported relying on patients to come on their own and did regular community meetings or field visits. It is unclear from the interviews, however, if this resulted in counselors doing field visits with less intensity or regularity.
- Only one counselor explicitly mentioned "contact tracing" as their primary strategy for finding new patients.

Effort on detection: Diversity of actions undertaken with a TB suspect

- If suspects who were given referral slips failed to get tested at the DMC, counselors would follow up with the patient again usually in person or over the phone to convince them to get tested. Most counselors followed up no more than 2-3 times after which they would cease to pursue the 'suspect'.
- As part of their repertoire of actions with a TB 'suspect', counselors often collected sputum samples and delivered them to get tested at the DMC.
- Most counselors did not indicate the length of time over which they followed up with the 'suspect'. Some counselors reported following up with the patient the next morning and one counselor stated following up after 4-5 days of initial contact with the 'suspect'. Another counselor spoke about the length of time it takes to go through the battery of tests at the DMC which often deters the 'suspect' from following through.

Effort on default prevention:

- Counselors who only received performance based incentives and not the biometric device spoke about having the ability to administer unsupervised doses and thus being able to curb missed doses and eventual default. They reported investing time in visiting patients at their home to deliver medicines, especially if the patient was too sick, had missed a dose or intended to go out of town. As one counselor put it: "I make sure that they [patients] have the medicine no matter what… The ones who take medicines from the hospital, they have a higher chance of having missed dose because they have to go to the hospital to get the medicine unlike us where we go and deliver the medicine. This also creates a pressure for the patients when their family member sees that I am delivering the medicine at the door step for the patient's good health".
- Aside from delivering medicines, these counselors would also enlist family members to enforce treatment compliance with patients who were at risk of defaulting. For patients already defaulting, counselors enlisted their program managers and TBHVs to reinforce the importance of treatment compliance.
- Counselors who received the biometric device expressed mixed feelings about the utility of the device and its ability to make their job easier. Most felt that while the device itself was useful, it increased the time they had to spend either at the centre or in the field collecting finger prints. When asked if the biometric device has made his work easy one counselor responded: "easy as well as difficult…. sometimes I

have to wait till the evening to get fingerprints, as patients leave for work in the day and return in the evening...but easy because we get all the details of the patients…who should get medicine today, who is in IP, CP". While he was also required to maintain a written record of the patients who had come to the centre to receive their treatment, he did not feel that the biometric device had added to his workload. Another centre based counselor added that "it's good for work" since "you can know that the patient is taking medicine on time and it's also easy to send reports to others" but that she faces difficulties when "sometimes the patient does not come on time and [she] has to go to their house after work, in the evening to get their finger prints otherwise the dose becomes a missed dose…sometimes they are not available at home, then [she] had to go again later".

- Counselors with biometric devices spoke about having to stay at the centre beyond regular hours to collect finger prints from patients who were not available during the daytime. They also spoke about unsupervised doses being counted as missed doses by the device and thus having to obtain permission from their program managers to administer such doses. While counselors stated that the device has made it easier to identify patients missing their pills, the task of collecting their fingerprints to record delivery of medicine prolonged the amount of time they spent on follow-up particularly when:
    - Patients could not come to the centre until late in the evening
    - Patients needed counselors to deliver the medicine to them
    - Patients needed unsupervised doses for which the counselor needed to obtain permission as well as deliver medicine to the patients home

- Much of the data on counselor experiences with the biometric device suggests that while the biometric device made it easier for counselors to track patients, the task of preventing defaults did not become easier or less time consuming. Counselor experience with the biometric device suggests that they may be investing less time in detecting new patients "because if you have more patients then you have to run around them to get their finger prints and that becomes difficult".

