The effect of an educational intervention to improve tuberculosis infection control among nurses in Ibadan, South-West Nigeria: a quasi-experimental study

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Research article

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Abstract

Background: Nurses are particularly vulnerable to acquiring tuberculosis (TB) because they are in the frontline of patient care. There is inadequate implementation of cost-effective TB infection control (TBIC) measures at most health facilities. Training has been shown to be effective in improving the knowledge and work practices of nurses. This study sought to utilize a multi-method educational intervention to improve the TBIC-related knowledge and practices of nurses in two secondary health facilities in Ibadan, South-West Nigeria. Methods: This quasi-experimental study involved 200 nurses (100 each in the intervention and comparison groups). Baseline data was collected in May 2014. This was followed by training of the nurses in the intervention group. After 6 months, the second wave of data was collected and the nurses in the comparison group also received the training thereafter. The final wave of data collection took place 12 months after the commencement of the study. Mean scores of the nurses were determined and comparison made between both groups at different time points using independent t-test. Results: The nurses in both groups were statistically comparable in their socio-demographic characteristics and baseline mean knowledge (68.6% and 67.7%) and practice scores (79.1% and 80.6%) respectively. After the intervention group received the training, there were appreciable improvements in the post-intervention scores of the group at 6 months (knowledge-85.9%; practice-98.5%), which were significantly different from those of the comparison group (knowledge-69.5%, practice-78.8%). A large effect size was demonstrated in the improvement in knowledge score in the intervention group at 6 months compared with the other group (Cohen's d = 1.7). Similarly, there were improvements in the scores of the nurses in the comparison group at 12 months after the group had also received the training (knowledge-88.2%, practice-93.5%). At this point, the mean scores between both groups were no longer significantly different. Conclusions: The improvement in post-intervention scores implies that the educational intervention adopted for this study was effective in improving TBIC among the nurses. It also underscores the importance of continuous training/retraining of nurses and other healthcare workers in improving and sustaining TBIC at health facilities.

Background

Globally, tuberculosis (TB) is the leading cause of death due to an infectious disease[1]. It is caused by a microorganism called *Mycobacterium tuberculosis* (MTB) and commonly affects the lungs (pulmonary TB or PTB) and this accounts for about 85% of all TB cases [2]. TB can also affect other organs in the body (extrapulmonary TB): the lymph nodes, abdomen, bones and joints, pericardium, pleura, genitourinary system and meninges; and it can be generalized. PTB is the most important source of TB transmission as MTB is carried in air-borne droplets or aerosols produced when a person infected with PTB coughs, sneezes, spits, talks or sings. TB is preventable and there is affordable and effective treatment for it. In 2017, an estimated 10 million new cases of TB were recorded globally, with the African region accounting for 25% of these cases.

Nigeria is the most populous country in Africa, with a 2017 estimated population of about 182 million people [1]. It ranks sixth among the countries with the highest TB burden in the world and is included in

three World Health Organization (WHO) lists of 30 high burden countries for TB, TB/human immunodeficiency virus (TB/HIV) and multi-drug resistant TB (MDR-TB) for the period 2016-2020, with each list accounting for 85–89% of the global burden [3]. Nigeria is one of the 14 countries that are in all 3 lists. It reported 418,000 incident TB cases in 2017, with an incidence rate of 219/100,000 [1]. TB was successfully treated in 86% of all cases registered in the country in 2016; approximately 155,000 people died from it in 2017, with about 23% of these deaths (35,000) occurred in TB/HIV co-infected people. The country has an MDR-TB/RR-TB prevalence of 4.3% and 25% among new cases and previously treated cases respectively [1]. Nigeria has consistently remained in the 3 high burden lists, compared to countries that were also in the 2015 lists. Two countries (Afghanistan and Uganda) are no longer in the high burden countries while 14 countries have left the TB/HIV list. Similarly, 6 countries have exited the MDR-TB list [3].

The transmission of TB in health facilities, known as nosocomial TB transmission, poses a particular challenge for healthcare workers (HCWs) worldwide. The increased risk of nosocomial TB transmission among HCWs has been well-documented and the incidence of TB disease in HCWs is higher than in the general population [4-7]. This risk is worsened by the increased exposure of HCWs to infectious TB patients, especially when there is inadequate implementation of TB infection control (TBIC) measures [8-10]. Effective TBIC requires strict adherence to recommended control measures. Because of the diversity of the risk factors for the transmission of TB in health facilities, WHO has recommended the adoption of several TB infection control measures [11]. These include (i)managerial measures; (ii)administrative measures- which are considered the first priority even in resource-limited settings;(iii)environmental control measures; and (iv)personal protection equipment (PPE) e.g. particulate respirator. Simple, practical and cost-effective interventions can be adopted in most low- and medium-income countries (LMIC) to reduce the exposure of HCWs to infectious TB patients [12]. These measures have been successfully implemented in most high-income countries and in some resource-limited settings [13]. Poor implementation of the recommended control measures by HCWs has however been reported [14-16]. The adoption and implementation of TBIC practices by HCWs are known to be positively influenced by good knowledge regarding occupational TB exposure [17,18]. HCWs have been shown to have varying levels of knowledge and practice concerning TBIC and a good understanding of TBIC does not necessarily translate into adequate TBIC practices [19]. In addition to poor knowledge, weak managerial support, poor funding, lack of space and inadequate staffing have been identified as barriers to implementation of TBIC [20].

