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Evaluation of a TB infection control implementation initiative in out-patient HIV clinics in Zambia and Botswana

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SUMMARY

SETTING: Out-patient human immunodeficiency virus (HIV) care and treatment clinics in Zambia and Botswana, countries with a high burden of HIV and TB infection.

OBJECTIVE: To develop a tuberculosis infection control (TB IC) training and implementation package and evaluate the implementation of TB IC activities in facilities implementing the package.

DESIGN: Prospective program evaluation of a TB IC training and implementation package using a standardized facility risk assessment tool, qualitative interviews with facility health care workers and measures of pre- and post-test performance.

RESULTS: A composite measure of facility performance in TB IC improved from 32% at baseline to 50% at 1 year among eight facilities in Zambia, and from 27% to 80% at 6 months among 10 facilities in Botswana. Although there was marked improvement in indicators of managerial, administrative and environmental controls, key ongoing challenges remained in ensuring access to personal protective equipment and implementing TB screening in health care workers.

CONCLUSION: TB IC activities at out-patient HIV clinics in Zambia and Botswana improved after training using the implementation package. Continued infrastructure support, as well as monitoring and evaluation, are needed to support the scale-up and sustainability of TB IC programs in facilities in low-resource countries.

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RESUME

Centres de consultation externe et de traitement du virus de l'immunodéficience humaine (VIH) en Zambie et au Botswana, pays durement frappés par l'infection à VIH et la tuberculose (TB).

Elaborer un kit de formation et de mise en œuvre de la lutte contre l'infection tuberculeuse (TB IC) et évaluer la mise en œuvre des activités de TB IC dans les structures de santé après l'utilisation de ce kit.

Une évaluation prospective de programme de formation et de mise en œuvre du kit de TB IC grâce à un outil d'évaluation standardisé des risques, des entretiens qualitatifs avec le personnel des structures de santé et des mesures de la performance avant et après le test.

La mesure composite de la performance des structures de santé dans la TB IC s'est améliorée de 32% au départ à 50% après un an dans huit structures de Zambie et de 27% à 80% à 6 mois dans 10 structures du Botswana. Bien qu'il y ait eu une amélioration marquée des indicateurs de lutte en termes de gestion, d'administration et d'environnement, des défis majeurs ont persisté en matière d'accès à l'équipement de protection personnel et de mise en œuvre du dépistage de la TB au sein du personnel de santé.

Les activités de TB IC dans les centres de consultation externe du VIH en Zambie et au Botswana se sont améliorées après une formation basée sur un kit de mise en œuvre. Il est nécessaire de continuer à soutenir les structures de santé et d'assurer un suivi et une évaluation afin de soutenir l'expansion et la pérennité des programmes de TB IC dans les structures de santé des pays à ressources limitées.

RESUMEN

Los consultorios de atención y tratamiento ambulatorio de la infectión por el virus de la inmunodeficiencia humana (VIH) en Zambia y Botswana, que son países con una alta carga de morbilidad por el VIH y la tuberculosis (TB).

Elaborar un módulo de capacitaciín y puesta en práctica de medidas de control de la infección tuberculosa (TB IC) y evaluar la ejecución de las actividades TB IC en los establecimientos, tras la utilización de este módulo.

El estudio consistió en un programa prospectivo de evaluación de un módulo de capacitación y puesta en práctica de medidas de TB IC, mediante la aplicación de un instrumento institucional normalizado de evaluatión de riesgos, entrevistas cualitativas con los profesionales de salud de los establecimientos y la evaluación de los conocimientos con pruebas anteriores y posteriores a la capacitación.

Se observó el progreso de una medida compuesta de la eficacia institutional de la TB IC de 32% al comienzo del estudio a 50% al año aplicación, en ocho establecimientos de Zambia y de 27% inicial a 80% a los 6 meses en 10 establecimientos en Botswana. Pese a que se puso en evidencia un avance considerable en los indicadores de las actividades de gestión, administrativas y ambientales de control, persisten dificultades críticas con respecto al acceso del personal de salud al equipo de protectión personal y a la aplicación de una detectión sistemática de la TB en los profesionales de salud.

