



REVIEW ARTICLE

Educational Intervention to Limit Occupational Tuberculosis among Healthcare Workers in Kaduna State, Northwestern Nigeria

Chiroma Laminu^{1*}, Adesola Zaidat Musa² and Tubosun Alex Olowolafe³



¹Department of Public Health, Faculty of Basic Medical and Health Sciences, Lead City University Ibadan, Ibadan, Nigeria

²Monitoring and Evaluation Unit, Nigerian Institute of Medical Research, Yaba, Lagos, Nigeria

³Department of Public Health, Faculty of Basic Medical and Health Sciences, Lead City University Ibadan, Ibadan, Nigeria

*Corresponding author: Chiroma Laminu, Department of Public Health, Faculty of Basic Medical and Health Sciences, Lead City University Ibadan, Ibadan, Nigeria, Tel: +2348061345266

Abstract

Tuberculosis (TB) has been documented as one of the occupational diseases affecting general healthcare workers globally, caused by mycobacterium tuberculosis (MTB) affecting the lungs (Pulmonary TB) and other part of the body (Extra pulmonary TB). The study provides educational interventions that limit occupational transmission of tuberculosis among healthcare workers in Kaduna State, Nigeria.

Methods: A seminar method was used to provide educational training on tuberculosis infection and prevention control using WHO guidelines on tuberculosis infection prevention control (TBIC).

Result: The training interventions provided among healthcare workers on tuberculosis infection control is statistically significant.

Conclusion: Providing effective training on tuberculosis infection prevention and control is the most effective interventions to reducing nosocomial transmission of tuberculosis among healthcare workers providing tuberculosis care services. In recommendation: Training and retraining of healthcare workers on tuberculosis infection and prevention strategy using WHO guidelines should be made a priority of all government and partners in the tuberculosis program.

Keywords

Intervention, Tuberculosis and healthcare workers

Abbreviation

TBIC: Tuberculosis Infection Control; HCWs: Healthcare Workers

Background

Tuberculosis (TB) is caused by the bacillus *Mycobacterium tuberculosis* (MTB) and remains a major problem threatening public health worldwide [1]. The disease was initially discovered as the disease of poverty, but with the emergence of other immune-compromised diseases like Human Immunodeficiency Virus (HIV), Covid-19 and diabetes, the risk of developing the disease is currently beyond poverty as a risk determinant [2]. The disease is on the increase of transmission among healthcare workers more especially these with poor knowledge of nosocomial transmission of tuberculosis in healthcare setting [3]. Tuberculosis has been confirmed as an occupational disease since the 1950s, making healthcare workers 7.5-60 times more vulnerable to developing the disease than the general population [4]. Healthcare professionals providing services in overcrowded environment such as correctional centers are also identified as more vulnerable to developing occupational tuberculosis than the general population. The disease is more common among nations with low economic status and poor provision and implementation of tuberculosis infection prevention and control (TBIC). The World Health Organization has developed guidelines on the control and prevention of tuberculosis in healthcare settings which include the administrative control, environmental control, managerial control and

personnel protective control, but the knowledge on the implementation of this guideline remains poor among healthcare workers more especially in developing world like Nigeria [5]. Poor documentation of active tuberculosis among healthcare workers in Nigeria is a documented reason increasing the transmission of occupational tuberculosis among these cohorts in the Country [6]. The impact of educational intervention to limiting nosocomial transmission of tuberculosis has indicated the promotion on the implementation of infection control among healthcare workers [7]. Training of healthcare workers on WHO guideline is the most effective interventions to reduce the burden of tuberculosis among healthcare workers [8]. Prevention of occupational tuberculosis among healthcare workers should be a priority of all governments' agencies, partners and individuals including healthcare workers for effective provision of healthcare delivery [9]. TB is a preventable and curable infectious disease provided all measures are put in place to adhere to the three pillars and ten components of the WHO End-TB strategy. The study aimed at providing the intervention that limit occupational transmission of tuberculosis among healthcare workers in Kaduna State.

Methodology

Design

Educational training using seminar method was used to provide training on tuberculosis infection and prevention control using WHO guidelines on tuberculosis infection prevention control (TBIC) as an intervention to limit occupational tuberculosis among healthcare workers in Kaduna State, Nigeria.

