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Meta-Analysis
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Effect of Tuberculosis Infection Control Training on Work Performance among Health Staff in Health Facilities: Meta-Analysis

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ABSTRACT

Background: Tuberculosis is a public health problem both in Indonesia and internationally. Tuberculosis is an infectious disease that can affect anyone and is one of the 10 leading causes of death worldwide. TB ranks second with the highest cases in Indonesia after India. Tuberculosis Infection Control (TBIC) is a form of TB prevention which is the core of safe and high-quality health services. TBIC is often neglected in patient management practice. This study aims to analyze and estimate the effect of tuberculosis infection control training on improving the performance of staff in health facilities.

Subjects and Method: The meta-analysis was carried out using the PICO format including: (1) Population: Health personil; (2) Intervention: TBIC Training; (3) Comparison: No TBIC training; and (4) Outcome: Performance. Article searches were carried out using several databases such as Google Scholar, PubMed, and Elsevier. Search for articles from 20 October 2022 to 21 January 2023. Keywords used: "Tuberculosis infection control training" OR "Performance" AND "Health personel" AND "Health facility" AND "Multivariate" AND "Cross-sectional". The inclusion criteria for the included articles were full text articles, relationship measures using multivariate analysis (aOR), English articles with a cross-sectional design, and article publications in 2012-2022. Articles are collected using PRISMA flow diagram guidelines. Data were analyzed using the Review Manager 5.3 application.

Results: A total of 13 cross-sectional studies, from the continents of Asia and Africa. Nine articles from East Africa (Ethiopia), 2 articles from West Africa (Nigeria), 1 article from Central Africa (Cameroon), and 1 article from South Asia (Nepal). The results showed that health personil who received TBIC training had a 2.35 times better chance of performance compared to health personil without training, and this result was statistically significant (aOR= 2.35; 95% CI= 1.96 to 2.81; p <0.001).

Conclusion: Tuberculosis infection control training can improve the performance of workers in health facilities.

Keywords: Health personil, tuberculosis infection control training, and health facilities

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BACKGROUND

Tuberculosis is an infectious disease that is a major cause of ill health and one of the leading causes of death worldwide. Tuberculosis is an infectious disease caused by the Mycobacterium tuberculosis germ which spreads when those with TB expel the bacteria into the air (for example through coughing). WHO notes that 44% of the world's tuberculosis cases are in India, Indonesia, China, the Philippines, Pakistan, Nigeria, Bangladesh and the Democratic Republic of the Congo. The ratio of TB reporting rates among health personel to TB reporting rates in the general adult population reflects the effectiveness of TB infection control in health facilities. The ratio supposed to be treated in 2018-2021 of the target of 30 million is around 1, but in 2021 it is greater than 1 in 14 countries reporting five or more TB cases among health personel. (WHO, Global Tuberculosis Report., 2022).

Indonesia has a high incidence of TB, low coverage of treatment and almost one-quarter of the population are children, the highest incidence of cases is in adolescents and adults aged (15-34 years), in young children (0-4 years) (WHO , 2022), older children (5-14 years). Indonesia reports that 9% of the 432,577 reported TB cases are children. The burden of TB in children is less than 5% in some provinces, and as high as 22% in Kabupaten Mimika Papua (WHO, 2022).

The prevalence and incidence of latent tuberculosis infection in health personel greatly influences the performance of officers in improving the quality of services (Whitaker et al., 2013). Implementation of TB infection control (TBIC) practices in several health facilities is still poor. The prevalence of TB in health personel is higher than the general population (Wang et al., 2018). General staff who have not received training have low knowledge compared to TB workers who are already trained. Target groups that can increase TBIC in health facilities are doctors, nurses, receptionists, and ward staff and other health personil who have received training (Phyu et al., 2020). The gap in knowledge and understanding of health personel is the cause of substandard patient care. 70% of subjects reported having never attended special TB training, of the 90% of subjects who were successful in the survey (Noe et al., 2017)

The level of knowledge about TB infection control among health personel was almost half (45.8%) poor, and much worse among administration and lower staff. Knowledge significantly with education and training status (accepted TB orientation), 73.2% of health personel have a positive attitude towards TB infection control. Effective infection control measures including regular skills-based training or orientation for all categories of health personel can improve infection control practices in health facilities. (Sharestha et al., 2015).

