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Implementation of Tuberculosis Control Measures in Rural Public Hospitals of Vhembe District, South Africa: A Thematic Analysis

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ABSTRACT This paper assessed the implementation of effective tuberculosis control measures in rural public hospitals of Vhembe district, South Africa.A qualitative approach using cross-sectional exploratory design was adopted. Purposive sampling was used to select fifty-seven focus group participants. Necessary approval, permission and clearance were obtained. Participants' rights were respected. The findings of this study revealed that rural public hospitals of Vhembe district implemented ineffective tuberculosis control measures.It was concluded that the ineffective measures practiced might increase the risk of becoming infected with tuberculosis at rural hospitals of Vhembe district. Hospital managers should consult and enforce national as well as international tuberculosis control legislative framework to enhance health care workers' implementation of effective tuberculosis control measures.

INTRODUCTION

Infections including tuberculosis (TB), multidrug resistant–TB (MDR-TB) and extensive drug resistance –TB (XDR-TB) is the leading cause of death in South Africa (Statistics South Africa [Stats SA] (2014). In 2013 alone, 1.3 million people died globally from TB with 5.7 million newly diagnosed cases notified in national TB programmes (World Health Organisation [WHO] Global TB report 2014). The total number of new TB cases notified in South Africa (SA) were 296 664, making the country to be amongst the three that had almost 60 percent of the world cases of MDR-TB. South Africa currently ranks the third highest in the world in terms of the TB burden, with incidences that has increased by 400 percent over the past 15 years (WHO global TB report 2014).The increased incidence of new TB infections in SA is attributed to the growing MDR-TB rates of about 15 419 in 2012.Of the 15 419 confirmed MDR-TB cases, only 6 494 patients were started on MDR-TB treatments, which is 42 percent. The remaining 68 percent were not started on MDR-TB treatments, which suggest that they continued to transmit the MDR-TB infection to people around them (such as their relatives, friends, health care workers and other patients).

The concern is that all infectious TB and untreated MDR/XDR-TB patients in Limpopo province including Vhembe district are first admitted at non-specialised hospitals in medical or TB wards, whilst appearing on the often long waiting lists for admissions to specialised public TB hospitals. During her 23 years of experience as a professional nurse caring for TB patients in public hospitals, the authors observed with concern that patients, who got admitted to the medical wards with diseases other than TB, were re-admitted with TB symptoms, which were then referred to as "new TB infection". To confirm this observation, the then MEC for Health Ms D Magadzi informed the gathering at Kutama-Sinthumule prison during a TB campaign in 2012 that new TB cases had increased from 6 286 to approximately 21 287 between 2000 and 2010 in the Limpopo province. Ms O Ramudingana (Ramudingana 2014), the Vhembe district TB coordinator reiterated that the district continues to have more new TB cases compared to other districts of the same province. Thus, SA up till 2014 had not reached the global target of 85 percent TB cure rate. In 2014 the South African cure rate was 79 percent, which was 6 percent below the target. Many reasons for not reaching the TB targets were revealed by previous studies. However, the implementation of ef-

fective TB control measures has hardly been the point of focus. This study therefore aimed to assess the implementation of effective TB control measures at rural public hospitals of Vhembe district.

Objectives of the Study

- Describe administrative tuberculosis control measures implemented at rural hospitals.
- Describe environmental tuberculosis control measures implemented at rural hospitals.
- Describe personal respiratory protective tuberculosis control measures implemented at rural hospitals.

METHODOLOGY

Study Design

In line with the purpose, this study adopted a qualitative approach using a cross-sectional exploratory design. Blanche et al. (2006) advices that in situations where it is difficult to identify and measure the important variables, researchers may engage in open-ended, inductive exploration that is possible by means of qualitative research.

Study Setting

The study was conducted at Vhembe district, in Limpopo province of South Africa. Vhembe district has eight rural-based hospitals. One of the eight hospitals (psychiatric) does not admit TB patients. Thus, this study was conducted at seven of the eight hospitals that render TB services in Vhembe district.

