RESEARCH ARTICLE

A Randomized Control Trial to Test Effect of Cash Incentives and Training on Active Casefinding for Tuberculosis among Community Health Workers in Nigeria [version 1; peer review: 2 not approved]

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Abstract

Background: Case detection for Tuberculosis remains low in high burden communities. Community Health Workers (CHWs) are the first point of contact for many Nigerians in the rural areas and have been found useful in active case finding. This study assessed the effect of cash incentives and training on tuberculosis case detection by CHWs in six Local Government Areas in Nigeria.

Materials and Methods: A randomised control trial was conducted in three PHC clusters. The intervention Arm (A) received cash incentives for every presumptive case referred. The Training Arm(B) had no cash incentives and the control had neither training nor cash incentives. Case notification rates from the TB program were used to assess the effect of cash incentives on TB case finding. Data was analyzed using Graph Pad Prism. Descriptive data was presented in tables and bivariate data was analyzed using chi square. Mean increases in case notification rates was calculated Statistical significance was set as $P=0.05$.

Results: The intervention identified 394 presumptive TB cases, contributing 30.3% of all presumptive cases notified in the LGAs. Findings also showed an increase of 14.4% ($\chi^2=2.976$, P value=0.2258) in case notification rates for the Arm A that received cash incentives alongside training, there was also an increase of 7.4% ($\chi^2= 1.999$, P value=0.1575) in Arm B that received Training only. Secondary outcomes indicated a 144.8% ($\chi^2= 4.147$, P value=0.1258) increase in

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community outreaches conducted in the Arm that were given cash incentives.

Conclusion: The study demonstrated an increase in TB control activities of case notification and outreaches among community health workers that received cash incentives and training. These findings support the use training and cash incentives for CHWs in high burden TB settings to improve TB case detection rates.

Keywords

Tuberculosis, Active Case finding, Cash incentives, Community Health workers

This article is included in the **TDR** gateway.

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Introduction

Background

Tuberculosis (TB) remains the leading cause of death from a single infectious disease worldwide. Globally, an estimated 10 million people had tuberculosis in 2018¹. 24% of all TB cases are said to occur in the WHO African region, with 4% of these cases occurring in Nigeria¹. TB mortality in Nigeria in 2016 was 39,933 deaths². Although mortality from TB in Nigeria has dropped substantially over time², the WHO Tuberculosis Report 2017 indicated that TB incidence has remained stagnant since the year 2000³. This is largely due to delayed diagnosis and treatment of active cases. A significant proportion of people infected with TB do not report any symptoms at all, and are therefore less likely to seek care or to be diagnosed of TB⁴. This leads to under diagnosing of TB cases, which is a major barrier for TB control.

In 2018, 7 million new cases of TB were notified globally, achieving the UN high-level meeting target which was built on the WHO Flagship Initiative “Find. Treat. All. #EndTB”¹. However, a large gap still remained between the number of cases reported and the estimated cases in 2018 (10 million cases). This gap was found to be due to underreporting and under diagnosis of TB globally, with India, Nigeria, Indonesia, and the Philippines being responsible for over 50% of the noticed gap¹. Under-detection of TB cases, especially active cases, has dire consequences for the infected individuals, their communities, and the country at large, causing a setback in national TB programmes. Traditional case finding methods have consistently failed to bridge the gap between observed cases of TB and the estimated cases¹, hence active case finding has been recommended by WHO, and implemented to increase case detection rates, notification and treatment of TB cases^{3,5}.

Active case-finding involves planned screening of high-risk individuals, such as contacts of TB patients or people living with HIV (PLWHIV). It includes all methods for the identification and then treatment of those with TB who would otherwise not report to the healthcare system⁶. It is also effective in the identification of latent TB, thereby preventing future development of active TB cases⁶. Common screening tools for active case findings include history taking, sputum smear, and chest x-rays.

Context

Nigeria is a high burden TB country with one of the lowest TB Case Detection rates (25%) and accounting for 8% of the total gap between incidence and reported cases globally in 2016⁷. The South-South of Nigeria, where Akwa Ibom (AK) state is, contributed 12% to all forms of TB cases notified nationwide in 2016⁸. The state also has the highest HIV prevalence rate of 5.5% compared to the national average of 1.4%⁸. This makes it imperative that the missing cases be traced as HIV is a major risk factor for TB disease. There are pockets of high TB burden communities in some LGAs in the state, making AKS one of the states with persistently low case detection of all forms of TB.

Many high-risk people such as co-infected, co-morbid, malnourished persons, and children with active TB do not experience typical TB symptoms in the early stages of the disease. They are therefore unlikely to seek care early and may not be properly diagnosed when they eventually seek care. Poor knowledge of symptoms and where to access care also affects the uptake of TB services in our communities. Active case detection has been initiated in high risk patient groups including PLWHIV and diabetes⁴. However, there are still gaps in the patient-initiated screening model. At the community level, passive case detection involves patient awareness and self-presentation to the health facility. It has been observed that awareness about TB is not incorporated into the usual health talks at facilities and outreaches in the state.

