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Reaching the underserved: Active tuberculosis case finding in urban slums in southeastern Nigeria

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ABSTRACT

Background: Nigeria ranks 10th among 22 high TB burden countries with low TB case detection that relies on passive case finding. Although there is increasing body of evidence that active case finding (ACF) has improved TB case finding in urban slums in some parts of the world, this strategy had not been implemented in Nigeria despite the pervasiveness of urban slums in the country.

Objective: To assess the yield and profile of TB in urban slums in Nigeria through ACF.

Methods: A prospective, implementation study was conducted in three urban slums of southeastern Nigeria. Individuals with TB symptoms were identified through targeted screening using a standardized questionnaire and investigated further for TB. Descriptive and bivariate analyses were performed using SPSS.

Results: Among 16,743 individuals screened for TB, 6361 (38.0%) were identified as TB suspects; 5894 suspects were evaluated for TB. TB was diagnosed in 1079 individuals, representing 6.4% of the screened population and 18.3% of those evaluated for TB. Of the 1079 cases found, 97.1% (n = 1084) had pulmonary TB (PTB), and majority (65%) had new smear-positive TB. Children (<15 years) accounted for 6.7% of the cases. Also, 22.6% (216) of the cases were HIV co-infected, among whom 55.1% (n = 119) were females. The average number of individuals needed to screen to find a case of TB was 16.

Conclusions: There is high prevalence of TB in Nigeria slum population. Targeted screening of out-patients, TB contacts, and HIV-infected patients should be optimized for active TB case finding in Nigeria.

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Introduction

Despite the progress made in the last decade, the urgency to improve tuberculosis (TB) case findings remains one of the leading concerns of national programs worldwide. The WHO global TB control policy endorses the directly observed treatment short course (DOTS) strategy which relies on symptomatic individuals voluntarily seeking care at health facilities as the standard strategy for case findings [1]. While passive self-presentation of patients advocated by the DOTS strategy was shown to improve TB case detection in some high-TB burden countries like Ethiopia, Peru and Vietnam [2,3], doubts of its effectiveness, however, emerged with the rising human immunodeficiency virus (HIV) epidemic [4]. In recent years, the rate of TB case detection has stagnated, while the rate of decline in estimated TB incidence has been slower than expected [5,6]. Although, "passive case-finding" appears efficient, as TB patients who voluntarily seek care at the health facility are more likely to be symptomatic and their TB detectable through bacteriologic examination, a drawback of this process is the decision of when and where to seek healthcare and thus, contact with the health system, however, remains with the patient. Patients seeking TB-related care through passive self-presentation are likely to face barriers, such as distance to the nearest health facility, gender, socioeconomic factors, age, and lack of trained healthcare workers, which have all been associated with patient and health system delays from the onset of illness to treatment initiation [7–9]. Moreover, TB/HIV co-infection can result in atypical presentation of TB symptoms [10]; thus, HIV-infected individuals may be less likely to suspect TB and be less likely to seek care for TB. Active case finding (ACF) has been recommended as a complementary approach to curtail delays in the care-seeking pathway, especially in high TB/HIV settings [11]. Early diagnosis of bacteriologic-positive TB cases can potentially break the chain of transmission of *Mycobacterium tuberculosis* to contacts [12]. An extensive review found that ACF was effective in reducing TB prevalence, incidence, and mortality from disease complications [13]. The WHO recommends ACF strategies to be conducted among targeted high-risk groups, such as healthcare workers, HIV-positive individuals, miners, urban slum dwellers, diabetic patients, smokers, prisoners, immigrants and contacts of TB patients [11,12,14]. Studies that explored ACF in detecting TB cases in a high-risk population of urban slum dwellers who are poor, marginalized and exposed to poor environmental conditions (overcrowding, poor housing and poor living conditions) are crucial for TB control programs in resource-poor settings [12–15].

