PROGRESS IN KNOWLEDGE OF MICROSCOPIC TUBERCULOSIS DIAGNOSIS LABORATORY TRAINING PARTICIPANTS

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ABSTRACT

Indonesia is the second highest tuberculosis (TB)-burden country in the world. TB affects men and women in productive ages. Early and accurate diagnosis of TB is crucial in TB management because it allows prompt treatment with appropriate regimen. Sputum smear microscopy is the most common method used in resource-limited laboratories. The aim of this study is to assess whether adult learning method with student-centered approach can improve knowledge in laboratory techniques in microscopic TB diagnosis. It was a quasi experimental research with one group pretest and posttest design. Pretest was conducted before the training started. During the training, participants attended lectures, discussion sessions, and hands-on laboratory activities. After training, participants were asked to respond to posttest. There were 33 participants of this training (n=33). Paired t-test analysis showed significant difference between pretest and posttest scores ($p=6.5x10^{-9}$). Variance between pretest scores was 4.00 and variance between posttest scores were 1.34. Pearson correlation coefficient was 0.45. Regardless their level of knowledge before training, participants could achieve relatively equivalent results after training. Significant difference between pre- and post-training test scores indicated that the learning method was effective and the training could improve participants knowledge in laboratory techniques in microscopic TB diagnosis.

Keywords: *Tuberculosis, Knowledge, Pretest, Posttest, Laboratory Training, Sputum Smear Microscopy*

ABSTRAK

Indonesia adalah negara kedua dengan beban tuberkulosis (TB) tertinggi di dunia. TB menyerang laki-laki dan perempuan usia produktif. Diagnosis dini dan akurat berperan dalam manajemen TB karena menentukan terapi dengan regimen yang tepat. Pemeriksaan sputum mikroskopik adalah metode yang paling sering digunakan di laboratorium mikrobiologi sederhana. Tujuan penelitian ini adalah mengetahui metode pembelajaran orang dewasa dengan berpusat pada siswa dapat meningkatkan pengetahuan tentang teknik laboratoris pada

diagnosis TB mikroskopik. Penelitian ini bersifat quasi eksperimental dengan rancangan satu grup pretest dan posttest. Pretest dilaksanakan sebelum pelatihan dimulai. Selama pelatihan, peserta mengikuti kuliah, sesi diskusi, dan kegiatan *hands-on* di laboratorium. Setelah pelatihan, peserta diminta mengerjakan posttest. Ada 33 orang peserta pelatihan (n=33). Uji t berpasangan menunjukkan perbedaan signifikan antara nilai pretest dan posttest ($p=6,5x10^{-9}$). Variasi nilai pretest sebesar 4,00 dan variasi nilai posttest sebesar 1,34. Koefisien korelasi Pearson sebesar 0,45. Meskipun memiliki tingkat pengetahuan awal yang berbeda, peserta dapat memperoleh nilai yang relatif setara setelah mengikuti pelatihan. Perbedaan signifikan antara nilai pre- dan posttest mengindikasikan bahwa metode pembelajaran sudah efektif dan pelatihan dapat membantu meningkatkan pengetahuan peserta dalam teknik laboratoris pada diagnosis TB mikroskopik.

Kata Kunci: Tuberkulosis, Pengetahuan, Pretest, Posttest, Pelatihan Laboratoris, Pemeriksaan Sputum Mikroskopik

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BACKGROUND

Indonesia is ranked 4th most populated country after China, India, and United States of America. Population pyramid of Indonesia is bell-shaped, which is typical for developing countries (Figure 1).[1,2]

Indonesia is known as the second highest tuberculosis (TB)-burden country in the world. TB affects mostly men, and in fewer number, women in productive ages (Figure 2). Thus, TB does not only deter health, but also social and economic aspect of the nation.[3]

