



## Room to Breathe: Four Steps to Reducing the Spread of Airborne Tuberculosis Infection



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# **Room to Breathe:**

## **Four Steps to Reducing the Spread of Airborne Tuberculosis Infection**



## Introduction

The Southern African Catholic Bishops' Conference (SACBC), with support from the United States Centers for Disease Control and Prevention (CDC), implemented "Tuberculosis Infection Control Measures in Faith-Based, Community-Based Organizations" as an add-on activity in fourteen church-based AIDSRelief<sup>1</sup> ART sites in South Africa. The purpose of the activity was to reduce the risk of transmission of tuberculosis (TB) among the antiretroviral therapy (ART) clients receiving treatment at SACBC facilities, the caregivers and staff accompanying them and the service providers caring for them. Catholic Relief Services (CRS) provided technical support during the two-year implementation period.

This activity is considered a promising practice because of the increasingly high priority placed on reducing TB-HIV co-infection, and its broad, practical applicability to all HIV treatment settings as well as other settings where adults and children -- some healthy and some immune-compromised -- congregate (schools, youth clubs, early childhood care and development centers, HIV support group venues, etc.). In these settings, people may be exposed to airborne pathogens such as the *tubercle bacillus* which are especially likely to cause disease in those who are immune-compromised, such as people living with HIV. In regions where HIV prevalence is high, activities aimed at prevention of airborne diseases have significant public health benefit, protecting the sick as well as the general population and health care providers. Implementing protective measures can also be considered an ethical responsibility for those managing and administering such settings.

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<sup>1</sup> AIDSRelief was a CRS-primed consortium that provided HIV care and antiretroviral treatment in ten countries, including South Africa, through a multi-year grant from the U.S. President's Emergency Plan for AIDS Relief (PEPFAR).

## Problem Statement

Nine million people become ill with TB each year and more than a million and a half of them die. About one third of the world's population is infected with TB, although only a small proportion of them will become sick with TB.<sup>2</sup> People with weakened immune systems, however, have a much greater risk of falling ill from TB. In fact, TB is the leading cause of morbidity and mortality among people living with HIV; the risk of developing TB is as much as 37 times greater among those living with HIV than among their HIV-negative peers.<sup>3</sup> Without treatment, most people with HIV who contract TB will die within a few months: one in four of all HIV-related deaths are caused by TB. Half a million children become ill with TB per year and 10 million children worldwide have been orphaned because a parent died of TB.

TB is transmitted primarily from person to person by breathing infected air during close contact. When people with TB in their lungs cough, sneeze, spit or talk, they propel the TB germs into the air. A person needs to inhale only a few of these germs to become infected. Left untreated, a person with active TB can infect between 10 and 15 people in a year.<sup>4</sup> Through its AIDSRelief program, staff observed the overcrowding in health facilities, where small enclosed waiting and consultation rooms allow respiratory infections to spread. Lack of awareness and inconsistent application of infection control guidelines contribute to the risk of transmission. The emergence of multidrug-resistant tuberculosis (MDR-TB) and extensively drug-resistant tuberculosis (XDR-TB) has caused health professionals to fear exposure to TB clients (thus increasing stigma) and has initiated a reappraisal of the importance of TB infection control in

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<sup>2</sup> WHO (2012). 10 facts about tuberculosis. WHO, Geneva.

<sup>3</sup> Stop TB Partnership (2011). Guidelines for intensified tuberculosis case finding and isoniazid preventive therapy for people living with HIV in resource-constrained setting. WHO: Geneva, Switzerland.

<sup>4</sup> WHO Media Centre. (2012). WHO Tuberculosis Fact Sheets 104. Retrieved from <http://www.who.int/mediacentre/factsheets/fs104/en/>

healthcare facilities, congregate settings and households.<sup>5</sup> People with HIV, healthcare workers and the community have a right to a safe clinical environment including immediate implementation of the Three I's including WHO recommended TB infection control.<sup>6</sup> (Box 1).

## The Three I's of TB Infection Control

- Intensified Case Finding
- Isoniazid Preventive Therapy
- TB Infection Control measures

### Box 1: The Three I's of TB Infection Control

Acknowledging the need for urgent action, SACBC engaged in a process of introducing practical, sustainable TB infection control measures at ART sites. This response was aligned with the WHO policy on Collaborative TB/HIV Activities (#7: Ensure TB infection control in healthcare and congregate settings) and aimed to reduce the burden of TB among people living with HIV while simultaneously offering a safer and healthier environment to clients, caregiver and healthcare workers.

Although this activity was originally devised for SACBC's ART treatment sites, the simplicity of its design provides exciting potential for replicability in most settings where adults and children congregate, including health clinics, schools, youth clubs, HIV support group venues and early childhood development centers.

