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ORIGINAL ARTICLE

Assessment of Organizational Measures to Prevent Nosocomial Tuberculosis in Health Facilities of 4 Sub-Saharan Countries in 2010

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BACKGROUND. The prevention of tuberculosis (TB) transmission in healthcare settings is a major issue, particularly because of the interaction between human immunodeficiency virus and TB and the emergence of multidrug-resistant TB.

SETTING. Healthcare facilities involved in TB management in 4 African countries (Benin, Cameroon, Cote d'Ivoire, and Togo).

METHODS. A questionnaire was developed by representatives of the 4 countries to evaluate the organizational measures implemented in facilities involved in TB management. On-site visits were performed between July 2010 and July 2011.

RESULTS. A total of 115 facilities, including 10 university hospitals and 92 basic management units, were visited. None had a TB infection control plan, and only 5.2% provided education for staff about nosocomial TB. Overall, 48.3% of the facilities performed triage of suspected TB cases on hospital arrival or admission, 89.6% provided education for TB cases on cough etiquette, 20.0% segregated smear-positive TB cases, and 15.7% segregated previously treated cases. A total of 15.5% of the facilities registered TB among staff, for a global prevalence rate of 348 cases per 100,000 staff members.

CONCLUSION. This survey identified simple and mostly costless administrative measures to be urgently implemented at the local level to prevent nosocomial TB, such as staff education, triage on admission, and segregation of previously treated patients.

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Because of the emergence of multidrug-resistant tuberculosis (MDR-TB) and the high incidence of TB among human immunodeficiency virus (HIV)–positive people infected with *Mycobacterium tuberculosis*, infection control in healthcare facilities is once more under the spotlight for TB control. When new, effective TB treatment became available in the 1960s, the interest in prevention of nosocomial TB decreased dramatically: the drugs were so efficient that TB transmission decreased drastically as soon as an effective treatment was initiated. Later on, however, numerous nosocomial outbreaks of MDR-TB, particularly among HIV-positive patients, were reported throughout the world,[1-3] and more recently the large and dramatic outbreak of nosocomial extensively drug-resistant TB (XDR-TB) among HIV-positive patients and healthcare workers (HCWs) in South Africa[4] has demonstrated that infection control needs to be one of the top priorities of healthcare facilities dealing with TB and HIV-infected persons.

Measures to prevent transmission of TB in healthcare facilities were recently updated by the World Health Organization (WHO).[5] At the facility level, the prevention of TB transmission is based on a combination of measures that have been grouped and prioritized from the most important (ie, administrative or organizational measures) to the second-most important (ie, environmental measures), finally being completed by implementation of personal protective measures.[5] However, the burden of TB and the lack of resources in many countries may often prevent the implementation of international infection control guidelines.[5,6] Therefore, to evaluate the current level of TB infection control in all types

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of healthcare facilities and to prioritize interventions, we conducted a multinational survey of organizational measures implemented in 4 sub-Saharan countries.

METHODS

Infection control issues were discussed during a group meeting of National Tuberculosis Program (NTP) representatives of West and Central African countries organized by the International Union against Tuberculosis and Lung Disease in 2010 in Cotonou, Benin. Four countries—Benin, Cameroon, Cote d'Ivoire, and Togo—decided to undertake a survey on prevention of nosocomial TB. In these 4 countries, according to the WHO, TB incidence in 2010 varied from 94 cases per 100,000 in Benin to 455 cases per 100,000 in Togo, with the 2 other countries reporting an incidence of approximately 150 cases per 100,000.[7] A standardized questionnaire was developed after extensive group discussion to allow all the participants to use the same methodology and definitions.

The questionnaire was based on WHO recommendations on TB infection control in healthcare facilities.[5] In addition to a description of the facility, the survey focused on organizational measures to prevent TB transmission.

Each of the 4 country representatives selected health facilities to be surveyed mainly on the basis of feasibility criteria and the opportunity to visit the infrastructure during the time frame of the study. The selected sites were visited between July 2010 and July 2011 under the supervision of the NTP managers. Trained staff from the NTP collected data by direct observation during on-site visits.