Community health workers (CHWs) are key to provision of health services at primary care level as they serve as first point of contact for care for many Nigerians especially those living in the rural areas. There are different categories of community health workers in Nigeria, including Community Health Extension Workers (CHEWs), Community Pharmacists (CPs) and Patent Medicine Vendors (PMVs). The CHEWs are health workers who have been formally trained in the Colleges of Health Technology. They are usually employed by the government to work in the primary health centers, though quite a number currently working in the PHCs in Akwa Ibom state are volunteers⁹.

Community Pharmacy is a branch of pharmacy practice which emphasizes providing medical services in a particular community. Community Pharmacists are responsible for dispensing medications, counselling patients according to their health needs, and providing basic access to health care¹⁰. Community Pharmacies are thought to be the first point of call for health services, in Nigeria, frequently more than the designated Primary Health Centers¹¹. according to a study, reasons cited for preference of the CPs include ease of access, short waiting time, free consultation, and longer-term availability of the community pharmacists to the people^{12,13}.

On the other hand, the patent medicine vendors (PMVs) are individuals that currently work as lay health workers in the community, diagnosing, prescribing and treating minor and major ailments. There are currently no barriers to entry to this level of health workers in the sector, therefore, there is a proliferation of PMVs and CPs, with varied qualifications. The major characteristic here is that they are all self-trained with no regulatory body to guide their training. However, their activities are regulated by the Pharmaceutical Society of Nigeria¹⁴. This body sometimes carries out unannounced checks on their shops to assess that they adhere to stocking and dispensing of only oral medications.

Efficient development of human resource is necessary if TB control is to be achieved, hence, training of frontline health workers to improve their knowledge and attitude with respect to diagnosis, treatment and prevention of TB is an

important strategy for TB control. Studies have shown that good TB knowledge scores among the health workers lead to better TB indices with respect to treatment and prevention. After a week-long training of community health workers in Mozambique, a 14.6% increase in TB case notification rate was noticed in the intervention group compared to a decrease of 16.5% in the control group¹⁵. Similarly, a facility-based study in Enugu reported a 100% increase in TB presumptive cases and TB cases diagnosed three months after health workers training was done¹⁶.

The use of cash incentives has been found to improve commitment of health workers, especially community health workers to their tasks. It has also been found to increase innovation and accountability among health care workers in other programs^{17,18}. There is however inadequate evidence on the use of cash incentives as a motivation for improved case detection rate of TB among health workers, especially community health workers in low middle income countries.

This study aimed to assess the effect of training and cash incentives for referral of presumptive cases of Tuberculosis for appropriate diagnosis and treatment among CHWs in Nigeria. The main research questions were: Can cash incentives and training be used to motivate CHWs to increase TB case detection? The specific objectives were i) to determine effect of cash incentives on TB case detection ii) to determine effect of training CHWs on TB case detection. The hypotheses made in this study were that cash incentives and training will not improve case detection for TB.

Methods

Setting

Akwa Ibom State is located in the South-South region of Nigeria, one of the states in the oil-rich Niger Delta region with a population of about 5.5 million based on 2006 National population census report⁷. The state has 31 local governments distributed across the three senatorial districts. It has 368 Primary health centers, unevenly distributed across the local government areas (LGAs)¹⁹.

Akwa Ibom state has a high burden of TB and HIV. As at the time of this study, the USAID was carrying out TB control activities in 15 LGAs and TB Reach had projects in three of the remaining 16 LGAs. The study population was the 13 LGAs that were not covered by the ongoing TB programs. Following randomization, the LGAs selected for the study were Esit Eket and Uyo (Arm A), Ibiono Ibom and Ibesikpo (Arm B), and Nsit Ibom and Uruan (Arm C-Control).

Study design

The study was designed as a three-arm parallel cluster randomized control study. A panel survey sampling of all Community Health Workers identified as practicing in the communities was planned. There were no exclusions, only if the CHW declined to participate. All clusters were assumed to be equal at baseline.

The RCT was conducted in three high TB burden LGAs in the state. The LGAs were selected from the sampling frame of 13 LGAs, with the aid of the State Tuberculosis and Leprosy Control Officer (STBLCO). In each participating LGA, six PHC facilities offering DOTS treatment and services were selected by simple random sampling and included in the study. Each PHC with availability of DOTS treatment plus the catchment communities served as a cluster for this study. A total of 18 clusters were used in this study, six clusters per Arm. The allocation of PHCs is seen in [Figure 1](#).

The study clusters were randomized to one of the three experimental arms with stratification according to LGA by the researchers. All CHWs in the study cluster were automatically assigned an intervention arm based on this randomization. Training and cash incentives were randomized to study cluster arms A and B. These were recruited with the aid of the facility focal persons, working with the Chairman of the PMVs. All CHWs in the catchment were given an invitation to the training, no exclusions were made, except the person declined to participate. The study PHC thus served as the focal point and referral centre for any cases picked up in the community by the CHWs.

Figure 1. Allocation of Primary Health Centres in the study.