Counselor experience with biometric device:

- Counselor experiences with the biometric device centred around the following themes:
    - Change in workload
    - Technical issues with the device
    - Lack of discretionary power
    - Automatic record of performance
- Change in workload:
    - Most counselors who had the biometric device noted that while the device made tracking of patients easier, it had added to their overall work load since now they spent more time on collecting fingerprints. None of the counselors mentioned that the presence of the device had increased patient attendance at the centres thus making tracking and ensuring treatment adherence easier overall.
- Technical issues with the device:
    - Most counselors reported experiencing some difficulties getting used to the device initially and experiencing some technical difficulties from time to time. Usually these technical difficulties related to the device not being able

to read the patient's fingerprint leading to delays. Counselors sometimes had to follow up and collect fingerprints from patients at their homes due to technical glitches during the patient's visit to the centre.

- Lack of discretionary power:
    - The biometric device made it difficult for counselors to give unsupervised doses, give medicines in bulk, and give medicines to family members of the patient. Counselors felt that this led to a loss of discretionary power that they previously had without the biometric device. One counselor felt "compulsion" to "tell the patient that he has to meet me to get his medicine otherwise I cannot give the medicine". He elaborated that "If a patient goes out or is not available then how will I get finger print? We can give unsupervised dose but the biometric displays it as missed dose in Delhi. If we give unsupervised dose without taking fingerprint then it becomes a missed dose. If our missed dose is below 10% percent than they deduct Rs. 500 from our salary. Then we have to think if we should give them unsupervised dose. If we give them unsupervised dose then my salary will get deducted". For another counselor the biometric device reduced her flexibility in deciding how to deliver medicines to the patient. She stated that "They [the patient] also ask us that government gives them medicine for more than one day, and why do we give them on the basis of per day. I can understand their problem, they also have to go to duty in the morning but I cannot come at 7 in the morning to give them medicine because even I have a family. This is all because of biometric. Without biometric, any family member can come and take the medicine or even I can go sometimes and give them the medicine".
- Automatic record of performance:
    - For counselors, while the device added to their workload and reduced their flexibility, it did however automatically record their performance which they perceived as a positive element. As one counselor put it: "No one needs to recheck my work….If someone wants to figure out about my work, he can check it in my biometric".

<u>Theme 3: Forgery and data misreporting</u>

- While most counselors provided perfunctory responses to questions on data forgery and misreporting, some (mostly ex-counselors) did elaborate on instances similar to what we had informally gathered. Most counselors referred either to having heard of patient data falsification at other centers or of having observed specific instances among their colleagues. In the following excerpt, one ex-counselor speaks of both the pressure from programme managers to meet targets as well as collusion between Operation ASHA staff and DMC staff in falsifying patient detection rates:

> Ex-counselor: There are things, in the upper level, its working well, but at this level, some people are trying to make it dirty for their selfish motives. Like I am not a TB patient, but they are issuing medicine on my name and misusing it.

Field staff: What happens to the medicine? Is it given to someone else?
Ex-counselor: Yes, they throw it or do anything with that.
Research Associate: You have to register the patient at the DMC right?
Ex-counselor: Yes but then people have contacts with the people who maintain these registrations at DMC, so that is not an issue.
Research Associate: But the patient has to go to DMC for registration, so they send a fake patient or how do they do this?
Ex-Counselor: I should not say, they somehow show positive cases…like we have targets…so to maintain the target, even if they requires me to bribe someone, I have to meet the targets. I have to pay from my salary.