With the WHO estimated TB incidence rate of 108 per 100,000 [5] and 3.4% HIV prevalence rate [16] in 2012, Nigeria remains one of the countries with the highest TB and HIV burden in the world. Almost a quarter (23%) of all TB cases notified in 2012 was HIV-infected [5], down from 26% the previous year [17]. The 2012 national TB prevalence survey in the country showed that TB prevalence rates in adults aged 15 years and above were estimated to be 318 per 100,000 population for smear-positive, and 524 for bacteriologically-confirmed cases [18]. Also, the survey showed that only one out of every five active TB cases in the community was notified by the Nigeria National TB Control Programme (NTP) – suggesting that substantial cases of TB in the community are not detected and treated [18]. The NTP adopted the WHO-approved DOTS strategy in 1993 and relies heavily on passive case finding to identify TB cases. So far, little is known about the feasibility of implementing active TB case finding among urban slum populations which are inadequately reached with TB services. This study, therefore, assessed the yield, demographic and clinical characteristics of undetected TB cases among urban slum populations in south-east Nigeria.

Methods

Study design

A prospective, implementation study was carried out in three urban slums in south-east Nigeria from 1 January to 31 December 2012.

Study setting

The study sites were three densely populated, low-income urban slum settlements in Abia and Anambra States, south-east Nigeria. Abia and Anambra States have an estimated population of more than 8 million people. In Anambra State, the study was implemented in two urban slums (Okpoko, Aba and Mammy market) with an estimated population of 670,000. The population density in the slums were estimated at 49.78 persons/hectare [19], and are inhabited by poor and lower middle class families. Residential and sanitary conditions are typical of any congested urban settlement. In Abia State, the study was implemented in a slum area regarded as the most densely populated slum in Nigeria, with a projected population of 471,516 [20]. The slum is comprised largely of a heterogeneous group of people, dump-sites and displaced populations, the majority of who are living in unstructured or informal temporary settlements. The slums were selected through purposeful sampling after consultation with the State Ministry of Health and local government area (LGA) authorities.

Target population

The target population for the intervention was all individuals utilizing the general outpatient department (GOPD) and HIV clinics in health facilities in the study sites and contacts of TB patients.

Selection of health facilities

The study was embedded in the existing health services in the study area. There were 19 healthcare facilities within the study area. These included 3 public and 16 private health facilities. The 3 public health facilities were providing TB services prior to the study and were selected for the study. Also, an additional 9 private health facilities were selected through purposeful sampling after consultation with the State Ministry of Health, LGA authorities and heads of the facilities.

Overall, 12 health facilities participated in the study and provided both diagnostic and treatment services.

Intervention

Prior to the study, sensitization meetings were held with community leaders, chairs and ministries of local government, directors of Primary Care, and relevant faith-based organizations in the study area and aimed at mobilizing community resources and support for the study. TB messages were disseminated through road shows, market shows and town criers. TB messages were produced in posters, leaflets and jingles, and focused on basic facts about TB and availability of the services.

Three key sets of individuals were engaged to work on the project. These included 120 community volunteers (consisting of community members who indicated a willingness to take part in the project), 32 general health workers (who consisted of nurses, community health officers, community health extension workers) and 12 laboratory personnel from the study sites. To enhance the capacity of project staff to effectively participate in the project, the community volunteers (CVs) were given 1-week training on suspect identification and referral, monitoring of TB treatment, and recordkeeping, including completion of data collection tools. The general health workers (GHWs) were offered a one-week training course in TB and HIV services – suspect identification, DOT administration and HIV counseling and testing (HCT) – after which they were provided with data collection tools. Also, a 1-week training course was held for the laboratory staff.