Using the facility focal person as entry point, invitations were sent to all CHWs in the selected communities for a workshop to be conducted centrally in Uyo, the capital city. A panel survey of all PMVs, CPs and any other CHWs identified was conducted in each cluster. All CHWs in each cluster who participated in the workshop and gave consent were enrolled for the study. Blinding of participants to their allocated arms was not possible. To ensure that participants were blinded to the intervention, the clusters were allocated by LGA. LGAs chosen were not contiguous. The training was also conducted on three separate days i.e., Arm A on Day 1, Arm B on Day 2, and Control Arm on Day 3. Blinding of assessors to the different arms was also not possible.

Interventions

All HCWs were targeted in each cluster, as the study was designed as a panel survey. However, a panel survey was not possible as there was large in-and out migration of the PMVs, especially those who originally sent their apprentices to the training. All the HCWs trained in the clusters were followed up for the duration of the study. At endline, we deployed the same method used in recruitment at baseline, targeting all HCWs in the study clusters. This design was used to minimize sampling error and take into account the design effect, and prevent contamination across the three study arms. Therefore, participants were selected as two independent cross-sectional samples.

The interest in evaluating training and cash incentives concurrently informed the choice of a multi-arm cluster randomized trial. The advantages of this design include increasing the chances of finding an effective intervention and lower costs as the two arms run at the same time. It is also documented that sharing a control arm reduces the sample size relative to performing separate 2-arm trials²⁰.

1. Training of CHWs and subsequent outreaches and community health education campaigns to the study population to improve knowledge on TB control services available. A total of 158 HCWs were trained, 85 in Arm A and 73 in Arm B. They were instructed to carry out community education campaigns, identify presumptive TB cases in communities,

collect sputum, and make referrals to the PHC for treatment. The control Arm C had 82 HCWs.

A one-day training session was carried out for each of the arms separately. This was a face-to-face workshop with participants grouped into three clusters. The allocation ratio for the three clusters was 1:1:1 as shown in [Figure 2](#). The training was conducted by the researchers in collaboration with the State Tuberculosis and Leprosy Control Program office. Prior to the workshop, a Training of Trainers was conducted by the Lead Researcher, AKSTBLP State Coordinator and researchers. The Workshop facilitators were trained on the course contents. This was to develop a shared understanding of the aims of the workshop and familiarize them with the contents of the workshop materials.

Training manuals were developed specifically for the research and distributed to participants. Facilitators used both the training manuals and power point presentations developed from the manuals. Facilitators used participatory learning methods to deliver the course contents. The contents of the training was based on the module developed for active TB case finding for community health workers through house-to-house search for community based organizations (CBOs) and CHWs by the National Tuberculosis and Leprosy Control Program (NTBLCP)²¹. The sessions included training on basic symptoms, misconceptions diagnosis and treatment of TB, identification of presumptive TB cases, sputum collection and transportation and linking TB patients to care and treatment.

Participants were also taught how to collect sputum samples by the State Laboratory Focal Person for TB. Sputum cups were donated by the STBLCP program, the researchers procured transportation media (plastic bowls that could contain 4 sputa cups). At the end of the training, each participant was given a container for transporting sputum, 4 sputa cups, a presumptive case referral booklet and information, education and communication (IEC) materials to be used in educating clients.

Participants were instructed to carry out community education campaigns, identify presumptive TB cases in communities, collect sputum and make referrals to the PHC for treatment.

Figure 2. Allocation of Community Health Workers by intervention.

The control Arm C had 41 CHWs. They were also requested to organize outreach health education campaigns in the communities.

2. Cash incentives to PMVs and CPs for referral of presumptive cases for screening. The intervention Arm A (85) received cash incentives of 200 naira (USD0.78) for every presumptive case referred for screening.

Besides these, there were also supportive supervisory visits (SSVs) to the CHWs, where they were encouraged to carry out outreaches. The CHWs were to identify Presumptive cases, collect sputum samples, transport the smears to the PHCs from where they were transported to designated laboratories. The results were sent back through the PHC TB focal persons and all individual positive results were offered treatment at home or the local health post.

The interventions took place in the PHCs and communities where the CHWs, PMVs and CPs practiced. While most of the CHEWs worked in the public sector PHCs, the CPs and PMVs work in the private sector, setting up their shops with the sole aim of making profit. The baseline interventions were carried out in April 2019 and follow-up was carried out quarterly until March 2020. The trial ended as scheduled after one year, though the COVID-19 pandemic lockdown interrupted endline data collection and close-out of project.

Data collection

Data collection was carried out for a period of 12 months starting in April 2019 and ended in March 2020. Data collection was done via quarterly supportive supervisory visits (SSV) made to the trained Community Health Extension Workers (CHEWs), PMVs and CPs. During the quarterly SSVs, data was collected from the CHWs and compared with the facility TB register. The number of presumptive cases referred, and number of outreaches conducted during the quarter were documented.

A pre-intervention assessment of CHWs knowledge on TB was done using a pre-tested self-administered structured questionnaire. This was a standardized and validated questionnaire used by the national TB program for the 2017 TB Prevalence survey in Nigeria. The questionnaires were administered just before the training workshop for study arms A and B. However, they were administered at the six PHC facilities for the control arm as there was no training conducted for them. A post-intervention assessment was also done using the same tool after 12 months, in the PHC facilities in each of the clusters.