- The ex-counselor cited the pressure to meet targets for detection coupled with the collusion between DMC staff and his colleagues as the reason he left his job. He states: "I didn't want to do these things. I joined only because I wanted to help people. My boss put a lot of pressure on me, he wanted us to meet targets, I couldn't and I left the job." For this counselor, the performance based pay structure gave rise to created unattainable expectation from management and opportunities for collusion that adversely affected his intrinsic motivation to "help people" and ultimately his job satisfaction.
- Two other ex-counselors also elaborated on instances of patient data falsification in collusion with DMC staff. One ex-counselor mentioned that counselors at his centre had "built some connections with lab technicians [at the DMC] to get new patients. They did not want to go for visits so this was an easy way to get patients". When probed about how the lab technicians got them detections, the ex-counselor replied that "They adjusted it from one to another. Like from my detection they would give few to the other counselors. They would also get sputum and give it for testing. I objected that as well as that is not our duty to take sputum. During training it was never said that we need to carry the sputum for testing. They would make slide with the lab technicians as well…They would take their own sputum at times. If they are not going for visits and detection, from where will the sputum come? They suspect name that was given for the daily reporting was also not correct". Another ex-counselor elaborated that she had heard of similar instances at a DMC where "the TBHV people were in good terms with the counselors who went there and they would agree to make patients for the [them]. They would write some name and give them". When probed about whether patient data was being verified at the DMC, the ex-counselor noted that the verification was not done thoroughly and that "counselor would fight the J-PAL people because J-PAL wanted to meet the patients and the counselors did not want that". The ex-counselor also referenced specific instances of counselors using someone else's fingerprints once the biometric device was introduced and thus, according to her, rendering the device 'meaningless'.
- Three counselors mentioned misreporting default data as a practice that occurred at government hospitals but neither mentioned similar occurrences at Operation ASHA. One counselor maintained that something similar "cannot happen at Op

ASHA, because we have visits, card are checked and if they want to visit a patient and see that the patient does not exist, then we will lose our job".

- One counselor and one ex-counselor spoke of counselors charging patients for treatment. One counselor stated that "for patients who live far away, these providers charge Rs. 500 and give them all the doses at once so that the patient does not need to keep coming for the medicines". When probed, he responded "yes, but that is none of our business".
- An ex-counselor mentioned that some counselors would "tell patients that patients that they need diet food and take other supplementary medicines. The counselor and Program Manager was against me, that's why they asked me to leave Op ASHA…They would sell supplementary medicines to patients that cost around Rs. 5000 or more".

Takeaways:

- While some of the counselor testimonies suggest that incentivising patient detection created an incentive for counselors to trick the system (registering fake patients, colluding with DMC staff, submitting someone else's sputum for lab tests) it is difficult to suggest that conclusively given the sensitive nature of the topic and the unwillingness of most counselors to speak openly on this topic. Furthermore, given that few counselors spoke about data forgery and misreporting, (and those who did were largely vague about citing specific instances) it is difficult to assess the magnitude of these issues from the available qualitative data.
- Given that ex-counselors were more open about this line of investigation, it may be safe to say that counselors may have feared negative repercussion of divulging information related to data misreporting or forgery.

<u>Theme 4: Counselor experiences of RNTCP hierarchy</u>

- Most Operation ASHA counselors' interact regularly with the Revised National Tuberculosis Control Programme (RNTCP) district level hierarchy illustrated in Figure 4. Within this hierarchy, the DMC is a key point of contact for Operation ASHA counselors.
    - Counselors visit the DMC to follow up on whether suspected patients have gotten tested for TB.
    - Counselors sometimes rely on DMC staff to assist with counselling defaulting patients or difficult patients to continue treatment.
    - Many counselors mentioned that DMC refers new patients to counselors.
    - Counselors visit the DMC to get payment sheets signed for cured patients at the end of their treatment.