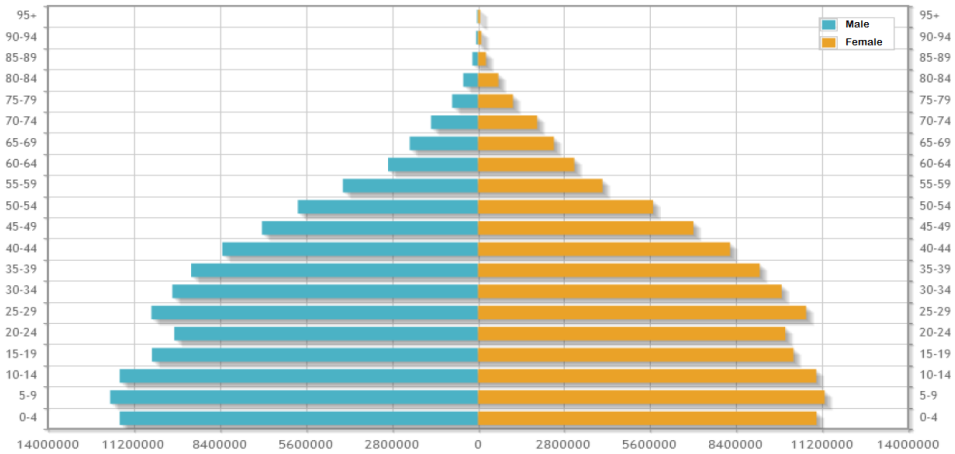

Figure 1. Population Pyramid of Indonesia[1]

Vertical axis: age group; Horizontal axis: number of population

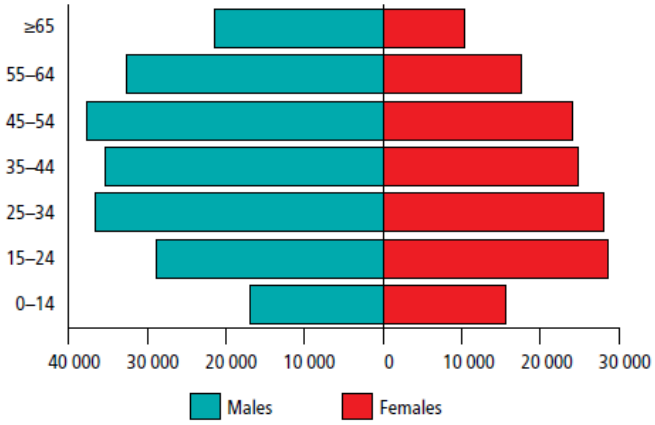

Figure 2. Notified Cases of TB by Age-group and Sex[3]

Vertical axis: age group; Horizontal axis: number of cases

Early and accurate diagnosis of TB is crucial in management of TB because it allows prompt treatment with appropriate regimen. Sputum smear microscopy is the most common method used in resource-limited laboratories.[4,5]

The aim of this study is to assess whether adult learning method with student-centered approach can improve knowledge in laboratory techniques in microscopic TB diagnosis. Participants of this training are medical doctors and laboratory technicians.

METHOD

It was a quasi experimental research with one group pretest and posttest design. Pretest was conducted before the training started. Pretest consisted of 10 questions about laboratory techniques in TB diagnosis. During the training, participants attended lectures, discussion sessions, and hands-on laboratory activities (Table 1). The training took place in Clinical Microbiology Laboratory of Faculty of Medicine Universitas Airlangga Surabaya on August 5th and 6th, 2017. After the training, participants were asked to respond to posttest with similar questions. There were 33 participants in this training (n=33). However, since the identities of pre- and posttest respondents were encoded, researchers could not compare test results based on respondents' background.

RESULT

The data of pretest and posttest was analyzed using paired t-test and the results are listed in Table 2.