Las actividades TB IC en los consultorios de atención ambulatoria de la infectión por el VIH en Zambia y Botswana mejoraron después de la capacitación sobre la aplicación del módulo. Se precisa un respaldo continuo a las infraestructuras, además del seguimiento y la evaluación de las actividades con el fin de ampliar la escala de aplicación y la sostenibilidad de los programas TB IC en los establecimientos de los países con bajos recursos.

Keywords

health care workers; monitoring; risk reduction; nosocomial transmission

TRANSMISSION OF TUBERCULOSIS (TB) in health care settings has been reported in sub-Saharan Africa to result in significant morbidity and mortality in patients and health care workers (HCWs).[1] Due to their exposure in the workplace, HCWs are at elevated risk for acquiring tuberculous infection and tuberculosis (TB) disease.[2] In a review of TB rates among HCWs, the median annual incidence of occupationally acquired TB was 5.8% in low-income countries and 1.1% in high-income countries, while the attributable risk for TB disease in HCWs, compared to the risk in the general population, ranged from 25 to 5361 per 100 000 per year.[3] People living with the human immunodeficiency virus (PLHIV) have increased susceptibility to TB, with rates of TB between 26 and 31 times greater than among those without HIV infection, and as HIV prevalence has increased in the past two decades, TB cases have also increased exponentially.[4] As PLHIV are at high risk for exposure to and contracting TB[5–7] in crowded and poorly ventilated HIV clinics, TB infection control (TB IC) practices are essential in these settings.

TB IC is a combination of measures aimed at minimizing the risk of TB transmission. The foundation of TB IC is early and rapid diagnosis of TB and appropriate anti-tuberculosis treatment. TB IC activities are divided into managerial, administrative and environmental activities, and personal protective equipment (PPE).[8] Evaluations have demonstrated the impact of implementing a package of TB IC procedures,[9,10] and have contributed to models for TB IC risk reduction,[11] using readily available IC measures such as improved natural ventilation, shortened length of hospital stay and the use of N-95 respirators by staff.

Through the President’s Emergency Plan for AIDS Relief (PEPFAR), the largest single country initiative to support HIV/AIDS (the acquired immune-deficiency syndrome) care and treatment, the US government has supported the scale-up of antiretroviral therapy (ART) at over 6500 HIV care and treatment sites, the majority of which are located in sub-Saharan Africa. As a part of its TB-HIV collaborative activities, PEPFAR has worked in partnership with ministries of health (MoHs) to develop national TB IC guidelines. However, at the facility level, TB IC practices remain inadequate, and improving these was identified as a priority.[12–14,15]

To address this gap in implementation, we developed a TB IC training package with a program evaluation component. Zambia and Botswana were identified as pilot countries due to the high burden of both TB and HIV and the existence of US partnerships with MoHs in both countries. Both countries published national TB IC guidelines in 2009 and were beginning to train facility level providers and measure facility practices.

Although previous studies have documented the elevated risk for TB among HCWs and lack of TB IC implementation, the literature on practical ways to improve implementation of TB IC at the facility level is limited.

We report the findings from the evaluation of the TB IC training and implementation package designed for HIV clinics and describe facility-level implementation in Zambia and Botswana.

STUDY POPULATION AND METHODS

The evaluation used a mixed-method prospective program evaluation approach. We conducted TB IC training courses for HCWs in Zambia and Botswana, assessed their knowledge with pre- and post-tests and evaluated facility performance before and after the training using a facility risk assessment tool. We also used a structured questionnaire to conduct key informant interviews to identify HCW implementation needs.