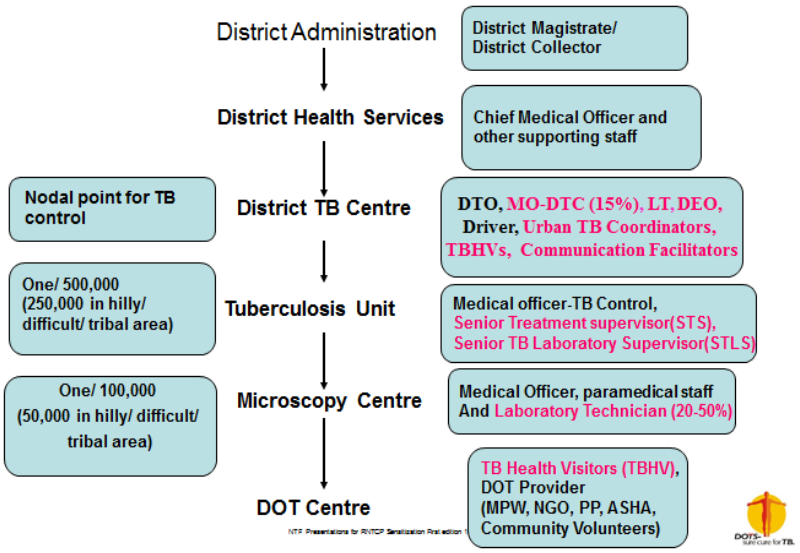


Figure 9: RNTCP structure at the district level

- In their interviews, counselors touched upon a few issues they experienced when dealing with DMC staff. One counselor mentioned difficulty getting payment sheets signed by the DMC staff for over a year. Two separate counselors mentioned having difficulty procuring medicine boxes from the DMC that indicate that the patient has now been assigned to the Operation ASHA counselor. Counselors also spoke about the bureaucratic nature of the DMC where counselors and patients often had to make repeated visits and were faced with moody officials. Only one counselor, based in Gwalior, had explicitly positive remarks about his interaction with the DMC. He mentioned having monthly meetings where counselors and programme staff meet with the DTO to discuss issues in the field, issues which he felt he could not bring up with TBHVs.

- Complex interactions with other community health workers also emerged as a theme in the qualitative data.
  - One counselor complained that the introduction of other community health workers had an impact on patient detection: "nowadays there are new community health providers, they fill forms and other things, because of this, less patients are coming to us because they take away the patients. They are working in ghettos and they take away these patients. Someone should talk to the authorities and tell them that Op ASHA counselors have been working for so long and that they should also get patients". Another counselor stated that since the last few month she has not been able to meet her target of 7-8 new patients per month: "Since Asha has come, our level has gone down…first they had training and since last 3-4 months they are getting patients, and since then our patients have become less… These people don't have proper training. They just get the medicine box and don't really care about the patient. They would give medicines for a week and sometimes month, and don't really check if the patient is taking the medicines. And here patient has to come every week, every day, why will

he/she want to come [to us] when they can get doses for a week or month at once from them (Asha)."

- Some counselors spoke of difficult interactions with TBHVs (government DOTS workers). One counselor complained that TBHVs were unsympathetic towards counselors who "have so much work that sometimes things [such as the filling up of duplicate cards] get delayed." He also protested that "they also do mistakes like they lose the original card and then they blame us saying we use them hence we have lost the cards." However the counselor also emphasized that these issues have no persisted since he has "worked for sometime and had built connections with them." For another counselor who is centre-based, the presence of TBHVs represented greater competition for patient referrals from the DMC. He said that "it not necessary that the patient goes for investigation right away, he may go after 15 days, hence we cannot visit him for 15 days, we can do it twice or thrice…like I visited this patient, but I got him (meaning came to the centre) after two months…when I asked him why did he take two months…then he responded, then I didn't think I was sick, now I am, now he has become a DMC patient. Now you send any patient, it becomes TBHV patient, TBHV goes for visit, and so they become TBHV patients, if they come to us they register just two in our name and the rest they keep it to themselves". He noted that since "now-a-days its 1000 rupees [RNTCP incentive scheme] so TBHV anyway does not want to give us [patients]". Another counselor noted that "sometimes TBHV forces us to take some patients and if we refuse, they don't give us new patients. We have lot of obligations".
    - While counselor testimonies of interactions with TBHVs were largely centered on the politics of patient referrals and general attitude towards Operation ASHA counselors, as mentioned in the previous section on data forgery and misreporting, there were instances of collusion between TBHVs and counselors.

