An Evaluation of Innovative Community-based Approaches and Systematic Tuberculosis Screening to Improve Tuberculosis Case Detection in Ebonyi State, Nigeria

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Abstract

Background: National tuberculosis (TB) programmes globally rely heavily on passive case finding for detecting TB in the community as advocated by the World Health Organization (WHO). TB case detection is low in Nigeria despite improvement in TB services and coverage.

Methods: A retrospective evaluation of an active case-finding intervention utilizing community-based approaches and targeted systematic TB screening in Ebonyi State, Nigeria was done. The analysis was performed using Epi Info. Results: Using community-based and health-facility-based systematic screening strategies, 218,751 persons were screened, with 19.7% of them being presumptive TB cases. Among these, 23,729 (55.1%) submitted sputum samples for microscopy, and 764 (3.2%) had smear-positive TB. In addition, 683 individuals were diagnosed with other forms of TB using X-ray and clinical evaluation giving a total of 1447 all forms of TB cases. The overall number needed to screen (NNS) to find one person with all forms of TB through the project was 151. The NNS was 53 for general outpatients, 88 through contact tracing, and 110 among HIV-infected persons. Conclusions: Active case-finding strategies achieved good yields though early loss to follow-up was high. Active case finding is recommended for integration into national TB control policy and practice.

Keywords: Active case-finding, Ebonyi State, intensified case finding, Nigeria, tuberculosis, tuberculosis screening

Introduction

Although tuberculosis (TB) control programmes have made considerable progress in detection and notification of TB and averted millions of deaths in the last two decades, TB case detection and notification have stalled in recent times. Every year, about 1.3 million people die from TB.1 One key reason for this high case fatality rate is inadequate TB case finding. Of the estimated 8.6 million incident TB cases in 2012, about 3 million were missed by the notification systems.2 Undetected pulmonary TB patients continue to transmit the disease while poorly managed cases often develop drug resistance – both instances are associated with high mortality.3,4 The World Health Organization (WHO) global TB control policy advocates the directly observed therapy-short course (DOTS) strategy which utilizes passive self-presentation for case detection. The current realities suggest that an active TB case-finding (ACF) strategy, especially in high prevalence areas with high burden of HIV, may be a necessary component of TB control. Compared with self-presentation, active case finding is likely to lead to an improved early diagnosis of TB, early initiation of treatment, reduced morbidity and mortality, reduced community transmission, and reduced incidence/prevalence of TB.5

Access this article online

Quick Response Code:  
Website: www.ijmyco.org

DOI: 10.4103/ijmy.ijmy_91_17

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How to cite this article: Oshi DC, Omeje JC, Oshi SN, Alobu IN, Chukwu NE, Nwokocha C, et al. An evaluation of innovative community-based approaches and systematic tuberculosis screening to improve tuberculosis case detection in Ebonyi State, Nigeria. Int J Mycobacteriol 2017;6:246-52.
TB remains an important cause of morbidity and mortality in Nigeria.[3] Despite the adoption of the DOTS strategy in the early 1990s and its 100% geographic coverage by 2009, the case notification of TB in Nigeria is far below the estimated number of cases.[5] The 2012 national TB prevalence survey in the country showed that only one out of every five TB cases in the community was notified (the highest in the world).[2] Although in 2013, the incidence rate of TB in Nigeria was 338/100,000 (NTP 2013 unpublished data), case notification rate was 57.3/100,000 population while treatment success rate reached 85% in 2012.[10] Furthermore, despite the high ratio of prevalent to notified TB cases, about 75% of prevalent cases already had typical TB symptoms but had not yet sought care or had sought health care but diagnosis missed.[5] This suggests that the burden of disease caused by TB remains high and there is considerable transmission of TB in the community in Nigeria. In accordance with the WHO, the Nigeria National TB Control Programme (NTP) relies on passive case finding among symptomatic individuals seeking care at the health facilities. However, as 75% of the population resides in rural areas, and a similar proportion lives below poverty line – and 95% of the population not having any financial protection for health – majority of these cases do not reach the health system.[6-8] Moreover, poor knowledge about the disease and availability of treatment contribute to TB patients failing or delaying to access health services.[9,10]

