Operational research on implementation of tuberculosis guidelines in Mozambique

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6. Implementation of tuberculosis infection prevention and control in Mozambican health care facilities

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Abstract

Setting: District and urban health care facilities in three provinces (Manica, Sofala, Tete) in central Mozambique.

Objective: To assess the level of implementation of selected tuberculosis infection prevention and control (TB-IPC) measures.

Design: In a cross-sectional study of TB-IPC implementation in 29 health care facilities, we assessed TB clinics, laboratories, out-patient departments and medical and TB wards. Assessment included selected managerial, administrative and environmental measures and the availability and use of respiratory protective equipment (N95 respirators).

Results: Guidelines for diagnosis and treatment of (presumptive) TB patients were not present in all facilities. Staff instructed patients on sputum collection in 91%, but only 4% observed it. Using a pragmatic ‘20% rule’, 52% of the rooms assessed had adequate ventilation. Potentially, this could be increased to 76%. Three quarters of the health care workers had N95 respirators. Only 36% knew how to use it correctly.

Conclusion: Implementation of TB-IPC measures showed wide variations within health care facilities. Relatively simple measures to improve TB-IPC include the availability of guidelines, opening doors and windows to improve ventilation, and training and support on correct N95 respirator use. However, even relatively simple measures are challenging to implement, and require careful attention for and evaluation of in the implementation process.
Transmission of tuberculosis (TB) in health care facilities constitutes a serious threat to health care workers (HCWs) and other facility users. Studies have shown that HCWs have a much higher risk of developing TB than the general population.\(^1\)\(^-\)\(^3\) TB infection prevention and control (TB-IPC) measures are aimed at reducing TB transmission risk in health care facilities. Attention to the implementation of TB-IPC measures in health care facilities has increased in recent years due to the spread of multidrug-resistant (MDR-) and extensively drug resistant (XDR-) TB in hospitals.\(^4\) The human immunodeficiency virus (HIV) epidemic and integration of HIV and TB services have further contributed to renewed attention for TB-IPC implementation.\(^5\)

The World Health Organization (WHO) policy on TB-IPC consists of a set of measures and activities for different levels of the health care system.\(^6\) In facilities, managerial activities should support the implementation of administrative and environmental measures, and the use of respiratory protection equipment. Administrative measures include promptly identifying (presumptive) TB patients and separating them from other facility users. Environmental measures aim to reduce the concentration of bacilli in the air, for example through the use of natural ventilation. Respiratory protective equipment refers to particulate respirators that prevent the wearer from inhaling TB bacilli.

Assessment tools for the implementation of TB-IPC measures in health care facilities are based on guidance from the WHO\(^6\) and the US Centers for Disease Control and Prevention (CDC).\(^7\) While WHO guidance applies to all countries, CDC guidelines target the United States health care system, which is very different from the reality in sub-Saharan Africa. The WHO recommends assessing all levels of the health care system for TB-IPC measures. Interventions and studies assessing the implementation of TB-IPC measures have usually targeted tertiary and regional referral hospitals first.\(^8\)\(^,\)\(^9\) However, many, if not most presumptive TB patients attend district hospitals and urban or rural health care facilities. The potential for TB transmission in these health care facilities is therefore substantial. Some studies recently evaluated the implementation of TB-IPC measures in district hospitals and primary health care facilities in sub-Saharan Africa, and reported limited implementation.\(^10\)\(^-\)\(^12\)

The implementation of TB-IPC measures has received more attention in recent years in Mozambique with the development of national guidelines in 2009.\(^13\) Mozambique is among the 22 high-burden countries (50 827 TB patients in 2012\(^14\)) and has an increasing estimated TB incidence. TB patients are mainly notified by district hospitals and urban health care facilities. However, little is known about the implementation of TB-IPC measures in district and urban health care facilities. We therefore addressed the following research question: how are TB-IPC measures implemented in district and urban health care facilities in central Mozambique in terms of managerial activities, administrative and environmental measures, and use of respiratory protection equipment?

**Methods**

We assessed the implementation of TB-IPC measures in all TB notifying health care facilities with at least 150 TB notifications (all forms) in 2008 in Manica, Sofala and Tete Provinces in central Mozambique. The assessments were performed in September and October 2010. We excluded provincial and central hospitals, as these hospitals have no separate TB department, and they have a different scope and scale of activities compared to district and urban facilities. The assessment included the TB clinic, the laboratory and the out-patient department (OPD). We included a medical ward and a TB ward if present.