Takeaways:

- While counselors' interactions with DMC officials and TBHVs varied both in terms of intensity as well as quality, they do bring attention to the need to further investigate the dynamics between overlapping front line health workers (public, private and NGO) as well as across the RNTCP hierarchy and how these dynamics shift with the introduction of exogenously introduced incentives.
- These interactions also highlight that detection and default prevention activities are not undertaken by counselors in isolation from the larger RNTCP structure and its operational politics.

<u>Theme 5: Counselors' knowledge and perception of overlapping incentive schemes</u>

- Another theme that emerged in the qualitative data relates to counselors' knowledge of multiple incentive schemes for treatment completion. In 2014, RNTCP revised its incentive scheme for DOTS providers for treatment completion. While earlier, DOTS providers received a flat cash incentive of Rs. 250; under the revised scheme a DOTS provider could claim RS. 1000 flat incentive for each patient treatment completion for new patients (CAT I) and Rs.1500 in the case of relapse patients (CAT II). Counselors, especially from

Bhopal, were acutely aware of this incentive structure. One counselor stated that while work is good at Op ASHA, "The only problem is our salary. Now outside you get Rs. 1000 for per patient after 6 months of treatment. And for CAT II patients, the get Rs. 1500, and we still get Rs. 225 for each patient regardless of anything. They should at least increase it to Rs. 500. We deposit the Rs. 1000 that we get for the patients to Op ASHA every month. And from that they pay our salary, it's like we get nothing for all the work".

Takeaways:

- From an implementation perspective, this is an important finding since incentive schemes are often thought of as operating in isolation with little attention given to how they interact with other schemes already in place and how information about competing incentive schemes can impact counselors' overall motivation and job satisfaction as well as on task prioritization.

<u>Theme 6: Counselors' perceptions of private health care providers</u>

- Counselors spoke about their perception of patient preference for private treatment facilities and health care providers over government counterparts.
    - Many counselors mentioned that patients often sought private treatment because of the 'side-effects' caused by the government medicine. As one counselor put it: "The medicines given by the government are very strong and because of that the patients have side-effects which is normal. But these fade away after 2 week or so once the medicines become more effective. But in these conditions, the new patients get scared. Then they tend to meet private doctors because of the side-effects. Private medicines are the same, but the mg is less so the side-effects are less".
    - Lack of trust in government services was also mentioned by some counselors as a reason why patients seek out or transfer to private care. One counselor stated that "because this medicine is free, they [the patients] don't trust it….because they pay in private, they trust it. They think its fake medicine as it's free. It's in their heads".
    - Counselors also felt that government provisions were frustrating and time consuming for the patient. One counselor stated that "In government [hospitals] you have to run from here to there. No one explain or gives proper information to the patient. Then the patient gets frustrated and prefers private treatment". Another counselor echoes this when she says that "you have to make many rounds of government hospitals for consultation. If you go to the DMC they tell you to go to the TB hospital. One department will send you to another, the other will refer somewhere else". Another counselor added that "in private they get all medicines at once, they also get 3-4 tonics, they don't have to wait in a queue, the doctor will charge Rs. 500 as fees but will check them properly but in government, no one even talks properly, because 50 different people come here, they cannot keep explaining to everyone".
    - Another aspect that only two counselors touched upon was that private treatment affords patients to conceal their illness and deal with it privately. As one of the counselors said: "People are still scared, there