Surveys have been conducted in Nigeria to assess the level of implementation of TBIC practices in health facilities, with generally poor results. At the time of this study, despite the availability of national guidelines for the implementation of TBIC, the policy was still trickling down to lower levels, training was ongoing but not yet widespread, and administrative measures were yet to be put in place in most facilities providing care for TB patients [15,20,21]. Nursing staff are at high risk of acquiring TB because they are in the frontline of patient care and are frequently exposed to patients with infectious TB disease [22,23]. They also play a critical role in curbing the spread of TB in health facilities. It is therefore imperative that they should be empowered with the necessary knowledge and skills to perform this function. The role of

training in enhancing work performance of nurses cannot be overemphasized. It ensures the acquisition of new knowledge and skills that can be effectively applied to work practices. Previous studies have noted post-training improvements in nurses' knowledge and practices regarding general infection control [24-26]. A multi-method educational intervention that involves the use of video presentation, group discussion, demonstration and handouts or notes, either alone or combined, as an adjunct to the traditional method of didactic lectures has been proven to be more effective in improving knowledge and altering the professional practices of nurses [27,28].

The aim of this study was to utilize a multi-method educational intervention to improve the TBIC-related knowledge and practices of nurses in two secondary health facilities in Ibadan, Nigeria.

Methods

Study design and setting

A quasi-experimental (pre- and post-test) design, with switching replication, was used for this study. A self-administered structured questionnaire was used to determine the TBIC-related knowledge and practices of nurses in an intervention group and a comparison group. It was administered to both groups before the intervention (baseline, T0), after which the intervention group was exposed to the educational programme. The same cohorts of nurses in both groups were followed up and the questionnaire was again administered 6 months later (T1), as illustrated in Figure 1 below. After the second data collection wave, the comparison group also received the training. Then six months later, final data collection was conducted (T2).

The study was conducted in Ibadan, the capital city of Oyo State, South-West Nigeria. It is the third largest metropolitan area in Nigeria, and the largest by geographical area (3,080 km^2) with an estimated 2011 population of about 3,034,206 (density of 985/km^2) [29,30]. Oyo State has the third highest TB burden in Nigeria, with 6901 cases reported in 2017 [31].

Study population and sample

Nurses who work at two secondary health facilities in two local government areas (LGAs), Ring Road State Hospital (Ibadan South-West LGA) and Adeoyo Maternity Teaching Hospital (Ibadan North LGA) constituted the study population: 173 and 217 nurses respectively (total=390), from available administrative data at the study sites. The LGAs, which are non-contiguous, were purposively selected to avoid the effect of contamination. With an expected moderate effect size ($ES \geq 0.50 < 0.80$) in the TBIC knowledge of the nurses, a significance level of 5% and power of 80%, the study required at least 32 participants in each group [32]. However, because of the public health and health system considerations of the educational intervention, all available nurses at the study sites were encouraged to participate. One hundred (100) nurses were eventually enrolled at each site (total=200).

Educational intervention

The multi-method educational intervention, which took place over a 3-hour period, consisted of didactic lectures in the form of Microsoft PowerPoint presentations prepared from WHO and CDC materials on TBIC; a 14-minute video presentation titled, *Implementing TB Infection Control in Outpatient Settings,* produced by CDC; as well as sessions for general discussion and practical demonstration [33-35]. A session on hand hygiene was included in the training as this has been recommended by WHO for implementation in the context of general infection control [11]. To serve as reminders, handouts or notes of the lectures were provided to the nurses after the training session. Also, CDC-designed educational materials (signages, posters and stickers on TBIC workplace practices) were conspicuously displayed at the facility after the training. Adjustments in the training time was made to accommodate the nurses' work schedule in order to train as many of them as possible: 5 training sessions were held for a group of 18-25 nurses each time, including sessions that were conducted in the evening for the nurses on night shift. Generally, the educational materials covered the following topics concerning TB: cause, transmission, symptoms and signs, infectiousness, risk factors and TB infection control measures.