Population, Sample and Sampling Procedure

All health care workers (HCWs) in participating hospitals who took part in TB management constituted the target population of this study. The participating hospitals differed in size, in terms of number of beds and wards. Thus, there were only three wards in some hospitals and a maximum of nine in others. Hence, the researcher included one representative from each of the wards per participating hospital. As a result, 57 HCWs participated in this study. Purposive sampling of a maximum variation type was used to select representative focus group participants believed to have the necessary knowledge needed for this study. The sample size for the focus group discussions (FDGs) was one focus group per participating hospital, making up seven focus groups, each comprising 5-10 members.

Ethical Consideration

The Limpopo Provincial Department of Health approved the study (Project No 4/2/2), and ethical clearance was issued by the University of Venda, Research Ethics Committee (Project No SHS/10/PDC/02). Permission to access the seven hospitals was obtained from each hospital manager. The participants signed informed consent. Participating hospitals were allocated codes (A, B, C, D, E, F and G) to ensure privacy and anonymity.

Data Collection Tool

A focus group discussion guide was developed which comprised of one central question namely, “which measures of tuberculosis control do you implement in the wards?” This was followed by probing questions that were dependent on participants’ responses.

Pilot Study

Data collection at the first hospital afforded the researchers a pilot study opportunity to pretest the FGD guide to determine whether or not the wording and construct was clear, and to check the feasibility of the entire study. Thereafter, the FGD guide was re-adjusted accordingly. However, data collected from the pilot study formed part of the empirical data for this study to prevent loss of the latter.

Data Collection

The focus group discussions were conducted in English. Focus group discussions took place in boardrooms at each hospital during office hours. The researcher facilitated the focus group discussions. Data was recorded as field notes.

Data Analysis

Analysis of the data was guided by Tesch’s (1984) open-coding method, as discussed in Cre-

swell (2009) whereby the researcher read through all of the field notes from the FGDs, and interpreted them carefully in order to obtain an overall sense of the notes. The interpretations were written as themes. Similar themes were clustered together and eventually arranged into one major theme with sub-themes.

Measures to Ensure Trustworthiness of the Study Findings

Trustworthiness of the results was ensured through the use of Lincoln and Guba's (1985) criteria, as outlined in Creswell (2009) namely credibility, transferability, confirm ability and dependability. Credibility was ensured through prolonged engagement with the participants, which lasted from 1.5-2 hours. Transferability was ensured through the provision of a complete description of the research method and interpretation of the research findings in the study report.The neutral colleague from the same university examined the running account of the process of inquiry as well as the findings and recommendations; and attested that the findings are supported by data; and that the study is internally coherent (Babbie 2010).

RESULTS

Focus groups from hospitals were coded 1, 2, 3, 4, 5, 6 and 7 based on the sequence of focus group discussions. The results are presented in Table 1 in the form of themes and sub-themes developed on the basis of the purpose of the study. The themes include the implementation of effective administrative TB control measures, implementation of effective environmental TB control measures, and implementation of effective personal respiratory protective TB control measures. Each theme is divided into a number of sub-themes. Table 1 summarises the findings. The sub-themes are discussed in the next section.

Table 1: Summary of the findings

Themes	*Sub-themes*
Theme 1: Implementation of effective administrative TB control measures.	Hospitals implemented ineffective measures of dealing with LTBI; Hospitals implemented ineffective triage measures; Ineffective measures of isolating infectious TB patients were implemented; Hospitals implemented unsafe sputum collection measures.
Theme 2: Implementation of effective environmental TB control measures.	Ineffective measures of improving room ventilation were implemented;
Theme 3: Implementation of effective personal respiratory protective TB control measures.	Ineffective measures regarding use, care and disposal of personal respiratory protective devices were implemented.