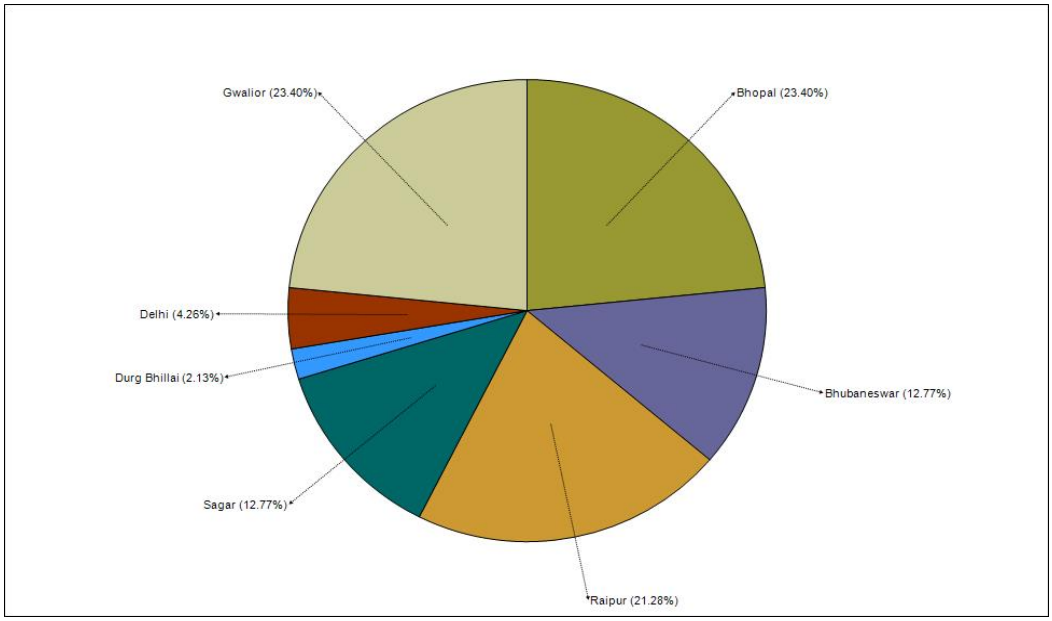
are some who have a centre right next to their home, but still want to go to the private hospital to take medicine because they don't want others to know".

- Some counselors, however, also distrusted private health care providers. These counselors insinuated that private doctors mislead patients by telling them that they don't have TB. According to one counselor, no one in the private sector will counsel patients. "If someone comes and questions us for one hour we cannot ask them to leave. We counsel them for 6 months. Private people don't invest so much time in one patient. Then the patients come to us after 2-3 months when they feel the private medicines have not been very effective. We also have patients who say in the middle of the treatment that the doctor has said they don't have TB".

Patient interviews – findings

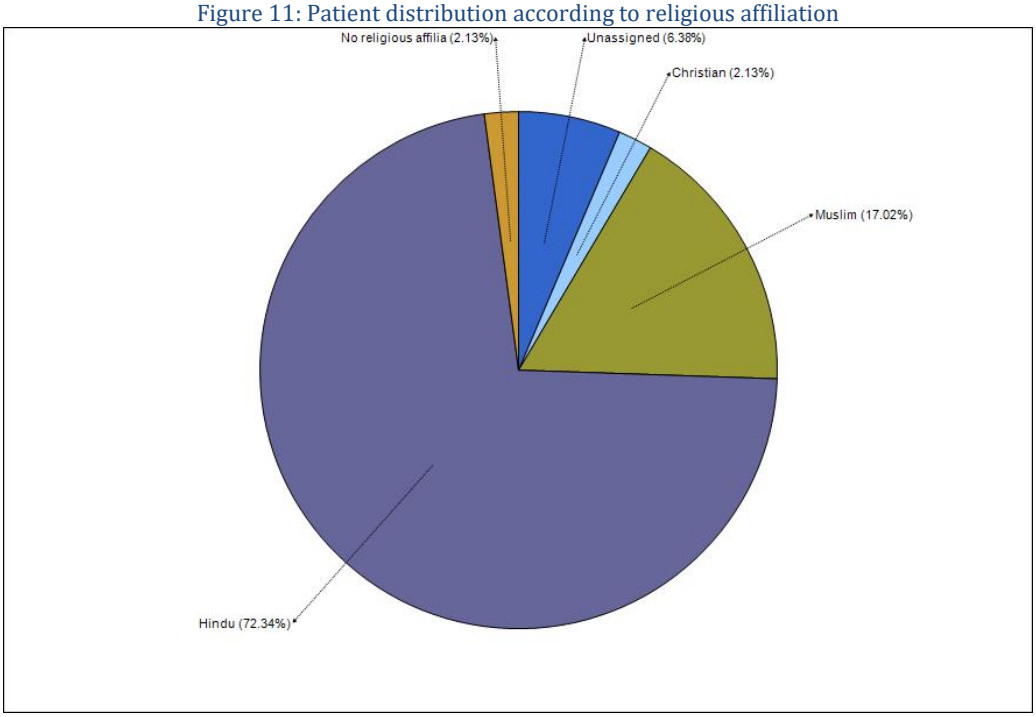
Descriptive statistics on patients interviewed:
43% of the patients interviewed are male and 57% are female. Patients from Bhopal, Raipur and Gwalior made up the bulk of the sample interviewed for this qualitative study.

