Am. J. Trop. Med. Hyg., 97(2), 2017, pp. 433–435
doi:10.4269/ajtmh.16-0674

Active Tuberculosis Case Finding in Haiti

Jack Masur,[1]* Serena P. Koenig,[2] Pierrot Julma,[1] Oksana Ocheretina,[3] Maria A. Durán-Mendicuti,[2] Daniel W. Fitzgerald,[3] and Jean W. Pape[1,3]

[1]*Haitian Study Group for Kaposi's Sarcoma and Opportunistic Infections (GHESKIO), Port-au-Prince, Haiti;* [2]*Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts;* [3]*Weill Cornell Medical College, New York, New York*

Abstract. In 2010, Haiti suffered from a devastating earthquake; data on the impact on the tuberculosis (TB) epidemic are limited. From January to June 2013, we conducted active case finding at the household level in a slum in Port-au-Prince. Community health workers identified individuals with cough ≥ 2 weeks, and referred them for evaluation. Contact tracing was conducted for patients with active TB. Of an estimated 7,500 residents screened, 394 (5%) had cough and were tested for TB. One hundred (25%) were diagnosed with active TB; 53 (53%) were smear positive. Ninety of these TB index cases provided 317 contacts, and 44 (14%) were diagnosed with active TB; 17 (39%) were smear positive. Overall, 144 TB cases were detected in 6 months (1,920/100,000; national estimate 200/100,000). We found a high burden of undiagnosed TB in Port-au-Prince 3 years after the earthquake. Further assessment of the burden of TB is indicated.

REPORT

Haiti is the poorest nation in the Western Hemisphere and has the highest rate of tuberculosis (TB) in the region, with an estimated incidence of 200 per 100,000 population.[1] Haiti also has the highest number of people living with human immunodeficiency virus (HIV) in the Caribbean.[2] An estimated 19% of TB patients are HIV infected.[1]

In 2010, Haiti suffered a devastating earthquake. Over 1.5 million people were forced to live in internally displaced person (IDP) camps.[3] The IDP camps consisted of poorly ventilated tents that were overcrowded, and many residents had poor nutritional status.[4] The majority of IDP camps have now been vacated, and residents have moved into the surrounding slums of Port-au-Prince.

The World Health Organization (WHO) conditionally recommends systematic screening for active TB for geographically defined subpopulations that have at least 1% TB prevalence, and for other subpopulations that have poor access to health care, such as residents of urban slums.[5] The conditional recommendation indicates that the desirable effects probably outweigh the undesirable effects, but the trade-offs, cost-effectiveness, feasibility, and affordability are uncertain.

The aim of this study was to assess the burden of undiagnosed TB in one slum in urban Port-au-Prince, and to examine the effectiveness of an active case finding (ACF) strategy with contact tracing. The study was conducted by the Haitian Group for the Study of Kaposi's Sarcoma and Opportunistic Infections (GHESKIO), the largest provider of HIV and TB services in the Caribbean. From January 8 to June 30, 2013, GHESKIO implemented an ACF strategy in Cite de Dieu (City of God), a slum community adjacent to GHESKIO with an estimated population of 10,000 people based on a 2011 census. During the 6-month study period, four community health workers (CHWs) worked 40 hours per week going door-to-door in Cite de Dieu to identify people with cough lasting ≥ 2 weeks, and to refer them to GHESKIO for evaluation. The study team estimated that 7,500 of the projected 10,000 residents were screened for cough during the study period. Information for patients who reported cough was stored in an electronic database.

*Address correspondence to Jack Masur, George Washington University School of Medicine & Health Sciences, 2300 Eye Street Northwest, Washington, DC 20052. E-mail: jackmasur@gmail.com

The GHESKIO protocol for evaluation of coughing patients for TB included physician evaluation, chest radiograph, and sputum microscopy for acid-fast bacilli (AFB), except for patients ≤ 5 years of age who received chest radiograph but no AFB smear test. The physician evaluated the chest radiograph on the day of presentation, but sputum smear microscopy results were not available until the second day, because specimens were transported across Port-au-Prince for testing at the GHESKIO BSL-3 laboratory. If the physician determined that the clinical presentation and chest radiograph were consistent with TB, treatment was initiated on the day of presentation. In some such cases, an AFB smear was not done. All patients received an HIV test at the time of evaluation.