Innovative case-finding interventions are therefore needed to improve TB case detection and treatment, especially in high prevalence settings. To address the shortcomings of the DOTS TB control strategies, the WHO and the Stop TB Partnership adopted the “Stop TB Strategy” in 2006.[11,12] Community approaches to TB prevention, diagnosis, care, and treatment were recognized as a critical element in the new strategies.[13,14] Efforts are now being made toward using active screening (case finding) approaches to detect more TB cases. Such efforts will contribute to our understanding of what specific ACF approaches may work in specific context, as well as the number of people needed to screen (NNS) in each specific ACF strategy. NNS provides a basic indicator of the efficiency of an intervention and a measure of the potential to improve case notification in a given population.[15] A systematic review of the NNS to detect an active case of TB found large variation across a few studies from high burden countries.[16]

The Ebonyi State TB and Leprosy Control Programme (EB STBLCP) alongside Centre for Development and Reproductive Health (CDRH), Nigeria, received funding from the wave-3 TB REACH grant to undertake a number of ACF interventions in Ebonyi State. This provided a unique opportunity for a Nigerian state to (i) Apply ACF approaches to increase TB case detection and (ii) contribute to our knowledge about which interventions may yield gains in case detection and whether active case finding is feasible and valuable to be integrated into TB control policy and practice. We, therefore, describe here the experience of implementing a multifaceted intervention package to improve TB case detection in Ebonyi State, Nigeria, document challenges encountered and outline lessons learnt for TB control policy and practice.

**Methods**

**Study design**

We evaluated the implementation of a multifaceted intervention package to improve TB case detection in Ebonyi State, Nigeria. The intervention was carried out in six of the 13 local government areas (LGAs) in the state. The intervention area has a population of 1,260,824.

**Study setting**

Ebonyi, one of the Nigeria’s 36 states, is located in south-east Nigeria with an estimated population of over 2.5 million people.[6] DOTS coverage in the state has reached 100%, and treatment success rate in 2008 was 88.7%;[17,18] however, its case detection rate remained around 40%,[19] and TB/HIV coinfection rate was 28%.[20] Ebonyi State has 13 administrative local government areas (basic management units) and is served by 150 health facilities.

**Intervention**

The intervention aimed to improve TB case detection through active case finding as opposed to passive case finding and help to generate evidence on whether or not active case finding should be integrated into the NTP as a policy strategy for TB control. The key components of the intervention package carried out in the intervention area are outlined below:

1. A capacity strengthening component with tailored training workshops for all health workers within the NTP and laboratory staff; familiarization and awareness creation workshops for political, community, and religious leaders and other stakeholders in Ebonyi State; the training of “community mobile health team,” “ad hoc staff” (screeners), the appointment of one project supervisor per local government area to support and supervise field activities.

2. Advocacy, communication, and social mobilization component delivering messages about TB and the availability of the services during community meetings, campaigns, and the local radios. In addition, roadside shows were carried out to further increase awareness about TB.

3. Active case-finding strategies: The six main strategies for active case finding were
   a. Community outreach: Community mobile health teams conducted TB screening outreaches and house-to-house visits in the intervention area to identify the individuals with chronic cough, inform symptomatic individuals how to produce sputum, and collect three (spot-morning-spot) sputum specimens for smear microscopy;
   b. Active case finding for TB among women attending antenatal care (ANC) clinics;
   c. Active case finding for TB among women attending mother and child health (MCH) clinics;
d. Active case finding for TB among people living with HIV (PLHIV) attending antiretroviral clinics;
e. Active case finding for TB among people attending general outpatient department (GOPDs); and
f. Active screening, at their homes, of contacts of registered smear-positive TB patients.