Data were computerized using EpiData (EpiData Association) or EpiInfo, version 6.04d (Centers for Disease Control and Prevention), software and were analyzed using Stata, version 11 (StataCorp). Categorical variables were compared using the χ^2 test. P values are 2-tailed, and differences with P less than .05 were considered statistically significant.

RESULTS

Description of the Facilities

None of the 4 countries had a national TB infection control program. A total of 115 facilities were visited in 4 countries, including 10 university hospitals (UHs), 8 specialized TB centers (STBCs), 92 basic management units (BMUs) providing either only diagnosis or both diagnosis and treatment for TB, and 5 other types of facilities. The majority (87.0%) belonged to the public sector. The proportion of visited facilities in each country was 100% (59/59) in Benin, 9% (19/216) in Cameroon, 6% (8/140) in Cote d'Ivoire, and 25% (29/117) in Togo.

The median number of employees, including medical staff and nurses, was 45 (interquartile range [IQR], 30–945). There were 9 exclusively outpatient clinics with no beds; among the 106 remaining facilities, the median number of hospitalization beds was 31 (IQR, 14–68). The median number of patients seen in the outpatient clinics of all facilities was 28 (IQR, 15–55) per day. The median number of TB inpatients and outpatients registered in the facility the previous year was 45 (IQR, 19–93).

Most of the facilities (97.4%) had a laboratory for microscopy (Table 1) and only 51 (44.4%) had a radiology unit, the latter being less frequent in BMUs (33.7%) than in UHs and STBCs (94.4%). Only 5 (4.4%) facilities had a clinic or a ward dedicated to patients with lung diseases (respiratory medicine department).

Administrative Measures

None of the 115 facilities had a TB infection control plan, and only 5 (4.4%) had staff dedicated to TB infection control. A total of 67 (58.3%) of the facilities had infection control and hygiene staff. The proportions varied between 21.1% and 86.4% according to country, and all UHs had an infection control unit while only 2 (25.0%) of the STBCs and 53 (57.6%) of the BMUs had one.

Only 6 (5.2%) facilities provided education for staff about nosocomial TB, but 60 (52.2%) provided education on the interaction between TB and HIV. Of interest, only 3 of the 10 UHs and 2 of the 8 STBCs provided such education.

Triage of suspected TB patients on hospital admission or on arrival for outpatients was performed in 48.3% of the facilities; this proportion varied between 6.9% and 87.5% according to country and from 20.0% in UHs to 51.7% in BMUs. The majority ($n = 103$ [89.6%]) of the facilities provided education for TB patients on cough etiquette, while 39.1% educated visitors about respiratory hygiene. The facility type with the lowest proportion of education of visitors was BMUs (34.8%), while the proportion was highest for STBCs (87.5%).

Known smear-positive TB patients and patients previously treated for TB were separated from others in 23 (20.0%) and 18 (15.7%) of the 115 facilities, respectively. Surprisingly, these proportions were not higher in UHs (10.0% and 20.0%, respectively), while segregation of previously treated TB patients was reported in 5 (62.5%) of the 8 STBCs. HIV-positive patients without TB were separated from TB patients in 46 (40.0%) of the 115 facilities, but this was done in only 1 of the visited facilities in Côte d'Ivoire and Togo and in 36 (61.0%) of the 59 facilities in Benin. The failure to separate TB patients from non-TB HIV-positive patients occurred because of a lack of knowledge about the HIV status of the non-TB patients. In the 3 centers where MDR-TB patients were managed (2 in Benin and 1 in Cameroon), all had specific rooms or wards dedicated to these patients. None of the other facilities managed MDR-TB patients once drug susceptibility testing results displayed multiresistance.