All materials used for training and data collection have been made available in the Dryad and Zenodo repositories²².

The Primary outcomes for the intervention were number of presumptive cases referred to the facility. However, TB case notification was used in analysis instead of presumptive cases. Two reasons accounted for this change i) presumptive cases are generally not used as a measure of TB control and

ii) some of the PHC clusters were new DOTS facilities and had zero presumptive cases pre-intervention. Case notification data was accessed from the State TB program database. Although the original intention was to assess outcome at cluster level, final analysis was carried out at LGA level. Secondary outcomes included number of outreaches conducted per cluster and proportion of CHWs with correct knowledge post intervention analyzed at cluster level. The proportion of CHWs with correct knowledge post-intervention has been fully discussed in another paper. The number of outreaches was also analyzed by LGAs.

Data analysis

Data was collected and entered into Microsoft excel spreadsheet, version 2013, then collated and analyzed using STATA version 13 (Stata, RRID:SCR_012763) and GraphPad Prism version 8 (GraphPad Prism, RRID:SCR_002798). The statistician was blinded to the study allocation until the data set was ready for final analysis. Descriptive data were analysed using summary statistics. Chi-square(χ^2) tests were used to test differences in proportions over the study period. Continuous variables with normal distributions were compared using means and SD and tested using parametric statistics. An open access alternative software than can perform these same functions would be R (R Project for Statistical Computing, RRID:SCR_001905).

Ethical approval

Ethical Approval was sought and obtained from the University of Uyo Institutional Health Ethics Research Board (UUTH/AD/S/93/VOLXXI/253). Approval was also obtained from the State Ministry of Health Ethics Review Board(MH/PRS/99/VOL.5/511). Individual verbal and written consent were sought and obtained from all participants. Verbal permission was also sought and granted by the Local Government PMV chairmen.

Only CHWs who consented to participate were recruited into the study. All presumptive cases identified were referred for screening and positive cases were linked up to the State TB program for treatment with DOTS.

Results

Participants were recruited in April 2019 and followed up for one year. The trial ended in a year as intended. In May 2020, the endline assessment was done. All 18 clusters were analyzed as intended, six clusters per Arm. A total of 240 HCWs were recruited as follows: Arm A (85), Arm B (73) and Arm C(82). See [Figure 2](#).

A total of 158 CHWs were trained at the beginning of the intervention, clustered as Arm A and Arm B. [Table 1](#) shows the socio demographic characteristics of participants. Of these, 62.5% were females, 87.9% were less than 40 years old and 33.3% had a tertiary level of education. Majority of the participants were PMVs (78.8%), while 17.9% were CHEWs and 3.3% identified themselves as students, auxiliary nurses and were categorized as 'others'.

Table 1. Baseline Socio-demographic Characteristics of the Health workers.

Variables	Arm A Training and Cash Incentives (n=85)	Arm B Training (n=73)	Control (n=82)	Total (n=240)	Statistical indices
Sex					Df=2
Male	38 (44.7)	30 (41.1)	22 (26.8)	90 (37.5)	X ² =3.7864
Female	47 (55.3)	43 (58.9)	60 (73.2)	150 (62.5)	P value=0.151
Age (years)					Df=2
≤30	32 (37.7)	39 (53.4)	44 (53.7)	115 (47.9)	P value=0.108
31–40	38 (44.7)	24 (32.9)	34 (41.5)	96 (40.0)	
≥41	15 (17.6)	10 (13.7)	4 (4.9)	29 (12.1)	
Level of education					Df=2
Primary	1 (1.2)	4 (5.5)	0 (0.0)	5 (2.1)	P value=0.389
Secondary	54 (63.5)	43 (58.9)	58 (70.7)	155 (64.6)	
Tertiary	30 (35.3)	26 (35.6)	24 (29.3)	80 (33.3)	
Job title					Df=4
PMVs	68 (80.0)	57 (78.1)	64 (78.0)	189 (78.8)	P value=0.936
PHC workers	15 (17.7)	14 (19.2)	14 (17.1)	43 (17.9)	
Others	2 (2.3)	2 (2.7)	4 (4.9)	8 (3.3)	
Duration at the current position					Df=8
Less than 1 year	12 (14.1)	15 (20.5)	8 (9.8)	35 (14.6)	P value=0.035*
1–4 years	26 (30.6)	29 (39.7)	22 (26.8)	77 (32.1)	
5–9 years	16 (18.8)	16 (21.9)	34 (41.5)	66 (27.5)	
10–14 years	17 (20.0)	4 (5.5)	10 (12.2)	31 (12.9)	
≥15 years	14 (16.5)	9 (12.3)	8 (9.8)	31 (12.9)	
Type of facility					Df=4
PHC	17 (20.0)	16 (21.9)	16 (19.5)	49 (20.4)	P value<0.0001*
Chemist shop	44 (51.8)	56 (76.7)	66 (80.5)	166 (69.2)	
Others	24 (28.2)	1 (1.4)	0 (0.0)	25 (10.4)	
Trained on TB					Df=2
Yes	15 (17.7)	21 (28.8)	36 (43.9)	72 (30.0)	X ² =9.7982
No	70 (82.3)	52 (71.2)	46 (56.1)	168 (70.0)	P value=0.007*
Have access to TB guideline					Df=2
Yes	11 (12.9)	21 (28.8)	26 (31.7)	58 (24.2)	X ² =8.0613
No	74 (87.1)	52 (71.2)	56 (68.3)	182 (75.8)	P value=0.018*

* = Statistically significant

The total of CHWs who had received a training on TB within the last two years was 72, representing 30% of the population. A significantly higher proportion of these were in the Control Arm (43.9%). Also 24.2% of the CHWs had access to TB guidelines, with a higher proportion of those in the control group stating that they had access to TB guidelines (31.7%).