Study instrument

The self-administered questionnaire used for this study had sections on socio-demographic characteristics, and TBIC-related knowledge and practices of the nurses. These scales were adapted from an instrument used by Kanjee et al. [14] to study TBIC in a high drug-resistance setting in South Africa. Subject matter experts (2 consultant chest physicians and 2 senior TB nurses) examined the study instrument for face validity to ensure that the instrument items were relevant, adequate and appropriate while the content validity was improved upon by the review undertaken by the Sefako Makgatho Health Sciences University Research Ethics Committee. Some of the initial instrument items were deleted and others rephrased based on expert opinions. As shown by Cronbach's alpha of 0.6 and 0.8 for the knowledge and practice scales respectively, the scales were found to have acceptable internal consistency. Fifteen nurses, who were eventually excluded from the main study, participated in the pilot-tested of the questionnaire at one of the study sites. Their feedback on the clarity of the questions and challenges encountered in responding to them were utilized to rephrase some of the questions. The study instrument was drafted in English and because this is the official language used by the participants and the medium of instruction during their training, there was no need for translation. The knowledge final scale contained 33 items, with each having response options of "true", "false", or "I don't know". Each correct answer had a score of "1" and an incorrect answer, "0" while "I don't know" was considered an incorrect answer. The knowledge and practice scales had a maximum possible scores of 33. The TBIC practice scale had 6 items which measured self-reported frequency of adherence to various TBIC practices. It was scored using a 5-point Likert-type scale: "never" (1 point), "rarely" (2), "sometimes" (3), "often" (4), and "always" (5), giving it a maximum possible score of 30.

Data collection

Two research assistants and a supervisor were recruited and trained for the study. The nurses were informed about the study through their administrative structure. After explaining the purpose of the study to the participants, each of them that consented to take part in the study received a copy of the information leaflet, consent form and study questionnaire. After signing the consent, the self-administered questionnaire was issued out and this was collected after completion in May 2014 (wave 1). Six months after the training was conducted on the intervention group, the questionnaire was again administered on both groups in November 2014 (wave 2). After this, the comparison group received the intervention. At the end of another six months (i.e. in May 2015), the questionnaire was administered again on both groups (wave 3).

Statistical analysis

The data collected was analyzed using SPSS Statistics version 24. Descriptive statistics in the form of means and frequencies were used to show the socio-demographic characteristics. Independent *t*-test and chi-square test (χ^2) respectively were utilized for comparison of the continuous and categorical variables between the intervention and comparison groups. The knowledge and practice scores of the respondents at different time points were presented as mean percentage scores, and independent *t*-test was also utilized to demonstrate significant differences between the scores of both groups. In addition, the scores were categorized into “good” and “poor” scores using cut-off points of 80% and 100% for knowledge and practices respectively. The cut-off for good practice score was set at 100% because optimal performance of TBIC measures is essential to minimize the nurses’ risk of contracting TB. The level of statistical significance was set at $p<0.05$. The effect size (Cohen’s *d*) was calculated using the 6th month measurement to investigate the magnitude of the change in the knowledge score of the intervention group resulting from the educational programme.

Ethics considerations

The study was approved by Sefako Makgatho Health Sciences University Research Ethics Committee (MREC/H/271/2013: PG) and Oyo State Ministry of Health Research Ethical Review Committee in Nigeria (AD 13/479/557). Permission was obtained from Oyo State Hospitals Management Board and the management of Adeoyo Maternity Teaching Hospital and Ring Road State Hospital, both in Ibadan, Oyo State, Nigeria. Participation in the study was completely voluntary and measures were taken to ensure privacy and confidentiality of the participants, and informed consent was obtained from each participant. In order to ensure anonymity of the participants, their name, address and other unique identifier were not included in the questionnaire. The participating facilities and individual participant questionnaires were allocated identification numbers, to which the participants could not be linked.

Results

At baseline, completed questionnaires were collected from 100 nurses in each group (total=200). During wave 2 data collection, the number of respondents dropped to 82 and 80 respondents in the intervention

and comparison groups respectively. These declined further to 67 (intervention group) and 68 (comparison group) at wave 3.

Socio-demographic characteristics of participants

Table 1: Socio-demographic characteristics of participants

	Intervention group (n=100)	Comparison group (n=100)	Test value	df	95% CI	*p*-value
ntinuous						
ariables						
e						
Mean (SD)	43.9 (8.88)	43.6 (9.11)	t=0.28	198	-2.15, 2.87	0 .78
perience						
Mean (SD)	19.6 (9.66)	19.0 (9.81)	t=0.44	198	-2.11, 3.33	0.66
ıtegorical						
ıriables						
x, n(%)						
Female	96 (96)	98 (98)	χ^2=0.69	1		0.68*
Male	4 (4)	2 (2)				
ofessional rank, n(%)						
Nursing Officer	18 (40)	21 (42)	χ^2=1.76	4		0.78
Senior Nursing Officer	22 (40)	21 (21)				
Principal Nursing Officer	22 (22)	19 (19)				
Assistant Chief Nursing ficer	5 (5)	9 (9)				
Chief Nursing Officer	33 (60)	30 (58)				
ıarital status, n(%)						
Married	90 (90)	93 (93)	χ^2=0.58	1		0.45
Unmarried	10 (10)	7 (7)				

* Fisher's *p*-value

Table 1 shows that the nurses in both facilities were comparable as there were no statistically significant differences in their socio-demographic characteristics at baseline.

