NDOLA DISTRICT

TB IC DEMONSTRATION PROJECT

FINAL REPORT

October 2014

Acknowledgements

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Contents

Abbreviations

ADCH	Arthur Davison Children Hospital
CDC	Centers for Disease Control and Prevention
CNR	Case Notification Rate
CXR	Chest X-ray
DCMO	District Community Medical Office
FAST	Find cases Actively, Separate and Treat them
FHI 360	Previously named Family Health International
GRZ	Government of the Republic Zambia
HCW	Health Care Worker
HIV	Human Immune-deficiency Virus
ICAN	Infection Control African Network
ICF	Intensified Case Finding
IEC	Information, Education and Communication
IPT	Isoniazid Preventive Therapy
KNCV	KNCV Tuberculosis Foundation
MCDMCH	Ministry of Community Development Mother and Child Health
MDR-TB	Multi-drug resistant Tuberculosis
MOH	Ministry of Health
NCH	Ndola Central Hospital
NTP	National Tuberculosis and Leprosy Control Program
PLHIV	People living with HIV
PMO	Provincial Medical Office
PMU	Program Management Unit of TB CARE I
TB	Tuberculosis
TB IC	Tuberculosis Infection Control
TDRC	Tropical Diseases Research Centre
The Union	The International Union against Tuberculosis and Lung Disease
WHO	World Health Organization

Executive Summary

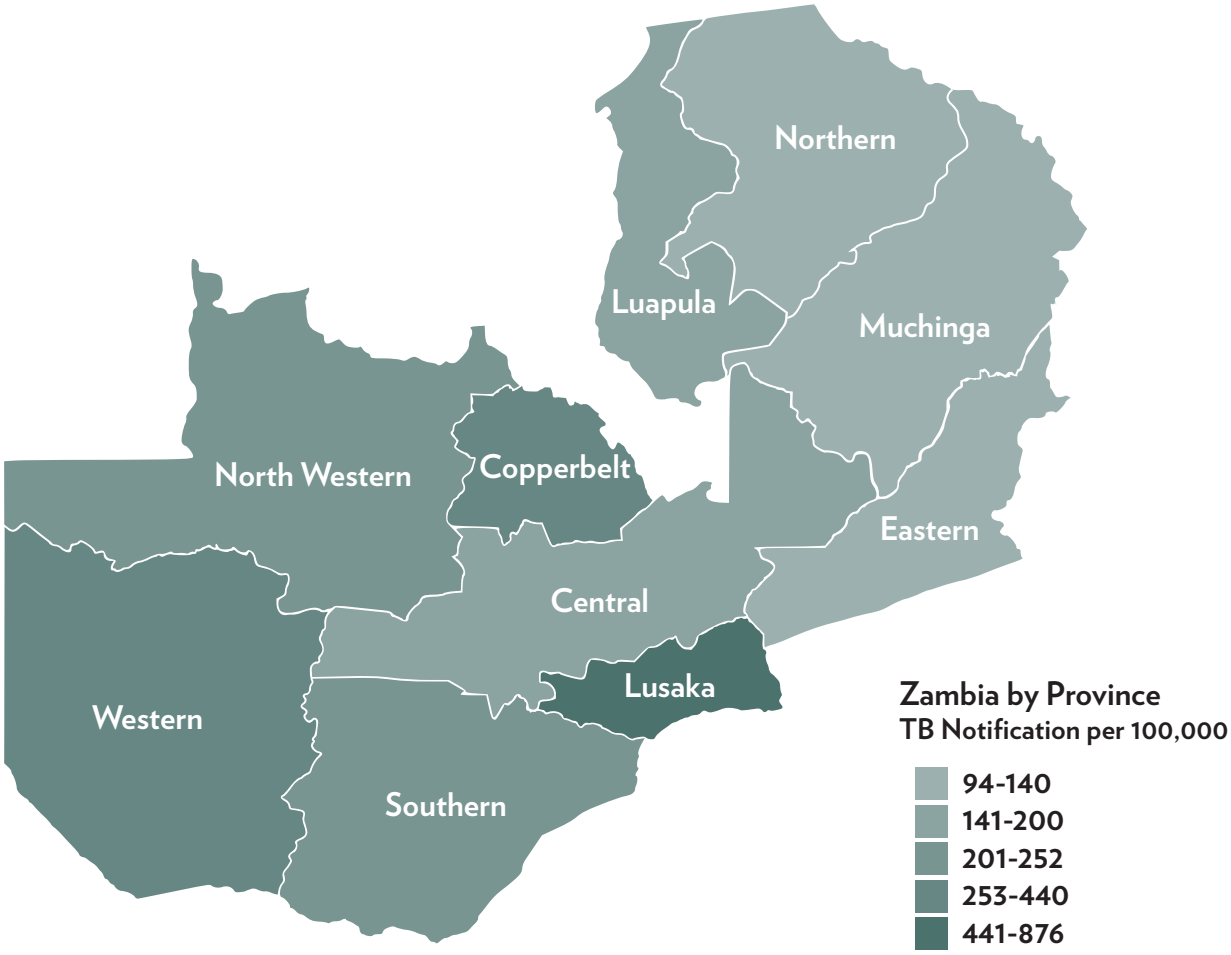
With support from TB CARE, the Ndola District TB Infection Control project was implemented to demonstrate the feasibility and effectiveness of introducing and sustaining TB Infection Control (TB IC) policies and practices on nosocomial transmission as measured by the TB incidence rate among health care workers (HCWs). Under the guidance of the National TB Program (NTP), the implementation of the project was coordinated by the Copperbelt Provincial Medical Office (PMO) and the Ndola District Community Medical Office (DCMO). Kitwe district, also situated in Copperbelt Province, served as a control district. Partners from TB CARE I (KNCV Tuberculosis Foundation, FHI 360) and TB CARE II (Partners in Health) provided technical, administrative and logistical support during the implementation period.

More than 80% compliance with TB IC policies and practices was achieved by 12 of the 15 intervention sites. Expedited diagnosis and start of treatment is part of the FAST intervention, and the average time to TB diagnosis and time to initiation of TB treatment was reduced by half. Both are considered good process indicators for the reduction of nosocomial transmission. Ndola district reported a 5% increase in notified TB cases (all forms) for 2013 after the implementation of administrative and environmental TB IC measures. The total number of cases diagnosed and notified through active case finding among HCWs was 18 out of 1,757 HCWs. This shows a notified TB incidence among HCWs of 1.02% (95% CI 0.6-1.6). When corrected for age, the case notification rate (CNR) ratio among HCWs compared to the general adult population of Ndola District was 1.05 (95% CI 1.02/0.97), suggesting good implementation of TB IC according to the WHO recommended proxy indicator.

The discussion section includes the following:
1. Monitoring the implementation of TB IC
2. Monitoring the effectiveness of TB IC implementation
3. Screening HCWs for TB
4. Improvements in TB case finding among the general population
5. The scale-up of TB IC Ndola Demonstration Project Model in Zambia

Introduction and Background

The Ministry of Health (MOH) and the Ministry of Community Development Mother and Child Health (MCDMCH) with the support of TB CARE I and TB CARE II partners implemented the Ndola District TB IC demonstration project, a core-funded project which was implemented over a two-year period (from October 2011 to September 2013) in 15 health facilities[1] situated in the Ndola District (Population 503,649 in 2012) of the Copperbelt province of Zambia.



The goal of the project was to provide safe work practices in order to reduce TB transmission among people living with HIV (PLHIV) and HCWs. The implementation process was aimed at strengthening the district healthcare system in implementing TB IC, acknowledging occupational risk for the health care workers acquiring TB infection and developing TB disease.

1 Ndola district has 31 health facilities: 28 primary health centers or clinics, two referral hospitals and one infectious disease reference laboratory. Out of the total of 31 health facilities, 13 clinics and the two hospitals were involved in different project interventions.