Hospitals Implemented Ineffective Measures of Dealing with Latent Tuberculosis Infection (LTBI)

When a probing question was asked namely, "How is HCWs' latent TB infection handled in this hospital?" Data collected revealed that pre-employment/placement/periodic screening for LTBI was not done at hospitals. Only three out of the seven hospitals revealed that their hospitals conducted pre-employment or pre-placement screening to rule out general diseases. The remaining majority (4) hospitals did not conduct pre-employment or pre-placement screening. Participants from hospitals that conduct pre-placement and pre-employment screening indicated that the screening tests utilized were limited to chest X-ray, ESR, FBC and hepatitis tests as the diagnostic tests of choice. Some participants highlighted that HCWs themselves are reluctant to be screened when pre-employment/pre-placement screening is made available. Explanations of the participants said,

*"Every nurse, including the general assistants, is screened periodically free of charge to rule out all diseases, though I am not sure how often these screenings are done per yea*r" *(*participant 7: focus group 4).

*"HCWs are invited to consult the occupational health nurse for screening before starting to work in a TB ward" (*participant 4: focus group3*). "In this hospital no HCW is screened for TB either upon employment or periodically" (*participant 1: focus group 7).

"Employees are offered pre-employment examination, which covers chest X-ray, FBC and hepatitis, the findings of which serve as baseline" (participant 1: focus group 2).

"A questionnaire is completed by staff asking about any contact with TB patient and any development of TB symptoms" (participant 7: focus group 3).

"So many nurses are infected with TB but do not want to be screened in this hospital" (participant 2: focus group3). *"HCWs do not attend periodic screenings."*

The researchers concluded that the measures of dealing with latent tuberculosis infection at rural public hospitals of Vhembe district are ineffective.

Ineffective Triage Measures Were Implemented

Data analysis found that no person was assigned the responsibility of identifying and fast-tracking TB suspect persons; the hospitals used only cough symptom as a criterion for TB suspect identification; coughing patients were not given masks; coughing patients were made to follow the queue until the history taking point in some hospitals; and there was more than 8hrs delay in the suspicion of TB. Participants said,

"There is no help desk nurse at this hospital. It is the responsibility of every nurse to identify coughing patients. This might take one to two hours" (participant 1: focus group 3).

"Coughing patients follow the queue until the history taking point" (participant 3: focus group 3). *"Coughing patients are never given surgical masks"* (participant from focus groups 2 and 4).

The researchers concluded that the triage measures implemented at rural public hospitals of Vhembe district are ineffective.

Hospitals Implemented Ineffective Measures of Isolating Infectious TB Patients

Data analysis revealed that TB in-patients' movement was not restricted; hospitals did not give mask to visitors and yet allowed them to see their patients in bed; HCWs did not put on masks when entering TB cubicles; TB in-patients were not given masks; the hospitals did not have TB wards; TB cubicles were established within medical wards, and were used to separate TB infectious in-patients from non-infectious patients. According to participants,

"TB suspect in-patients and confirmed TB in-patients in isolation are not given masks" (participant 8 and 9: focus group 6).

"Whenever a nurse enters one of the TB cubicles puts on N95 mask" (participants 2 and 3: focus group 6). *"Nurses put on surgical masks in TB cubicles*" (participants 2, 3 and 4: focus group 3). *"Nurses do not put on masks"* (participants 2 and 3: focus group 2).

*"Movements of TB patients are not restricted in this hospital because it is difficult to control movement of a patient who can walk" (*participants 2, 3 and 4: focus group 3).

"Visitors see their TB patients in beds. There is no visitor restriction. Masks are sometimes used by visitors" (participants 2 and 3: focus group 2).

A TB suspect in this hospital is mixed with all other patients such as diabetes and immune-compromised patients" (participant 2, 3 and 4: focus group 3).

The researchers concluded that HCWs at rural public hospitals of Vhembe district are implementing ineffective measures of isolating infectious TB patients.

Unsafe Sputum Collection Measures Were Implemented

The analysis of data discovered that the hospitals collected only two sputum specimens; the hospitals did not collect sputum on the spot, unless it was an urgent order; nurses who supervised the coughing of sputum by TB suspect persons put on surgical masks and stood near or in front of the coughing patient; and the coughing of sputum took place in enclosed areas such as bathrooms, toilets, dressing rooms and at patients' beds. Participants said,

*"Only two sputum specimens are collected either in OPD/casualty or from home or in the wards" (*participant 4, 5 and 6: focus group 3*).*

"The first sputum specimen is collected the following mornings by night nurses before the patient washes his mouth and before breakfast until all three is collected. On the spot sputum is rarely collected. Only stat orders are collected on the spot" (participant 1 and 4: focus group 7).