Scores of respondents at different time points

Table 2: Scores of respondents at different time points

	Intervention group	Comparison group			
Scores			t-value	95% CI	*p*-value
Baseline, T0	**n=100**	**n=100**			
Mean knowledge % (SD)	68.6 (9.83)	67.7 (10.9)	0.62	-1.99, 3.80	0.54
Mean practice % (SD)	79.1 (15.1)	80.6 (15.5)	-0.66	-5.70, 2.83	0.51
6 months, T1	**n=82**	**n=80**			
Mean knowledge % (SD)	85.9 (9.26)	69.5 (10.3)	10.7	13.4, 19.5	0.00
Mean practice % (SD)	93.5 (8.32)	78.8 (11.4)	9.39	11.6, 17.8	0.00
12 months, T2	**n=67**	**n=68**			
Mean knowledge % (SD)	84.8 (11.8)	88.2 (9.70)	-1.85	-7.10, 0.24	0.07
Mean practice % (SD)	90.7 (10.3)	93.5 (7.85)	-1.83	-6.00, 0.24	0.07

As illustrated in Table 2, the nurses in the intervention group had a higher mean knowledge score at baseline than those in the comparison group, although the scores were not statistically significantly different, $t(198) = 0.62$, $p = 0.54$. Similarly, there was no significant difference between their mean practice scores, even though this was higher in the comparison group, $t(198) = -0.66$, $p = 0.51$. After the training had been received by the intervention group, data collected at 6 months showed that there was an appreciable increase in the mean knowledge score in the intervention group while the comparison group only experienced a slight increase. The mean knowledge scores were statistically significant difference between both groups at 6 months, $t(160) = 10.7$, $p < 0.00$. Similarly, the mean practice score of nurses in the intervention group showed an improvement while there was a decline in that of the comparison group. The difference in the mean practice scores between both groups was also statistically significant at this time, $t(160) = 9.39$, $p < 0.00$. After the comparison group had also been trained, measurement taken at 12 months revealed that the mean knowledge score in the comparison group improved from the 6 months value while there was a slight drop in that of nurses in the intervention group. The difference between the mean knowledge scores of both groups at 12 months was however not statistically significant, $t(133) = -1.85$, $p = 0.07$. Likewise, the difference in the mean practice scores between both groups at this time was also not statistically different, $t(133) = -1.83$, $p = 0.07$, although the mean practice score improved in the comparison group from the 6 months value while the intervention group experienced a slight decrease.

Score categories of respondents at different time points

Table 3: Score categories of respondents at different time points

	Baseline, n (%)		6 months, n (%)		12 months, n (%)	
	Good	Poor	Good	Poor	Good	Poor
ledge						
ention group	12 (12.0)	88 (88.0)	59 (72.0)	23 (28.0)	43 (64.2)	24 (35.8)
arison group	9 (9.0)	91 (91.0)	10 (12.5)	70 (87.5)	53 (77.9)	15 (22.1)
ice						
ention group	4 (4.0)	96 (96.0)	44 (53.7)	38 (46.3)	22 (32.8)	45 (67.2)
arison group	8 (8.0)	92 (92.0)	6(7.50)	74 (92.5)	36 (52.9)	32 (47.1)

Table 3 shows that at baseline, using cut-off scores of 80% (knowledge) and 100% (practice) to categorize the scores of the nurses, only a small minority of them in both groups had good scores on both scales. At 6 months, the proportion of nurses in the intervention group (which had earlier received the training) that had good scores increased on both scales. These proportions were higher than those of nurses with good scores in the comparison group. After the training was received by the comparison group, there was an increase in the proportions of nurses in this group with good knowledge and practices scores from the 6 months values while the proportions dropped in the intervention group.

Effect size determination at 6 months

Effect size for the knowledge scores resulting from the intervention received by nurses in the intervention group compared with those in the comparison group was calculated using

Cohen's d = $Mean_1$-$Mean_2$/Pooled Standard Deviation= (85.9-69.5)/9.8= 1.7.

According to Cohen's classification, a large effect size (1.7) was produced on the knowledge score by the intervention [32].