Overall Project Achievements

The implementation of the project was coordinated by the Copperbelt PMO under the Ndola DCMO. Partners from TB CARE I (KNCV Tuberculosis Foundation, FHI 360) and TB CARE II (Partners in Health) provided technical, administrative and logistical support during the implementation period. Ndola Central Hospital (NCH) and Arthur Davison Children Hospital (ADCH) also participated in the implementation process. Kitwe district, also situated in Copperbelt Province, served as a control district.

Fourteen activities were identified for implementation and described in a protocol:

1. Start-up meeting
2. Baseline facility assessment
3. Training of key facility and supervisory staff
4. Facility specific TB IC plans, policies and procedures
5. Work practices compliance
6. FAST (core package) strategy
7. Quarterly supervisory visits
8. TB and HIV screening among HCWs
9. IEC materials
10. Rapid diagnostics
11. PMDT referral system
12. Minor renovations
13. Abstracts and publications
14. End-symposium

All but two of the 14 activities (#10 and #11) were realized by September 2013.

Project Achievements

Through the TB IC demonstration project, a systematic process of introducing and reinforcing infection control measures was implemented, from managerial (supportive) activities, to administrative and environmental control measures. Nine months after the start of the project, on October 1st, 2012, the Ndola DCMO formally accepted full ownership of the project implementation. Facility heads played a key role in the implementation process, ensuring that:
i) facility level TB IC plans were incorporated in annual facility plans and district budgets, and
ii) facility staff adhered to key TB IC work practices.

Compliance was monitored every quarter. The DCMO also introduced innovative ideas such as providing incentives to community volunteers to support sputum transportation from facilities with no TB laboratory capacity to TB diagnosing facilities and also paying overtime for the TB/HIV screening of HCWs outside regular office hours.

Main Achievements

1. Eight percent (49 males, 96 females) of HCWs including TB treatment supporters[2] from 12 clinics were trained on TB IC. Training was followed up by focused quarterly supervision.
2. Each clinic developed a TB IC facility plan applying assessment and planning tools in which facility staff were trained. The plans were endorsed by management and by the DCMO, then costed and incorporated in the overall annual district implementation plan.
3. At the 14 health facilities that were assessed on a quarterly basis, compliance with TB IC work practices increased by an average of 54%, up from 27% at baseline to 81% compliance over a period of 20 months. Twelve out of the 14 health facilities assessed, reached the targeted compliance score of 80%.
4. The average time to TB diagnosis (defined as the time interval in days between sputum collection and the receipt of the sputum microscopy results by the requesting service provider) was reduced from seven days to three days. Time to initiation of TB treatment (defined as the time interval in days between receipt of sputum microscopy results to commencement of treatment) was reduced from an average of four days to 1.5 days. Treatment supporters were given the role of tracking the lab results and informing patients the same day the results were out.
5. The project provided renovation support to 12 clinics. A total of 385,710.75 ZMW (73,891 USD) was spent on minor renovations. The renovations enhanced environmental control measures.
6. As a result of triage for cough, the number of general outpatients identified with presumptive TB increased in 2012 and 2013 in Ndola District while during the same period the number of presumptive TB decreased in the other nine (non-intervention) districts of the Copperbelt province (source TB MIS database). However, reported numbers of presumptive TB cases fluctuated considerably over the past few years. Therefore, no definite conclusion regarding notified presumptive TB can be made.
7. Post-project data collection (May 2014) showed a 5% increase in notified TB cases for 2013 from Ndola District after the TB IC intervention. The increase in case notification for Ndola District is noteworthy because the number of notified cases continued to decrease in 2013 for Kitwe District (control district) and the Copperbelt province (-13% and -4% respectively).
8. In one year (May 2013-April 2014), 62% of the 1,619 HCWs on the facilities pay roll and 51% of 138 TB treatment supporters (total 1,757) were screened (n=1,071) by a screening clinician or nurse. An analysis of calendar year 2013 showed the total number of cases diagnosed and notified through active case finding among HCWs was 18 out of 1,757 HCWs. This shows a notified TB incidence among HCWs of 1.02% (95% CI 0.6-1.6). At least five of those 18 HCWs were diagnosed with TB during screening. One HCW died from TB in 2013.
9. Although 76% of HCWs reported knowing their HIV status, only 59% were actually tested in the previous 12 months or were known positive. 4% of HCWs said they tested HIV positive in the last year.
10. When corrected for age, the case notification rate (CNR) ratio among HCWs compared to the general adult population of Ndola District was 1.05 (95% CI 1.02/0.97), suggesting good implementation of TB IC according to the WHO recommended proxy indicator. We could not correct the CNR for gender due to missing information.

2 For the purpose of this project TB treatment supporters are considered as HCWs consistent with the WHO definition of HCWs (2006), because they perform several tasks in the provision of TB services at facility and community level, and they are officially registered by the clinic/DCMO

Training & Quarterly Supervision

A three day training curriculum and training materials were developed. Eight percent (145/1757) of all HCWs (49 males, 96 females) were trained on TB IC. The participants included 13 facility heads, 16 TB focal point persons (supervisors) and 116 TB treatment supporters.

Three trainings were conducted in the first quarter of the demonstration project. The HCWs (including the treatment supporters) were trained in facility based TB IC and the treatment supporters received additional training in community based TB IC. The trainings were conducted by two teams of trainers; one team focused on facility based TB IC, while the other looked at community TB IC using the simplified checklist, a risk assessment tool for transmission at community level. Participants were trained in the use of standardized assessment and planning tools.

Training was followed up by focused quarterly supervision. Supervisors used several tools during their quarterly supervisory visits with facility staff, including a 15 minute instructional video on TB IC measures for outpatient settings developed by the CDC, a pocket guide with Standard Operating Procedures (SOPs) and instructions for signage to keep a specific window or door open.

Work Practices Compliance

TB IC facility plans were developed following the training and a baseline assessment. The plans were endorsed by management and the DCMO. The plans included TB IC work practices. In addition, a pocket guide with SOPs for these work practices was specially developed to reinforce staff compliance. During quarterly supervisory visits, the DCMO team and TB CARE I staff members assessed the compliance of facility staff with these work practices.

The supervisors used a modified CDC checklist for clinical sites, to determine the extent to which TB IC work practices were implemented and sustained. The CDC tool is a 32 item checklist of TB IC work practices. For this demonstration project we changed the wording of some items, so that all assessors had the same understanding of their meaning. For each item, we also added a means of verification, to ensure that rating was not dependent on the personal interpretation of individual assessors (see annex). Each item was scored as '1' if compliance with the practice was observed or '0' if no compliance was observed. The percentage of work practices that were observed was calculated at the end of the assessment. The results were always shared and agreed upon with the responsible staff at each facility.

Four assessors (3 males, 1 female) were trained on-the-job by the same external consultant. This consultant also took part in the first and the last quarterly assessment round. The assessment team consisted of at least two assessors: one assessor from the DCMO and one assessor from the TB CARE I Ndola office. The composition of the assessment team varied per round of quarterly assessments. After the baseline assessment, at 14 health facilities, seven rounds of assessments were conducted over a period of 20 months.

At the 14 health facilities that were assessed on a quarterly basis, compliance with TB IC work practices increased by an average of 54%, up from 27% at baseline to 81% compliance over a period of 20 months. Twelve out of the 14 health facilities assessed, reached the targeted compliance score of 80%. The results are presented in the table below, showing the percentage of compliance for each facility, each quarter. If performance improved or was sustained in the reporting quarter, the box is colored green, when compliance deteriorated, the box is colored red.