"Nurses stand in front of a coughing patient as long as they have a mask on" (participant 4 and 6: focus group 5).

"Sputum specimen is coughed in enclosed areas such as patients' beds, at bathrooms, toilets and dressing rooms" (participant 9 and 10: focus group 6).

The researchers concluded that HCWs at rural public hospitals of Vhembe district are implementing unsafe sputum collection procedures.

Ineffective Measures of Improving Room Ventilation Were Implemented

During observations, the researcher discovered that fixed window curtains did not allow maximum air entry into the wards; ceiling fans were used in rooms with closed windows and doors; and there was no evidence that air entering isolation rooms flew from clean to unclean and to the outside. The researchers concluded that HCWs at rural public hospitals of Vhembe district are implementing ineffective measures of improving room ventilation.

Ineffective Measures Regarding Use, Care and Disposal of Personal Respiratory Protective Devices Were Implemented

Data analysis revealed that at the participating hospitals, HCWs used N95 respirators when taking care of TB patients; TB suspects as well as confirmed TB patients were not given masks; care of masks varied from being put in pockets to being folded in paper towels; the duration of use of masks varied from discarding them immediately after using them once to discarding after 8-9hrs of use and re-using indefinitely if not wet; and the disposal of used masks and respirators included throwing them into the dirty bins. According to participants,

"Masks are used for sterile procedure in OPD only by nurses and doctors, not for the purpose of preventing TB infection transmission. Only nurses in casualty and OPD use surgical masks. Nurses in general wards use disposable white paper masks for sterile procedure" (all participants: focus group 7).

"No patient has ever been seen with a mask at this hospital." TB ward nurse, Female medical ward nurs*e"* (participant 3 and 4: focus group 7).

"When going for tea or lunch breaks, masks are folded in a clean paper towel and put somewhere safe" (participant 8 and 9: focus group 6).

"N95 masks are re-used if not wet because they are sometimes out of stock" (participant 2 and 3: focus group 2).

"*In TB ward, nurses put on N95 masks, which are not always available"* (participant 2. 3 and 4: focus group 3).

DISCUSSION

The discussion of the results is arranged according to the sub-themes of the study.

Hospitals Implemented Ineffective Measures of Dealing with Latent Tuberculosis Infection (LTBI)

In support of these findings, Eshun-Wilson et al. (2008) discovered poor management of HCWs' LTB attributed to increased incidences of HCW TB infection in South Africa. Similarly, Jingtao (2015) found that in China no periodic TB screenings were done and there were no special allowances for HCWs working in high risk environment such as TB wards. The same applies to Tygerberg Hospital in Cape Town in South Africa, where Taljaard (2014) found that pre-employment/placement/periodic screening for TB was not done and prophylaxis TB treatment was not given to HCWs exposed to TB infection.

The practices discovered in this study demonstrate ignorance in that in South Africa, TB is classified as an occupational disease according to the Department of Labour's (2004) circular instruction regarding compensation for pulmonary tuberculosis associated with silica dust exposure. Thus, HCWs can claim compensation for contracting TB disease at work. Hence, the WHO (2008) urges hospitals to conduct tuberculin skin test (TST) regularly on all HCWs who are frequently in contact with TB infectious patients and to support those with positive TST to diagnose LTBI.

Ineffective Triage Measures Were Implemented

These findings are similar to what prevails in India as outlined in the guidelines on airborne infection control in health care and other settings in the context of TB and other airborne infections (Ministry of Health and Welfare, India 2015). In India, TB diagnosis is frequently delayed due to weak suspicions. In China, Jingtao (2015) found that coughing and non-coughing patients were not separated; coughing patients moved around hospitals without masks. Furthermore, used tissues and masks were not correctly disposed of.

The WHO (2009) warns that using cough as the only criterion for identifying TB suspects is not enough, as HIV and other immune-compromised patients might go unnoticed continuing to transmit TB infection. The practice of not having a help desk nurse or cough officer to identi-

fy TB suspect persons delays TB suspicion, diagnosis, and treatment, as TB suspect persons might spend many hours sharing infected air with non-infectious patients, thus fuelling risks of TB transmission (WHO 2009).