Training package

The TB IC training and implementation package included a 14 min training video, training slide presentations, a TB IC facility risk assessment tool and a template for facilities to use to develop a TB IC plan tailored to their specific needs. The package employed a continuous quality improvement approach by encouraging daily monitoring of practices and used a behavior change approach by providing HCWs with job aids to support their practices and opportunities to rehearse role play situations that would likely be encountered in their facilities.

The facility risk assessment tool had 32 elements to assess practices such as identifying a TB IC focal person, triaging and separating coughing patients, and conducting annual TB screening of HCWs (Table 1). The tool was based on World Health Organization (WHO) recommendations in the policy on TB IC in health-care facilities, congregate settings and households[8] and the US Centers for Disease Control and Prevention's (CDC's) guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings.[16]

Training courses in Zambia and Botswana

In Zambia, a multidisciplinary team composed of national and international experts in TB-HIV care and treatment and IC trained 43 HCWs from eight health care facilities in four provinces in September 2011 and conducted follow-up site assessments in September 2012. In Botswana, 50 HCWs from 10 health care facilities in five districts were trained in February 2012 and follow-up site assessments were conducted in August 2012. Facilities were chosen by MoH leadership in each country. The facilities selected were among the largest HIV clinics in the country and were chosen by the respective MoHs due to their geographic representativeness and burden of disease. Each training course was conducted over 3 days and included visits to facilities to conduct facility risk assessments. In both countries, the staff trained included MoH representatives from the national and regional levels, TB coordinators, medical officers, nurses, health education specialists, as well as implementing partners. Staff were chosen because they were designated as responsible for leading the implementation of TB IC measures in their facilities.

We conducted baseline and follow-up assessments of TB IC implementation at health care facilities using the risk assessment tool. Each facility was assessed through a site visit that included observations of physical structures and equipment available, actions of health care staff, review of supporting documentation and brief interviews with facility staff. Data were collected by MoH and CDC staff. Based on the results of the initial assessment, each facility developed its own facility-specific IC improvement plan. The results were entered into a dashboard with a visual display of the results of the facility assessment coded as ‘not done’, ‘done’ or ‘not applicable’ (Figure). Each indicator in the facility assessment was given a weight of one.

We also asked trainees to complete a 44-question assessment tool before (pre-test) and after (post-test) receiving training; the tool covered key concepts in TB transmission and TB IC preventive measures. We compared pre- and post-test scores using a paired *t*-test in SAS version 9.3 (Statistical Analysis System, Cary, NC, USA).

To assess barriers to facility-level implementation, we developed structured interview guides and conducted in-depth interviews with HCWs at follow-up using an informed consent process. We interviewed all persons available at the site who had undergone training, as well as other HCWs who had not attended the course to assess whether they had received subsequent in-service training on TB IC as recommended. We transcribed the interviews and identified key themes related to challenges and additional needs for implementation of TB IC.

Ethics approval

The protocol and supporting data collection and consent forms for the study were reviewed, and the study was determined to be a non-research program evaluation by the US CDC (Atlanta, GA, USA), the Botswana Ministry of Health (Gaborone, Botswana), and the Zambia Ministry of Health (Lusaka, Zambia) ethics committees.

RESULTS

Facility evaluations

In Zambia, the evaluation demonstrated an improvement in performance on the 32-indicator risk assessment tool; overall, indicators categorized as ‘done’ increased from 32% at baseline to 50% at 1 year of follow-up. At baseline, clinic performance ranged from 10% to 48%, while at 1 year follow-up it ranged from 39% to 76%. By the end of the follow-up period, all facilities had identified a TB IC focal person and had formed a TB IC committee. The proportion of facilities with facility and patient flow assessments had increased, as had facilities with TB IC training conducted for all staff (Table 2).

In Botswana, the evaluation demonstrated an overall improvement in performance on the 32-indicator assessment tool from 27% ‘done’ at baseline to 80% ‘done’ at the 6-month follow-up visit. At baseline, individual clinic performance ranged from 16% to 34%, and at follow-up, it ranged from 52% to 97%.