Figure 10: Patient distribution according to location



Over 72% of the patients identified as Hindu while 17% identified as Muslim. 6% of the patients were not asked about their religious affiliation and thus have been marked as 'unassigned'.

Figure 11: Patient distribution according to religious affiliation



Theme 1: Pathway to diagnosis

- Presence of treatment seeking behaviour:
    - Most patients lacked knowledge about TB symptoms and treatment leading to low disease recognition and treatment seeking behaviour. Patients did not suspect that they had TB at their first consultation with a health provider and many continued to cycle through different private and government doctors without suspecting TB. In fact, most patients consulted multiple doctors on their pathway to diagnosis. While patients did access treatment, although not immediately upon becoming symptomatic, only 10 patients admitted to recognizing the symptoms as TB related.
- Private doctors or healthcare providers were the first point of contact for over 50% of the patients. Most of these patients opted for the private healthcare provider based on recommendations from either friends or family. Few others opted for a private healthcare provider whom they had visited previously. Only 2 patients opted for a private healthcare provider because they were nearby. Similarly only one patient mentioned opting for government care because it was more easily accessible. Most people who sought government care did so because private care was too expensive. In fact, for many patients who sought private care as the first point of contact on their pathway to diagnosis, many did end up seeking treatment at government facilities because of inability to pay for private treatment.
- Most patients' pathway to diagnosis spanned the course of weeks if not months. Patients rarely stuck to one doctor or healthcare provider for more than a few days, citing no results as a common factor in their decision to seek diagnosis elsewhere.

Theme 2: Government care vs. private care

- Although many patients did not elaborate much on their preference for government care or private care, of those who did, 4 patients stated that they preferred government care over private care which was costly and had proved to be ineffective. One patient relayed the following experience of consulting healthcare providers: "I took treatment in private. That didn't help. First I took it from here and there, that didn't stop the cough, so I went for private treatment. It cost me Rs. 10000 in private. Then I changed to Lal Bahadur (hospital). That didn't help either. The coughing would reduce a little but come back". However it is significant to note that most patients did not (and could not financially) afford to visit a private healthcare provider consistently. Most patients waited a few days to see a change in their symptoms before switching healthcare providers.
- Two patients indicated preference for private treatment because of lesser side effects from the medicines. These statements lend some support to counselors who suggested that the strong dosage of government medicines contributed to patient default, however given that this issue did not come up in any other patient interviews, it is difficult to generalize this as a contributing factor.
- Counselors mentioned that patients tend to put less trust in government services, indicating a preference for private care which was deemed not only more trustworthy but also more effective. This observation is not well reflected in the patient interviews where most patients responded being satisfied with the quality of government care for TB. There were two testimonies, however, that stand out for showing explicit bias for one over the other. One patient stated that while "earlier no one in [her] family would do to a government hospital" through her experience accessing free treatment for TB, "now everyone [in her family] says we should go there". In contrast, another patient maintained that government treatment should be the last resort: "when the money is over, then you go for government treatment". When probed that he was recovering only after having started treatment in a government facility, he stated that while he "realized that the [government] medicine is powerful…[his] family will not listen, they function according to money". Again, there are few instances in the data where patients have spoken openly about their preference for government or private care, making it difficult to make more general comments on patient preference.