Not giving coughing patients surgical masks and HCWs not putting on N95 respirators when attending to TB suspects are also not good triage practices as this exposes HCWs to TB infection, fuelling TB transmission (WHO 2009). Allowing coughing patients to follow the queue until their turn arrives prolongs facility users' exposure to TB infectious patients, thereby fuelling risks of TB transmission (WHO 2009).

Thus, Young et al. (2008) caution that delayed identification of TB suspect leads to delayed TB diagnosis; during which time the disease can progress and transmission continue. de Vries et al. (2006) state that delayed diagnosis of the index case is the main cause of patient-to-HCW TB transmission in hospitals. Greenfield (2015) emphasises that an undiagnosed person with TB disease poses an increased risk for TB transmission. Furthermore, the WHO (2008) stresses that placing potentially infectious TB patients in waiting areas with other patients without TB, especially those who are immune-compromised (for example, AIDS, diabetes or babies), poses an increased risk of transmitting TB infection.

Hospitals Implemented Ineffective Measures of Isolating Infectious TB Patients

These findings concur with Basu et al. (2007) who asserts that the capacity for safe airborne isolation does not exist in South African hospitals. According to Basu et al. (2007), non-XDR-TB patients are frequently admitted to the wards with other patients who have a TB disease and risk super infection/nosocomial infection. Similarly, Sissolak et al. (2011) discovered a total lack of isolation facilities in South Africa. Knirsch et al. (2008) also found that practices and facilities for recognizing and isolating potential TB patients in South Africa were inadequate.

The CDC (2005) warns that hospitals can be breeding grounds for drug-resistant TB. Hussey, director of the Institute of Infectious Diseases and Molecular Medicine at the University of Cape Town (SAFAIDS 2012) confirmed that hospitals could be dangerous environments, especially for patients with HIV-compromised immune systems. Thus, the research conducted at the Church of Scotland hospital in Tugella Ferry, Kwazulu-Natal, where an outbreak of XDR-TB claimed 50 lives in 2006, confirmed this claims stating that most cases of drug-resistant TB were attributable to airborne infections often contracted within the hospitals (SAFAIDS 2012). To make this matter worse, nurses at Port Elizabeth's Joseph Pearson TB hospital reported that MDR-TB patients were contracting XDR-TB strains at an intense rate in a situation where XDR-TB patients were in a different ward from MDR-TB patients.

Unsafe Sputum Collection Measures Were Implemented

Collecting only two sputum specimens and not collecting sputum on the spot is contrary to the international standards for TB care, diagnosis and treatment (WHO Global TB report 2014) which prescribe that three (3) sputum specimens should be collected for AFB smear at least eight hours apart within a 48-hour period. According to the WHO Global TB report (2014), the first specimen should be collected on the spot when patients are first encountered, regardless of the time of day in order to expedite management among ill suspects and unreliable patients. Furthermore, at least one specimen should be a first morning specimen. Expediting sputum collection would expedite TB diagnosis.

Allowing the coughing of sputum specimens to take place in enclosed areas is contrary to the WHO Global TB report (2014) prescription that sputum collection should not be done in small rooms such as toilets or other enclosed areas, but should be collected in a well-ventilated area or outside in the open, where air movement will rapidly dilute infectious droplets and UV rays from the sun will rapidly inactivate TB bacilli (WHO 2012). The concern is that other people such as patients and nurses use these enclosed areas. For example, patients frequently use bathrooms and nurses frequently use dressing rooms. Depending on the size of the droplet nuclei, the small nuclei do not fall to the ground immediately, but are suspended in the air (Wells 1934). Droplet nuclei suspended in the air might be inhaled by nurses or other patients, thereby contracting TB infection, which leads to the development of new TB cases.

Moreover, putting on surgical masks while supervising the coughing of sputum was found to be contrary to the WHO (1999) policy, which states that all personnel assisting the sputum collection must put on N95 respirator. N95 respirators filter at least 95 percent of airborne TB particles thereby reducing TB transmissions. However, putting on surgical masks does not protect the nurse from inhaling tubercle bacilli (WHO 1999).