Facility level results of the quarterly assessment of work practices compliance using the (modified) CDC checklist for clinical sites

Health Facility	Baseline	Q1/2012	Q2/2012	Q3/2012	Q4/2012	Q1/2013	Q2/2013	Q3/2013
Railway	19	47	63	53	63	69	81	88
Chipulukusu	33	34	53	50	59	72	81	84
Twapia	41	44	59	66	69	69	81	88
Kabushi	41	47	50	59	69	69	84	88
Lubuto	45	53	59	63	69	72	72	75
ZFDS	19	44	59	66	63	56	72	88
New Masala	37	41	53	59	53	66	78	88
Mushili	15	44	44	63	53	56	75	84
C Mayamba	19	41	63	56	63	59	75	84
Kaloko	4	41	56	63	69	72	81	84
Kawama	19	44	59	59	66	69	81	84
ADCH	30	38	38	56	56	56	Not Assessed	78
Kavu	44	50	66	66	69	69	81	84
Prisons	12	34	59	56	66	69	81	84
Average	27	42	54	58	61	64	70	81

Diagnosis & Treatment Turnaround Times

Expedited diagnosis and start of effective treatment is an essential part of the FAST intervention. FAST is an acronym that stands for Finding cases Actively, Separating Safely and Treating Effectively. Turnaround times were assessed at baseline and assessed again in the second quarter of 2013. Three sites do not provide TB diagnostic services. A sputum transportation system to the nearest clinic offering TB diagnostic services was in place, but the system was strengthened by giving treatment supporters the role of tracking the lab results and informing patients the same day the results were out. The average time to TB diagnosis (defined as the time interval in days between sputum collection and the receipt of the sputum microscopy results by the requesting service provider) was reduced from seven to three days. Time to initiation of TB treatment (defined as the time interval in days between the receipt of the sputum microscopy results to commencement of treatment as recorded in the TB register) was reduced from an average of four days to 1.5 days.

Xpert testing to improve the diagnosis of TB among smear-negative PLHIV was one of the project interventions. Two GeneXpert machines were procured for the Ndola District with funded from the TB CARE I country work plan, however, the machines only became operational after the project had ended. Therefore, the effect on improved TB diagnosis, i.e. diagnosing more TB cases among PLHIV and notifying more bacteriologically confirmed TB cases, could not be assessed during the project period.

Renovations

Renovation support was provided to 12 health facilities. Transmission of airborne infectious diseases such as tuberculosis is reduced by improving ventilation and thus reducing the suspended infectious particles in the room air. The minor renovations included setting up outdoor waiting areas for coughing patients, improved airflow in the health facilities (especially in consultation rooms and laboratories), establishment of a more efficient patient flow, and improved air movement and air mixing by the installation of extractor fans in high risk areas.

The facilities were grouped in three lots according to geographical location to ensure that local contractors would bid for the works. Details of the renovated facilities are provided in the table below.

Type of Renovation per Health Facility

	Clinic name	Setting up of outdoor waiting area(s)	Configuration of large (window) openings	Change of patient flow	Installation of (Extractor) fans	Establishment of outdoor dispensaries
Lot 1	Kansenshi	X	X	X		X
	C. Mayamba	X	X		X	
	Kawama	X	X			
Lot 2	Chipulukusu	X	X	X		
	Railway		X			
	Kavu		X			
	Twapia	X	X			
Lot 3	Kaloko	X	X			
	Mushili	X	X			X
	Kabushi	X	X			
	Lubuto		X			
	New Masala	X	X		X	

Benchmarks of TB and TB/HIV Data

During quarterly supervisory visits, data were collected from the TB, presumptive TB, laboratory, ART and OPD registers by the DCMO and TB CARE I staff. Collected data of project sites was compared with reported data of other sites in Ndola District (see below).

TB and TB/HIV data of the intervention sites and non-intervention sites in Ndola District for 2011[3]-2013[4]

Ndola District	Intervention sites Catchment population: 377,737 (75% of district population)			Percentage change	Non-intervention sites Catchment population: 125,912 (25% of district population)			Percentage change
	2011	2012	2013		2011	2012	2013	
Presumptive TB	2169	2528	3026	+40%	703	707	904	+29%
Notified TB (all forms)	1993	2081	2133	+7%	791	733	795	+1%
Smear positive TB	508 (25%)	722 (35%)	631 (30%)	+5%	200 (25%)	232 (32%)	268 (34%)	+9%
TB Tested for HIV	1760 (88%)	1824 (88%)	1936 (91%)	+5%	630 (80%)	617 (84%)	713 (90%)	+10%
TB Tested HIV positive	1186 (67%)	1199 (66%)	1299 (67%)	0%	404 (64%)	388 (63%)	477 (67%)	+3%
TB patients on ART	844 (71%)	924 (77%)	915 (70%)	-1%	275 (68%)	219 (56%)	303 (64%)	-4%

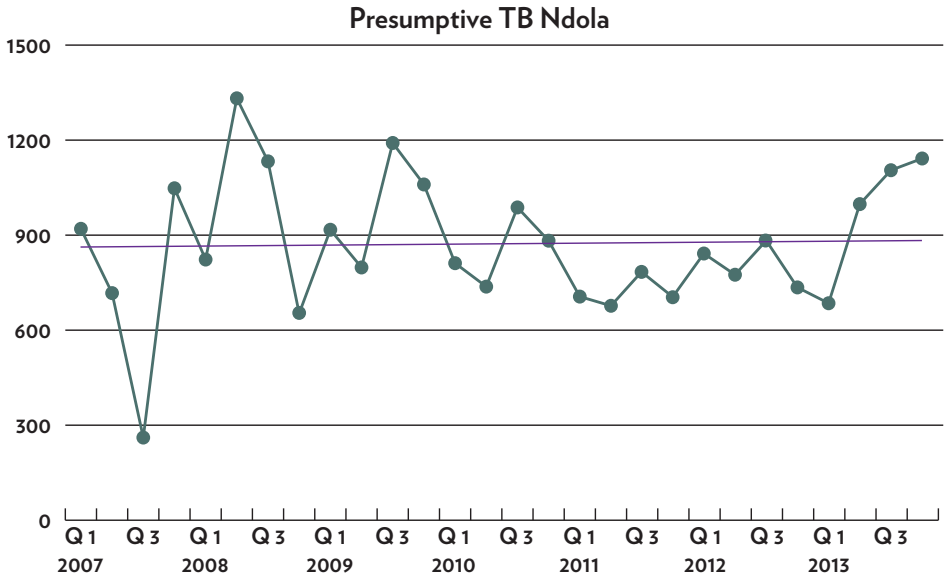
In both the intervention and non-intervention sites, the number of presumptive TB cases increased, although the level of increase differed. The intervention sites reported 40% more presumptive TB in 2013 compared to 2011, the year before the project was implemented. The non-intervention sites reported 29% more presumptive TB cases during the same period. However, there are potential issues with the reported numbers of presumptive TB cases. First they fluctuate considerably over several years as the data from 2007 to 2013 indicates (see page 14). Also the proportion of presumptive TB cases that are diagnosed as being TB is very high at 70-90% suggesting not all presumptive TB cases are registered or there is strong selection of presumptive patients. Therefore, although the data suggests an increasing trend, no definite conclusion regarding notified presumptive TB can be made. The quarterly data of reported presumptive TB for all districts of the Copperbelt province suggests a decreasing trend (source TB MIS database) but they have the same potential reporting issues. The proportion of reported presumptive TB cases in Copperbelt province that are diagnosed as being TB is also high at 60% compared to 44% for Zambia. The quarterly data of the province are shown on page 14.