Discussion

This quasi-experimental study was conducted to determine the effect of a multi-method educational intervention aimed at improving TBIC among nurses at two secondary health facilities in Ibadan, Oyo State, Nigeria. The nurses in both groups were comparable in their socio-demographic characteristics and their mean knowledge and practice scores at baseline. Using the cut-off points of 80% and 100% for good knowledge and practice scores respectively, the majority of nurses in both groups had poor scores on the TBIC-related knowledge and practice scales at baseline.

The poor levels of baseline TBIC knowledge and practice found in this study are consistent with reports from other studies in Nigeria, where generally, poor levels concerning TBIC have been demonstrated among HCWs [16,19,20]. This also agrees with reports from other countries such as Russia and Georgia [17,36]. On the contrary, "good" or "adequate" TBIC knowledge among HCWs were observed by previous

investigators, even though lower cut-off points were used for these studies. For instance, using a lower cut-off (70%) than that used in the present study to categorize good knowledge, Bhebhe et al. reported that 89.2% of HCWs in their study in Lesotho had “appropriate” TBIC knowledge [8]. Even the mean score of 61.5% reported by them was lower than 68.6% and 67.7% observed in the present study. Similarly, 69 % of the HCWs in the study by Buregyeya et al. were said to have adequate TBIC knowledge, based on a lower cut-off of 70% [37].

Most of the studies from LMIC are in support of the results of the current study regarding the baseline TBIC practices. Researchers have reported inadequate implementation of TBIC measures in Nigeria, South Africa, Lesotho, Ethiopia, among others [9,10,15,38]. In contrast, an overall “good” TBIC practice was reported by Temesgen and Demissie in another study in Ethiopia, using a lower cut-off point of 50%, although implementation of “specific practices” was noted to be poor [39]. It must be noted that TBIC guidelines had just been released Nigeria at the time of the study and the implementation was still in its early stages [15,21]. The finding of high proportions of nurses with poor levels of knowledge and practices at baseline in this study is therefore not unexpected.

After the training of the nurses in the intervention group, there was considerable improvement in the mean scores for knowledge and practices at 6 months, as well as in the proportions that had good scores on the two scales. The nurses in the comparison group, where the intervention had not taken place at the time, only had a slight improvement in their mean knowledge score while there was a slight drop in their mean practice score. The differences in the mean scores between nurses in the two facilities were statistically significant on the two scales at 6 month after the intervention group had received the training. These findings suggest that the educational intervention had indeed contributed to improving their knowledge and practices, considering that at baseline, their scores were not statistically significant different between both groups. A large effect size of 1.7 on the knowledge scale resulted from the training received by nurses in the intervention group measured at 6 months. This finding concurs with earlier reports by other investigators who noted improvements in knowledge and practices among nurses in Nigeria and elsewhere after an educational intervention [24-26,40,41]. After the intervention was implemented in the comparison group, there were similar improvements in the mean scores of the nurses in this group at 12 months on both knowledge and practice scores. In the intervention group, there were slight reductions in the mean scores at 12 months. The increase in the mean scores of the comparison group on both scales was enough to ensure that the scores were not statistically significantly different from those of the intervention group at 12 months. This shows that the implementation of the intervention activities in the comparison group had resulted in the group catching up with the intervention group. The post-intervention increase in the mean scores of both groups observed in the present study (6 months for the intervention group and 12 months for the comparison group) is in alignment with the findings in a study conducted by Buregyeya et al. in Uganda, where most of the HCWs had correct TBIC knowledge, beliefs and practices after national TB guidelines had been introduced and training on TBIC had taken place in the few years preceding the study [37]. Although information on the pre-training levels was not provided, the investigators reported that those that did not receive the training had poor knowledge and practices concerning TBIC.

At 12 months, the nurses in the intervention group experienced a slight decline in both mean knowledge and practice scores. This is consistent with findings from similar follow-up studies involving nurses where their scores dropped slightly in follow-up (wave 3) measurement after an appreciable improvement recorded in the immediate post-intervention measurement (wave 2) [25,26]. This however contrasts with a report by Price which showed a good retention of the positive improvement 12 months later [42]. The decline in scores at 12 months in the present study suggests a loss of knowledge and a tendency to revert to old practices with the passage of time and emphasizes the need for retraining and continuous professional education for the nurses as this is necessary to reinforce important TBIC messages and the practice of infection prevention skills [43].