Pre- and post-test trainee scores

In Zambia, 22 (51%) participants completed the pre- and post-test on a 44-question assessment. The mean pre-test score was 36.1 and the mean post-test score was 39.6, an increase of 3.5 (95% confidence interval [CI] 2.35–4.65, $P < 0.0001$). In Botswana, 45 (92%) participants completed the pre- and post-test. The mean pre-test score was 34.0 and the mean post-test score was 37.6, an increase of 3.5 (95%CI 2.42–4.65, $P < 0.0001$).

Health care worker interviews

At the follow-up visits interviews were conducted with 69 HCWs: 18 in Zambia, 9 of whom had been trained, and 51 in Botswana, 25 of whom had been trained. Of the HCWs interviewed, 57% in Zambia and 100% in Botswana had received a TB IC mentorship and supportive supervision visit. Clinic TB IC committees had met an average of 2.6 times in Zambia over a 1-year period and 5.0 times in Botswana over a 6-month period. Of those HCWs who did not attend the training, 18% in Zambia and 76% in Botswana had received on-site training from those who had been trained. In addition, 36% of the HCWs had watched the training video in Zambia and 68% in Botswana. All those who viewed it described it as informative and helpful. When asked about challenges in implementing TB IC practices, issues related to scarce human resources, education and sensitization of patients, problems with facility structures and financial support were strong themes. When asked about what was needed to increase implementation, training and mentorship of staff, community mobilization, structural improvements and maintenance and resources were discussed (Table 3).

DISCUSSION

Our evaluation is among the first to document longitudinal monitoring of TB IC before and after a comprehensive training and implementation intervention in a low-resource setting. Following in-depth training with practical exercises, HCWs at out-patient HIV facilities in Zambia and Botswana had made significant gains in implementing TB IC practices. Particularly striking was the progress in the implementation of managerial and administrative control measures. Almost all facilities had TB IC committees, all facilities had identified focal persons for TB IC and most had a facility IC plan. Segregation of coughers and use of outdoor waiting areas was improved, along with the presence of signage to encourage opening windows and doors.

The keys to effective TB IC in out-patient HIV facilities include timely screening and separation of coughing patients, rapid diagnosis of TB and starting anti-tuberculosis treatment as quickly as possible. We demonstrated improvements in the proportion of facilities with cough monitors, practices for separating and fast-tracking coughers, and returning microscopy results to providers within 24 h. The scale-up of Xpert® MTB/RIF (Cepheid, Sunnyvale, CA, USA) laboratory testing technology in Zambia and Botswana, as well as other countries in the region, is an opportunity to provide a more rapid, sensitive and accurate TB diagnosis and further reduce the transmission risks associated with undiagnosed TB.[17]

The WHO recommends that HCWs be monitored for tuberculous infection and TB disease to provide them with appropriate care, and to monitor the effectiveness of TB IC.[7] An initiative in Swaziland demonstrated increased case finding of TB and HIV among HCWs following the introduction of an HCW wellness program.[18] In Zambia, the MoH has implemented a HCW screening initiative in one district, and plans to expand this to additional districts. Botswana has also begun HCW screening at some facilities.

Monitoring and mentoring were also important to the success of this program. In Botswana, between the baseline and follow-up period, mentorship and supportive supervision visits were conducted by the MoH, a district TB IC team, and partners, including the CDC and the African Comprehensive HIV/AIDS Partnership (ACHAP). In Zambia, TB IC is monitored by provincial TB coordinators.

Our evaluation also documented challenges to TB IC as described in other evaluations.[15,19,20] In Zambia, N-95 or FFP2 respirators and supplies for coughing patients were not consistently available. In both countries, even at facilities with access to respirators, most HCWs had not received training on their use. In both settings, some health facilities were not well-designed for TB IC, and renovations may be necessary. These can be costly and administratively challenging. However, even in these settings, it was possible for HCWs to make important progress in TB IC practice. Although only one facility in this evaluation had a specific budget for TB IC, most were able to accomplish the majority of TB IC objectives within existing facility budgets.