Table 2 shows the socio-demographic characteristics of participants at endline across the three arms. At endline, there was female preponderance (53.4%), 81.9% were below 40 years old, majority of them had attained secondary education (64.3%) and 77.4% of them being PMVs. There was a statistically significant difference in the duration of current job of the

HCWs across the three arms ($p=0.006$), and in the type of health facility across the three arms ($p<0.001$).

Data from the intervention shows a total of 394 presumptive cases notified from the intervention. This represents 30.3% of all presumptive case notification from the LGAs covered by this intervention and 41.6% of all presumptive case notifications from the PHCs serving as cluster focal facilities. Figure 3 shows the trend in presumptive TB case notification in the intervention LGAs.

Data from the intervention suggests an increase of 14.4% in case notification rates between 2018 and 2019 for Arm A

Table 2. Endline Socio-demographic characteristics of the HCWs.

	Training and Cash Incentives (n=72)	Training only (n=77)	Control (n=72)	Total (n=240)	
Sex					Df=2
Male	32 (44.4)	39 (50.6)	32 (44.4)	103 (46.6)	X ² =0.7762
Female	40 (55.6)	38 (49.4)	40 (55.6)	118 (53.4)	P value=0.7762
Age (years)					Df=6
30 and below	24 (33.3)	36 (46.8)	23 (31.9)	83 (37.6)	X ² =6.2618
31–40	36 (50.0)	26 (33.8)	36 (50.0)	98 (44.3)	P value=0.395
≥41	12 (16.7)	15 (19.5)	13 (18.1)	40 (18.1)	
Level of education					Df=4
Primary	3 (4.2)	3 (3.9)	0 (0.0)	6 (2.7)	X ² =4.8985
Secondary	44 (61.1)	46 (59.7)	52 (72.2)	142 (64.3)	P value=0.298
Tertiary	25 (34.7)	28 (36.4)	20 (27.8)	73 (33.0)	
Job title					Df=4
Health workers	13 (18.1)	8 (10.4)	11 (15.3)	32 (14.5)	X ² =5.9548
PMVs	52 (72.2)	60 (77.9)	59 (81.9)	171 (77.4)	P value=0.203
Others	7 (9.7)	9 (11.7)	2 (2.8)	18 (8.4)	
Duration of current job					Df=8
Less than 1year	7 (9.7)	16 (20.8)	1 (1.4)	24 (10.9)	X ² =21.6794
1–4 years	31 (43.1)	28 (36.4)	25 (34.7)	84 (38.0)	P value=0.006*
5–9 years	16 (22.2)	14 (18.2)	16 (22.2)	46 (20.8)	
10–14 years	8 (11.1)	7 (9.1)	18 (25.0)	33 (14.9)	
15 years and above	10 (13.9)	12 (16.6)	12 (16.7)	34 (15.4)	
Type of health facility					Df=4
Primary	14 (19.4)	13 (16.9)	12 (16.7)	39 (17.7)	X ² = 123.9411
Chemist	52 (72.2)	7 (9.1)	58 (80.6)	117 (52.9)	P value<0.0001*
Others	6 (8.3)	57 (74.0)	2 (2.8)	65 (29.4)	

Trends in presumptive cases referred to cluster facilities from 2nd quarter 2019 to 1st quarter 2020

A = Cash incentives and training arm, B = Training only,
C = Control Arm

Figure 3. Trends in presumptive cases referred to cluster facilities during the intervention Period.

(Cash incentives and Training) and an increase of 7.4% in Arm B. However, as seen in Table 3–Table 5, the increases were not statistically significant.

A total of 120 outreaches were conducted during the intervention period. For Arm A, there was a 144.8% increase in number of outreaches over the previous year (pre-intervention).

Arm B recorded a 46.7% increase while the control Arm C showed a 22.7% increase in number of outreaches (Table 6). These differences were however not statistically significant.

Discussion

This study aimed to assess the effect of cash incentives and training on active case finding for TB in a high burden setting.

Table 3. Comparison of Case Notification in the three intervention arms.

	Arm A (Cash Incentives + Training)	Arm B (Training only)	Arm C (Control)	
Pre Intervention(2018)	362(46.7)	134(48.2)	131(41.7)	Df=2 X ² =2.976 P value=0.2258
Post Intervention(2019)	414(53.3)	144(51.8)	183(58.3)	
Difference(Increase in case notification)	14.4%	7.5%	39.7%	

Table 4. Comparison of Case Notification in Cash Incentives and Training Arm.