The outcomes of this study show that the educational intervention, which had the added benefit of incorporating a video presentation, group discussion and demonstration methods into the traditional lecture method, was effective in improving the knowledge and practices scores of the nurses. Various researchers have demonstrated the impact of adopting these methods, when they are used either singly or in combination, rather than lectures only. In a study comparing structured group discussion lecture notes combined with lecture notes/or handout (intervention group) and lecture only (control group), Johnson et al. reported that the mean scores of the intervention group in a surgical nursing course was significantly higher than that of the control group [27]. Lee et al., in an investigation of the effect of an instructional DVD (video) on paediatric intraosseous needle insertion observed that there was improved clinical skills learning outcomes in the intervention group compared with the traditional face-to-face didactic teaching method (control group) [28]. On the contrary, students' performance outcomes remained unchanged after training with video method in an evaluation of instructional videos designed to teach clinical skills to student nurses conducted by Kelly et al [44]. They concluded that videos are “best used to complement rather than replace lecturer demonstration”, in support of a blended model, as utilized in the present study. The discussion method is thought to provide the learners with the opportunity to express and discuss their concerns and clarify concepts within the group while the video method is related to increased cognitive and procedural knowledge, and high learner satisfaction with the teaching experience [27,45].

Limitations Of The Study

The nurses in the study reported their TBIC practices using self-administered questionnaires. Direct observation of the practices could not be carried due to reasons of time and the cost of engaging several research personnel as observers. Self-reports tend to be exaggerated by respondents (social desirability bias), as previously observed in the study by Engelbrecht et al. [16].

Conclusions

This study revealed that the multi-method educational intervention was effective in improving the nurses’ post-intervention TBIC knowledge and practices. This approach, which incorporates didactic lectures, video presentation, group discussion and demonstration, as well as the use of TBIC educational

materials, is recommended for TBIC-related training and retraining for nurses and other HCWs, as part of continuous professional development. This would enhance the acquisition and retention of knowledge and skills that are necessary to minimize the risk of nurses (and HCWs in general) contracting TB and to improve TBIC in health facilities.

Abbreviations

CDC: U.S. Centers for Disease Control and Prevention; CI: confidence interval; DOTS: directly observed treatment short-course; HCW: healthcare worker; HIV: Human Immunodeficiency Virus; LGA: Local Government Area; LMIC: low- and medium-income countries; MDR-TB: multi-drug resistant tuberculosis; MTB: *Mycobacterium tuberculosis;* OR: Odds Ratio; PHC: primary health centre; PLHIV: people living with HIV; PPE: personal protective equipment; PTB: pulmonary tuberculosis; RR-TB: rifampicin-resistant tuberculosis; UVGI: ultraviolet germicidal irradiation; WHO: World Health Organization.

Declarations

Ethics approval and consent to participate

The study was approved by Sefako Makgatho Health Sciences University Research Ethics Committee (MREC/H/271/2013: PG) and Oyo State Ministry of Health Research Ethical Review Committee in Nigeria (AD 13/479/557). Permission was obtained from Oyo State Hospitals Management Board and the management of Adeoyo Maternity Teaching Hospital and Ring Road State Hospital, both in Ibadan, Oyo State, Nigeria. Participation in the study was completely voluntary and measures were taken to ensure privacy and confidentiality of the participants, and written informed consent was obtained from each participant.

Consent for publication

Not applicable.

Availability of data and material

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

No competing interests declared.

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Author's contribution

PAA conceived the study, conducted the field work, analyzed the study data and drafted both the original thesis report and the manuscript.

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References

1. World Health Organizati Global tuberculosis report. Geneva: WHO; 2018.
2. Cruz-Knight W, Blake-Gumbs L. Tuberculosis: an overview. Primary Care: Clinics in Office Practice. 2013;40(3):743-756.
3. https://www.who.int/tb/publications/global_report/high_tb_burdencountrylists2016-2020summary.pdf
4. Joshi R, Reingold AL, Menzies D, Pai M. Tuberculosis among health care workers in low- and middle-income countries: a systematic review. PLoS Med. 2006;3(12).
5. Menzies D, Joshi R, Pai Risk of tuberculosis infection and disease associated with work in health care settings. Int J Tuberc Lung Dis. 2007;11(6):593–605.
6. Malangu N, Legothoane A. Analysis of occupational Infections among health care workers in Limpopo province of South Africa. Global Journal of Health Science. 2013;5(1):44-
7. Claassens MM, van Schalkwyk C, du Toit E, Roest E, Lombard CJ, Enarson DA, Beyers N, Borgdorff MV. Tuberculosis in healthcare workers and infection control measures at primary healthcare facilities in South Africa. PLoS ONE. 2013;8(10).
8. Bhebhe LT, Van Rooyen C, Steinberg WJ. Attitudes, knowledge and practices of healthcare workers regarding occupational exposure of pulmonary tuberculosis. Afr J Prim Healthcare Fam Med. 2014;6(1).
9. Malangu N, Mngomezulu M. Evaluation of tuberculosis infection control measures implemented at primary health care facilities in Kwazulu-Natal province of South Africa. BMC Infectious Diseases.

2015;15,117.