In the active case finding, screening of individuals for TB symptoms was carried out by GHWs and CVs using simple, standardized questionnaires. GHWs screened all individuals who visited the general outpatient department (GOPD) and HIV clinics in the selected health facilities for TB symptoms, while trained CVs visited homes of TB patients to screen all available household members for TB symptoms. TB symptoms assessed were cough, fever, weight loss, night sweats and lymph node/spine/bone/abdominal swellings. Individuals with a cough $\geqslant$2 weeks with or without other clinical presentations were identified as pulmonary TB suspects. A productive cough <2 weeks with the presence of one or more TB-related symptoms was also considered as inclusion criteria for pulmonary TB. In the case of an absence of cough, if an individual had fever and the presence of one or more TB-related symptoms, TB was suspected. Individuals identified as TB suspects were referred to a TB clinic for further evaluation by a clinician. If no symptoms were reported, no further attempts were made.

For the diagnosis of TB among the suspects, those coughing were requested to submit three sputum specimens (spot–morning–spot) at the health facility for microscopy. Trained laboratory staff guided patients on how to produce good quality sputum samples. Diagnosis of TB was made in line with the NTP guidelines [21]. Pulmonary smear-positive was defined as a positive sputum smear confirmed with one or more positive smear. Pulmonary smear-negative was defined by negative smear for AFB with radiology, clinical and/or histology findings consistent with active TB, followed by the decision made by a clinician to treat with a full course of TB chemotherapy. Extra-pulmonary TB (EPTB) was based on histological or strong clinical evidence consistent with active EPTB, followed by the decision made by a clinician to treat with a full course of TB chemotherapy. HIV counseling and testing was provided to all persons with suspected TB during submission of their sputum for microscopy.

TB treatment, support and care

All newly-diagnosed TB patients were started on first-line anti-TB drugs in accordance with the NTP guidelines [21]. The GHWs and CVs followed up on patients who interrupted treatment and encouraged them to commence or complete TB treatment.

Data collection

Three trained local government TB supervisors visited the health facilities weekly to supervise and retrieve collected data. Data on all individuals screened for TB were obtained from the screening forms/referral forms, while data on all TB cases found were extracted from the TB treatment cards and TB registers. This included: TB case registration, age, sex, HIV status, smear status, type of TB.

Statistical analysis

Data were double-entered into a Microsoft access database by two independent data operators were validated for inconsistencies and were analyzed using the Statistical Package for Social Sciences (SPSS) version 16.0. Patients' demographic and clinical characteristics were described in terms of frequencies and percentages. Bivariate analyses were performed with χ^2 test. A P-value <0.05 was considered statistically significant.

Ethics approval

The Ethics Committee of the University of Nigeria Teaching Hospital, Enugu, Nigeria approved the study. Permission was also obtained from the National TB control program, Nigeria and from the respective heads of the study facilities.

Results

Identification of symptomatic individuals and diagnosis

Over the one year period, 16,743 individuals were screened for TB. Of these, 6361 (38.0%) were identified with symptoms suggestive of active TB (Table 1), and 5894 (92.7% of the individuals identified with TB symptoms) were evaluated for TB. TB was diagnosed in 1079 individuals representing 6.4% of the screened population and 18.3% of those evaluated for TB. About 65% (697/1079) were new smear-positive TB cases, with conventional smear microscopy being the most common form of diagnosis.

Overall, screening at the GOPD accounted for 90.5% (15,159) of all individuals screened, while screening of

Table 1 – Characteristics of patients identified through screening and testing.

Variable	Total (*n*)	Contact tracing (*n*)	GOPD (*n*)	HIV clinic (*n*)
Individuals screened	16,743	192	15,159	1392
Individuals identified with symptoms of TB	6361	98	5298	965
Individuals of tested	5894	64	5298	532
TB cases (all forms)	1079	10	923	146
TB cases (new smear positive)	697	5	615	77
NNS (number needed to screen)	16	19	16	10
TB cases (all form) as % of screened	6.4	5.2	6.1	10.5
TB cases (all forms) as % of tested	18.3	15.6	17.4	27.4

TB = tuberculosis; GOPD = general outpatients department.