	Arm A (Cash Incentives + Training)	Arm C (Control)	
Pre Intervention (2018)	362(46.7)	131(48.2)	Df=1 X ² = 1.999 P value=0.1575
Post Intervention(2019)	414(53.3)	183(51.8)	

Table 5. Case Notification rates in 2018(Pre-intervention) compared with 2019(Post Intervention).

	Arm B (Training only)	Arm C (Control)	
Pre Intervention(2018)	362(50.57)	414(44.04)	Df=1 X ² =2.250 P value=0.1336
Post Intervention(2019)	131(49.43)	183(55.96)	

Table 6. Outreach Activities across the 3 study arms pre and post-intervention.

	Arm A (Cash Incentives + Training)	Arm B (Training only)	Arm C Control	Statistic
Number conducted 2018	29(43.9)	15(22.7)	22(33.3)	Df=2 X ² = 4.147 P value=0.1258
Number conducted 2019	71(59.2)	22(18.3)	27(22.5)	
Difference in outreach(percentage increase)	42(144.8%)	7(46.7%)	5(22.7%)	

A total of 158 CHWs were trained at the beginning of the intervention. The majority were females, less than 40 years old, and had a tertiary level of education. Most were also PMVs (78.8%), while only 17.9% were CHEWs. Both baseline and endline characteristics of the CHWs showed striking similarities. This shows that the CHWs sampled were essentially the same. Studies in Kenya had reported similar characteristics for CHWs^{23,24}. The study showed that 30% of the respondents had previously been trained on TB. Our findings give evidence that PMVs are the first point of contact for care especially in rural communities, where our study was based.

Our study demonstrated an increase in presumptive case notifications in the intervention Arms. With data from the intervention facilities accounting for a total of 394 presumptive cases representing 41.6% of all presumptive case notifications from the PHCs serving as cluster focal facilities. This also accounted for 30.3% of all presumptive case notification from the LGAs covered by the intervention. Other studies have documented evidence that community based interventions for active case finding leads to improved outcomes for TB control programs^{25–27}. Such interventions include training of health care workers on presumptive case detection, sputum collection, and referral for treatment. However, evidence seemed to find that these led to short term improvements²⁶.

The index study demonstrated a 7.4% increase in the training Arm, suggesting an effect of training increased presumptive cases detected. This compares with previous studies on training interventions to improve health outcomes. In a systematic review of interventions on cardiovascular disease prevention and management, eight studies showed improved knowledge of health care workers after training, and retention of acquired knowledge up to six months after training²⁸. In a study in China, it was found that training improved the knowledge of definitions, case detection and laboratory diagnosis of TB up to a year after training²⁹. Similarly, studies done in Fiji show TB case notification rates during the period of training activities increased significantly compared with the years when no training activities took place²⁷.

We also found a 14.4% increase in case notification in the cash incentives Arm and 7.4% in the training Arm. This study utilized case notification instead of case detection rates (CDR). This is because CDR uses incidence as a denominator, which is a very uncertain estimate as it is not measured but estimated. Similar observations have been made in previous studies^{17,30}. In an evaluation of TB REACH Wave 1 interventions in Pakistan, sputum smear positive (SS+) TB notifications increased by 24.9%. It was also found that among 19 projects with control populations, sputum smear positive TB case notifications increased by 36.9%, while in the control populations a 3.6% decrease was observed³¹. Again, this contrasts with findings of the index study which recorded increases in the intervention arms (14.4% and 7.4%), and an even larger increase (39%) in the control Arm. Our findings are also similar to that seen in Mozambique where there was a 14.6% increase in notification of all forms of people

with TB over the baseline. However, contrary to what we found in our study, the control districts had a decrease in notification (-16.5%)¹⁵.

Cost effectiveness analysis also demonstrates that incentive-driven active case finding of TB was more effective and less expensive per disability-adjusted life years (DALY) averted when compared to the baseline passive case finding. This was seen in a study in Pakistan, when both alternatives are compared to a common baseline situation of no screening³².

The paradoxical increase in case notification found in our study was thought to be due to the fact there was another ongoing intervention in the LGAs. This was evident in the findings that a higher proportion of the participants in the control group had received training on TB prior to the commencement of this study, and also had access to TB guidelines.

With regard to TB outreach activities carried out during the one-year period, A marked increase was observed across all three study arms, with the training and cash incentive arm having an increase of about 145%, far higher than was noticed in the training only and control arms. Community outreach programmes have been found in some studies to improve detection of symptomatic and infectious TB cases in the community²¹. However, others have found that cases detected through TB outreaches were the less infectious cases with few symptoms who are reluctant to commence or complete treatment²². Nevertheless, it is important to track and notify all forms of TB in the community if the End TB Strategy goal of reduction of incidence by 80% is to be achieved³³.