The limitations of this program evaluation are that as it was conducted in a limited number of facilities, the results may not be generalizable. However, the facilities included were high-volume and located in high HIV burden regions. Although evaluations were conducted at baseline and follow-up by personnel with expertise in TB IC, it is possible that some behaviors and responses were modified because of the presence of reviewers.

Studies have shown that the presence of a trained TB IC practitioner or TB IC focal person can result in reduced infection rates and improved outcomes.[21] To build country capacity in TB IC, it may be helpful to develop a cadre of TB IC practitioners who can integrate broad-based TB IC issues and support the growth of in-country IC practitioner networks.[22] Networks such as the Infection Control Africa Network (http://www.icanetwork.co.za/) can play a role in building regional and international support for such practitioners. Although TB IC implementation is possible, it will need continued support to expand to all settings where HIV clinical care is provided in sub-Saharan Africa.

CONCLUSIONS

This evaluation demonstrated improved implementation of facility level TB IC practices in two countries with a high burden of TB and HIV. These findings show that implementation of TB IC measures at HIV clinics in sub-Saharan Africa is feasible and acceptable. Scale-up of training and continued, monitoring and evaluation of TB IC measures is essential to institutionalizing TB IC at the facility level.

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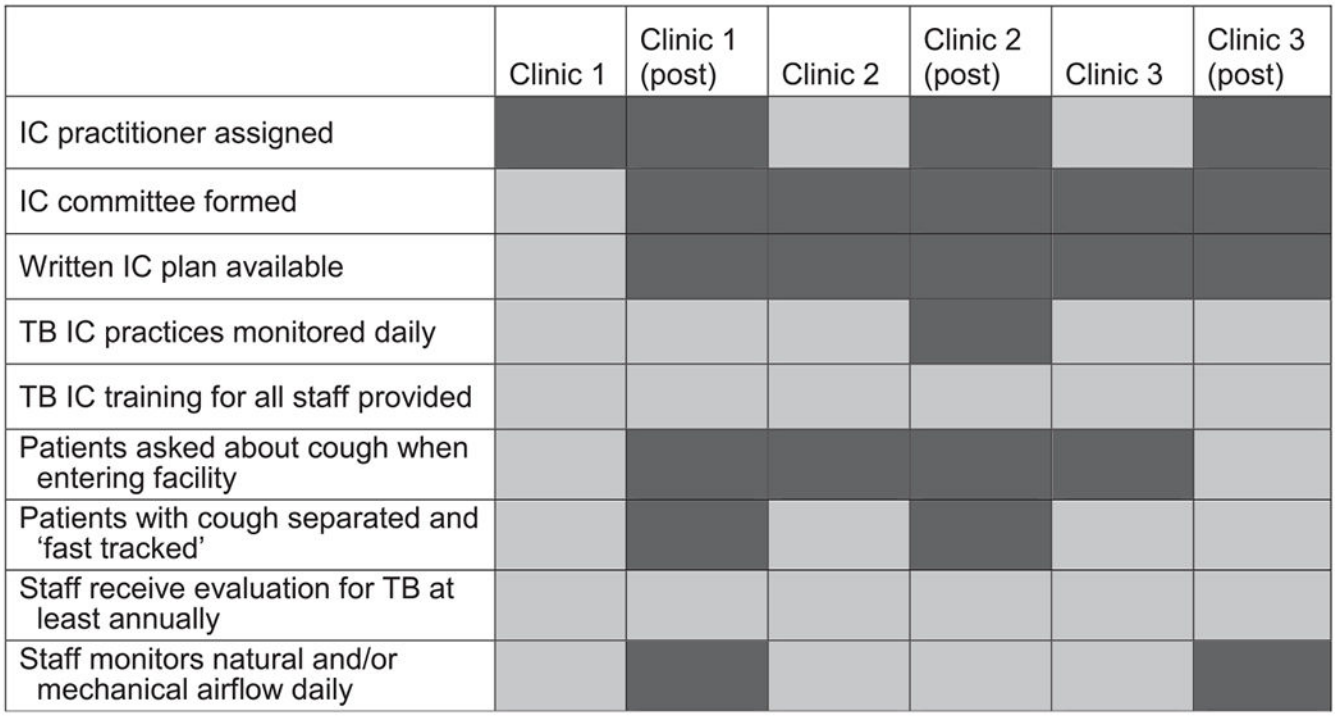