3 Before the intervention
4 After the intervention

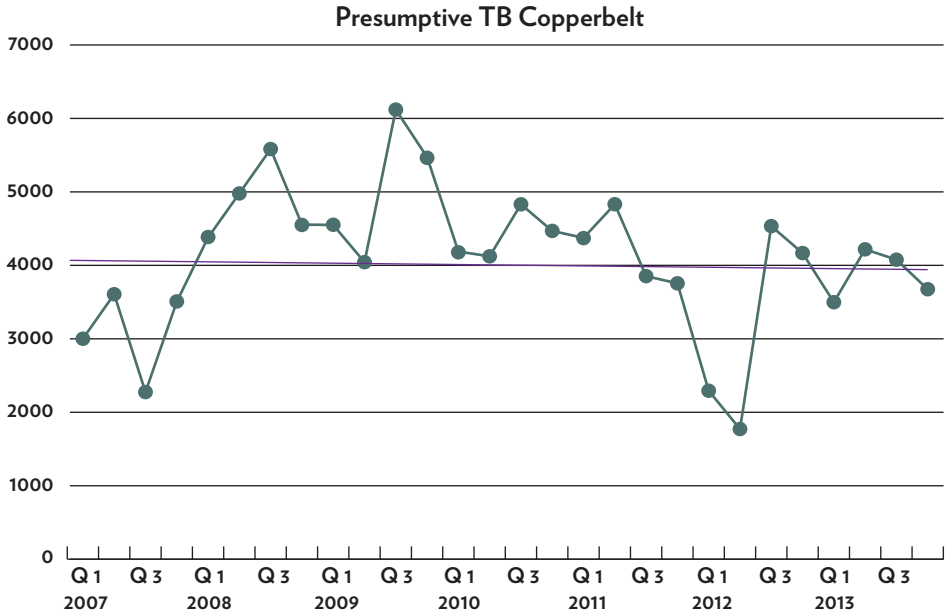
Reported Presumptive TB Cases

Reported Presumptive TB Cases

Quarterly data as reported by Ndola District for 2007-2013 in the TB-MIS

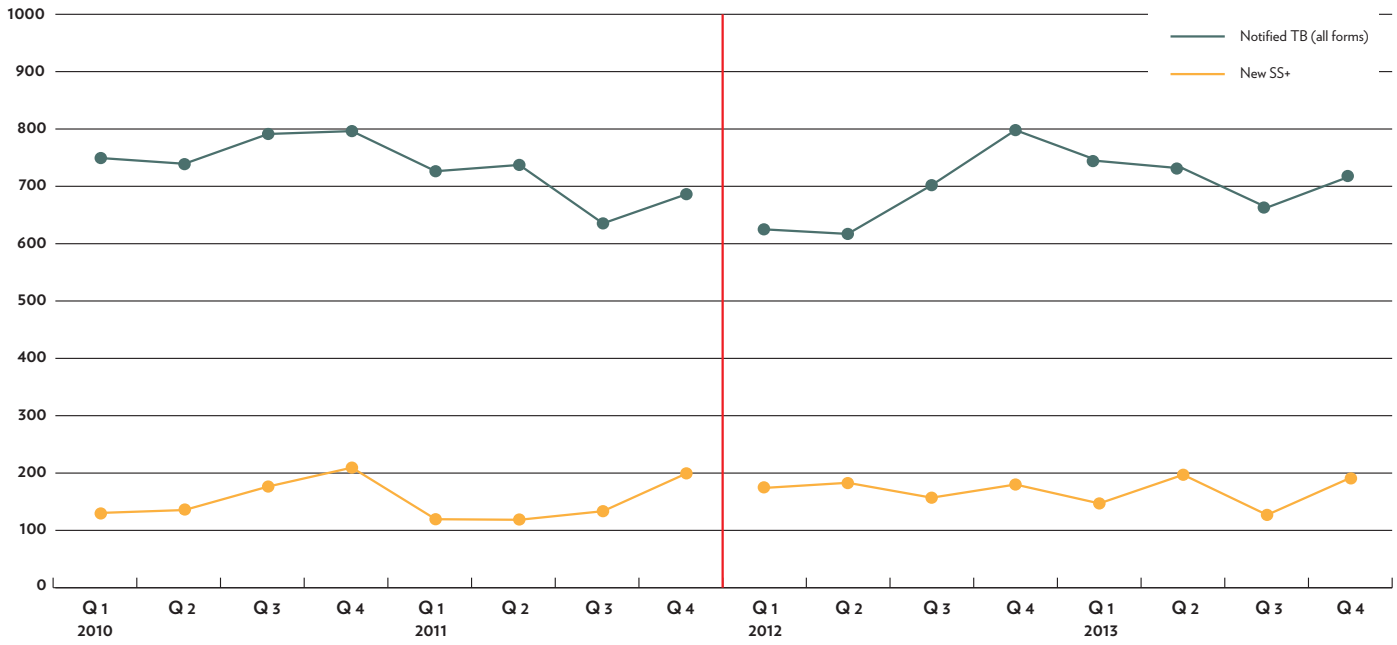


Quarterly data as reported by Copperbelt province for 2007-2013 in the TB-MIS



Pre-intervention (2010-2011) there was a decreasing trend in notified TB cases (all forms) while post-intervention (2012-2013) there is a visible increasing trend in Ndola District. The data for new SS+ TB cases do not show a clear trend. (See below)

Notified TB (all forms) and new SS+, Ndola District, pre-intervention (2010-2011) (left side of the red line) and intervention (2012) and post-intervention (2013) (right side of the red line)



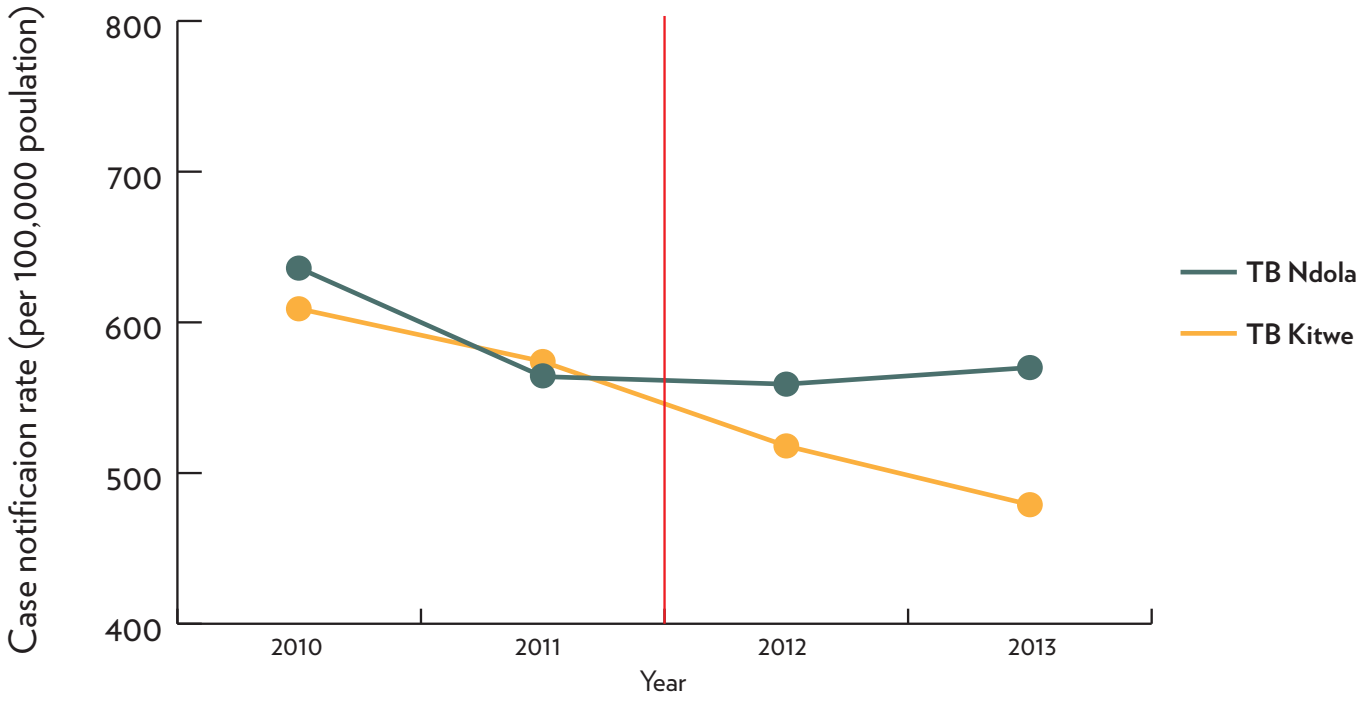
Comparing Ndola and Kitwe Districts

Besides comparing pre/post-intervention for Ndola District, a comparison was made between the Ndola District and Kitwe District TB notifications rates. In Kitwe no intervention took place. Kitwe District is also situated in the Copperbelt province and is very similar to Ndola District in terms of population size, health facilities and urbanization. Ndola District had an estimated population of 513,945 in 2013 and Kitwe District, the only other large (>250,000 people) district in Copperbelt province had an estimated population of 520,781.