Other components of this study included cash support for outreaches and supportive supervision. Although a recently concluded systematic review conducted to inform the recent World Health Organization (WHO) guidelines on CHW programmes reported “very low certainty” regarding the evidence on supportive supervision³⁴, other studies have demonstrated improved performance of CHWs with supportive supervision³⁵. In a recent review of literature on CHW productivity, the authors suggested that productivity was based on a combination of three elements: (1) knowledge and skills, (2) motivation, and (3) the work environment. The work environment encompassed workload, supervision, supplies and equipment, and level of respect that other health workers had for the CHWs. In their review, the authors maintained that supportive supervision was a critical factor in creating and maintaining an enabling work environment. In another recent study, the majority of participants stated that supervision was one of the most important factors for maintaining a functional cadre of motivated CHWs because supervisors serve as a link between CHWs and the health system. The support that supervisors can provide CHWs helps them to feel valued and feel like an important part of a larger organization^{36,37}. The findings of these components of our study will be fully discussed in another paper.

A limitation of this study was the inability to completely retain all HCWs recruited at baseline, this led to the analysis at LGA level instead of the cluster level originally planned. However, the similarity in baseline and endline characteristic shows the participants were essentially similar and were thus comparable

Another limitation of this study was the ongoing parallel active case finding intervention in the control communities, during the period of the study. This explains the somewhat paradoxical findings. In retrospect, a baseline assessment of all participants before randomization would have helped to mitigate this effect. However, the study findings are generalizable and applicable to other high burden TB settings.

Conclusion

The study demonstrated an increase in TB case notification and outreaches among health workers that received cash incentives and training. There was a double increase in case notifications in the Arms that received cash incentives compared to the Arm that received training only. TB outreach programmes however saw considerable increase in the LGAs in the training and cash incentive arm compared to the training only and control arms.

The results from this study suggest that the cash incentives given the CHWs motivated them to improve presumptive case detection above the previous years. These findings support the use of incentives for CHWs in high-burden TB settings to improve TB case detection rates. Therefore, cash incentives and training can be used to motivate lay health workers and integrate them into the TB control program to improve TB case detection.

These results add to the growing evidence base showing that different multicomponent approaches like training, supporting health workers and cash incentives for TB case finding can have a significant improvement on TB notifications.

We recommend implementation of the intervention in other low case detection, but high TB burden settings. Future researchers into active case finding for TB in high burden areas need to consider carefully the recruitment and randomization process. Further studies are needed, however, to demonstrate the cost-effectiveness of using cash incentives in TB case finding in high burden settings.

Data availability

Dryad: Improving Tuberculosis case finding in Nigeria. <https://doi.org/10.5061/dryad.tht76hf0737>.

This project contains the following underlying data.

- Readme_Improving Tuberculosis case finding in Nigeria.xlsx (files of all variables in csv file)
- TB Community data Post intervention.xlsx (data from post intervention community survey in csv file)

- TB Community data pre-intervention.xlsx (data from post intervention community survey in csv file)
- TB Health care workers Baseline.xlsx (data from baseline survey of health care workers in csv file)
- TB Health care workers endline.xlsx (data from endline survey of health care workers in csv file)
- TB study Outcome (summary data from intervention and state TBL program).xlsx

Data are available under the terms of the [Creative Commons Zero “No rights reserved” data waiver](#) (CC0 1.0 Public domain dedication).

Extended data

Zenodo: Improving Tuberculosis case finding in Nigeria²². <https://doi.org/10.5281/zenodo.5062448>.

This project contains the following extended data:

- Ethical_Approval_2_SMOH.jpg (ethical approval from the Akwa Ibom State Ministry of Health)
- Ethical_Approval_TB_1.pdf (ethical approval from the University of Uyo Teaching Hospital)
- FINAL_RESEARCH_PROTOCOL_FOR_TB_STUDY-docx.docx (Research protocol used for the study)
- Questionnaires_for_the_TB_Study.zip (Health care worker and community questionnaires used for the survey)
- Training_Kit.zip (copy of modules used for training intervention)
- TrialApprovalLetter3.pdf (Trial approval letter from PanAfrican Clinical Trial Registry)

Reporting guidelines

CONSORT checklist for ‘**A Randomized Control Trial to Test Effect of Cash Incentives and Training on Active Casefinding for Tuberculosis among Community Health Workers in Nigeria**’ <https://doi.org/10.5281/zenodo.5062448>.

Consent

Written informed consent for publication of the participants details was obtained from the participants.

Acknowledgements

The authors acknowledge Mr. Edidiong Umoh and Mrs Ekom Ekwo for the coordination of the field work and database for the entire project roles. We also acknowledge the Health Systems Research Hub, University of Uyo for providing the platform to conduct this study.

Trial registration

This study was registered in the Pan African Clinical Trial Registry (www.pactr.org) database, with the unique identification number **PACTR202010691865364**.

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Angela Oyo-Ita

Department of Community Medicine, University of Calabar Teaching Hospital, Calabar, Nigeria

TITLE: Should be amended to read "Effect of training of Community Health workers and cash incentive on active case finding of Tuberculosis in Nigeria: a cluster randomized control trial"

ABSTRACT: Description on the three arms of study imply that Arm "A" received cash incentive, Arm "B" received training and Arm "C" received none of the two interventions. Full description in the text shows that Arm "A" received both training and cash incentive and both Arms "B" and "C" received training. This needs to be clarified.