A study assessment tool based on the Mozambican Infection Control Guidelines and internationally used assessment tools was developed and used.\(^6\)\(^,\)\(^7\)\(^,\)\(^13\) We assessed sputum collection and separation of
(presumptive) TB patient procedures (administrative measures) through observation and interviews with a HCW in each of the departments. Among the environmental measures, we assessed ventilation by a pragmatic rule of thumb: ventilation was adequate if the surface of all open windows and doors during the assessment was >20% of the floor surface (the 20% rule). This rule was also applied to the surface of all windows and doors, assuming they could all open, to assess ventilation potential. In addition, we assessed through observation the correct use of the N95 respirators (3M 1860; 3M, St Paul, MN, USA). Use was reported as correct if users followed the manufacturer’s instructions.

The assessment also included an interview with the facility’s manager to assess aspects of the managerial component. The interview covered attendance of adults, children and HIV-infected individuals at the facility, presence of a written TB-IPC plan and an open question about the presence of guidelines for the diagnosis and treatment of TB patients.

Six provincial and district TB supervisors collected the data. They underwent a 4-day training course that included TB-IPC theory, practical exercises and assessment in a health care facility not selected for the study. The last day of the course comprised an assessment under supervision in one of the study facilities.

Data were entered and analysed using SPSS Statistics version 20.0.0 (Statistical Package for the Social Sciences, Chicago, IL, USA). The data were cleaned and checked for completeness and consistency. The characteristics of the health care facilities were summarised descriptively with medians and ranges for continuous variables. For categorical variables, frequencies were used.

Ethics

The National Bio-ethics Committee of the Mozambican Ministry of Health approved the protocol. The relevant health care authorities of the provinces approved the study taking place in the selected health care facilities. For Health Alliance International, the Institutional Review Board of the University of Washington in Seattle, WA, USA reviewed the protocol and waived the need for ethical approval.

Results

We assessed 29 health care facilities: 6 in Manica (3 urban), 14 in Sofala (6 urban) and 9 in Tete Province (4 urban). The three provinces notified 26% of the country’s TB patients in 2010 (source: National TB Control Programme (NTP) data). The participating facilities notified 87% of the TB patients in the three provinces in 2010. All facilities had a TB department and 28 had a laboratory with smear microscopy services. The one urban facility without a laboratory took samples for microscopy to the nearest facility with microscopy services. All facilities had OPDs, of which 41 rooms were assessed. All district hospitals had a medical ward (n = 12), a TB ward (n = 3) or both (n = 5) assessed. One urban facility had a TB ward that was solely for the admission of patients with multidrug-resistant TB (MDR-TB). Table 6 provides an overview of the key characteristics of the study facilities.

Managerial Activities

Almost half (14 of 29) of the facilities had a written IC plan, and when present, 79% included TB. Most facilities (26/29) provided TB education for their workers, 58% of which did this at least monthly.

Facility management in 66% (19/29) of the facilities said they had written guidelines for the diagnosis of presumptive TB patients. All facilities had guidelines for the treatment of diagnosed TB patients. The TB staff corroborated these figures. Table 7 shows the available guidelines.
Table 6 Characteristics of health care facilities

Administrative measures

Sputum collection is the first step in the laboratory diagnosis of TB. Table 8 shows the location of sputum production, and whether or not HCWs provided instructions to patients on sputum sample production; 50% of HCWs said that sputum was produced at home. Most HCWs (91%) instructed patients on sputum sample production, and 4% observed sputum production.

In 11% of the laboratories, OPDs and medical wards, (presumptive) TB patients were separated from other facility users while waiting for care or while admitted. In addition, 62% of these departments attended to presumptive TB patients before attending to other patients.