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<sup>5</sup> WHO (2009). Policy on TB Infection Control in Health-Care Facilities, Congregate Settings and Households.

<sup>6</sup> Stop TB Partnership. (2011). Time to act. Save a million lives by 2015 - Prevent and treat tuberculosis among people living with HIV. WHO/UNAIDS: Geneva, Switzerland.

## A four-step process

The activity implemented by SACBC followed a four step process:

### **Step 1: Site-specific infection control planning**

To raise awareness and commitment to the process of making TB infection control a priority, a refresher training workshop was provided for two hundred site managers, nurses and medical doctors from the fourteen facilities. The training provided an overview of TB epidemiology, screening, prevention, treatment, care, client counseling, and basic personal and environmental public health measures to minimize risk of infection. Armed with updated knowledge and with guidance from workshop facilitators, teams from each facility drafted infection control plans that responded to the specific needs of their facilities, and resonated with local capabilities, priorities, culture and customs. Acknowledging that airborne infection control is an especially challenging health systems issue, with unclear ownership and multiple lines of authority, the formation of multi-sectoral facility-level planning teams was essential to the development of ownership, excitement and accountability among team members.

### **Step 2: Technical review of Infection Control plans**

CRS, in its role as provider of technical assistance to SACBC, reviewed each facility's plans and provided input<sup>7</sup>, assisting each facility team to produce finalized plans that were both practical and specific. A synthesis of the review process produced two overarching recommendations that proved especially influential:

1. Each facility was encouraged to appoint a TB Infection Control Manager who would be responsible for the plan's implementation; and

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<sup>7</sup> CRS based its feedback on McCarthy K et al (2009). Implementing TB infection control in health facilities. RHRU, Johannesburg, South Africa.

## 2. Each Infection Control

Manager was encouraged to appoint one or two TB Infection Control Officers to assist the Manager in training “Cough Officers.” “Cough Officers” are the first point of contact for clients arriving at a treatment site. Their responsibilities include conducting verbal screening for cough with all new clients, providing on-the-spot cough etiquette education and tissue paper for patients to cover their mouths, and fast-tracking or separating coughing clients.



Visual cues remind clients and staff of protocol.

As technical input was provided, each treatment site was asked to incorporate the feedback and re-submit their plans for a second review. Final drafts were then reviewed by CDC and the Council for Scientific and Industrial Research/Department of Health (CSIR/DoH).

## **Step 3: Improving ventilation**

The simplest and most important measure in the prevention of transmission of airborne diseases is good ventilation. This refers to the removal of old, ‘diseased’ air, and replacing it with new, ‘clean’ air. Infectious particles are removed, and those that remain are diluted, thus the chances of inhaling infectious particles are kept to a minimum. Ventilation can also control the direction of air flow so that air flows from less contaminated to more contaminated areas (rather than vice versa).<sup>8</sup> In health facilities it is common for clients to congregate in closed, poorly ventilated waiting areas. Improving these waiting areas was deemed a high priority.

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<sup>8</sup> ibid

Each action plan was designed according to the needs and preferences of the individual ART treatment site, taking into consideration the space available, daily average client demand, availability of and local preference for different types of construction materials, and weather patterns throughout the seasons. Waiting areas were then constructed or renovated using a range of materials including corrugated iron sheeting over metal structures, vinyl canopies, and gazebos with thatched roofs. Some designs included side blinds (with slits and openings to allow for adequate ventilation) that could be attached during rainy or windy weather conditions.

**Sites designed own open-air structures according to needs and preferences.**



*Open waiting area covered with corrugated iron sheets.*



*Open waiting area covered with traditional thatched roof.*



*Fixed wood benches in open area*

Seating arrangements for clients and those accompanying them were also considered. While some treatment sites chose fixed wooden and metal benches, others chose free-standing chairs to allow mobility to and from sunny or shaded areas.

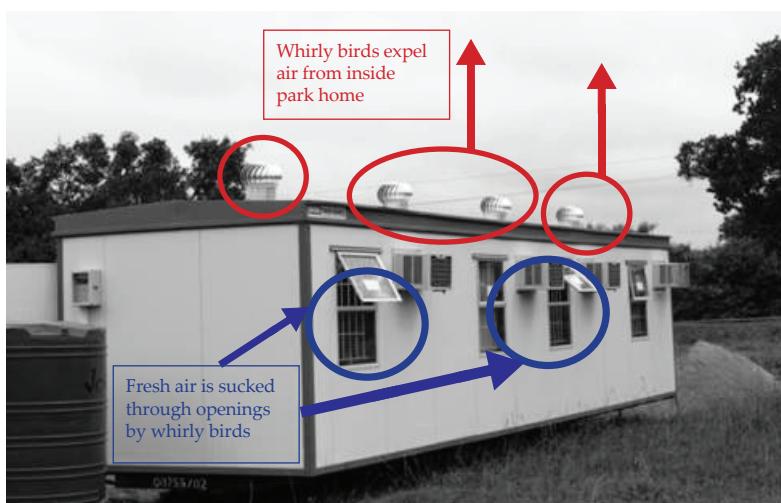
Since the open waiting areas are to be used year round, including during the cold season, gas patio heaters for use during the winter months were included in the design and costing.