Screening methods
The screening procedures for all clinics and the GOPD were identical. Screeners worked in the waiting area of the sites and approached all patients and their attendants. They administered a short questionnaire to identify people for further diagnostic testing. Anyone with a cough for 2 weeks or more, previous history of TB or a family member currently/previoulsy with disease was suspected of having TB. Verbal consent was requested; further personal details were obtained, and then, the individuals were asked to submit three sputum samples for smear microscopy. A spot sample was obtained from all presumptive TB cases after the screening questionnaire was completed. In addition, the second sputum container was provided, so presumptive TB cases would return with a morning specimen the following day and when this container was returned, another spot sputum sample was collected as per NTP guidelines. Project supervisors visited the clinics each evening to transport sputum samples to the laboratory where they were examined the following morning. In addition, the clinician could designate an individual as someone with suspected extrapulmonary TB which would also be captured by the screeners. A similar approach was used for the evaluation of contacts of TB patients in the intervention area. Among people identified for further testing, the screener captured information on other TB-associated symptoms, including hemoptysis, fever, weight loss, and night sweats.

Diagnostic procedures
All sputum samples were examined in one of the quality-assured laboratories within the NTP laboratory network using sputum smear microscopy. As per the NTP guidelines for TB diagnosis, any person with at least two positive smear results (inclusive of scanty readings) was considered SS + and eligible for treatment. However, individuals who are HIV positive were diagnosed as having TB with one or more positive sputum samples. If multiple slides had different results, the highest smear grading was used for classification. Presumptive TB cases who had negative smear results were further evaluated by clinicians using chest X-ray. Diagnosed individuals were placed on treatment, which was provided free of charge with NTP provided drugs. Screeners made phone calls to patients who were identified as cases but yet to be initiated on treatment – i.e., those about to default.

Evaluation
Data collection took place at the study sites (healthcare facilities) and EB STBLCP and CDRH offices. The investigators retrieved data from project Screening Forms, Screening Registers, Facility TB Treatment Registers, TB Treatment Cards, Laboratory Registers, and Patients’ folders. Variables included sociodemographic data, screening outcome (whether or not an individual was identified as a presumptive TB case), diagnostic outcome (whether a presumptive TB case was confirmed as having TB disease), mode of diagnosis, whether the confirmed case was registered and treated at the facility or not.

The main focus of the evaluation was to critically examine the extent to which each of the strategies was successful in screening individuals who did not self-present for TB diagnosis and cascaded the identified presumptive cases through to diagnosis and treatment. The individuals screened and diagnosed through this ACF approach were added to the number of TB cases detected through the routine passive (self-presenting) case finding.

Statistical analysis
The effective yields of each of the intervention strategies were computed. A yield was operationally defined as a TB case detected directly through the active case-finding activities of this project (as opposed to individuals who went on their own to TB treatment clinics because they felt they had symptoms of TB and were diagnosed as TB cases).

For each of the main active case-finding strategies, the research team analyzed the total number of individuals screened, number suspected of having TB (presumptive TB cases), number investigated, number confirmed as TB, and the types of TB diagnosed. The numbers and percentages were compared to the projects targets that were set a priori to assess the extent of achievement of project objectives/targets.

The NNS to detect one confirmed case of TB was also computed. The analysis was done with Epi Info 3.4.1 (CDC, Atlanta, GA USA).

Results
Analysis of project data
During the study, 218,751 persons were screened across all interventions assessed [Table 1]. Screening at the ANC clinics, 58,811 women were screened while 40,377 individuals were screened at the MCH clinics. Together, they accounted for 45.3% of all individuals screened in the project. In community outreaches, 34,595 people were screened, accounting for 15.8% of all screened individuals. The highest number of people was screened in the GOPD, (61,316 individuals) representing 28% of all screened individuals. TB was suspected in 43,078 (19.7%) of all the individuals screened. Of those who were suspected of TB, 23,729 (55.1%) of them submitted sputum for microscopy, and 764 (3.2%) had smear-positive TB [Table 1].

The overall NNS to find one person with all forms of TB through the project was 151. However, when disaggregated by intervention, the NNS to find one person with all forms of TB was 53 in general OPD clinics, 88 through contact tracing, and 110 among HIV-infected persons. The NNS was highest in MCH clinics (10,094) [Table 1].
Out of the total of 1447, all forms of TB cases detected, 764 cases were smear-positive while 683 individuals were diagnosed with other forms of TB through chest X-ray and clinical evaluation (not shown on tables).