Prevention and control of tuberculosis infection in health personel is a top priority with the existence of government policies to protect health personel from TB and other workplace conditions. Health personel are a resource at high risk of exposure to TB in the workplace, the study results found that there were 2,677 cases of TB diagnosed among health personel from 2002 to 2012 in 1 decade and an estimated 1,280 cases. The overall TB incidence rate in hospital during the study period was 1,496.32 per 100,000 population compared to the general population incidence rate of 719.37 per 100,000 population, from this case incidence it is necessary to increase infection, prevention and control measures in all health care settings with a high burden of TB (O'hara et al., 2017).

Control of TB infection through 4 pillars, namely: managerial control, administrative control, environmental control, and personal protective equipment (PPE) is considered to have not been implemented properly. A description of the inhibiting factors for TB infection control includes: Weak managerial support, poor funding, structural insufficiency, labor shortages, stigmatization and poor patient compliance (Kuyinu et al., 2016). According to Vigenschow et al. (2021). states that health personel are required to have training and national TBIC guidelines to improve performance in carrying out tuberculosis infection control measures in health facilities. The implementation of TBIC in public health services is still low. As a consequence, health personel are not sufficiently protected and are at risk of being infected with mycobacterium tuberculosis. Tuberculosis infection control through: (1) Managerial control in performance measurement, performance standards and action plans to take corrective action when needed does not exist, as well as the TBIC budget. (2) Administrative control for the implementation of TBIC measures in the form of systematic triage of cough patients is not implemented as recommended by WHO. (3) Environmental controls in each facility do not yet have adequate ventilation for open air, especially in the consulting room. (4) Personal protective equipment in the form of N95 masks are sometimes available but not used or limited, lack of awareness of the importance of PPE, and a budget must be allocated for the provision of respirators so that health personel can protect themselves from airborne infectious diseases. Control of tuberculosis infection is often neglected in handling practices, poor implementation and lack of knowledge of TBIC-related officers will affect optimal TB prevention practices (Akande., 2014).

Based on the existing literature review, a summary of statistics is needed to study, analyze and estimate the magnitude of the effect of training on tuberculosis infection control in health care workers.

SUBJECTS AND METHOD

1. Study Design

Meta-analysis was carried out using the PRISMA flowchart using Google Scholar, PubMed, and Elsevier databases published from 2012 to 2022. The keywords used were “Tuberculosis infection control training” OR ”Performance” AND “Health personel” AND “health facility” AND”Multivariate“ AND ”Cross-Sectional”. There were 13 studies with a cross-sectional study design that met the inclusion criteria. Analysis using RevMan 5.3 software.

2. Steps of Meta-Analysis

Meta-analysis analysis was carried out through 5 steps as follows:

1) Formulate study questions using the PICO model. P = health worker; I = TBIC training; C= No TBIC training; O = Officer performance.
2) Search for primary study study articles from 3 online databases namely Google Scholar, PubMed, and Elsevier.
3) Conduct screening and quality assessment of primary study articles.
4) Extract and analyze data into RevMan 5.3 software.
5) Interpret the results and draw conclusionsan.

3. Inclusion Criteria

English-language study article, full-text, relationship size using adjusted odds ratio (aOR) with a cross-sectional study design that analyzes the effect of tuberculosis infection control training on the performance of workers in health facilities and Outcomes in the form of performance.

4. Exclusion Criteria

Article publication before 2012 and after 2022. Relationship analysis uses bivariate analysis.

5. Operational Definition

Performance: is a condition that an officer wants to achieve through various efforts to achieve it .

TB infection control training (TBIC) : is the provision of material in the form of knowledge and skills regarding TB prevention and control practices or measures.