*Removable gas heaters are used to keep open air waiting areas comfortable in the cold season.*

Although this activity initially targeted low-cost solutions to improve air flow within the health facilities, it was soon observed that most buildings had been poorly designed with “dead zones” where the number of “air changes” per hour was not sufficient.<sup>9</sup> When air is still, pockets of air may contain higher numbers of infectious droplets, and therefore increase risk to clients. Thus, infection control plans also included installation of and maintenance contracts for mechanical ventilation systems in areas where natural air flow was interrupted or unreliable. SACBC and CRS contracted a South African engineering company to assess the air flow rate in these buildings, design and install mechanical ventilation systems.

Once the assessments were complete, the company advised on the best mechanical ventilation systems available to address the low air change rate. Depending on the needs of each site, several different systems were installed, including “Whirly Birds Air Expellers,” “Vent Air Expellers,” “Extractor Duct Systems” and “Extractor Fans.” Stickers and posters were affixed to remind users of the importance of keeping doors, windows and openings unobstructed to allow the equipment to work properly.



<sup>9</sup> WHO (2009). Policy on TB Infection Control in Health-Care Facilities, Congregate Settings and Households.



All of these low cost, low maintenance systems are suitable for installation in both permanent and semi-permanent constructions. However, they did present some challenges, including high noise levels created by ducts (solved by installing sound reducers), extractor fans not working correctly, and in some cases, weak public electric systems with insufficient amperage to power the ventilation systems.

Lastly, information and education materials for both clients and health care providers, including posters on cough etiquette and hand washing, were developed and field tested by CDC. Stickers were placed on doors and windows to remind site personnel and clients to keep windows and doors open during consultation. At sites where the budget allowed, masks were provided to infectious TB clients. However, most sites provided clients with tissues, paper towels, or toilet paper and educated them about cough etiquette.

## **Step 4: Continuous on-site monitoring**

All fourteen ART sites are now continuously monitored for successful implementation of TB infection control activities. Regular site visits are conducted using a quality improvement checklist (see Annex) adapted from existing South African

guidance.<sup>10</sup> The checklist covers four basic topics: 1) is there an enabling environment through which to implement TB infection control activities? 2) are there administrative controls and strategies in place to reduce infection aerosols? 3) are there adequate environmental controls to remove infectious aerosols; and 4) are staff, clients and others aware of personal protection strategies to reduce inhalation of infectious aerosols?



Posters on cough etiquette are posted in health facilities.

To track airflow and ensure proper functioning of ventilation systems, incense is lit briefly in a waiting or consultation area. The absence of scent after five minutes is equated with 12 air changes per hour. If removal of the scent takes ten minutes, there are six air changes per hour. Adequate ventilation is defined as six to 12 air changes per hour.

<sup>10</sup> McCarthy K et al (2009). Implementing TB infection control in health facilities. RHRU, Johannesburg, South Africa.

## Lessons Learned

### ***Development of infection control plans***

SACBC's experience showed the importance of individually tailored infection control plans, designed locally by those with intimate knowledge of the structure of the buildings, the geographic location, the energy supply, and the availability of engineers and technicians.

### ***Types of ventilation systems***

In future applications of this approach, implementers should consider the use of solar energy to power small ventilation systems, especially where electricity supplies are unreliable. Insufficient electricity in the rural facilities, as well as the shortage of skilled engineers, were drawbacks to using the heavy-draw ventilation systems. In addition, the cost involved in their installation and maintenance made these systems less cost-effective and less sustainable than simple renovations, such as knocking down walls and putting in windows. The use of whirly bird air expellers, which are powered by wind, is a practical and cost effective option.

### ***Ventilation system monitoring***

It is important to keep the checklists short and simple to fill out, for both the clinic focal point and the visiting project officer. Compliance improved considerably when a shorter and simplified checklist--focusing only on the essentials--was put into place. Even at that, it takes constant encouragement and reminders to ensure that busy clinic staff continually monitor infection control procedures at their treatment sites.

### ***Information, education and communication (IEC) materials***

IEC materials should be produced in local languages for maximum uptake. Child-friendly versions invite children to

become advocates in schools and other children's gathering places.

## ***The use of masks and stigma***

The use of a mask, in SACBC's experience, did not exacerbate the stigma that still exists in South Africa. It is important to note that the use of masks by either health workers or clients is seldom an option due to lack of funds. However, in an ideal situation, masks could be considered and education of staff and communities would be required.