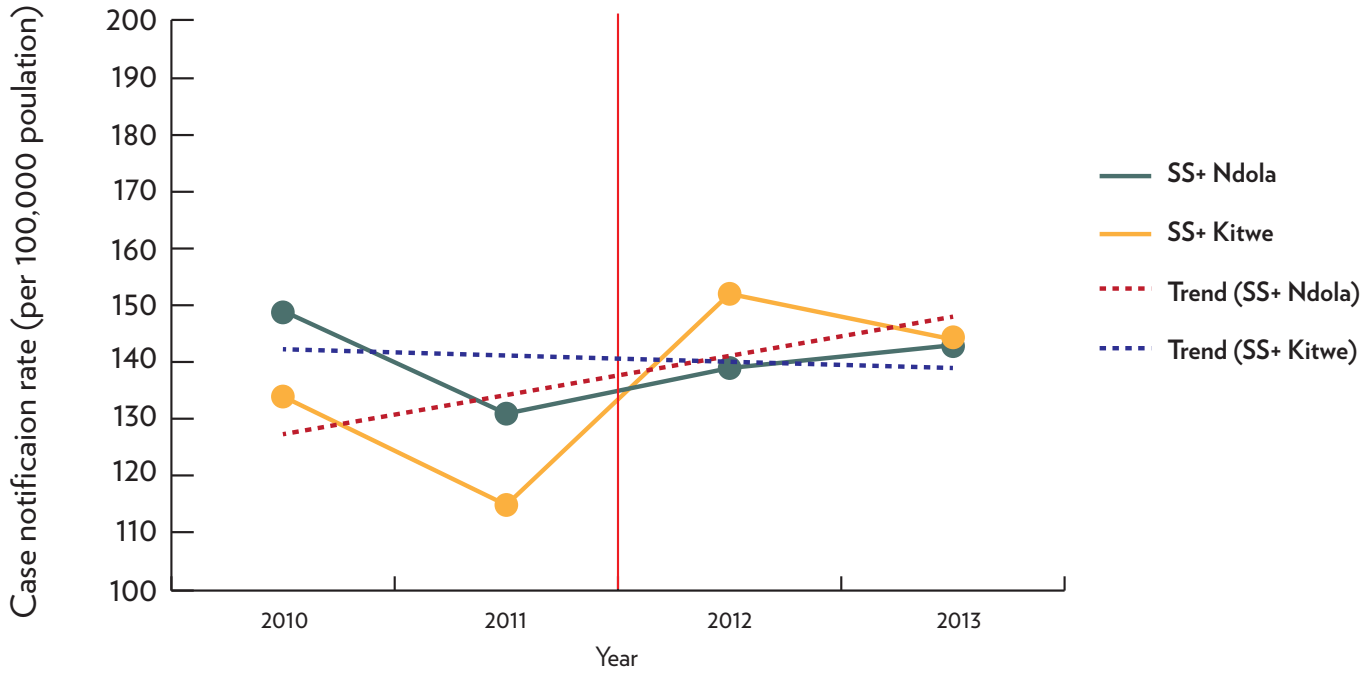
When comparing the two districts, the difference in the number of notified TB cases is striking: there was 5% increase in TB notifications (all forms) in Ndola District compared to a 13% decrease in Kitwe District. Differences in the TB notifications rates of new SS+ cases are too small to draw conclusions. The figures on page 16 show the TB Case Notifications rates of Ndola and Kitwe Districts and the rates of new SS+ cases of both districts.

TB Notifications

TB notification rates (all forms) for Ndola and Kitwe District from 2010-2013 (Note: the red line indicates the time of intervention in Ndola District)



Rates of notified new SS+ cases for Ndola and Kitwe District from 2010-2013 (Note: the red line indicates the time of intervention in Ndola District)



TB/HIV

In 2014, Zambia started implementing ICF and provision of IPT among the PLHIV, therefore we could not present data on these activities.

The intervention sites reported that 91% of notified TB patients were tested for HIV in 2013; an increase of 3% compared to 2011. Also the non-intervention sites reported 90% of notified TB patients being tested for HIV in 2013; an increase of 10%. Of those tested for HIV, 67% were HIV positive. At the intervention sites, the reported percentage of co-infected patients receiving ART fluctuated: from 71% in 2011, to 77% in 2012, to 70% in 2013 (100% of co-infected patients should be on ART according to the WHO policy on collaborative TB/HIV activities). At the non-intervention sites, this percentage also fluctuated: from 68% receiving ART in 2011, to 56% in 2012), to 64% in 2013. Note that non-intervention sites have less co-located TB and ART services (27%) compared to the intervention sites (73%).

TB and ART service provision in Ndola district

Intervention sites			Non-intervention sites		
Facility	TB	ART	Facility	TB	ART
ADCH			Commando		
C. Mayamba			Kalewa		
Chipulukusu			Kaniki		
Kavu			Tug-Argan		
Kawama			Dola Hill		
Lubuto			Hill Top		
NCH			Itawa		
New Masala			Main Masala		
Prisons			Mary Begg		
Twapia			Ndeke		
ZFDS			Nkwazi		
Kabushi			Pamodzi		
Kaloko			TDRC Clinic		
Mushili			Telnor		
Railway			Zesco		
Total	15	11		15	4

TB/HIV data in all other districts of the Copperbelt province are similar to Ndola District: a 4-6% increase in TB patients receiving a HIV test: up to 90% in 2013. Of those tested for HIV, also 67% tested positive in the other districts and 65-75% of co-infected patients are receiving ART.

Health Care Worker Screening

Background/Development
A baseline assessment on experiences and opinions related to HCW TB screening was done in January 2012 in order to develop a protocol for screening. This was followed by the approval processes required in Zambia for the implementation of research. The MOH's Ethics committee provided approval in July 2012, The Permanent Secretary gave permission to conduct the interventions in the protocol in November 2012, and agreements were made by the project partners (MOH/NTP Manager, KNCV, FHI 360, the Provincial Medical Officer and the District Medical Officer in Ndola) on the operational and technical requirements for organizing the screening. The protocol described the screening of HCWs as part of the demonstration project on TB IC in all 15 selected health facilities of Ndola District. The risk of developing active TB as an occupational disease is well established, and it has been proven that in many settings the burden of TB is higher among HCWs than among the general population. Screening of HCWs for TB is part of occupational healthcare to prevent spread of TB to colleagues and other patients and may lead to early case finding.

The aim and specific objectives of the intervention
The aim of this intervention was to assess the feasibility and acceptance of active screening of HCWs and TB treatment supporters for TB symptoms (annually and when having symptoms) as well as the challenges encountered. The knowledge gained would be used to guide the development of a national TB monitoring system for HCWs and TB treatment supporters.

The specific objectives of this intervention were:
- To encourage active screening of HCWs and TB treatment supporters for TB symptoms (annually and when having symptoms)
- To encourage HCWs and TB treatment supporters to know their HIV status
- To diagnose TB among HCWs and TB treatment supporters suspected of having TB
- To effectively treat and notify HCWs and TB treatment supporters diagnosed with TB (and HIV) earlier.

Methods
Participants were all HCWs working in the 15 facilities participating in the Ndola District TB IC demonstration project. This included laboratory staff, administrative staff, and support staff such as cleaners, drivers and registered TB treatment supporters. Throughout the year, HCWs were encouraged to report to an assigned clinician/nurse if they had any symptoms that may be related to TB as a matter of routine and cough monitors were charged to strengthen early care seeking behavior.