Of the interventions carried out, screening at the GOPD clinics accounted for 80% of the yield of TB cases found, followed by intensified TB case finding among PLHIV (12%), active case finding in rural communities (4%), and contact tracing among TB patients on treatment (3%). Overall, screening at the ANC and MCH clinics had the lowest yield (1%) [Table 2].

**Cases detected versus cases registered and treated**

Among 1447 cases (all forms), 1182 cases (81.7%) were registered and treated in the project sites. Thus, 265 cases (18.3%) did not receive treatment at the project health-care facilities. Similarly, out of the 764 new smear-positive cases, 642 cases (84.0%) were registered and treated in the project sites while 122 cases (16%) were not accounted for in terms of treatment at the project sites.

Further analysis of the 642 new smear-positive cases registered and treatment at project sites shows that smear positive TB most commonly occurred in the age group of 15–54 years. Females accounted for 38% of new smear-positive cases notified to the NTP [Table 3].

We further compared the number of cases registered and treated (notified) during the implementation year with the number registered and treated during the baseline year [Table 3]. A total of 642 new smear-positive cases were notified during the project implementation year compared to 665 cases in the baseline year, giving a decrease of 23 cases (~3% of the baseline). Similarly, while 1182 all forms of TB cases were registered and treated during the implementation year, 1259 all forms of cases were registered and treated during the baseline year, giving a decrease of 77 cases (~6% of the baseline) [Table 3]. Interestingly, higher number of all forms of TB cases (1447 cases) was detected during the implementation year compared to 1259 cases in the baseline year (a difference of 188 all forms of TB cases; 14.9% of the baseline). The analysis also showed a higher number of new smear-positive cases was detected through the project compared to the baseline, 764 cases and 665 cases in implementation and baseline years, respectively (difference of 99 cases or 14.9%).

### Table 1: Characteristics of 1447 tuberculosis patients identified through screening and testing by the project

| Indicator                                      | ANC screening | MCH screening | Contact tracing | Community outreach | HIV patients | GOPD screening | Total |
|------------------------------------------------|---------------|---------------|----------------|--------------------|--------------|----------------|--------|
| Target (number of people) to be screened       | 54,000        | 21,540        | 8668           | 92,600             | 8181         | 6000           | 250,987|
| Individuals screened n (as percentage of target)| 58,811 (109)  | 40,377 (187)  | 3705 (43)      | 34,595 (37)        | 19,947       | 61,316         | 218,751|
| TB suspects identified (as percentage of number screened) | 10,347 (17.6) | 4675 (11.6)  | 1048 (28.3)    | 7026 (20.3)        | 3287         | 16,695         | 43,078 |
| Suspects investigated (as percentage of TB suspects) | N/A           | N/A           | 873 (83.3)     | 5181 (73.7)        | 2989         | 14,686         | 23,729 |
| TB cases (all forms)                           | 9             | 4             | 42             | 56                 | 180          | 1156           | 1447   |
| Smear positive TB                              | 6             | 1             | 37             | 29                 | 56           | 635            | 764    |
| Number of all TB cases (as percentage of number screened) | 0.02          | 0.01          | 0.13           | 0.28               | 0.90         | 1.89           | 0.66   |
| Number needed to screen                       | 6534          | 10,094        | 88             | 617                | 110          | 53             | 151    |

N/A: Not available, TB: Tuberculosis, ANC: Antenatal clinics, MCH: Mother and child health clinics, HIV: Human immunodeficiency virus, GOPD: General outpatient department clinics