6. Istrument

The quality assessment of the main articles in this study used the reference critical appraisal, a critical appraisal checklist for cross-sectional studies published by the Joanna Briggs Institute (JBI). It consists of 8 questions with the categories "Yes" = 2, "Unclear" = 1, and "No" = 0.

7. Data Analysis

Articles in this study were collected using PRISMA flow diagrams and analyzed using the Review Manager 5.3 application (RevMan 5.3) by calculating the effect size and heterogeneity (I^2) to determine the combined study model and form the final results of the meta-analysis results . A data analysis is presented in the form forest plots and funnel plots.

RESULTS

The process of searching for articles is carried out through several journal databases which include Google Scholar, PubMed, and Elsevier. The article review process can be seen in the PRISMA flow diagram in Figure 1. The study related to the effect of tuberculosis infection control training on the performance of staff in health facilities consisted of 13 articles that were considered appropriate. The initial search process yielded 587, after the article deletion process, 142 articles were obtained, of which 115 met the requirements for further full-text review, 13 articles that met the quality assessment were processed in the quantitative synthesis meta-analysis. The results of the search for articles can be seen in Figure 2. that study articles come from 2 continents, namely Africa and Asia. East Africa (Ethiopia 9 articles), 2 articles from West Africa (Nigeria), 1 article from Central Africa (Cameroon), and 1 article from South Asia (Nepal).

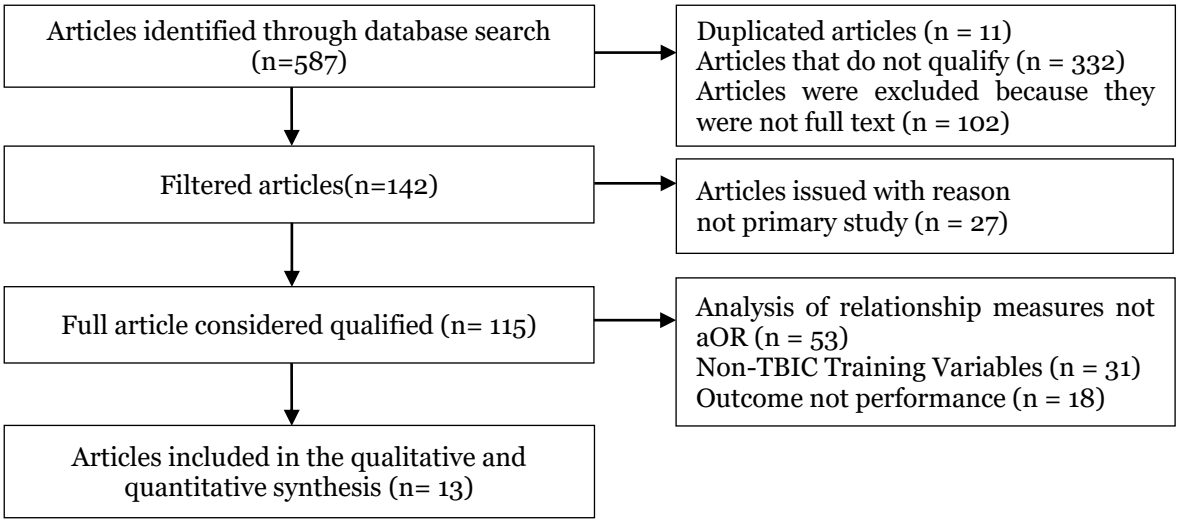

Figure 1. PRISMA Flow diagram

Figure 2. Map of the study area on the effect of control training tuberculosis infection on the performance of workers in health facilities

Table 1. Critical appraisal checklist for cross-sectional studies in meta- analysis

Article	Checklist Questions								Total
	1	2	3	4	5	6	7	8	
Alene et al. (2019)	2	2	2	2	2	2	2	2	16
Ajayi and Isiyaku (2019)	2	2	2	2	2	2	1	2	15
Baral et al. (2022)	2	2	2	2	2	2	2	2	16
Carol et al. (2021)	2	1	2	2	2	2	2	2	15
Gizaw et al. (2015)	2	2	2	2	2	2	2	2	16
Kebede dan Sisay (2022)	2	2	2	2	2	2	2	2	16
Lebena et al. (2021)	2	2	2	2	2	2	1	2	15
Tadesse et al. (2020)	2	2	2	2	2	2	2	2	16
Tamiru (2015)	2	2	2	2	2	2	2	2	16
Vukugah et al (2022)	2	2	2	2	2	2	2	2	16
Tamir et al. (2016)	2	2	2	2	2	2	2	2	16
Temesgen dan Demissie (2014)	2	2	2	2	2	1	2	2	15