Environmental Measures and respiratory protection

Of the 98 waiting rooms, 89 (91%) were open spaces, and observed ventilation was considered adequate in 87 (98%) of these. Table 9 shows the implementation of ventilation-related measures and the availability and use of respiratory protective equipment.
Guidance material & Guidelines for identification of presumptive TB patients available & Guidelines for treatment of diagnosed TB patients available & 
 & Facility managers & TB staff* & Facility managers & TB staff & 
None & 10 & 11 & & & & 
NTP manual & 12 & 10 & 19 & 22 & 
Leaflets and Information Education and Communication (IEC) material & 4 & 5 & 8 & 7 & 
TB treatment dosage table & 4 & 3 & 18 & 21 & 
Other/Unknown & 4 & 6 & 2 & & 

Legend: * Most facilities had only one TB staff member. If a facility had more than one TB staff member, the head of department provided the information.

Table 7 Guidelines available in health care facilities according to facility managers (n=29) and TB staff (n=29)

Discussion

The level of implementation of TB infection prevention and control measures in health care facilities in central Mozambique shows great variation in managerial TB-IPC activities, administrative and environmental measures, and the use of respiratory protection equipment. All facilities implemented measures such as the presence of guidance about the treatment of TB patients, whereas implementation of separation of (presumptive) TB patients only reached 11%.

Table 8 Sputum collection by department

<table>
<thead>
<tr>
<th>Sputum collection</th>
<th>TB clinic (n=29)</th>
<th>Laboratory (n=28)</th>
<th>OPD (n=41)</th>
<th>Medical ward (n=12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location sputum collection</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>At the laboratory</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>12 (29)</td>
<td>1 (8)</td>
</tr>
<tr>
<td>At a ventilated space in HF</td>
<td>12 (41)</td>
<td>4 (14)</td>
<td>8 (20)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>At home</td>
<td>12 (41)</td>
<td>22 (79)</td>
<td>20 (49)</td>
<td>1 (8)</td>
</tr>
<tr>
<td>In the bathroom of HF</td>
<td>3 (10)</td>
<td>2 (7)</td>
<td>1 (2)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Other/Unknown</td>
<td>2 (8)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>10 (83)</td>
</tr>
<tr>
<td>HCW gives instruction on how to collect sputum sample (yes)</td>
<td>NA</td>
<td>28 (100)</td>
<td>41 (100)</td>
<td>11 (92)</td>
</tr>
<tr>
<td>HCW observes production of sputum sample (yes)</td>
<td>NA</td>
<td>1 (4)</td>
<td>0 (0)</td>
<td>2 (17)</td>
</tr>
</tbody>
</table>

Legend: HF = health care facility; OPD = out-patient department; HCW = health care worker; NA = not available
Our findings are in line with other studies on the implementation of TB-IPC measures in health care facilities in similar settings. However, there is little evidence on the relevance of the implementation of certain measures on the practice of TB-IPC. For example, a measure emphasised in international TB infection prevention and control guidelines is that all facilities should have a TB infection prevention and control plan. However, a knowledge, attitudes and practices study looking at MDR-TB facilities found no relation between the presence of a plan and actual TB-IPC practices. This raises the question as to whether the emphasis on having such a plan is justified and how valid the inclusion of such a measure in TB-IPC assessment tools might be. A South African study investigating the relationship between TB-IPC assessment scores and TB in HCWs found no relation between the scores and the incidence of TB in HCWs. The study suggested developing and testing TB infection prevention and control assessment tools locally in different settings. This may also apply to the different levels of the health care system.

Administrative measures aiming to diagnose, isolate and treat (presumptive) TB patients promptly are considered basic measures applicable to all facilities. However, some studies identified several gaps in the diagnostic and treatment initiation process. HCWs do not necessarily test for TB in individuals presenting with respiratory symptoms. (Presumptive) TB patients are often not separated from other patients (only 11% in our study). When tests confirm TB diagnosis, treatment is not always initiated promptly. As adequate treatment renders patients less infectious in a short time, prompt diagnosis and treatment initiation is crucial as a TB-IPC measure to reduce transmission. An obstacle to adequate diagnosis and treatment may be the lack of NTP guidelines. In our study, some managers and TB staff even referred to patient education material as their guidelines for TB diagnosis and treatment. Although this material is highly relevant for patients, HCWs require different guidelines.

Sputum collection is part of the TB diagnostic process. The TB manual indicates that presumptive TB patients should produce the first sample following consultation in the facility. In our study, 50% of HCWs stated that sputum was produced at home. Although production at home reduces the possibility of TB transmission in the facility, patients may not return to submit their samples and remain undiagnosed, in which case they may spread disease for a prolonged period. There is a need for places in health care facilities where sputum production can take place safely for patients, HCWs and other users, particularly if HCWs are to observe sputum production.