Table 2 – Demographic and clinical characteristics of TB patients found (N = 1079).

Category	*n* (%)
Gender	
Female	447 (41.4)
Male	632 (58.6)
Age (years; *n* = 1079)	
0–14	72 (6.7)
15–24	170 (15.8)
25–34	277 (25.7)
35–44	249 (23.1)
45–54	154 (14.3)
55–64	88 (8.2)
65+	69 (6.4)
Type of TB	
Pulmonary	1048 (97.1)
Extra-pulmonary	31 (2.9)
Case registration	
New cases	944 (87.5)
Retreatment cases	135 (12.5)
Extra-pulmonary sites (*n* = 31)	
Spondylitis	19 (61.3)
Lymphadenitis	3 (9.7)
Abdominal	1 (3.2)
Bone and joint	3 (9.7)
Unknown	5 (16.1)
HIV status	
Positive	216 (20.0)
Negative	739 (68.5%)
Unknown	124 (11.5%)
HIV care (*n* = 216)	
Received CPT	133 (61.6)
Received ART	146 (67.6)

TB = tuberculosis; CPT = Cotrimoxazole Preventive Therapy; ART = Anti-Retroviral Therapy.

contacts of TB patients and people living with HIV (PLHIV) accounted for 1.2% (192) and 8.3% (1392) of individuals screened, respectively. More than a quarter (146; 27%) of HIV-infected individuals (532) tested for TB had TB. The number of individuals needed to screen (NNS) to find one case of TB in the study was 16. However, when disaggregated by intervention, the NNS to find one case of TB was 19 among contacts of TB patients, 16 in GOPD and 10 among HIV-infected persons (Table 1).

Characteristics of TB patients detected

Among the individuals diagnosed with TB (1079), 447 (41.4%) were females, 72 were children (<15 years) (6.7%), 944 (87.5) were new cases, and 12.5% (135) were previously treated TB cases (Table 2). The majority (97.1%; 1,048) of them had pulmonary TB (PTB), while about 2.9% (31) had EPTB, with spondylitis accounting for more than half (61.3%) of these cases. Only 955 (88.5% of the individuals diagnosed with TB) were tested for HIV co-infection, while the remaining 124 (11.5) declined HIV testing. Of those tested for HIV, the rate of TB/HIV co-infection was 22.6% (216), the majority (55.1%; 119) of whom were females. The rate of cases of TB was highest among individuals aged 25–44 years, while children (0–14 years) and the elderly (65+ years) had the lowest proportions of cases of TB (Table 2).

Of the 944 new cases found, 697 (73.8%) had smear-positive PTB, 216 (22.9%) had smear-negative PTB and 31 (3.3%) had EPTB. Also, TB/HIV co-infection rate among new cases tested for HIV (850) was 22.8% (194). Furthermore, of the 135 re-treatment cases, 77 (57.0%) had smear-positive PTB, and 58 (43.0%) had smear-negative PTB. TB/HIV co-infection rate among re-treatment cases tested for HIV (105) was 21.0% (22). The male–female ratio among all and new cases found was 1.4:1 and 1.3:1, respectively (Table 3).

Upon further evaluation, the distribution of TB cases was found to be in accordance with registration status (Table 3) and gender (Table 4). In new versus re-treatment cases (Table 3), new cases found were significantly younger (7.6% vs. 0; $p < 0.001$), had higher EPTB cases (3.3% vs. 0; $p = 0.04$), but with less TB/HIV patients on ART (63.9% vs. 100%; $p = 0.001$). Furthermore, compared with male cases found (Table 4), females were significantly younger (<15 years) (9.4% vs. 4.7%; $p = 0.004$), had a higher rate of HIV co-infection (28.1% vs. 18.3%; $p < 0.001$) and a higher proportion of TB/HIV patients on ART (79.4% vs. 57%; $p < 0.001$).