Study area

Kaduna State is located at the north-western geopolitical zone in Nigeria, with a total coverage area of 46,053 square kilometers. The state has a projected population of 8,397,541 across the 23 LGA in 2017 with an increased to 3.0% of 6,113,503 of 2006 National projection (NBS, 2017). Agricultural activities are the major source of income in the state.

Study settings

The training was conducted in General Hospital Rigasa for Zone A, General Hospital Gambo Sawaba for Zone B and Primary Healthcare Center Kauru for Zone C respectively.

Participants

The participants of the study include all healthcare workers providing tuberculosis care services through DOTs which includes medical doctors, nurses, community health workers, health record officer, environmental health etc.

Study variable

The pre-test assessed the participants level of knowledge on WHO guideline on tuberculosis infection prevention and control before the training intervention while the post-test assessed the participants level of knowledge on WHO guideline on tuberculosis infection prevention and control after the training intervention.

Data source

Data was collected using a pre- and post-test on the general knowledge of WHO guidelines on tuberculosis infection prevention and control (Table 1).

Study size

The study was conducted among 252 healthcare workers invited for training on WHO guidelines on tuberculosis infection prevention and control, as interventions to limit nosocomial transmission of tuberculosis among healthcare workers in Kaduna State, Nigeria.

Sampling procedure

A multistage convenient sampling procedure was used to select the study participants. At the first stage, all Local Government Area (LGAs) providing TB care services through directly observed treatment short course (DOTs) were selected. The second stage stratified the local government according to the three geo political zones. The third stage selected 2 LGAs from each of the geological zones considering urban and rural characteristics, and 252 healthcare workers were invited for the training intervention across all the selected LGAs using a convenient sampling procedure due to insecurity.

Statistical methods

All data collected was validated through data triangulations method and analyzed using Statistical Package for Social Sciences (SPSS version 23.0) Software. All information was presented in tables.

Ethical issues

Ethical clearance was obtained from Lead City University research ethical committee, Kaduna State Ministry of Health Research Ethics Committee and Health Research Ethics Committee of the National Tuberculosis and Leprosy Training Center (HREC, NTBLTC). All data collected was managed under high level of confidentiality and strictly used for the purpose of this study.

Test of Hypotheses

Hypothesis 1

H_01 : There is no significant difference between the pre- and post-test

Result

Demographical characteristics of the respondents

A total of 252 participants were trained (52.6%) were males, (53.8%) are between the ages of 25-34 with mean age of 31.51 ± 8.24 . Among these health workers (67.7%) are married, (48.6%) had NCE/OND degrees, (41.1%) had higher degree and only (9.5%) has secondary school certificate and below. More than 50% of the respondents were either laboratory personnel (28.7%) or community healthcare workers (26.8%). The result of this analysis also shows that majority of the respondents (26.8%) while only (6.5%) were doctors respectively. About 36.6% of the respondents were from the general outpatient's department, while (14.2%) where from the DOTS centre.

Educational intervention to limit occupational transmission of tuberculosis among healthcare workers providing TB care services (pre-test and post-test)

Of the 252 total respondents 204(81.6%) answered correctly at the pre-test that TB is an infectious disease that can be transmitted through the droplet while 48(18.4%) answer incorrectly, On the same question 221(87.6%) of the respondents answered correctly at the post-test that TB is an infectious disease that can be transmitted through the droplet while 31(12.4%) answer incorrectly, this implies that the proportions of the respondents 221(87.6%) that answered correctly at the post-test is higher than the proportion of the respondents 204(81.6%) that answered correctly at the pre-test, this means that the training has increased the level of knowledge among the respondents that TB can be transmit via the droplet. It's also observed that 177(72.6%) of the respondents answered correctly at the pre-test on the types of tuberculosis while 75(27.4%) answered incorrectly, on the same questions 198(76.3%) of the respondents answered correctly at the post-test on the types of TB while 54(23.8%) answered incorrectly, this implies that the proportions of the respondents 198(76.3%) that answered correctly at the post-test is higher than the proportion of the respondents 177(72.6%) that answered correctly at the pre-test, this means that the training has increased the level of knowledge among the respondents on the types of tuberculosis infection. It's also observed that 84(73.6%) of the respondents answered correctly at the pre-test that the common risks factors to developing TB are associated with poverty, alcoholism and HIV while 68(26.4%) answered incorrectly, on the same questions 203(80.4%) answered correctly at post-test that the common risks factors to developing TB are associated with to poverty, alcoholism and HIV while 49(19.6%) answered incorrectly, this implies that the proportions of the respondents that answered correctly at the post-test 203(80.4%) is higher than the proportion of the respondents that answered correctly at the pre-test 84(73.6%), this means that the training has added value to the respondents. Its also showed from the analysis of