Description of the answer score:

2= Yes

1= Unclear

0= No

Question criteria descriptions:

1) Were the criteria for inclusion in the sample clearly defined?
2) Were the study subjects and settings described in detail?
3) Is exposure measured in a valid and reliable way ?
4) What are the standard criteria used for objective condition measurement?
5) Were confounding factors identified?
6) Was a strategy for dealing with confounding factors stated?
7) Are the results measured in a valid and reliable way ?
8) Has proper statistical analysis been used?

Table 2. PICO table summary of cross-sectional articles from primary study sources with sample size (n = 4.109)

Author (year)	Country	Sample	P	I	C	O
Alene et al. (2019)	Ethiopia	337	Health personel (doctors, nurses, laboratories, and other health personel)	Had TBIC Training	No Training TBIC	Performance
Ajayi (2019)	Nigeria	78	Health worker (Nurse)	Had TBIC training	No TBIC Training	Performance
Baral et al. (2022)	Nepal	156	Health worker (Nurse)	Had TBIC training	No Training TBIC	Performance
Carol et al. (2021)	Nigeria	74	Health personel (doctors, nurses, laboratories and medical record officers).	Had TBIC training	No Training TBIC	Performance
Gizaw et al. (2015)	Ethiopia	582	Health personel (doctors, nurses, lab/pharmacy, health personel and others)	Had TBIC Training	No Training TBIC	Performance
Kebede and Sisay (2022)	Ethiopia	384	Health personel (doctors, nurses, pharmacies, laboratories, radiology, midwives, health personel, janitors and others)	Had TBIC Training	No Training TBIC	Performance
Lebena et al. (2021)	Southern Ethiopia	478	Health personel (doctors, nurses, laboratories, midwives, pharmacists, health personel, and others)	Had TB training	No Training TB	Performance
Tamir et al. (2016)	Northwest Ethiopia	631	Health personel (health personel, laboratory technicians, midwives, nurses, pharmacists)	Had TBIC Training	No Training TBIC	Performance
Tedesse et al. (2020)	Southern Ethiopia	411	Health personel (doctors , x-Ray nurses, pharmacists, and laboratories)	Had TBIC training	No TBIC Training	Performance
Temesgen and Demissie (2014)	Amhara, Northwest Ethiopia	313	Health personel (doctors, nurses, laboratories, pharmacies and others)	Had TBIC Training	No Training TBIC	Performance
Tamiru (2015)	Ethiopia	125	Health worker (Laboratory technician)	Had TBIC training	No Training TBIC	Performance
Vukuga et al. (2022)	Cameroon	342	Health personel (pediatricians, general practitioners, nurses, laboratories and others)	Had TBIC training	No Training TBIC	Performance
Wondimu et al. (2021)	Ethiopia	198	Health personel (doctors/health personel, nurses/midwives, pharmacists and others)	Had TBIC Training	No Training TBIC	Performance

Table 3. Data on the adjusted odds ratio (aOR) for the effect of TBIC training on the performance of staff in health facilities

Authors	aOR	CI 95%	
		Upper limit	Lower limit
Alene et al. (2019)			
Ajayi and Isiyaku (2019)	13.80	2.10	32.36
Baral et al. (2022)	1.57	0.67	3.68

Authors	aOR	CI 95%	
		Upper limit	Lower limit
Carol et al. (2021)			
Gizaw et al. (2015)	.	.	.
Kebede and Sisay (2022)	2.96	1.32	6.62
Lebena et al. (2021)			
Tadesse et al. (2020)	.	.	.
Tamir et al. (2016)	1.30	0.83	2.04
Temesgen dan Demissie (2014)	3.39	1.38	8.33
Tamiru (2015)	0.94	0.43	2.05
Vukugah et al. (2022)	1.18	0.71	1.96
Wondimu et al. (2021)			