Each HCW was invited for TB screening, using a standard questionnaire that included questions on TB symptoms and duration, TB contacts, and TB disease in the past. Active screening was preceded by informed consent and HCWs who did not consent were asked for the reasons. Those HCWs with symptoms (identified during the screening process or presenting themselves throughout the year) were offered sputum smear testing, as recommended by the NTP (in the absence of GeneXpert), this service is usually available for free in their own health facility. HCWs with symptoms of TB were also offered priority access to NCH for chest x-ray (CXR) and Tropical Disease Research Centre (TDRC) for sputum culture. Screening was performed by a designated person in the facility and he/she would follow-up to make sure that treatment was started. The outcome of the TB and HIV examination was confidential, but HCWs with TB or HIV were encouraged to disclose their status to their facility head.

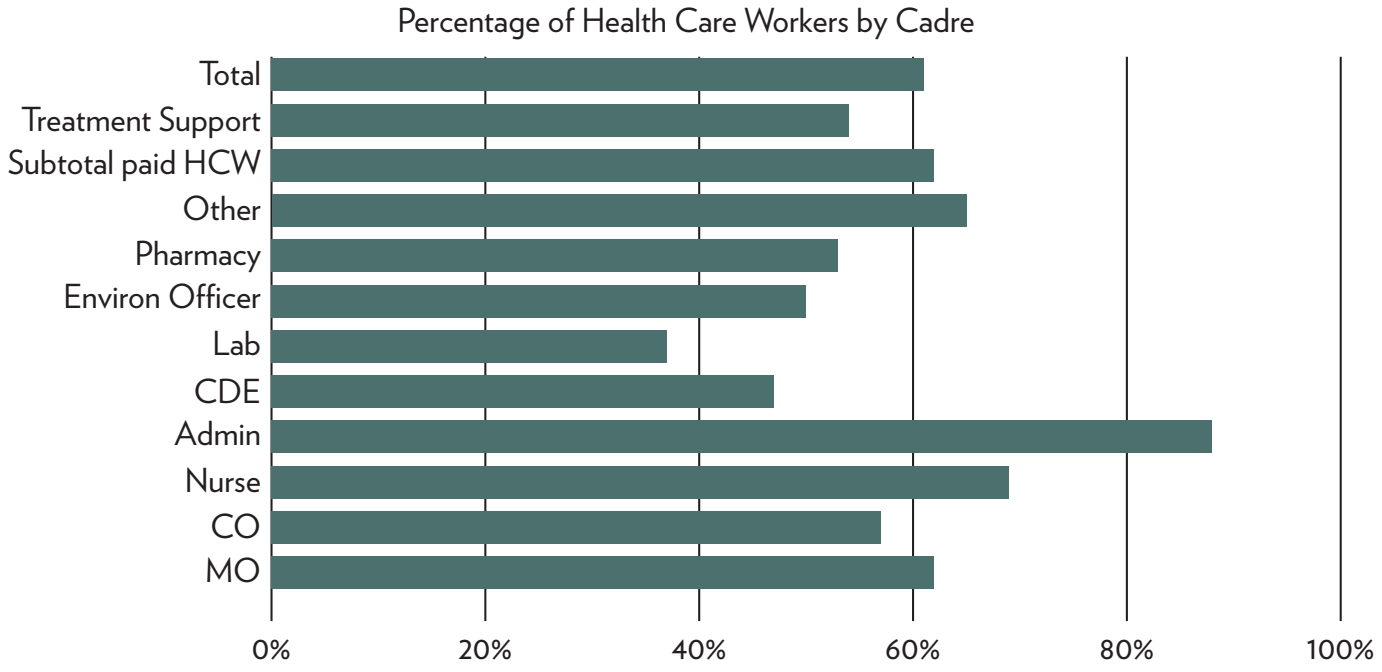
Results were anonymized and recorded in a provisional HCW TB register by the facilities. Confidentiality was guaranteed and all forms containing personal identifiers, such as names, addresses, telephone numbers and ID

numbers were kept confidential. One form linked the name and address of the HCW with his or her unique ID number to allow for the identification of the participant if follow-up activities were required, this one form/ database was kept by a person entrusted by the health facility. Summary reports were developed and filled/ completed by facilities, with assistance from the DCMO and FHI 360 until April 2014. Only summary reports without names were collected by the project staff and used for entering of aggregated (not individual) data.

Results

TB screening among HCWs began in April 2013. In all health facilities a trusted person, who would conduct the screening, was identified. Reported time needed for screening was 15-30 minutes in clinics and 15-20 minutes in the main hospital. A total of 1,011 out of 1,619 (62%) HCWs on the facility payroll and 70 out of 138 (51%) TB treatment supporters were screened by May 2014 (total 1,071 out of 1,757). The 13 clinics reached a mean coverage (proportion screened) of 56% and NCH 76% (724 screened by 1 screener within 9 months) and ADCH 15% (very low because suitable timing for screening could not be found). At least four of the 13 clinics stated they had finished the screening of staff, although figures showed around 80% coverage, due to frequent staff changes. Coverage was similar between different cadres, although higher for administrative staff than others (see below). Those who were not screened sometimes reported they had been screened elsewhere, were not willing to be screened, had not yet made up their minds or both HCW and screener were too busy with other work priorities, but often no reason was given. We conclude that a coverage of 80% should be achievable, especially if more than one screening person is assigned. Five percent of those screened were presumptive TB cases (n=52), 4% in hospitals and 10% in clinics. Based on our results, we assert that only 5% needed priority diagnostics, thus the cost of HCW screening should be feasible.

HCWs Screened by Cadre



The total number of cases diagnosed and notified through screening and passive case-finding among HCWs in

2013 was 18 out of 1,757 HCWs, showing a notified incidence rate among HCWs of 1.02% (95% CI 0.6-1.6), similar in hospitals and clinics. At least five HCWs were diagnosed with TB during screening. For many HCWs diagnosed with TB it was not clear whether they were detected by the screening, or had been detected before/after, as this was not part of our aggregated indicators. No drug resistant TB was reported. One HCW died from TB in 2013. The gender was only known for 11 TB patients; seven females and four males.

We collected some retrospective data on TB incidence among HCW in 2012 and found this was similar (0.9%) to 2013. There was no difference in the mean incidence between hospitals (1.0%) and clinics (0.9%) over two years combined (2012 and 2013).

Although 76% of HCWs reported knowing their HIV status, only 59% were actually tested in the previous 12 months or were known positive. 4% of HCWs said they tested HIV positive in the last year. Those not tested in the previous 12 months and not known to be positive, were referred for voluntary counseling and testing, but the results of this have not been collected. Confidentiality was handled well, with signed informed consent forms being available for all the HCWs screened, and screening forms kept in locked cabinets provided by the project.

Challenges and sustainability

The introduction and continuation of screening required a lot of meetings, training and visits to implement, especially in hospitals that are not under supervision by DCMO/NTP. The main challenge of the screening was that not all persons with presumptive TB got all three diagnostic tests (smear microscopy, culture and CXR). Only 31% got a sputum smear, 8% a culture, 39% Xpert and 73% CXR (with some overlap). This was mainly because the screening clinicians tended to use the national algorithm for diagnosing TB (starting with smear microscopy), rather than the algorithm agreed upon for HCW screening; that included the priority diagnostics culture and chest x-ray for all HCWs with presumptive TB. Besides that, the usual challenges with sample transport for all persons with presumptive TB, were also experienced by HCWs with presumptive TB. The data-analysis from aggregated data was challenging, and gave limited detailed results, but enough results for policy recommendations. The screening will continue as a DCMO program or campaign around World TB Day (every year on 24 March) and will be overseen by the district management and hospital managements respectively.

Recommendations (from the lessons learned) to NTP/MCDMCH and MOH (Hospital level care):

1. Screening of TB among HCWs should be implemented countrywide since TB incidence among HCWs is usually higher than in the general population (if infection prevention and control practices are not established and adhered to). As this project showed HCWs are willing to be screened and screening is feasible, scale-up should be discussed after the acceptance of the study report by the Ethics committee. Consider starting with high risk groups/settings, such as laboratory and MDR-TB treatment sites. Note that transmission risk is highest from TB cases not yet on treatment.