All diagnoses of active TB were made in accordance with the 2013 revised WHO guidelines.[6] A bacteriologically confirmed pulmonary TB case was defined by a positive sputum smear microscopy. A clinically diagnosed TB case was defined as one that did not fulfill the criteria for bacteriological confirmation but had been diagnosed with active TB by a clinician who prescribed a full course of treatment based on clinical presentation and chest radiograph.

For all patients diagnosed with active TB (smear-positive or clinical diagnosis), contact tracing was conducted. TB patients identified contacts following diagnosis. Contacts were defined as any person who had resided in the same living area or who had been a regular visitor to the household of the index case. Index cases were asked to encourage contacts with cough to visit GHESKIO for evaluation. CHWs also visited the location of all reported contacts and accompanied coughing individuals to GHESKIO. Contacts with cough ≥ 2 weeks received the same TB evaluation as index cases. Patients diagnosed with TB through either ACF or contact tracing started TB treatment on the day of diagnosis, when feasible. All diagnostic and treatment services were provided free of charge.

From January 8 to June 30, 2013, CHWs identified 394 individuals with cough ≥ 2 weeks: 208 (53%) were female, the median age was 23 years (interquartile range [IQR]: 9–35), and 21 (5%) were HIV infected (Table 1). Of these 394 patients, 70 (18%) were children ≤ 5 years of age; 12 (17%) of these children ≤ 5 years were clinically diagnosed with TB (Table 2). Of the 324 patients > 5 years of age, 272 (84%) received AFB smear, and of these, 53 (19%) were positive. An additional 35 patients > 5 years of age received a clinical diagnosis of TB

TABLE 1
Sociodemographic characteristics of patients identified through active case finding and contact tracing

	Active case finding		Contact tracing	
Characteristics	Patients reporting cough for ≥ 2 weeks (*N* = 394)	Patients diagnosed TB+(*N* = 100)	All contacts provided (*N* = 317)	Contacts diagnosed TB+ (*N* = 44)
Sex				
Male	186 (47.2%)	59 (59.0%)	144 (45.4%)	20 (45.5%)
Female	208 (52.8%)	41 (41.0%)	173 (54.6%)	24 (54.5%)
Age (years)				
0–5	70 (17.8%)	12 (12.0%)	30 (9.5%)	2 (4.5%)
6–10	41 (10.4%)	1 (1.0%)	27 (8.5%)	1 (2.3%)
11–24	96 (24.4%)	25 (25.0%)	83 (26.2%)	8 (18.2%)
> 25	187 (47.5%)	62 (62.0%)	177 (55.8%)	33 (75.0%)
Education				
None	123 (31.2%)	26 (26.0%)	78 (24.6%)	9 (20.5%)
Primary	133 (33.8%)	34 (34.0%)	113 (35.7%)	14 (31.8%)
Secondary	130 (32.9%)	36 (36.0%)	117 (36.9%)	19 (43.2%)
University	8 (2.1%)	4 (4.0%)	9 (2.8%)	2 (4.5%)
Annual income				
None	288 (73.1%)	71 (71.0%)	196 (61.8%)	25 (56.8%)
Less than US$570	47 (11.9%)	12 (12.0%)	46 (14.5%)	8 (18.2%)
More than US$570	59 (15.0%)	17 (17.0%)	75 (23.7%)	11 (25.0%)
HIV (+)	21 (5.3%)	10 (10.0%)	27 (8.5%)	6 (13.6%)

HIV = human immunodeficiency virus; TB = tuberculosis.

(Table 2). Of the 100 total TB cases diagnosed, 10 (10%) were HIV infected (Table 1).

Ninety of 100 TB index cases detected through ACF provided 317 contacts (3.5 contacts per index case who provided contacts). Of the 317 contacts, 173 (55%) were female, the median age was 27 years (IQR: 17–40), and 27 (9%) were HIV infected (Table 1). Of these 317 contacts evaluated, 196 (62%) had cough confirmed by a physician. Of the 196 contacts with cough, 3 (2%) were ≤ 5 years of age; all received a clinical diagnosis of TB (Table 3). Of the 193 individuals > 5 years of age with cough, 169 (86%) received AFB smear and 17 (10%) were positive. An additional 24 contacts > 5 years of age were clinically diagnosed with TB (Table 3). Six (14%) of the 44 contacts diagnosed with TB were HIV infected (Table 1).