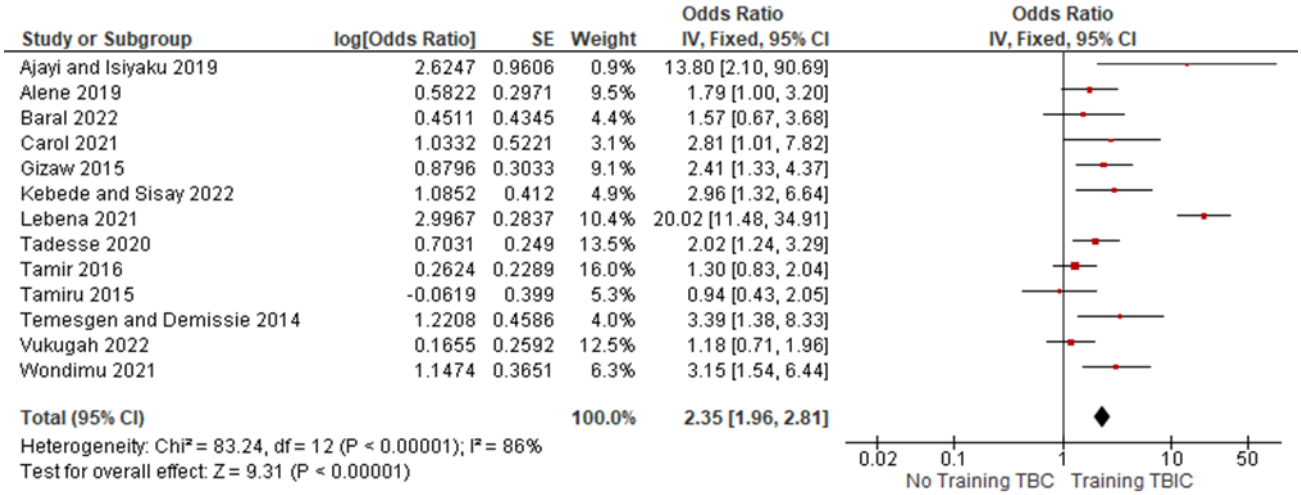

Figure 3. Forest plot of the effect of tuberculosis infection control training on the performance of officers in health facilities

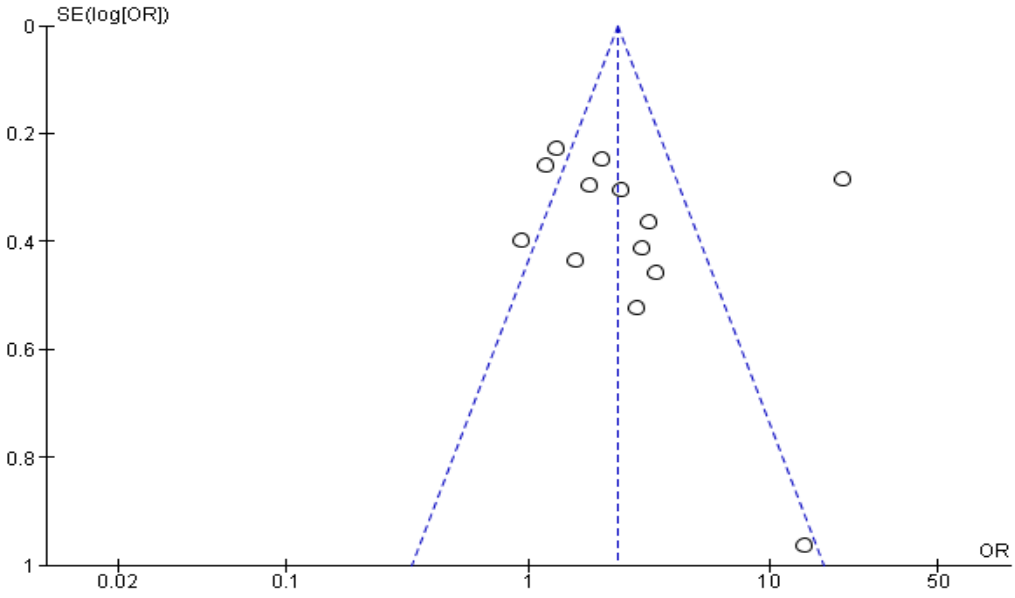

Figure 4. Funnel plot of the effect of control training tuberculosis infection on the performance of workers in health facilities