Figure.

Example of abbreviated dashboard for monitoring TB IC activities. Light gray box = not done or not correctly done; dark gray box = done, or desired outcome; TB = tuberculosis; IC = infection control.

Table 1

Facility TB IC risk assessment tool

Managerial	
1	The National Infection Control Policy is available on-site
2	An IC practitioner or nurse has been assigned to carry out IC in the facility
3	An IC committee/team has been designated at this site
4	A written site-specific IC plan has been written and is available to staff
5	The IC plan contains a statement of endorsement by the facility manager
6	A TB IC risk assessment is completed at least annually
7	Facility design and patient flow have been assessed for the best use of space and ventilation
8	TB IC practices are monitored daily
9	TB IC training for all staff has been done and documented at least annually
10	Information on TB IC is available for all patients and visitors and is offered by staff
11	An occupational health program has been implemented in this facility
Administrative	
12	Patients are routinely asked about cough when entering the facility
13	Patients with cough are separated from others and ‘fast tracked’ to a clinician
14	A ‘cough monitor’ or other designated person gives cough etiquette guidance and assists with separation and triage
15	Signage for cough etiquette is present in the clinic
16	Supplies are available to patients with cough (tissues, cloths, masks, trash bins, etc.)
17	Sputum samples are collected in a designated area and away from others
18	Processing of sputum samples is expedited in the laboratory; there is a tracking mechanism to monitor turnaround time of laboratory results
19	Staff receive an evaluation for TB at least annually
20	A confidential log is kept of all staff who are diagnosed with TB disease
21	Staff are offered HIV testing annually and offered ART if they are positive
22	HIV-infected staff are reassigned on request
Environmental	
23	Staff monitors natural and/or mechanical airflow daily, especially in waiting rooms, sputum collection rooms, if available, and at least one examination room
24	HCWs who assist during sputum collection take precautions
25	Regular cleaning and maintenance of directional and extractor fans are ensured
26	Servicing documentation is maintained and is available for review
27	Signage is in place to keep doors and windows open when feasible
28	If UVGI fixtures are used, routine cleaning and maintenance are conducted and documentation logs maintained
29	Patient waiting areas are out of doors or have good cross-ventilation
Personal protective equipment	
30	Surgical masks are available and worn by patients with cough
31	N-95 or FFP2 respirators are readily available and used by staff
32	Staff have been trained on the proper fit of respirators and documentation of training is provided

TB = tuberculosis; IC = infection control; HIV = human immunodeficiency virus; ART = antiretroviral therapy; HCW = health care worker; UVGI = ultraviolet germicidal irradiation.