Discussion

In this study, it was found that 6.4% of the targeted population in three slum settings screened had TB, with 65% of cases being new smear-positive TB. The average overall number of people needed to screen to find one case of TB was 16–being 19 among TB contacts, 16 in GOPD attendees and 10 in HIV patients. Most of the cases found were males, and about one-fourth of them were co-infected with HIV. Almost half

Table 3 – Relationships between demographic and clinical variables and type of TB (N = 1079).

Variables	Total n (%)	New cases n (%)	Retreatment cases n (%)	Chi-square	P-value
Age (years)					
<15	72 (6.7)	72 (7.6)	0 (0.0)	8.95	<0.001
⩾15	1007 (93.3)	872 (92.4)	135 (100.0)		
Gender					
Female	447 (41.4)	399 (42.3)	52 (38.5)	0.68	0.47
Male	632 (58.6)	545 (57.7)	83 (61.5)		
Type of TB					
PTB	1048 (97.1)	913 (96.7)	135 (100.0)	2.68	0.042
EPTB	31 (2.9)	31 (3.3)	0 (0.0)		
HIV positive (n = 955)					
Yes	216 (22.6)	194 (22.8)	22 (21.0)	0.19	0.77
No	739 (77.4)	656 (77.2)	83 (79.0)		
CPT use (n = 216)					
Yes	133 (61.6)	122 (62.9)	11 (50.0)	1.38	0.34
No	83 (38.4)	72 (37.1)	11 (50.0)		
ART use (n = 216)					
Yes	146 (67.6)	124 (63.9)	22 (100.0)	9.36	0.001
No	70 (32.4)	70 (36.1)	0 (0.0)		

TB = tuberculosis; EPTB = Extra-pulmonary; CPT = Cotrimoxazole Preventive Therapy; ART = Anti-Retroviral Therapy.

the cases found were aged 25–44 years, while children and the elderly had the lowest proportions of cases. Females were significantly younger, had higher rates of HIV co-infection and were more likely to be on ART.

These findings reveal a high prevalence of TB, mostly smear-positive TB. This suggests that there is a likelihood of a high community transmission of TB in the population studied. The underlying factors promoting this transmission are likely due to overcrowding, poor housing and poor living conditions [12–15]. Overall, the yield of TB in this study was higher than in similar studies conducted elsewhere, i.e., 3.5% in Uganda [12], 0.2% in Cambodia [22] and 0.3% in Bangladesh [14]. The high yield of TB observed is an indicator of high underlying TB and HIV prevalence in urban slum settings of Nigeria and agrees with the findings of the recent TB prevalence survey in the country which showed that the majority of TB cases (most being smear-positive) in the community are not notified to the NTP [5].

Table 4 – Relationships between demographic and clinical variables and gender of cases (N = 1079).

Variables	Total n (%)	Male n (%)	Female n (%)	Chi-square	P-value
Age (years)					
<15	72 (6.7)	30 (4.7)	42 (9.4)	9.08	0.004
⩾15	1007 (93.3)	602 (95.3)	405 (90.6)		
Type of TB					
PTB	1048 (97.1)	616 (97.5)	432 (96.6)	0.73	0.54
EPTB	31 (2.9)	16 (2.5)	15 (3.4)		
Case registration					
New	944 (87.5)	545 (86.8)	399 (88.5)	0.68	0.47
Re-treatment	135 (12.5)	83 (13.2)	52 (11.5)		
HIV positive (n = 955)					
Yes	216 (22.6)	97 (18.3)	119 (28.1)	12.92	<0.001
No	739 (77.4)	434 (81.7)	305 (71.9)		
CPT use (216)					
Yes	133 (61.6)	68 (57.1)	65 (67.0)	2.19	0.18
No	83 (38.4)	51 (42.9)	32 (33.0)		
ART use (216)					
Yes	146 (67.6)	65 (57.0)	81 (79.4)	12.27	<0.001
No	70 (32.4)	49 (43.0)	21 (20.6)		

TB = tuberculosis; EPTB = Extra-pulmonary; PTB = Pulmonary TB; CPT = Cotrimoxazole Preventive Therapy; ART = Anti-Retroviral Therapy.