this result that 84(33.1%) of the respondents answered correctly at the pre-test that the Goal for TB control in Nigeria is to reduce TB burden to 85% by 2030 while 168(66.9%) answered incorrectly, on the same questions 105(41.2%) of the respondents answered correctly at the post-test that the Goal for TB control in Nigeria is to reduce TB burden to 85% by 2030 while 147(58.8%) answered incorrectly, this implies that the proportion of the respondents that answered correctly at the post-test 105(41.2%) is higher than the proportion of the respondents that answered correctly at the pre-test 84(33.1%), this means that the training has increased the respondents knowledge on the Goals of tuberculosis control in Nigeria. It's also observed that 98(38.4) of the respondents answered correctly at the pre-test that the target for TB control in Nigeria is to reduced death rate due to TB to 99% by 2050 while 154(61.6%) answered incorrectly, on the same questions 180(71.0%) of the respondents answered correctly at the post-test that that the target for TB control in Nigeria is to reduced death rate due to TB to 99% by 2050 while 72(29.0%) answered incorrectly, this implies that the proportions of the respondents that answered correctly at the post-test 180(71.0%) is higher than the proportions of the respondents that answered correctly at the pre-test 98(38.4), this is means that the training has increased the level of knowledge of the respondents on the targets of TB control in Nigeria.

Its also observed that 174(69.9%) of the respondents answered correctly at the pre-test that Nosocomial transmission of TB is the transmission of TB from patients to healthcare workers at the health facility while 78(30.1%) answered incorrectly, on the same questions, 201(79.5%) of the respondents answered correctly at the post-test that Nosocomial transmission of TB is the transmission of TB from patients to healthcare workers at the health facility while 51(20.5%) answered incorrectly, this implies that the proportions of the respondents 201(79.5%) that answered correctly at the post-test is higher than the proportions of the respondents 174(69.9%) that answered correctly at the pre-test, this means that the training has increased the level of knowledge among the respondent that nosocomial transmission of TB is the transmission of TB from patients to health care workers in health facilities. It's also observed that 174(69.9%) of the respondents answered correctly at the pre-test that Effective training on TBIC is the best way to intervein nosocomial transmission of TB while 78(30.1%) answered incorrectly, on the same questions 192(79.9) of the respondents answered correctly at the post-test that Effective training on TBIC is the best way to intervein nosocomial transmission of TB while 60(20.1%) answered incorrectly, this implies that the proportions of the respondents 192(79.9) that answered correctly at the post-test is higher than the proportions of the respondents 174(69.9%) that answered correctly at the

pre-test, this means that the training has added value to the respondents that effective training on TBIC is the best way to intervene the transmission of TB among HCWs.

It showed from the analysis of this study that 172(68.7%) of the respondents answered correctly at the pre-test that the WHO guideline on TBIC include administrative, environmental and personal protective equipment while 80(31.3%) answered incorrectly, on the same questions 202(79.9%) of the respondents answered correctly at the post-test that The WHO guideline on TBIC include administrative, environmental and personal protective equipment while 50(20.1%) answered incorrectly. This implies that the proportions of the respondents 202(79.9%) that answered correctly at the post-test is higher than the proportions of the respondents 172(68.7%) that answered correctly at the pre-test, this means that the training has increased the level of knowledge of the respondents that WHO TBIC includes the administrative control, environmental control and the personal protective control measures. It's observed that 165(66.5%) of the respondents answered correctly at the pre-test that TBIC in healthcare settings is recommended according to the department/units such as GOPD, DOTs, Pharmacy etc. while 87(33.5%) answered incorrectly, on the same questions 194(77.6%)