2. Ensure sustainability by involving district and hospital management and by having two screeners per facility. Nurses can be considered to be screeners. Alternative models should be investigated, such as conducting screening by rotating screening teams from district, provincial or central level or even an independent organization, visiting a group of clinics/hospitals. Screening can still be done on-site. Training is needed for screeners.

3. Follow-up regularly to ensure screening continues, ensure all the results of all diagnostics are made available to the treating clinician and the respective HCW, and make reporting of screening results part of district reports. It will be useful to set targets: all presumptive TB cases among HCW to have complete diagnostics within one

week (except culture); strengthen sample tracking system and reporting on results.

4. Screening HCWs for TB and HIV should be included in national occupational health policy; possibly integrated with screening for other diseases.

5. The screening algorithm used with priority diagnostics needs more practice and wider implementation before it can be proven to be effective. When Xpert is available, it should be offered to all HCWs with symptoms, in line with the recently approved national Xpert algorithm. It can replace smear and culture but not symptom screening and CXR. When more funding is available, annual CXR may be considered as a screening step before Xpert, even for those without symptoms. Results to be confirmed by Xpert or culture. DST of first-line anti-TB drugs with a line probe assay is recommended to confirm MDR-TB diagnosis of RR-positive (Xpert) patients.

6. Develop a screening protocol and algorithm in collaboration with all stakeholders. Ensure inclusion of non-paid staff such as treatment supporters/community volunteers. Ensure confidentiality by using anonymous personal identification numbers. Ensure those detected in between screenings are included in the monitoring system.

7. Take time to build buy-in for the process and algorithm, especially in large health facilities and pay attention to stigma.

8. A pre- and post-intervention cohort analysis comparing treatment outcomes could not be conducted given the short project period and small numbers. This should be done in future studies.

Three poster presentations and one oral presentation were made at the Infection Control Africa Network

Abstracts, Presentations and Publications

(ICAN) conference held in Cape Town, South Africa in November 2012 and one poster presentation and one oral presentation were made at the International Union conference in Paris, France in November 2013. The presentations are listed below:

- Meis M, Kaminsa Kabanje S, Mukwangole C, Maambo L, Hamilton C, Maboshe M, Longwe J, Kapata N. Demonstration model for scale up of TB infection control in Ndola, Zambia. ICAN conference, Cape Town, South Africa, November 2012.
- Kirkendale S, Nota A, Maambo L, Chilo A, Kaminsa Kabanje S, Simpungwe MK, Kapata, N. TB Infection Control (IC) in Household and Community Settings, Ndola Zambia. ICAN conference, Cape Town, South Africa, November 2012.
- Mukwangole C, Longwe J, Girma M, Simpungwe MK, Kapata N, Meis M. Environmental Baseline Assessment for Ndola TB IC Demonstration Project. ICAN conference, Cape Town, South Africa, November 2012.
- Meis M, Kaminsa Kabanje S, Mukwangole C, Kakungu Simpungwe M, Hamilton C, Maboshe M, Longwe J, Kapata N. Demonstration model for scale up of TB infection control in Ndola, Zambia, 44th Union World Conference on Lung Health in Paris, France, November 2013.
- Verver S, Kapata N, Simpungwe MK, Kaminsa Kabanje S, Mwale M, Mukwangole C, Sichinga B, Meis M. Implementing HCW TB screening in primary care clinics and hospitals in Ndola, Zambia. Oral presentation at the 44th Union World Conference on Lung Health in Paris, France, November 2013.

Four papers will be developed on the Ndola District TB IC Demonstration project and submitted for publication to scientific or peer-reviewed journals. The following papers were agreed to:

- Paper on the compliance with TB IC practices and impact on TB case finding & management (Meis M. et al),
- Paper on the design of the renovations (Mukwangole C. et al),
- Paper on the overall approach i.e. model used in the Ndola District demonstration project for submission to the ICAN Newsletter (Kaminsa Kabanje S. et al),
- Paper on the outcome/results of screening of HCWs for TB and HIV (Verver S. et al).

End Symposium

The end symposium for the Ndola District TB IC Demonstration project included site visits to two health facilities, the main symposium was held on September 26, 2013 and a closed meeting for key stakeholders on September 27, 2013.

The following recommendations were made during the symposium:

1. Incorporate TB IC into the district supervisory visit checklist by recording quarterly expenditures on TB IC activities as per annual district action plan budget.

2. Incorporate TB IC routinely in the district quarterly reports by reporting turnaround times for diagnosis and treatment, work practice compliance and the number of HCWs diagnosed with TB.

3. Develop a plan for the scaling-up of successful interventions, to all provinces in at least one selected district as the next scalable step towards country-wide implementation of TB IC.

4. Start monitoring of TB among HCWs by including HCWs as a risk group in the national surveillance system.

5. Consider the inclusion of HCW screening for TB and HIV in the HIV workplace policy which is under revision.

Discussion

Monitoring the implementation of TB IC

To assess the implementation of the TB IC practices, we used a checklist developed by the CDC which is the 32 item TB IC monitoring tool for clinical sites. Quarterly assessment scores showed how TB IC practices were systematically introduced and if the selected project facilities complied with these practices. We recommend using the comprehensive 32 item version at least once a year in high risk settings. Shorter versions of the checklist can be used in low risk settings. Shorter versions can also be used for quarterly assessments, as has become the practice in the current 3I's project, introducing ICF, IPT and Infection Control in 37 facilities across Zambia. Twelve items were selected for the 3I's project. However, in other countries such as Botswana, shorter versions may have different items and in some cases fewer items. In total, seven countries are now using (a shortened version of) the checklist and three other countries may soon adopt it. To compare TB IC implementation across countries, we recommend using the comprehensive 32 item TB IC checklist, in program reviews for example.

Monitoring the effectiveness of TB IC implementation

The WHO recommends monitoring TB disease among HCWs. We found this was most easily achieved by asking each facility head once a year: how many HCWs with TB were diagnosed in this facility in the last calendar year (leading to an estimate of TB incidence). Asking the question every quarter or for the study specific period was more challenging, as people did not easily remember when a case was actually diagnosed. It was even more difficult to find out whether a HCW was detected passively or through screening, as for some the distinction was not clear. For example, a HCW who reported during screening that they already had symptoms and a negative smear sample, whilst the CXR showed TB.

A more integrated way of monitoring TB among HCWs would be by indicating risk groups in the regular TB registration system, of which HCWs could be one. This is relatively easy in electronic TB registers, but more complicated in the current paper based systems, where the remarks column may be used. This method is more cost-efficient, but both monitoring systems may lead to non-confidentiality, and to missing notifications due to stigma and HCWs obtaining care elsewhere. A regular screening system can, when well implemented, contribute to increased case finding and notification, earlier case finding, increased awareness on the occupational risk and more confidentiality. We found that screening for both TB and HIV by facility-level screeners is feasible.

Screening HCWs for TB

The WHO believes that screening for TB is justifiable in populations with a TB prevalence rate >100/100,000. In general, early diagnosis and treatment is known to lead to better treatment outcomes, but at the same time, TB patients detected by screening are often less adherent to treatment. The screening method we applied, based on symptoms only, has a relatively low cost. The main costs in our project were time of the screeners, registration forms, lockable file cabinets, a few chest x-rays, cultures (or Xpert in future) and the transport of the additional samples. Sputum smears for those who have symptoms, is already included for free in the current national program and Xpert as a primary diagnostic for HCWs instead of sputum smear microscopy is already included in the new national Xpert algorithms.

The screening method we applied had relatively low yield. We found at least five out of 18 TB cases in 2013 were detected by screening. These numbers are not exactly comparable since the five are prevalent cases, while the 13 are incident cases. Without screening these five might have been detected later, but with a longer possible duration of transmission. The yield can be improved by adapting the algorithm by adding an annual CXR as screening method. This can be considered for HCWs working in high risk settings since it is also more costly.