Ineffective Measures of Improving Room Ventilation Were Implemented

The concern is that Miller-Leiden et al. (2015) found a strong association between ventilation, air movements in buildings and the transmission/spread of airborne infectious diseases such as TB. Thus, the WHO (2009) emphasizes that adequate ventilation in health care facilities is essential for preventing transmission of airborne infections and is strongly recommended for controlling the spread of TB.

The CDC (2005) specifies and quantifies the minimum ventilation requirements in hospitals, schools, offices, homes and isolation rooms in relation to spread of infectious diseases via the airborne route. According to the WHO (2009), ventilation rates lower than two air exchanges per hour are associated with higher Tuberculin Skin Test conversion amongst staff. Conversely, a higher ventilation rate is able to provide a higher dilution of airborne pathogens and consequently reduces the risk of air-borne infections.

Shenoi et al. (2010) state that mechanical ventilation delivering negative pressure and twelve air exchanges per hour is the standard of care for respiratory TB isolation. Similarly, every TB isolation room should have a minimum of 12 air exchanges per hour (CDC 2005). The current WHO (2009) recommendation for airborne precaution room is at least 12 air exchanges per hour. However, poorly maintained mechanical ventilation systems have been widely documented in resource-rich settings and implicated in several TB outbreaks (Shenoi et al. 2010).

According to the CDC (2005) simply opening windows and doors provides a median of 28 air exchanges per hour, increasing to 40 air exchanges per hour in older facilities with high ceilings and large windows. However, wind speed, window size and cross ventilation determine the number of air exchanges per hour. This means that windows that do not open to the outside, such as those found in this study, do not allow 12 air exchanges per hour. Furthermore, windows with fixed curtains such as that found in this study cannot allow 12 air exchanges per hour. Flip-type of windows such as that found in this study do not allow 12 air exchanges per hour as well. Any room with less than 12 air exchanges per hour is associated with high risk of TB transmission (WHO 2009; CDC 2005).

Ineffective Measures Regarding Use, Care and Disposal of Personal Respiratory Protective Devices Were Implemented

It is very interesting to hear that Fisher-Mackey (2010) enquired about the kind of masks to be used and the safety of re-using masks and sharing them. Fisher-Mackey (2010) asked these questions after a visit to South Africa where she was given an N95 mask, which was readily hung on the wall. The following day she was given a surgical mask, which was drawn from a drawer. She then decided that re-using masks as well as types of masks would be a future research topic.

Re-using masks seem to pose risks of TB infection transmission. Block (2001) states that live TB bacilli were found in 33.3 percent of anaesthetic masks removed from active TB patients in 1940 at a Paris hospital, which means that re-using masks poses TB transmission risk. Fifteen per cent of the masks were still positive after routine washing in water and were potential sources of the spread of TB. However, the CDC (2011) condones the re-use of respirators as long as the functional and material is not physically damaged or soiled because according to the CDC (2011), their functionality can be maintained for weeks. According to the WHO (2009), cloth surgical masks can be sterilized and re-used. The WHO (2009) emphasises that although respirators are disposable, they can be re-used repeatedly for several months if they are properly stored. Consequently, respirators should be stored in a clean dry place folded in a light towel and care taken not to crush them (WHO 2009).

The CDC (2011) therefore urges HCWs to use these efficiency filters always when they enter rooms with suspected or confirmed infectious TB, when performing high-hazard procedures on suspected or confirmed TB, and when transporting individuals with suspected or con-

firmed TB in a closed vehicle. In addition, the WHO (2009) emphasizes that a disposable surgical mask should be placed on infectious and suspect TB patients whenever they leave the isolation areas.

CONCLUSION

Rural public hospitals of Vhembe district generally implemented ineffective measures of TB control, which does not minimize the risk of acquiring TB infection.

RECOMMENDATIONS

Hospital managers should consult and enforce national and international TB control legislative framework to enhance HCWs' adoption ofeffective TB control measures known to reduce the chances of acquiring tuberculosis at congregate settings.

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