of the respondents answered correctly at the post-test that TBIC in healthcare settings is recommended according to the department/units such as GOPD, DOTs, Pharmacy etc. while 56(22.4%) answered incorrectly, this implies that the proportions of the respondents 194(77.6%) that answered correctly at the post-test is higher than the proportions of the respondents 165(66.5%) that answered correctly at the pre-test, this means that the training has added value to the respondent that TBIC is recommended according to the units and departments. It showed from the analysis of this study that 135(54.0%) of the respondents answered correctly at the pre-test that TB diagnosis and treatment of TB disease was made available and free of charge in Nigeria, while 117(46.0%) answered incorrectly, on the same questions 164(64.7%) of the respondents answered correctly at the post-test that TB diagnosis and treatment was made available and free of charge in Nigeria, while 88(35.3%) answered incorrectly respectively, this implies that the proportions of the respondent that answered correctly at the post-test 164(64.7%) is higher than the proportions of the respondents 117(46.0%) that answered correctly at the pre-test, this means that the training has increased the knowledge of the respondents that the diagnosis and treatment of tuberculosis was made available in Nigeria (Table 1).

Table 1: Knowledge of TB Infection Control (Pre and Post Test Scores).

Questions	Pre-test Frequency (%)	Post- test Frequency (%)	P-Value
TB is an infectious disease that can be transmitted through the droplet	Correct 204(81.6) Incorrect 48(18.4)	Correct 221(87.6) Incorrect 31(12.4)	< 0.0001
The following are types of tuberculosis	Correct 177(72.6%) Incorrect 75(27.4%)	Correct 198(76.3%) Incorrect 54(23.8%)	< 0.001
The common risks factors to developing TB are associated with to poverty, alcoholism and HIV	Correct 184(73.6%) Incorrect 68(26.4%)	Correct 203(80.4%) Incorrect 49(19.6%)	0.512
The Goal for TB control in Nigeria is to reduce TB burden to 85% by 2030	correct 84(33.1%) Incorrect 168(66.9%)	Correct 105(41.2%) Incorrect 147(58.8%)	0.173
The target for TB control in Nigeria is to reduced death rate due to TB to 99% by 2050	Correct 98(38.4) Incorrect 154(61.6%)	Correct 180(71.0%) Incorrect 72(29.0%)	< 0.001
Nosocomial transmission of TB is the transmission of TB from patients to healthcare workers at the health facility	Correct 174(69.9%) Incorrect 78(30.1%)	Correct 201(79.5%) Incorrect 51(20.5%)	0.01
Effective training on TBIC is the best way to intervein nosocomial transmission of TB	Correct 174(69.9%) Incorrect 78(30.1%)	Correct 192(79.9) Incorrect 60(20.1%)	0.049
The WHO guideline on TBIC include includes administrative, environmental and personal protective equipment	Correct 172(68.7%) Incorrect 80(31.3%)	Correct 202(79.9%) Incorrect 50(20.1%)	0.001
TBIC in healthcare settings is recommended according to the department/units such as GOPD, DOTs, PHARMACY etc	Correct 165(66.5%) Incorrect 87(33.5%)	Correct 194(77.6%) Incorrect 56(22.4%)	0.002
TB diagnosis and treatment was made available and free of charge because the disease is not preventable but curable	Correct 135(54.0%) Incorrect 117(46.0%)	Correct 164(64.7%) Incorrect 88(35.3%)	0.005

Decision rule

If the P value is greater than the critical value (0.05) we fail to accept the null hypothesis, hence otherwise. Since the majority of the p value satisfies otherwise (i.e. less than 0.005), then the decision rule is to reject null hypothesis (H_0) which states that *there is significant difference between the pre and post-test*.

Discussion

This finding is in line with a study that reported that effect of an educational intervention to improve tuberculosis infection control among nurses in Ibadan, south-west Nigeria [10]. Another study also documented that training of clinicians is the bases to reducing occupational tuberculosis [11]. Similarly, another study has reported that educational intervention is the key to limiting occupational diseases among healthcare workers [12].

Limitations of the Study

This study has limitation. The findings cannot be generalized to the entire healthcare settings in the country. However, the study provided an in-depth information on the intervention to limit the transmission of occupational tuberculosis among healthcare workers in the study area.

Interpretation

The result of the training interventions provided on WHO guideline on tuberculosis infectious control shows that the interventions is statistically significant comparing pre and post training overall scores.