### Table 2: Yield of tuberculosis cases according to intervention based on project records

| Intervention                                                                 | All TB cases | Smear-positive cases |
|------------------------------------------------------------------------------|--------------|---------------------|
|                                                                              | Number of cases | Percentage of yield | Number of cases | Percentage of yield |
| Intensified case finding for TB among women attending ANC clinics             | 9             | 1                   | 6              | 1                  |
| Intensified case finding for TB among women attending MCH clinics             | 4             | 0                   | 1              | 0                  |
| Contact tracing among registered patients on treatment                        | 42            | 3                   | 37             | 5                  |
| Active case finding in the rural areas (community)                            | 56            | 4                   | 29             | 4                  |
| Intensified TB screening among persons with HIV                                | 180           | 12                  | 56             | 7                  |
| GOPD screening                                                                | 1156          | 80                  | 635            | 83                 |
| Total                                                                        | 1447          | 100                 | 764            | 100                |

TB: Tuberculosis, ANC: Antenatal clinics, MCH: Mother and child health clinics, HIV: Human immunodeficiency virus, GOPD: General outpatient department clinics
However, as noted earlier, case holding seemed to be weak in the project, resulting in many early defaults that diminished the additional cases (188 cases [14.9%] all forms and 99 [14.9%] new smear positive).

**Discussion**

Active case-finding intervention consisting of community-based approaches (TB screening outreaches, community outreach/house-to-house screening, and contact tracing of members of households of TB patients) and systematic screening of target groups (pregnant women, women attending maternal and child health clinics, OPD clinics, and HIV-infected individuals) was carried out in a Nigerian state with no previous experience of active case-finding strategies. The project produced valuable insights into the potential outcomes and challenges of such interventions.

Although the direct yield from the project was as high as 1447 all TB cases, only 1182 cases were registered and treated. Thus, as many as 265 cases (all forms) were not registered and treated in the study sites. Similarly, 764 new smear-positive cases were directly detected through the project’s active screening activities, but as many as 122 cases defaulted before treatment. The reasons for the difference between the project’s direct yield and the number registered and treated were not very clear. One plausible explanation is that those not treated in the intervention sites chose to go back to home states/LGAs to access TB treatment. Another possible reason for the difference between the number of cases detected and the number eventually placed on treatment was “initial default” (early default), which refers to a diagnosed case failing to start treatment. Reasons for early default include inadequate health education/adherence counseling and/or individuals being in a state denial of their diagnosis, especially among those who did not seek care for TB but were diagnosed through active screening either in the community or when they sought care for some other ailment in a health facility.

Ostensibly, not accounting for all diagnosed cases is a limitation in the project as those who did not register and receive treatment were not adequately tracked to ensure that they were brought back and placed on treatment or commenced treatment elsewhere outside the project area [Table 4]. Indeed, had all the cases detected through active case finding been placed on treatment, the project would have had 188 “additional” cases (all forms) and 99 “additional” new smear-positive cases; “additional” cases refer to the cases that would not have been detected if the project was not implemented.

Despite this shortcoming, the strength of this intervention is that it explored varying active case-finding strategies in an under-resourced setting believed to have a high burden of TB. The study findings suggest that the following active case-finding strategies were effective: active screening of general outpatient clinic attendees, active screening of contacts of TB patients, active screening of PLHIV, and community outreaches. They are therefore very likely to prove effective strategies if integrated into the TB control policies/programs of countries with similar socioeconomic and epidemiological characteristics like Nigeria. They are likely to promote early and increased TB case detection.

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**Table 3: Age and sex distribution of new smear-positive tuberculosis cases (n=642) registered and treated (notified) between July 2013 and June 2014 in the project sites**

| Reporting period | Sex   | 0-4 | 5-14 | 15-24 | 25-34 | 35-44 | 45-54 | 55-64 | 65+ | Total |
|------------------|-------|-----|------|-------|-------|-------|-------|-------|-----|-------|
| Q3 2013          | Male  | 0   | 24   | 34    | 28    | 12    | 12    | 6     | 116 |
|                  | Female| 0   | 19   | 18    | 16    | 8     | 3     | 1     | 65  |
| Q4 2013          | Male  | 0   | 10   | 30    | 26    | 16    | 7     | 2     | 91  |
|                  | Female| 0   | 14   | 18    | 15    | 4     | 6     | 1     | 58  |
| Q1 2014          | Male  | 0   | 8    | 36    | 22    | 16    | 12    | 4     | 101 |
|                  | Female| 0   | 23   | 19    | 7     | 8     | 5     | 5     | 68  |
| Q2 2014          | Male  | 0   | 8    | 24    | 20    | 24    | 6     | 7     | 90  |
|                  | Female| 0   | 12   | 18    | 11    | 7     | 4     | 1     | 53  |
| Total            | Male  | 0   | 50   | 124   | 96    | 68    | 37    | 19    | 398 |
|                  | Female| 0   | 68   | 73    | 49    | 27    | 18    | 8     | 244 |