10. Mugomeri E, Chatanga P, Lefunyane M, Ruhanya V, Nyandoro G, Chin'ombe N. Adherence to tuberculosis infection control guidelines by nurses in Lesotho. Am J Infect Control. 2015; 43(7):735-738.
11. World Health Organizati Policy on TB infection control in health care facilities, congregate settings and households. Geneva: WHO; 2009.
12. World Health Organizati WHO guidelines on tuberculosis infection prevention and control 2019 update. Geneva: WHO; 2019.
13. Jensen PA, Lambert LA, Iademarco MF, Ridzon R. Centers for Disease Control and Prevention. Guidelines for preventing the transmission of Mycobacterium tuberculosis in health care setting MMW Recomm Rep. 2005; 54,1-141.
14. Kanjee Z, Amico KR, Li F, Mbolekwa K, Moll AP, Friedland Tuberculosis infection control in a high drug-resistance setting in rural South Africa: information, motivation, and behavioural skills. Journal of Infection and Public Health. 2012;5(1),67-81.
15. Ogbonnaya LU, Chukwu JN, Uwakwe KA, Oyibo PG, Ndukwe The status of tuberculosis infection control measures in health care facilities rendering joint TB/HIV services in "German Leprosy and Tuberculosis Relief Association" supported states in Nigeria. Niger J Clinical Pract. 2011;14(3):270-5.
16. Engelbrecht M, van Rensburg AJ, Kigozi G, van Rensburg HCJ. Factors associated with good TB infection control practices among primary healthcare workers in the Free State Province, South Africa. BMC Infect Dis. 2016;16:633.
17. Woith WM, Volchenkov G, Larson Russian health care workers' knowledge of tuberculosis and infection control. Int J Tuberc Lung Dis. 2010;14(11),1489-1492.
18. Kanjee Z, Catterick K, Moll AP, Amico KR, Friedland Tuberculosis infection control in rural South Africa: survey of knowledge, attitude and practice in hospital staff. Journal of Hospital Infection. 2011;79(4),333-338.
19. Kuyinu YA, Mohammed AS, Adeyeye OO, Odugbemi BA, Goodman OO, Odusanya OO. Tuberculosis infection control measures in health care facilities offering TB services in Ikeja local government area, Lagos, South West, Nigeria. BMC Infectious Diseases. 2016;16,126.
20. Akosu TJ, Tolulope A, Agbo HA. Assessment of tuberculosis infection control measures in primary and secondary health care facilities in Enugu. IOSR Journal of Dental and Medical Sciences. 2015;14(6),72-76.
21. Federal Ministry of Health. National Tuberculosis and Leprosy Control Programme (NTBLCP). The national guidelines for TB infection control. Abuja, Nigeria: FMOH;
22. Chanda D, Gosnell D.. "The Impact of Tuberculosis on Zambia and the Zambian Nursing Workforce". Online Journal of Issues in Nursing. 2006; Vol. 11, No. 1, Manuscript 3.
23. Christopher DJ, James P, Daley P, Armstrong L, Isaac BTJ, et al. High Annual Risk of Tuberculosis Infection among Nursing Students in South India: A Cohort Study. PLoS ONE. 2011;6(10).

24. Galal YS, Labib JR, Walaa A, Abouelhamd WA. Impact of an infection-control program on nurses' knowledge and attitude in pediatric intensive care units at Cairo University hospitals. J Egypt Public Health Assoc. 2014;89(1),22-28.
25. Adly RM, Amin FM, Abd El Aziz MA. Improving nurses' compliance with standard precautions of infection control in pediatric critical care units. World Journal of Nursing Sciences. 2014; 3S:1-9.
26. Suchitra JB, Lakshmi Devi N. Impact of education on knowledge, attitudes and practices among various categories of health care workers on nosocomial infections. Indian J Med Micribiol. 2007;25(3):181-7.
27. Johnson JP, Mighten A. A comparison of teaching strategies: lecture notes combined with structured group discussion versus lecture only. J Nurs Edu. 2005; 44(7):319-322.
28. Lee JC, Boyd R, Stuart P. Randomized controlled trial of an instructional DVD for clinical skills teaching. Emerg Med Australas. 2007; 19(3):241–245.
29. Aremu FJ, Olugbire OO, Adebayo DA, Apata OV. Socio-economic characteristics of Bodija sawn wood market in Ibadan, Oyo state, Nigeria. Journal of Social Sciences and Public Policy. 2015;7(2):94-102.
30. National Bureau of Statistics. Annual Abstract of Statistics. Abuja, Nigeria: NBS; 2012.
31. Federal Ministry of Health. National Tuberculosis and Leprosy Control Programme (NTBLCP). Annual Repor Abuja, Nigeria: FMOH; 2017.
32. Cohen J. Statistical power analysis for the behavioral sciences. 2nd Hillsdale, NJ: Lawrence*Erlbaum* Associates; 1988.
33. World Health Organization. Participant's Manual for IMAI TB Infection Control Training at Health Facilities. Geneva: WHO; 2008.
34. World Health Organization (WHO), Centers for Disease Control and Prevention (CDC). Tuberculosis infection control in the era of expanding HIV care and treatment: an addendum to WHO guidelines for the prevention of tuberculosis in health care facilities in resource-limited settings. Atlanta: CDC; 2006.
35. Centers for Disease Controland Prevention. Implementing TB infection control in outpatient settings. 2012. [Online] Available from: https://www.youtube.com/watch?v=tsnGi-eLIQc. Accessed 12th December 2013.
36. Mirtskhulava V, Whitaker JA, Kipiani M, Harris DA, Tabagari N, Owen-Smith AA, Kempker RR, Blumberg HM. Determinants of tuberculosis infection control-related behaviors among healthcare workers in the country of Georgia. Infect Control Hosp Epidemiol. 2015;36(5):522–528.
37. Buregyeya E, Kasasa S, Mitchell EMH. Tuberculosis infection control knowledge and attitudes among health workers in Uganda: a cross-sectional study. BMC Infectious Diseases. 2016;16,416.
38. Tamir K, Wasie B, Azage M. Tuberculosis infection control practices and associated factors among health care workers in health centers of West Gojjam zone, Northwest Ethiopia: a cross-sectional study. BMC Health Services Research. 2016;16,359.