## ***Reduced fear and stress***

Anecdotally, health professionals expressed a reduction in stress and fear about providing care for clients with cough. They reported feeling more confident in carrying out their duties with potentially infectious clients, especially in spending the one-on-one time required to ensure client education and counseling needs have been thoroughly met. Clients expressed appreciation of the open-area waiting areas, noting that they now felt more comfortable waiting, more inclined to talk with other clients and let their children play while they waited.

## ***The need for more research***

The scope of the project did not include research on changes in hospital-acquired TB incidence; while such a study would be helpful in establishing effectiveness (and cost-effectiveness) of infection control interventions, cost is prohibitive and attribution remains questionable.

## Conclusion

This project demonstrated that practical, low-cost TB infection control measures are feasible to be introduced into rural and semi-urban, low-resource HIV treatment clinics to reduce the risk of TB transmission to highly vulnerable adults and children. This intervention may work well in other settings where children gather, such as Drop-in Centers and Early Childhood Development Centers to decrease the risk of TB among pre-school children.

## Annex

### TB Infection Control Checklists for SACBC/CRS ART sites | 2011

**Instructions:**

1. This checklist should be completed once every month and the completed sheet should be filed in your facility TB infection control file.
2. The checklist should be completed by the **TB infection control manager/coordinator/focal person** in the facility, together with another staff member in the facility.
3. The TB infection control manager/coordinator/focal person has the responsibility to verify that this checklist is completed every month.

#	Ask Question	Tick/Answer		
1	Does this facility have an assigned infection control manager/coordinator/focal person who is responsible for TB/HIV infection control?	Yes		No
2	Does this facility have an Infection Control Committee?	Yes		No
3	Did this committee meet in the last quarter?	Yes		No
4	Are there any health care workers that were treated for TB in this facility during the past year?	Yes		No
5	Are there records available of health care workers who contracted TB in the past year?	Yes		No
6	Do health care workers undergo 6 monthly TB sputum tests?	Yes	Sometimes	No
7	Are patients that are coughing for longer than 2 weeks immediately referred for a sputum test?	Yes	Sometimes	No
8.1	Does the personnel who visit patient's homes (adherence monitors/home-based caregivers) ask patients or observe if they cough?	Yes	Sometimes	No
8.2	Are there any TB signs and symptoms questionnaires they completed during home visits on file?	Yes	Sometimes	No
8.3	Does the cough officer ask all patients or observe if the patients cough before they sit down?	Yes	Sometimes	No
8.4	Are there any TB signs and symptom questionnaires attached to the patient files in the clinic?	Yes		No
9	Are patients educated in cough hygiene as they enter your facility?	Yes	Sometimes	No
10	Are all patients with TB disease receiving DOTS support as per National Department of Health TB guidelines?	Yes	Sometimes	No
11	Are patients crowded in the hallways and inside waiting areas?	Yes	Sometimes	No
12	Are TB suspects/patients separated from those who are not?	Yes	Sometimes	No
13	Is there a 'fast-queue' for collection of sputum smear results?	Yes	Sometimes	No
14	Are those who cough and TB suspects fast tracked? i.e. seeing the nurse or doctor first or immediately when they arrive?	Yes	Sometimes	No
15	If patients cough, are they provided with paper masks or tissues/paper towels/toilet paper to reduce of infectious aerosols?	Yes	Sometimes	No
16	Was staff trained in TB infection control?	Yes		No
17	Is there an open-window policy at this facility?	Yes	Sometimes	No
18	Are all the windows open in this clinic (on all days)?	Yes	Sometimes	No
19	Are fans/extractor fans/whirly birds used to increase circulation of air in the facility?	Yes	Sometimes	No
20	Is there a designated person who is responsible for opening and keeping open the windows at this facility?	Yes	Sometimes	No
21	Are there cough hygiene posters on the walls of the waiting rooms?	Yes		No
22.1	Are there any hand washing facilities available for patient use?	Yes		No
22.2	Are there any hand washing stickers/posters at the hand washing basins?	Yes		No
23	Do you know the direction of airflow in each consultation room in your facility?	Yes	Sometimes	No
24	Are N95 respirators (for personnel use) available in this facility?	Yes	Sometimes	No
25	Have all the staff been trained on the proper fit/use of N95 respirators?	Yes		No
26	Is sputum collection taking place outside?	Yes	Sometimes	No
27	Are all newly diagnosed HIV+ clients' sputum screened for TB symptoms?	Yes	Sometimes	No
28	Is TB infection control health education provided at this facility?	Yes	Sometimes	No
29	Was staff encouraged to know their HIV status this month?	Yes		No

Name of Infection Control Manager

Name of Person Accompanying

\_\_\_\_ / \_\_\_\_ / \_\_\_\_ Date

Name of the Facility





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