Most contacts diagnosed with TB (42/44; 95%) were family members of the index TB cases. Eight (18%) of the 44 contacts diagnosed with active TB were the parent of the index case and seven (16%) were the sibling of the index case. Of the 44 contacts diagnosed, 34 (77%) were sleeping in the same room as the index TB case.

The prevalence of undetected TB in this study (1.3% versus 0.2% estimated country prevalence) was higher than that among inhabitants of slums in Cambodia (0.2% versus 0.7% estimated country prevalence) but lower than the prevalence in Uganda (3.5% versus 0.2% estimated country prevalence) and Nigeria (6.4% versus 0.3% estimated country prevalence).[1,7–9] Both Uganda and Nigeria have significantly higher HIV prevalence than Haiti or Cambodia (7.4% and 3.2% versus 1.9% and 0.6%, respectively).[10] In Nigeria, 23% of newly diagnosed TB patients were HIV coinfected,[8] compared with 11% of TB patients in our study. The Uganda study did not test for HIV coinfection, though the authors cite the possibility that high HIV prevalence among the population was linked to high rate of TB detection.[9]

Among individuals with chronic cough, our study detected a higher rate of active TB (24%) compared with the studies conducted in Cambodia (8%),[7] Nigeria (17%),[8] and Uganda (18%).[9] Differences in the proportion of coughing patients diagnosed with TB could be attributed to the ability of CHWs to properly diagnose symptoms, the prevalence of TB in the population, the prevalence of other processes causing chronic cough, and/or the evaluation techniques used for TB diagnosis.

The WHO conditionally recommends systematic screening for residents of urban slums in TB-endemic settings.[5] Recent studies have shown the utility of targeting such populations for ACF.[7–9] It has been suggested that TB screening will be most efficient when targeting high-prevalence groups such as slum residents, and that TB screening in slums would be effective because slum populations are more likely to have characteristics such as malnutrition, crowding, and low socioeconomic status that increase vulnerability for TB.

An important component of our study was a contact tracing investigation that coincided with ACF. Fox and others examined 95 studies from low- and middle-income settings and found average prevalence of active TB among contacts to be 3%.[11] The previously mentioned study in Nigeria combined ACF and contact tracing, and found a 5% TB prevalence among contacts.[8] During our investigation, 14% of contacts were diagnosed with active TB. Our findings demonstrate that the detection rate among contacts of diagnosed TB cases was high in one urban slum of Port-au-Prince. These results suggest that combining contact tracing with ACF may contribute to TB detection.

TABLE 2
TB+ diagnosis for active case finding

Age group	*N*	AFB tested	AFB+	Chest radiograph tested	Chest radiograph consistent with TB	Diagnosed TB+
Children ≤ 5 years	70 (18%)	0 (0%)	0 (0%)	70 (100%)	12 (17%)	12 (17%)
Individuals > 5 years	324 (82%)	272 (84%)	53 (19%)	324 (100%)	88 (27%)	88 (27%)
Total	394	272	53	394	100	100 (25%)

AFB = acid-fast bacilli; TB = tuberculosis.

TABLE 3
TB+ diagnosis for contact tracing

Age group		*N*	AFB tested	AFB+	Chest radiograph tested	Chest radiograph consistent with TB	Diagnosed TB+
Children ≤ 5 years (*N* = 30)	With cough	3	0 (0%)	0 (0%)	3 (100%)	3 (10%)	3 (10%)
	With no cough	27	0 (0%)	0 (0%)	27 (100%)	0 (0%)	0 (0%)
Individuals > 5 years (*N* = 287)	With cough	193	169 (86%)	17 (10%)	193 (100%)	41 (14%)	41 (14%)
	With no cough	94	0 (0%)	0 (0%)	94 (100%)	0 (0%)	0 (0%)
Total		317	169	17	317	44	44 (14%)

AFB = acid-fast bacilli; TB = tuberculosis.

Our study was limited by the challenge of working with an ill-defined population. The use of contact tracing in addition to ACF sought to detect patients who may have been initially missed by CHWs, either because they developed cough later or they were away from home during the initial screening. It is also possible that some were tested for HIV when their status was already known, but none reported receiving HIV care at the time of testing.