The median time between sputum collection and obtaining a result was estimated at 1 day or fewer in 31 (27.2%) facilities,

TABLE 1. Measures for the Prevention of Tuberculosis (TB) Transmission in Healthcare Facilities by Country

Variable	All (n = 115)	Benin (n = 59)	Cameroon (n = 19)	Côte d'Ivoire (n = 8)	Togo (n = 29)
Center characteristics					
Public	100 (87.0)	51 (86.4)	16 (84.2)	7 (87.5)	26 (89.7)
On-site laboratory for microscopy	112 (97.4)	59 (100)	18 (94.7)	6 (75.0)	29 (100)
On-site radiology	51 (44.4)	22 (37.3)	13 (68.4)	6 (75.0)	10 (34.5)
Respiratory medicine ward	5 (4.4)	2 (3.4)	3 (16.7)	0	0
Hospitalization of TB cases	94 (81.7)	47 (79.7)	17 (89.5)	2 (25.0)	28 (96.6)
TB infection control plan	0	0	0	0	0
TB infection control staff	5 (4.4)	2 (3.4)	1 (5.3)	2 (25.0)	0
Infection control and hygiene staff	67 (58.3)	51 (86.4)	4 (21.1)	2 (25.0)	10 (34.5)
Administrative measures[a]					
Staff education about TB-HIV interaction	60 (52.2)	39 (66.1)	11 (57.8)	8 (100)	2 (6.9)
Staff education about nosocomial TB	6 (5.2)	1 (1.7)	3 (15.8)	2 (25.0)	0
Triage of patients suspected of TB	55 (48.3)	40 (67.8)	6 (33.3)	7 (87.5)	2 (6.9)
Education of patients on cough etiquette	103 (89.6)	57 (96.6)	17 (89.5)	8 (100)	21 (72.4)
Education of visitors on respiratory hygiene	45 (39.1)	17 (28.8)	9 (47.4)	7 (87.5)	12 (41.4)
Specific management of patients suspected of TB	52 (45.2)	40 (67.8)	4 (21.1)	8 (100)	0
Segregation of infectious TB cases	23 (20.0)	17 (28.8)	3 (15.8)	2 (25.0)	1 (3.5)
Segregation of previously treated cases	18 (15.7)	11 (18.6)	4 (21.5)	3 (37.5)	0
Separation of non-TB HIV-positive patients	46 (40.0)	36 (61.0)	8 (42.1)	1 (12.5)	1 (3.5)
Personal protective equipment used by the staff					
Use of particulate respirators	1 (0.9)	0	1 (5.3)	0	0
Use of surgical masks	1 (0.9)	0	1 (5.3)	0	1 (3.5)

NOTE. Data are no. (%). HIV, human immunodeficiency virus.

[a] Total may be different from the overall total of facilities because of absence of specific wards or rooms in some facilities or missing data. Percentages have been adapted to the total response.

2 days in 63 (55.3%) facilities, and more than 2 days in the remaining 20 (17.5%) facilities (data were missing for 1 facility). There was no significant difference in time to diagnosis according to size or type of facility.

The median time between TB diagnosis and treatment was estimated to be 1 day or fewer in 88 (76.5%) facilities, 2 days in 9 (7.8%) facilities, and more than 2 days in the remaining 18 (15.7%) facilities. There was no significant difference in time to treatment according to size or type of facility.

Personal Protective Equipment (PPE)

Of the facilities not dealing with known MDR-TB patients, none provided either surgical masks or respirators for protection of HCWs. Of the 3 facilities dealing with recognized MDR-TB patients, only 1 provided respirators and surgical masks for protection of HCWs against TB exposure. None of the 3 facilities had an educational program for the use of PPE.

TB among Staff Members

A total of 20 (17.5%) facilities had registered at least 1 staff member with TB disease within the last 3 years, including 7 (6.1%) with more than 1 case. The mean incidence was 348 cases per 100,000 staff members. Of the 20 facilities that registered TB among staff, 11 were among the 16 facilities that had more than 100 beds ($P < .01$). Facilities that registered TB among staff were more likely to have staff dedicated to TB infection control (15.0% vs 2.1%; $P = .01$) and staff educated in nosocomial TB (15.0% vs 3.2%; $P = .03$). Of interest, facilities that registered TB among staff were not more likely to have infection control staff (55.0% vs 59.0%; $P = .75$) or staff educated about TB-HIV interaction (40.0% vs 54.7%; $P = .23$).

DISCUSSION

Implementation of measures to prevent nosocomial TB infection is an important challenge everywhere, but it is particularly important in low-income and low- to middle-income countries, where the present survey was performed. We were able to collect data on administrative measures aimed at the prevention of nosocomial TB in a large sample of healthcare facilities of 4 sub-Saharan countries. In general, there was a general lack of organizational measures, demonstrated by the absence of TB infection control plans, staff education, and specific management of previously treated TB patients. On the other hand, positive points, such as education of patients regarding cough etiquette and time to diagnosis and treatment, were observed. Of interest, some of the facilities were able to provide administrative data on staff with TB disease.