Separation of (presumptive) TB patients reduces the time during which these patients share the same waiting room or ward with other facility users. This measure therefore reduces the risk of TB transmission. The OPDs in our study generally had only one waiting room, which made separation difficult. It therefore recommended that patients with (presumptive) TB be prioritised for attention before other patients. This reduces the time (presumptive) TB patients spend in the facility, which is considered an important TB infection prevention and control measure.

The availability of N95 respirators was better in the TB clinics (90%) than in OPDs (59%). Although this was better than in other reports, anecdotal evidence from Mozambique reveals that the supply of respirators is irregular. Even more worrisome is that only 36% of observed staff used the respirators correctly. A rapid assessment of the implementation of TB-IPC measures in Mozambique found that in 75% of the health care facilities assessed, at least one HCW was seen using the N95 respirator incorrectly (Samu Gudo, et al. Report of a rapid assessment: tuberculosis transmission risk and infection control compliance in Mozambican health care settings. Unpublished). Incorrect use of respirators reduces the protection of the wearer and may lead to inhalation of TB bacilli.
Legend: *In the laboratories this was when processing the sputum samples.

<table>
<thead>
<tr>
<th>OPD</th>
<th>Medical ward</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n=41)</td>
<td>(n=12)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environmental measures</th>
<th>TB clinic</th>
<th>Laboratory</th>
<th>OPD</th>
<th>Medical ward</th>
<th>TB ward</th>
</tr>
</thead>
<tbody>
<tr>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Staff work with door open</td>
<td>29 (100)</td>
<td>15 (54)</td>
<td>14 (34)</td>
<td>10 (83)</td>
<td>9 (100)</td>
</tr>
<tr>
<td>Staff work with window open</td>
<td>29 (100)</td>
<td>21 (75)</td>
<td>39 (95)</td>
<td>11 (92)</td>
<td>9 (100)</td>
</tr>
<tr>
<td>Staff work with door and window open</td>
<td>29 (100)</td>
<td>13 (46)</td>
<td>12 (29)</td>
<td>9 (75)</td>
<td>9 (100)</td>
</tr>
<tr>
<td>Ventilation adequate at time of assessment (“20% rule”)</td>
<td>12 (41)</td>
<td>13 (46)</td>
<td>22 (54)</td>
<td>8 (67)</td>
<td>7 (78)</td>
</tr>
<tr>
<td>Ventilation potentially adequate* if all openings open (“20% rule”)</td>
<td>20 (69)</td>
<td>15 (54)</td>
<td>36 (88)</td>
<td>12 (100)</td>
<td>8 (89)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Personal Protective Equipment</th>
<th>TB clinic</th>
<th>Laboratory</th>
<th>OPD</th>
<th>Medical ward</th>
<th>TB ward</th>
</tr>
</thead>
<tbody>
<tr>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>N95 respirators available (yes)</td>
<td>26 (90)</td>
<td>24 (86)</td>
<td>24 (59)</td>
<td>9 (75)</td>
<td>8 (89)</td>
</tr>
<tr>
<td>When do you use N95 respirators</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attending patients</td>
<td>25 (96)</td>
<td>1 (4)</td>
<td>12 (50)</td>
<td>5 (56)</td>
<td>7 (88)</td>
</tr>
<tr>
<td>Attending patients with cough</td>
<td>1 (4)</td>
<td>1 (4)</td>
<td>10 (42)</td>
<td>2 (22)</td>
<td>1 (13)</td>
</tr>
<tr>
<td>Other*</td>
<td>0 (0)</td>
<td>22 (92)</td>
<td>2 (8)</td>
<td>2 (22)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Where do HCW keep N95 respirator in-between use?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drawer/cupboard</td>
<td>17 (65)</td>
<td>13 (54)</td>
<td>20 (83)</td>
<td>5 (56)</td>
<td>5 (63)</td>
</tr>
<tr>
<td>On desk</td>
<td>3 (12)</td>
<td>1 (4)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Pocket of coat</td>
<td>2 (8)</td>
<td>0 (0)</td>
<td>2 (8)</td>
<td>1 (11)</td>
<td>1 (13)</td>
</tr>
<tr>
<td>Other/unknown</td>
<td>4 (15)</td>
<td>10 (42)</td>
<td>2 (8)</td>
<td>3 (33)</td>
<td>2 (25)</td>
</tr>
<tr>
<td>HCW uses N95 correctly</td>
<td>10 (38)</td>
<td>4 (17)</td>
<td>9 (38)</td>
<td>4 (44)</td>
<td>6 (75)</td>
</tr>
<tr>
<td>Observed incorrect use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crossed elastics</td>
<td>5 (31)</td>
<td>8 (40)</td>
<td>6 (40)</td>
<td>1 (20)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Touched inside</td>
<td>5 (31)</td>
<td>1 (5)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1 (50)</td>
</tr>
<tr>
<td>Crossed elastics and touched inside</td>
<td>3 (19)</td>
<td>4 (20)</td>
<td>3 (20)</td>
<td>2 (40)</td>
<td>1 (50)</td>
</tr>
<tr>
<td>Other</td>
<td>3 (19)</td>
<td>7 (35)</td>
<td>6 (40)</td>
<td>2 (40)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