39. Temesgen C, Demissie M. Knowledge and practice of tuberculosis infection control among health professionals in Northwest Ethiopia; 2011. BMC Health Serv Res. 2014;14(1),593.
40. Mockiene V, Suominen T, Välimäki M, Razbadauskas A. Impact of intervention programs on nurses' knowledge, attitudes, and willingness to take care of patients with human immunodeficiency virus/acquired immunodeficiency syndrome: a descriptive review. Medicina (Kaunas). 2010;46(3),159-168.
41. Odutayo PO, Olaogun AA, Oluwatosin AO, Ogunfowokan AA. Impact of an educational program on the use of standardized nursing languages for nursing documentation among public health nurses in Nigeria. Int J Nurs Knowl. 2013;24(2):108-112.
42. Price SL. Becoming a nurse: a meta-study of early professional socialization and career choice in nursing. Journal of Advanced Nursing. 2009;65(1),11-19.
43. Bluestone J, Johnson P, Fullerton J, Carr C, Alderman J, BonTempo J. Effective in-service training design and delivery: evidence from an integrative literature review. Human Resources for Health. 2013;11,51.
44. Kelly M, Lyng C, McGrath M, Cannon G. A multi-method study to determine the effectiveness of, and student attitudes to, online instructional videos for teaching clinical nursing skills. Nurse Educ Today. 2009; 29(3):292-300.
45. Cardoso AF, Moreli L, Braga FTMM, Vasques CI, Santos CB, Carvalho EC. Effect of a video on developing skills in undergraduate nursing students for the management of totally implantable central venous access ports. Nurse Educ. Today. 2012;32(6):709–713.

Figures

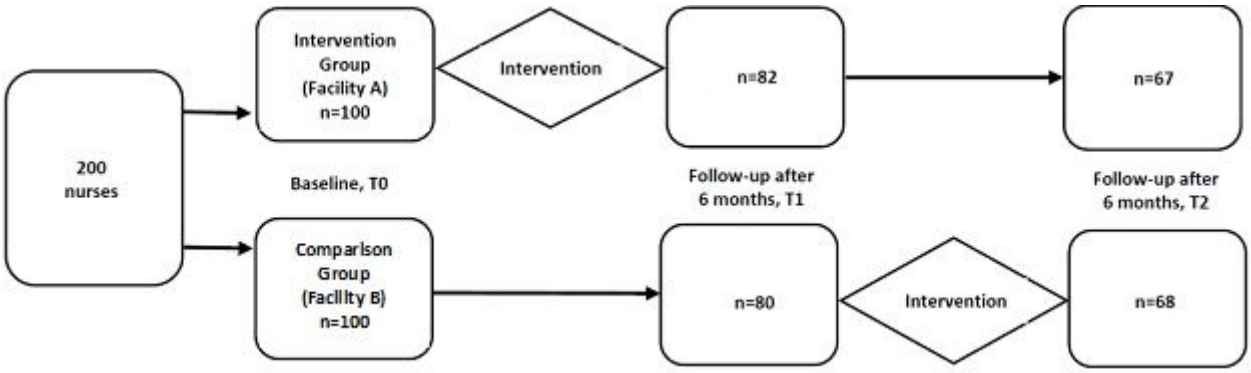

Figure 1

Flow diagram of the study

Supplementary Files

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- Appendix1StudyQuestionnaire.docx