Although some facilities had staff dedicated to TB infection control, none had a TB infection control plan, and only 5.2% provided education for staff about nosocomial TB. Therefore,

helping facilities to develop an infection control plan should be prioritized by the NTP. Of note, the presence of infection control staff not dedicated to TB infection control was reported in 58.3% of the facilities, a substantial rate considering that some BMUs are too small to have dedicated infection control staff. Therefore, efforts should be focused on the integration of TB infection control into general infection control programs.

As expected, when the diagnosis of MDR-TB is made, such patients are not hospitalized with others. However, there is a high risk of transmission before MDR diagnosis. Knowing that the risk of MDR-TB is much higher among previously treated TB patients,[8] it is surprising to see only 15.7% of such patients being segregated. This simple measure is of major importance in most of the surveyed facilities, as bacteriological proof of MDR arrives well after admission, if ever. Indeed, there are only 1 or 2 laboratories performing drug susceptibility tests in the 4 countries. Therefore, drug susceptibility testing is not systematic and is performed only for selected patients. New rapid and automated diagnostic tests for rifampicin resistance may help to shorten the time to diagnosis of resistance to this drug, but they are currently not available in most facilities.[9] In addition, they will not replace segregation of high-risk patients by clinical screening and low-cost organizational measures before availability of the result. Other organizational measures, such as triage on admission (48.3%) and, above all, cough education (87.5%) and a short delay between sputum collection and treatment initiation (1 day or fewer in 76.5%), were widely observed. It is therefore likely that facilities will be able to rapidly implement additional administrative measures to improve TB control after provision of incentives by the NTP, in light of local data such as those provided by this survey.

Apart from dramatic outbreaks involving MDR or XDR strains,[4] it is usually very difficult to measure the magnitude of the nosocomial TB problem. A convenient practice is to record TB among hospital staff. In our survey, we found that 17.5% of the facilities reported at least 1 staff member with TB disease, giving an overall estimated incidence of 348 cases per 100,000 staff members. We did not record the presence of either a registry for TB among HCWs or a program to screen staff for TB. Therefore, this figure likely represents an underestimate because of underreporting and lack of surveillance. Nevertheless, it is near the median of incidence rates reported in other retrospective studies performed in countries with similar economies, but there were wide variations (208 to 5,780 per 100,000)[10]; the highest rates were reported by Malawi, where the TB and HIV epidemics are larger than those in the countries included in this survey.[11,12] Of note, facilities reporting the highest number of TB cases among HCWs are the biggest, with more TB patients and dedicated staff for TB infection control. The availability of the latter may improve the reporting of suspected occupational TB, while it may be overlooked in smaller centers.

PPE was used in only 1 setting, where MDR-TB patients were treated. It is reassuring that facilities do not rely solely on the use of PPE for the prevention of occupational TB, particularly when more important administrative measures are not implemented. PPE is considered to be the least effective method for TB infection control. It should be underlined that the main reason for not using PPE is that it is not identified as a priority, but it is also because there is a general lack of financing.

This survey does not represent the overall situation of TB infection control in the 4 countries that participated in the survey apart from Benin, where all of the TB centers were included. The representativeness of the surveyed facilities in the other 3 countries was not assessed, and auditing more centers in these countries will be of major interest. However, the main goal of such a study is to draw attention to a major health issue, and we feel it is a starting point for better awareness regarding TB prevention. The collection of local data will help us focus on critical points to be implemented to prevent TB transmission in healthcare facilities. From this study, some priority actions may be recommended, above all the involvement of infection control staff in TB prevention. After training, this staff may be the relay for the NTP to implement quite rapidly simple administrative measures, such as triage on arrival and separation of previously treated patients from others. Finally, the dynamic created by this multicountry survey may be used to develop and distribute widely in each healthcare facility a simple leaflet on TB infection control. These actions will be easily evaluated by a second survey, which may also be conducted to analyze environmental measures to prevent TB transmission.

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