Legend: *In the laboratories this was when processing the sputum samples. OPD = out-patient department; HCW = health care worker

Table 9 Environmental measures and respiratory protection by department

In Mozambique, as many other resource-limited settings, N95 respirators are used more than once. Keeping the respirator in good condition between uses in an adequate place and maintaining the shape of the respirator is therefore crucial. This was difficult for many HCWs, who kept the respirator between uses in their coat pockets, where it loses its shape, or on their desk where the respirator may collect dust and become less functional. These findings show that HCWs need more support in the correct use and maintenance of respirators.
The implementation of several TB-IPC measures seems relatively easy. Examples of apparently easy to implement measures are prioritisation of presumptive TB patients and opening doors and windows to increase ventilation. However, as simple as it may seem, prioritisation requires a person to identify those patients who need to be attended to first. In a setting like Mozambique, where human resources for healthcare are scarce, this is a real challenge. Furthermore, working with open doors and windows has its challenges. HCWs keep doors closed for patient privacy; windows cannot always open, as other studies also found; and weather conditions and security are also relevant considerations when working with open doors and windows. Nevertheless, natural ventilation has good potential to reduce airborne transmission at little cost.

The use of wind-driven roof turbines is a relatively cheap intervention in situations where privacy requires closed doors and ventilation is inadequate.

Most of our findings showed that the implementation of TB-IPC measures was inadequate due to the lack of guidelines or insufficient implementation of available guidelines. A study from South Africa showed that informing HCWs about TB-IPC measures is not sufficient for HCWs to incorporate them into their daily practice. Motivation of HCWs as well as social support from colleagues and superiors is very important for the implementation of and adherence to guidelines. Increasing motivation and social support require ongoing attention to improve the implementation of TB-IPC measures.

The implementation of TB-IPC measures is not a goal in itself. The measures aim to reduce TB transmission in health care facilities. In addition to assessing the implementation of TB-IPC measures, HCWs should be monitored for TB.

Limitations

We obtained information on TB-IPC in the facilities using a questionnaire, but did not confirm all answers through observation. Several studies have shown gaps between knowledge or information given and practice. This means that the actual situation regarding TB-IPC could be worse or unknowingly better than we describe here. In addition, the results of our study are context-specific, which limits their generalisability. However, given that our findings and those of a rapid assessment done at the same time in Mozambique (Samu Gudo, et al. Report of a rapid assessment: tuberculosis transmission risk and infection control compliance in Mozambican health care settings. Unpublished) were similar indicates that our results are probably accurate in presenting the TB-IPC situation in Mozambican health care facilities. Our findings are also similar to other studies in sub-Saharan Africa.

Conclusions

The implementation of TB-IPC measures at lower level health care facilities varies from complete implementation of some and almost no implementation of other TB-IPC measures. We also conclude that it remains a considerable challenge to translate guidelines or research findings into applicable actions or interventions in practice. Implementation science looks into theories or models of how to obtain successful outcomes and how to assess the success of implementation. However, research efforts in TB-IPC have seldom included these aspects, leaving many implementers to learn how to implement measures for themselves instead of being able to use best practice experiences of other implementers.

We recommend that future research looks into the relevance of international recommended guidelines in certain settings and pay more attention to aspects related to the implementation of guidelines.
References