Conclusion

Providing effective training on tuberculosis infection prevention and control is the most effective interventions to reducing occupational transmission of tuberculosis among healthcare workers providing tuberculosis care services.

Recommendation

Training and retraining of healthcare workers on tuberculosis infection and prevention strategy using WHO guidelines should be make priority of all government and partners in the tuberculosis program.

What is known about this topic

- The significance of educational intervention on tuberculosis infection prevention control in healthcare settings has been documented in many scientific studies.
- The effect of educational intervention on tuberculosis infection control was documented among nurses in Ibadan, Oyo State, Nigeria.

What this study adds

- The educational intervention on WHO guideline

on tuberculosis infection control provided by this study is statistically significant

Competing Interests

The authors declared no competing interests.

Authors Contribution

Conception and study design: CL and ZAM. Data collection: CL, ZAM and TAO. Data analysis and interpretation: CL, ZAM and TAO. Manuscript drafting: CL. Manuscript revision: ZAM and TAO. Guarantor of the study: CL. All the authors have read and agreed to the final manuscript.

Acknowledgments

We acknowledge the nurses, doctors, health record officers, community health and all allied health professionals in Kaduna state, Nigeria for their cooperation in data collection. We also thank staff of the Research and Ethics Committee of Kaduna State Ministry of Health, Nigeria and National Tuberculosis and Leprosy Training Center Zaria, Kaduna State Nigeria for assisting to secure the ethical approval to conduct the study.

References

1. da Silva EH, Lima E, dos Santos TR, Padoveze MC (2022) Prevalence and incidence of tuberculosis in health workers: A systematic review of the literature. *Am J Infect Control* 50: 820-827.
2. MacNeil A, Glaziou P, Sismanidis C, Date A, Maloney S, et al. (2020) Global Epidemiology of tuberculosis and progress toward meeting global targets- Worldwide, 2018. *MMWR Morb Mortal Wkly Rep* 69: 281-285.
3. Paleckyte A, Dissanayake O, Mpagama S, Lipman MC, McHugh TD (2021) Reducing the risk of tuberculosis transmission for HCWs in high incidence settings. *Antimicrob Resist Infect Control* 10: 106.
4. Okpokoro E, Lesosky M, Osa-Afiana C, Bada F, Okwor U, et al. (2023) Prevalence and risk factors for mycobacterium tuberculosis infection among health workers in HIV treatment centers in North Central, Nigeria. *Am J Trop Med Hyg* 109: 60-68.
5. Baussano I, Nunn P, Williams B, Pivetta E, Bugiani M, et al. (2011) Tuberculosis among health care workers. *Emerg Infect Dis* 17: 488-494.
6. Islam MS, Chughtai AA, Banu S, Seale H (2021) Context matters: Examining the factors impacting the implementation of tuberculosis infection prevention and control guidelines in health settings in seven high tuberculosis burden countries. *J Infect Public Health* 14: 588-597.
7. Agaya J, Nnadi CD, Odhiambo J, Obonyo C, Obiero V, et al. (2015) Tuberculosis and latent tuberculosis infection among healthcare workers in Kisumu, Kenya. *Trop Med Int Health* 20: 1797-1804.
8. Zhou F, Zhang L, Gao L, Hao Y, Zhao X, et al. (2014) Latent tuberculosis infection and occupational protection among health care workers in two types of public hospitals in China. *PLoS One* 9: e104673.
9. Williams M, Ndlebe L, Ten HBW, Venter D (2020)

- Employees' knowledge and practices on occupational exposure to tuberculosis at specialised tuberculosis hospitals in South Africa. *Curationis* 43: 1-8.
10. Akande PA (2020) The effect of an educational intervention to improve tuberculosis infection control among nurses in Ibadan, south-west Nigeria: A quasi-experimental study. *BMC Nurs* 19: 81.
 11. Murgia N, Gambelunghe A (2022) Occupational COPD- The most under-recognized occupational lung disease? *Respirology* 27: 399-410.
 12. Abdollahi T, PedramRazi S, Pahlevan D, Yekaninejad MS, Amaniyan S, et al. (2020) Effect of an ergonomics educational program on musculoskeletal disorders in nursing staff working in the operating room: A quasi-randomized controlled clinical trial. *Int J Environ Res Public Health* 17: 7333.