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Table 2

Results of facility TB IC risk assessment: Zambia and Botswana

	Zambia (*n* = 8)			Botswana (*n* = 10)		
Indicator	**Clinics complying pre-intervention**	**Clinics complying post-intervention**	**Difference**	**Clinics complying pre-intervention**	**Clinics complying post-intervention**	**Difference**
National IC policy available	7	2	−5	9	9	0
IC practitioner assigned	7	8	+1	8	10	+2
IC committee formed	6	8	+2	6	9	+3
Written IC plan available	4	5	+1	2	9	+7
IC plan has facility director endorsement	3	3	0	0	6	+6
TB IC risk assessment completed annually	1	5	+4	0	10	+ 10
Facility design and patient flow assessed	4	8	+4	0	8	+8
TB IC practices monitored daily	2	4	+2	1	8	+7
TB IC training for all staff provided	0	3	+3	0	7	+7
TB IC information available for all patients and visitors	1	4	+3	0	10	+10
Facility has an occupational health program	3	5	+2	2	7	+5
Patients asked about cough when entering facility	3	7	+4	2	9	+7
Patients with cough separated and fast tracked	0	6	+6	2	9	+7
Cough monitor gives cough etiquette guidance and triages	1	6	+5	1	8	+7
Signage for cough etiquette present	4	7	+3	1	10	+9
Supplies are available to patients with cough	0	2	+2	1	9	+8
Sputum samples collected away from others	4	6	+2	8	10	+2
Processing of sputum samples is expedited in the laboratory	6	7	+1	7	9	+2
Staff receive evaluation for TB at least annually	0	1	+1	2	9	+7
Confidential log is kept of all staff diagnosed with TB	0	1	+1	1	8	+7
Staff offered HIV testing annually and ART if positive	1	3	+2	4	9	+5
HIV-infected staff are reassigned on request	3	4	+1	5	9	+4
Staff monitors natural and/or mechanical airflow daily	2	6	+4	0	7	+7
HCWs who assist in sputum collection take precautions	4	6	+2	6	7	+1
Regular cleaning and maintenance of fans done	1	1	0	0/4*	1/4*	+1
Servicing documentation maintained and available	1	1	0	0/4*	1/4*	+1

Indicator	Zambia (*n* = 8)			Botswana (*n* = 10)		
	Clinics complying pre-intervention	Clinics complying post-intervention	Difference	Clinics complying pre-intervention	Clinics complying post-intervention	Difference
Signage in place to keep doors and windows open	5	7	+2	1	10	+9
If UVGI fixtures are used, maintenance is done	NA	NA	NA	NA	NA	NA
Patient waiting areas outdoors or with cross-ventilation	3	6	+3	1	5	+4
Surgical masks available and worn by patients with cough	0	2	+2	5	8	+3
N-95 or FFP2 respirators readily available and used	0	0	0	6	8	+2
Staff trained on proper fit of respirators	1	1	0	0	2	+2

*Only four facilities had fans.

TB = tuberculosis; IC = infection control; HIV = human immunodeficiency virus; ART = antiretroviral therapy; HCW = health care worker; UVGI = ultraviolet germicidal irradiation; NA = not applicable.

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Table 3

Health care worker responses to in-depth interviews

What are the challenges of implementing TB IC at your facility?
Human resources (attitudes, challenge of disseminating information)
‘Not enough IC officers’
‘Time constraints as TB IC is not only duty and not primary duty’
‘If you find places like the pharmacy, we give them information, but the implementation is not clear’
Education and sensitization of patients
‘Most difficult is getting the clients to understand what you mean by TB IC’
Facility structures
‘The main problem is the structure… it is difficult in the rainy seasons—it will be different because there will be patients crowded inside’
‘Patient waiting area is not adequate for volume, few and small screening rooms.’
Financing
‘Measures that need financial assistance such as tissues, fans, extractors’
‘Running out of N-95 masks’
What is needed to increase implementation of TB IC at your facility?
Training and mentorship of staff
‘More sensitization of the staff’
‘Frequent reminders and pressure to focus on TB IC’
Community mobilization
‘Community education to be disseminated to other community members’
‘IEC materials for patients and relatives’
‘Train community treatment supporters in TB IC’
Structural improvements and maintenance
‘Environmental modifications, the structures are not conducive’
‘Maintenance personnel’
‘More benches for outdoor seating’
Resources
‘IEC materials (specifically TV and DVD players to use for TB IC DVD)

TB = tuberculosis; IC = infection control; IEC = information, education & communication; DVD = digital versatile disc.