a. Forest plot

The forest plot in Figure 3 shows that there is an effect of tuberculosis infection control training on improving the performance of officers on duty in health care facilities. Health personel who received TBIC training had a 2.35 times better performance than health personel without training, and this result was statistically significant (aOR= 2.35; 95% CI= 1.96 to 2.81; p < 0.001). Forest plots also showed high heterogeneity of effect estimates between studies (I^2= 86%; p <0.001). Thus the calculation of the average effect estimate is carried out using the random effect model approach**.**

b. Funnel plot

The funnel plot in Figure 4 shows the distribution of the asymmetric effect estimates. The distribution of effect estimates is located to the right of the average vertical line, thus this funnel plot shows publication bias. The publication bias tends to overestimate the true effect (over estimte).

DISCUSSION

Human Resources (HR) is the most important part in a management so it is very important to develop in order to improve its performance. Education and training is a form of human resource development to increase knowledge and skills so that they have special skills and expertise in achieving the goals to be achieved. The health profession has an important role in efforts to control tuberculosis infection. The professional role of health personel is largely determined by their knowledge, skills and attitudes in practicing TBIC. This systematic review and meta-analysis study combining several cross-sectional studies stated that high-quality tuberculosis infection control prevention training for all health professionals is at the heart of a TB prevention program. as recommended by WHO. This study supports the recommendation by highlighting TBIC training as a related subset (aOR= 2.35; 95% CI= 1.96 to 2.81; p < 0.001). The results of the study show that there is a relationship between training and performance. Health personel who receive training in tuberculosis infection control (TBIC) have a 2.35 times better performance than health personel without training, which is statistically significant . Heterogeneity of study data shows I 2 = 86% so that the spread of data is declared high heterogeneity (random effect model).

This study is supported by another study conducted by Geberemariyam et al. (2018) stated that health personel who receive infection prevention training and infection prevention guidelines in the workplace will increase their knowledge and perform better. Assefa et al. (2020). Stating that health personel who have participated in any form of training program are more likely to practice than those who have not attended training. Health personel with a history of having attended TBIC training are very influential in improving the performance of officers, the knowledge and skills obtained by officers from the training are able to apply TB infection control practices in the workplace (Buregyeya et al., 2016).

Knowledge and skills gained from training need to be strengthened to ensure appropriate knowledge and good practices for tuberculosis infection control. Education on cough etiquette and hands-on skills in compatibility testing should be emphasized (Ramlah et al., 2020). Higher education, knowledge and training can improve the performance of health cadres (Kurniavie et al., 2019). Training is an activity to increase the knowledge and technical skills of health cadres that can improve work performance (Chasanah et al., 2020). Meanwhile, according to Pangestuti et al (2018). states that

good or high performance of health personel can reduce TB rates.

This systematic review and meta-analysis study raised the theme of the effect of tuberculosis infection control training on the performance of staff in health facilities. The dependent variable is performance. The independent variable analyzed was TBIC training. Study results from several studies have identified that training can improve better work abilities so that training is recommended to be repeated every year. The importance of training on Tuberculosis Infection Control (TBIC) among health personel which aims to reduce morbidity and mortality due to TB by both health personel and the general public.

AUTHOR CONTRIBUTION

Rahmawati as a studyer who selects topics, searches for and collects study data. Setyo Sri Rahardjo and Bhisma Murti analyzed the data sis and reviewed study documents.

CONFLICT OF INTEREST

There was no conflict of interest in the study.

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