TB: Tuberculosis; Q: Quarter (period of 3 months)

**Table 4: Comparison of tuberculosis cases registered and treated in the project local government areas, Q3, 2012 to Q2, 2013 (baseline) and Q3, 2013 to Q2, 2014 (implementation period)**

|                      | Baseline July 2012 to June 2013 | Implementation period July 2013 to June 2014 | Change from baseline (%) |
|----------------------|---------------------------------|---------------------------------------------|--------------------------|
|                      | Q3, 2012 | Q4, 2012 | Q1, 2013 | Q2, 2013 | Q3, 2013 | Q4, 2013 | Q1, 2014 | Q2, 2014 |                        |
| Smear positive       | 176      | 140      | 171      | 178      | 181      | 149      | 169      | 143      | -3                      |
| All forms            | 344      | 258      | 370      | 287      | 324      | 274      | 335      | 249      | -6                      |

TB: Tuberculosis, LGAs: Local government areas, Q: Quarter
Our finding on yields was consistent with results from Pakistan, Ethiopia, and Afghanistan where screening of clinic attendees was found to have consistently accounted for substantial yields from TB screening projects.[4,15,21-23]

The project had challenges relating to human resources for health. The Nigerian health system has been underfunded for some years, resulting in dearth of health-care workers. Consequently, the regular health-care workers in the project facilities were somewhat overburdened to take on extra duties that came with active case finding. To address this, the project implementers engaged adjunct staff to supplement the regular staff. They also gave little incentives to the regular workers such as call cards, which served an additional purpose for tracking defaulters.

**Lessons for public health (tuberculosis control) policy and practice**

The lessons drawn from the study that could be useful for formulation and/or modification of TB control policies and practice include:

i. Active case-finding interventions should be preceded by carefully planned and well-implemented stakeholder engagement through advocacy at various levels and awareness and sensitization of community members. This will help to increase buy in from the stakeholder.

ii. Since many program staff and health-care workers in the TB program are not accustomed to ACF strategies, capacity building should be carried out before the actual case finding starts.

iii. Early/initial defaults are likely to occur and may be quite high as the active screening often detects TB among individuals who may not be yet seeking care for TB and so are not psychologically prepared to initiate treatment.

iv. Care must be taken to ensure that all cases detected through the approach are immediately registered and placed on treatment. Health-care workers should be prepared to take on extra workload brought about by this approach to case finding.

v. Where possible, adjunct staff should be employed to complement the efforts of the regular health-care workers.

**Conclusion**

An intervention package consisting of community-based approaches and systematic screening of target groups is feasible and can contribute to improved TB case detection in resource-limited settings. We recommend that (1) Targeted screening of general outpatient clinic attendees, screening of contacts of TB patients, screening of PLHIV, and TB community outreach should be integrated into TB control policies and practice. (2) TB cases diagnosed should be actively followed up to commence treatment, and initial defaulters identified and closely followed. Activities such as advocacy and stakeholder engagement, community sensitization, and capacity building should be done before the active case finding proper.

**Acknowledgment**

We are indebted to the funders for making this research possible. We wish to thank the staff of EB STBLCP and CDRH and to the leaders of the communities where the intervention was conducted for their assistance.

**Financial support and sponsorship**

The research was sponsored by the TBREACH Unit of the StopTB Partnership with funding from the Canadian International Development Agency under the Ebonyi State TB and Leprosy Control Programme (EB STBLCP)/Centre for Development and Reproductive Health (CDRH) TBREACH Wave 3 Grant.

**Conflicts of interest**

There are no conflicts of interest.

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