In the materials and methods section authors state that "mean increases in case notification rates was calculated." This statement is not clear.

Only presumptive cases of Tb increased from the study sites which is expected. It is uncertain how this improved Tb case finding in the study as indicated in the title. Non statistically significant differences between study arms are reported as increase in effect; conclusion is therefore faulty.

STUDY DESIGN: This needs more clarification. Are the 13 LGAs the high burden LGAs? The unit of clustering is not clear. On one hand it is said to be "PHC with availability of DOTS treatment plus the catchment communities" and on the other it is the LGA ("... the clusters were allocated by LGA"). The latter is further supported that the LGAs were non-contiguous. The statement on blinding is also contradictory. The training should be moved to the intervention sub-section.

INTERVENTION: The three arms of study are reported as receiving training. This implies that there was no control arm with no intervention as stated in the abstract.

Sampling was not necessary as all the eligible health workers were included in the study except those who declined.

DATA COLLECTION: There was a change in the primary outcome from number of presumptive cases referred to Tb case notification, but the former is what is presented in the abstract. There should be consistency in reporting the outcomes that were studied.

RESULTS: The report of training of 158 participants contradicts what is presented in the

“intervention” sub section. Odds or Risk Ratio analysis is preferable to chi square test.

DISCUSSION: The reported increase in the number of reported presumptive cases is not supported by the data. It should be reported in the perspective of the analyzed data. It is indicated that the interventions were not limited to training and cash incentive to the Community Workers but included supportive supervision and cash support for outreaches. The extent to which the different arms of study were impacted with these added interventions cannot be ascertained. Whatever “effect” there may be, therefore, cannot be attributed to the training and cash incentive only.

LIMITATIONS: Authors should state the number loss-to-follow up. In reference to the comment on sampling in the intervention sub section all participants should have been followed up at pre and post intervention. Having a pre and post demography data implies that it was not the same people that were trained that the investigators followed up with.

CONCLUSION: this is not supported by the available data. It needs to be reviewed.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

No

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Maternal and Child Health

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Reviewer Report 11 July 2022

<https://doi.org/10.5256/f1000research.57244.r143446>

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Title and abstract

1. In the title, replace the word "effect" with "effectiveness".
2. Proposed title - "Effectiveness of providing cash incentives and training to community health workers on active case finding for tuberculosis in Nigeria: a randomized control trial"
3. In the abstract, make it clear whether the community health workers are contracted or employed under the national TB program, or, are health workers associated with the primary health centers.
4. Clarify PHC 'clusters' in the abstract. Why use the term clusters for PHC? It is giving an impression as if a group of PHCs was included in the trial.
5. "Descriptive data were presented in tables and bivariate data was analyzed using chi-square. Mean increases in case notification rates were calculated Statistical significance was set as $P=0.05$." - this reads quite non-impressive and simple. Authors can avoid mentioning "descriptive data was presented in tables". In this section, the authors need to elaborate on the analysis plan.
6. "bivariate data were analyzed using chi-square" - what were the primary exposure and outcome variables? The authors need to mention that 'abc' was compared with 'xyz' using the 'pqr' test of statistical significance.
7. What is "LGAs"? Please refrain from using unstandardized abbreviations.
8. None of the results were statistically significant. However, the authors have not mentioned this in words in the results section, which is compulsory.
9. What was the effect size? The authors should report Odds Ratios and the adjusted Odds Ratios with 95% confidence intervals.
10. None of the results are statistically significant, however, the authors conclude that "training and cash incentives for CHWs in high burden TB settings to improve TB case detection rates", which is a wrong conclusion. Authors should state that "though statistically insignificant, in our study setting of a high burden of TB with low incomes, we found improvement in percentages of active case finding through training and cash incentive interventions. Future research should test the effectiveness of these interventions to

determine their impact on active case finding in other high-burden settings to confirm statistically significant associations.”

11. The full text mentions the use of both STATA and graph pad prism, whereas the abstract mentions only one. Please clarify and correct it.

Introduction

- Background and context - both increase the word count and decrease readability. Authors should be very precise and succinct in their writing. Focus on the rationale, rather than on the problem statement.

Materials and methods

1. Please refer to all comments given in the abstract, many of them might need correction in the full text as well.
2. “An open access alternative software than can perform these same functions would be R (R Project for Statistical Computing, RRID:SCR_001905).” - why this sentence?
3. Why was a multivariable analysis not planned by the investigators? Any bivariate analysis should be followed by multivariable analysis.

Results

- Please refer to all comments given in the abstract, many of them might need correction in the full text as well.

Discussion

- “The study findings are generalizable and applicable to other high burden TB settings.” - so, are the authors suggesting that there is no effect of cash incentives and training on active case finding. The authors should cautiously interpret their data in light of the insignificant results presented in the results section.

Conclusion

- Please refer to all comments given in the abstract and discussion sections, many of them might need correction in the full text as well.

Figures and tables

- No comments, however, tables of univariable and multivariable analysis (preferably logistic regression) are compulsory.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

No

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Tuberculosis, epidemiology, public health

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

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