Also, this study provided insights into the potential outcomes of the systematic screening of high risk groups for TB. Although targeted screening of GOPD attendees accounted for substantial yields of TB cases, the intervention that appeared to be most effective based on the NNS was screening of people living with HIV/AIDS (PLWHIV), while the least effective was the screening of contacts of TB patients. This finding was consistent with findings from Rwanda, Ethiopia, Brazil and Peru where continuous screening of PLWHIV at HIV clinics was consistently found to have substantial yields from TB screening projects [11,14,23]. This study also showed that more than a quarter of the HIV-infected individuals tested for TB had TB, reinforcing the need to prioritize and promote early case finding strategies among PLWHIV. The NTP currently promotes TB/HIV collaborative activities [21]. There is a need to strengthen these mechanisms for collaboration and orient it toward active detection of TB in PLWHIV. And, as documented elsewhere [11,23], active TB case finding in GOPD attendees should be considered among innovative approaches to promote early TB detection in Nigeria.

The age-specific distribution of TB showed that TB was most common in the 25–44 year age group in this study. This finding is consistent with findings in Nigeria, Kenya and India [24–26]. In contrast, in Cambodia, China and Vietnam, the age group most affected was 65 years and older, followed by the 45–54 year age group [27]. The reasons for these differences are not clear; it may be due to differing levels of economic and demographic transition and TB transmission occurring in these countries. The male–female ratio was 1.4:1 among all TB cases found – a consistent observation in several other countries [28]. The age-gender distribution indicates that TB was more among the younger females than males, but reverses at an older age. The difference in the gender distribution of TB observed may be due to the epidemiologic situation in the setting concerned. However, biological mechanisms and cultural factors leading to differences in access to health services have been implicated as possible reasons for differences in TB susceptibility between men and women [29].

The strength of this study was that it explored varying active case finding and systematic screening strategies in a poor and marginalized setting believed to have a high burden of TB, and it improved the capacity of the health facilities across the slums, including the private sector, for TB care. Also, data were collected and verified monthly for errors and consistency. However, the study also had some limitations. First, the urban slums were purposefully selected. This was because the areas are inadequately reached with TB services in spite of their greater need for such services. Second, data on CD4 cell count were not collected for HIV-positive individuals. Differences in CD4 cell count may be responsible for the high undetected TB in PLWHIV; previous studies have demonstrated an association between TB occurrence and a decrease in CD4 cell counts in PLWHIV [30]. Moreover, the higher incidence of TB in women infected with HIV despite a higher proportion being on ART suggests a poor quality of HIV care or delays in initiating ART; this warrants further studies. Finally, it is not known how many of the individuals with TB cases notified through the intervention would have sought care at a DOTS facility in the absence of the intervention, nor is it known if the intervention reduced barriers faced by special groups like women in accessing TB services; these issues should be considered and evaluated further in future active TB case finding interventions.

Conclusion

It was found that 6.4% of the individuals screened had TB, with a majority being smear-positive. Therefore, ACF is feasible and can contribute to improved TB case detection in urban slums in resource-limited settings like Nigeria. It is recommended that: (1) targeted screening of GOPD attendees, TB contacts, and PLWHIV should be considered in active case finding strategies in the setting; (2) TB/HIV collaborative activities need to be strengthened and proximate determinants of TB in HIV-infected individuals need to be identified to optimize TB case detection in PLWHIV; (3) Future ACF strategies should evaluate its impact in reducing barriers of access to TB services in women; and (4) Other ACF strategies, e.g., community outreach and in-patients with diabetes mellitus, should be considered in future studies.

Conflict of interest

We have no conflict of interest to declare.

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