We conclude that countries can consider a mix of passive case finding in low risk settings and active screening in high risk settings, screening HCWs for latent TB infection could also be considered.

Improvements in TB case finding among the general population
To assess the impact of the intervention at district population level, we compared the CNR of the Ndola district with the CNR of a control district which is Kitwe district. The comparison shows different trends for Ndola and Kitwe. For Kitwe, TB notifications continued to fall, while the trend in TB notifications (all forms) stopped decreasing and started to increase for Ndola which is ascribed to the intervention conducted in Ndola district. Comparing trend lines between the two districts shows a clear difference in trends but further statistical analysis comparing the different trends is planned to determine if the difference in trends is also statistically significant.

However, the SS+ notification rates show a different picture. In both districts, the trend in notified SS+ cases switched for decreasing to increasing. For Ndola, the increase seems to be sharper in 2012 (the year of the intervention) than in 2013 (the year after the intervention). The difference in increase in 2012 and 2013 could have different reasons; It could be that the intervention cleared a backlog of cases resulting in fewer SS+ cases in 2013 and it could also be that the level of effort reached in 2012 could not be maintained in 2013, although the quarterly work practices assessments do not support this possible explanation.

The utilization of rapid molecular diagnostics was part of the demonstration project design and TB CARE I received additional funding to support the implementation of the GeneXpert technology in Zambia in 2012. However, the two GeneXpert instruments were installed in August 2013 and were not fully functional before the project ended, therefore we were not able to show that replacing smear microscopy by Xpert testing would have increased the number of bacteriologically confirmed TB cases.

The scale-up of TB IC Ndola Demonstration Project Model in Zambia
Between 2007 and 2010, the Government of the Republic Zambia (GRZ) launched several major activities which created an enabling and supportive policy environment for TB IC in the country. These activities included the development of the national TB IC strategy in 2007, the establishment of a TB IC working group in 2008, the development of national TB IC guidelines for Zambia in 2008, and the conduct of a national TB IC training workshop in 2009, in which 77 MoH staff (including medical doctors, nurses, clinical officers, environmental specialists, laboratory specialists and building design and construction professionals) from all nine administrative provinces were trained in the planning, implementation and monitoring of TB IC measures at national, provincial, district and health facility levels. All these investments by the GRZ laid the groundwork and provided the strategic framework for the implementation of the Ndola Demonstration project.

Many of the core activities of the Ndola Demonstration project model (staff orientation and refresher trainings, facility-level assessments of infection control measures, development and implementation of facility-specific TB IC action plans, policies and SOPs to address TB IC gaps identified during the facility assessments) are important components of the national TB IC strategy of Zambia and currently replicated and expanded into other districts (within the Copperbelt province) and to other TB CARE I provinces.

The scale up of the Ndola TB IC interventions is carried out in a phased manner, with an emphasis on fostering local ownership of the interventions and enhancing the institutionalization and sustainability of the TB IC interventions and procedures. The national team of IC consultants/experts which was formed as a result of the national and provincial trainings in 2009 and 2010 participated in the implementation of the Ndola District TB IC demonstration project from 2012 to 2013. The team has also participated in the scale up of facility level TB

IC activities in the other nine provinces in Zambia, working with the provincial TB/HIV liaison officers and the district TB/Leprosy/HIV-STI coordinators. Based on the lessons learned from the implementation of the Ndola demonstration project, TB CARE I has partnered with the Centre for Infectious Diseases Research in Zambia (CIDRZ) to implement TB IC activities in four of the ten target provinces in Zambia, including the Ndola District in the Copperbelt province, and the national team of IC consultants has provided technical support through scheduled visits to the provinces. Other partners implementing TB/HIV activities in Zambia (The CDC, JHPIEGO and the Churches Health Association of Zambia, to name a few) have also scaled up support for TB IC activities in their respective sites, and many provinces (that did not receive direct support through the TB CARE I or the Ndola demonstration project) began planning and implementing new TB IC activities, after participating in national and provincial trainings, using the TB IC implementation guidelines and tools developed and disseminated through the TB CARE I project.

Annex

Modified CDC Focused TB IC Monitoring Tool for Clinical Sites

Name of Facility		Date of audit		Name of auditor
##	Work Practice	Score (Y=1, N=0)	Comments	Means of Verification
	Managerial			
1	An infection control committee in Place			Minutes of meetings and/or Names documented in current facility plan
2	A written Infection Control (IC) Plan or Checklist is available for this site			Document available
3	TB IC training for all staff was done			List of participants and/or training topics
4	Staff are provided continuing education opportunities on TB IC			List of participants and/or training topics
5	Facility design and patient flow have been assessed(best use of space and ventilation)			Assessment checklist with date and findings
6	Monitoring and evaluation of TB IC data forms are reviewed routinely			e.g. Numbers of suspects at OPD and/or ART, and TATs, and Planned actions documented every month or quarter
7	A tracking system for all presumptive TB cases, referrals, and their sputum smear results is in place			Up-to-date presumptive TB register available
8	A register is kept of all TB patients reported to District TB program			Complete, up-to-date Register and/or Quarterly TB reports available
9	All patients with TB disease are managed on DOT as per the national guidelines			Dates of DOT recorded on treatment cards of five randomly selected patients
10	Patient and visitor information on TB IC is available for all and offered by staff			Posters displayed and/or topics of health education talks documented
11	Operational research to improve TB IC measures is conducted at this site			Research data base and/or publications documented
	Administrative Controls			
12	Patients are routinely identified about cough upon entering facility			Policy available and practice observed
13	Patients that are coughing are separated from others or “fast tracked” to caregiver			Policy available and practice observed
14	A “Cough Monitor” gives cough etiquette guidance and assists with triage			Roster available and practice observed

15	Signage for cough etiquette is present in the clinic			Cover-you-cough poster displayed
16	Sputum samples are collected in a designated area and away from others			Designated collection area or booth available
17	HCWs that assist during sputum collection take precautions			Policy available and practice observed
18	There is a tracking mechanism to monitor time to diagnosis. Dates of smear (and culture/Xpert) results are recorded in the lab register			Complete, up-to-date lab register with dates of receipt of sample and date of sputum examination result recorded
19	There is a tracking mechanism to monitor time to treatment. Dates of start of treatment are also recorded in the TB suspects register			Complete, up-to-date TB suspects and TB registers with dates of receipt of sputum examination result and initiation of treatment recorded
20	A log is kept of all staff who are diagnosed with TB disease			Up-to-date separate staff register available or 'HCW' recorded on TB register
21	Staffs receive an evaluation for TB at least annually. A log is available of all staff who are screened			Up-to-date screening log available
22	Staffs are offered an HIV test annually and offered ART if positive. A log is available of all staff that tested.			Up-to-date screening log available
23	HIV-infected staff are reassigned if requested			Policy available
24	INH preventive treatment is offered to HIV-infected staff			Policy available
	Environmental Controls			
25	Natural and/or mechanical airflow is monitored daily (especially in waiting rooms and examination rooms)			Policy available and practice observed
26	Regular maintenance for electrical fans is conducted. A maintenance log is available on site.			Up-to-date log available
27	Signage is in place to keep doors and windows open when feasible			Signage displayed
28	If UV lighting is used, routine maintenance is scheduled			Up-to-date log available with date for next maintenance
29	Crowd control measures are in place to prevent overcrowding in hallways or poorly ventilated waiting areas			Practice observed

30	N-95 or FFP2 respirators are readily available for eligible staff			Drugstore log available and no stock outs in last quarter
31	Eligible staff have been trained on proper fit of respirators			Up-to-date list of fit-tested staff with results of test available and/or staff have certificate of pass
32	Supplies are available to coughing patients (tissues, serviettes, masks, bin, etc.)			Drugstore log available or practice observed

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