The prevalence of undiagnosed TB cases identified by ACF and contact tracing in this study was over 5-fold higher than national WHO prevalence estimates. It is possible that the earthquake could have increased the burden of TB in the urban slums. We suspect that other slums in Port-au-Prince also likely have high rates of undiagnosed TB. These results emphasize the importance of more extensive studies to assess the prevalence of TB and cost-effectiveness of expanded case finding in Haiti.

Received August 16, 2016. Accepted for publication April 6, 2017.

Published online May 30, 2017.

Authors' addresses: Jack Masur, George Washington University School of Medicine and Health Sciences, Washington, DC, E-mail: jackmasur@gmail.com. Serena P. Koenig, Brigham and Women's Hospital, Boston, MA, E-mail: skoenig@partners.org. Pierrot Julma and Jean W. Pape, Centres Haitian Study Group for Kaposi's Sarcoma and Opportunistic Infections (GHESKIO), Port au Prince, Haiti, E-mails: pierrot25fr@gmail.com and jwpape@gheskio.org. Oksana Ocheretina and Daniel W. Fitzgerald, Center for Global Health, Weill Cornell Medical College, New York, NY, E-mails: ocheretina@yahoo.com and dwf2001@med.cornell.edu. Maria A. Durán-Mendicuti, Department of Radiology, Brigham and Women's Hospital, Boston, MA, E-mail: mduranmendicuti@partners.org.

REFERENCES

1. Report GT, 2015. *Tuberculosis Country Profiles*. World Health Organization Web Site. Available at: http://extranet.who.int/sree/Reports?op=Replet&name=%2FWHO_HQ_Reports%2FG2%2FPROD%2FEXT%2FTBCountryProfile&ISO2=HT&LAN=EN&outtype=html. Accessed July 21, 2016.
2. Rouzier V et al., 2014. Factors impacting the provision of antiretroviral therapy to people living with HIV: the view from Haiti. *Antivir Ther 19 (Suppl 3):* 91–104.
3. United Nations Office for the Coordination of Humanitarian Affairs, 2011. *Haiti: One Year Later.* Available at: http://unocha.org/issues-in-depth/haiti-one-year-later. Accessed April 10, 2013.
4. Ministère de la Santé Publique et de la Population, UNICEF, World Food Programme, 2012. *Rapport de l'enquête nutritionnelle nationale avec la méthodologie SMART*. Haïti, Port-au-Prince: UNICEF-Haïti, Ministère de la Santé Publique et de la Population. Available at: http://mspp.gouv.ht/site/downloads/SMART.pdf. Accessed December 1, 2014.
5. WHO, 2013. *Systematic Screening for Active Tuberculosis. Principles and Recommendations*. Geneva, Switzerland: World Health Organization. Available at: http://www.who.int/tb/publications/Final_TB_Screening_guidelines.pdf. Accessed April 20, 2014.
6. World Health Organization, 2014. *Definitions and Reporting Framework for Tuberculosis–2013 Revision (updated December 2014)*. Available at: http://apps.who.int/iris/bitstream/10665/79199/1/9789241505345_eng.pdf?ua=1. Accessed March 5, 2015.
7. Lorent N et al., 2014. Community-based active tuberculosis case, finding in poor urban settlements of Phnom Penh, Cambodia: a feasible and effective strategy. *PLoS One 9:* e92754.
8. Ogbudebe CL et al., 2015. Reaching the underserved: Active tuberculosis case finding in urban slums in southeastern Nigeria. *Int J Mycobacteriol 4:* 18–24.
9. Sekandi JN, Neuhauser D, Smyth K, Whalen CC, 2009. Active case finding of undetected tuberculosis among chronic coughers in a slum setting in Kampala, Uganda. *Int J Tuberc Lung Dis 13:* 508–513.
10. The World Bank, 2016. *Prevalence of HIV, Total (% of Population Ages 15–49)*. Available at: http://data.worldbank.org/indicator/SH.DYN.AIDS.ZS. Accessed July 21, 2016.
11. Fox GJ, Barry SE, Britton WJ, Marks GB, 2013. Contact investigation for tuberculosis: a systematic review and meta-analysis. *Eur Respir J 41:* 140–156.