Table 1. Event Rundown

Time	Event	Provider(s)
Day 1		
07.30-08.00	Opening Ceremony	Organizing Committee
08.00-08.10	Pretest	Organizing Committee
08.10-08.50	Lecture: National Program of TB Eradication	Lecturer
08.50-09.30	Lecture: Update on TB Diagnosis	Lecturer
09.30-10.00	Coffee break	Organizing Committee
10.00-10.40	Lecture: Collection of Sputum Specimens	Lecturer
10.40-11.20	Lecture: Microscope Use and Maintenance	Lecturer
11.20-12.40	Lecture: Microscopic TB Examination	Lecturer
12.40-13.30	Discussion Session and Lunch	Organizing Committee
13.30-14.00	Lab session: Safety Precautions in TB laboratory	Tutors
14.00-16.00	Lab session: Practice of Sputum Smearing and Staining; Result Interpretations	Tutors
Day 2		
08.00-08.40	Lecture: Internal Quality Control of Microscopic TB Laboratory	Lecturer
08.40-09.20	Lecture: External Quality Control of Microscopic TB Laboratory	Lecturer
09.20-09.50	Coffee Break	Organizing Committee
09.50-10.30	Lecture: Result Documentation and Reporting	Lecturer
10.30-12.30	Lab session: Practice of Sputum Smearing and Staining; Result Interpretations	Tutors
12.30-13.30	Discussion Session and Lunch	Organizing Committee
13.30-15.30	Lab session: Practice of Sputum Smearing and Staining; Result Interpretations	Tutors
15.30-15.40	Posttest	Organizing Committee
15.40-16.00	Closing ceremony	Organizing Committee

Table 2. t-Test: Paired Two Sample for Means

	Pretest score	**Posttest score**
Mean	6.242424242	8.696969697
Variance	4.001893939	1.34280303
Observations	33	33
Pearson Correlation	0.450580768	
Hypothesized Mean Difference	0	
Degree of freedom	32	
t Stat	-7.814605737	
P(T<=t) one-tail	$3.24756x10^{-9}$	
t Critical one-tail	1.693888703	
P(T<=t) two-tail	$6.49512x10^{-9}$	
t Critical two-tail	2.036933334	

Pretest mean was 6.24 and posttest mean was 8.70, indicating increase in post-training knowledge. Variance between pretest scores was 4.00 and variance between posttest scores was 1.34, indicating that participants knowledge before training varied greatly, but it became more equivalent after training. Pearson correlation value was 0.45, indicating moderate degree of correlation between pretest and posttest. Result of t Stat was smaller than t Critical two-tail with p value $6.5x10^{-9}$ ($p<0.05$), indicating significant difference between pretest and posttest scores.

DISCUSSION

Indonesia is the largest archipelago country in the world with total 240 millions inhabitants. Most of its population (57.5%) lives in Java island. The population density and economic disparities between provinces had contributed in spread of TB. In 2016, estimated incidence of TB in Indonesia was >1 million cases per year; estimated incidence of TB in people living with HIV was 45,000 cases per year; and estimated incidence of multi-drug resistant (MDR) TB was 32,000 cases per year.[1,3]

Diagnosis of TB can be made based on clinical presentations or laboratory examinations. There are several methods of laboratory diagnosis of TB, i.e., rapid molecular tests, sputum smear microscopy, and culture-based methods.[3,4,6-8]

Sputum smear analysis requires serial sputum specimens, i.e., one specimen is taken on spot and the second specimen is sputum on early morning. The sensitivity of this method may vary from 20% to 80% (depending on specimen quality, smearing and staining process, and competency of examiner in detecting acid-fast bacilli), and

requires at least $5x10^3$ bacilli per ml of sputum. This method is also less sensitive compared to simplified molecular procedure that are adaptable in routine settings. Despite its inferiority, sputum smear microscopy is the most common method used in resource-limited laboratories in high TB prevalence countries due to its speed, easy performance, and low cost. To avoid low sensitivity of this method, effective External Quality Assurance (EQA) according to World Health Organization (WHO) standards is needed. However, compliance to EQA programs can be difficult in resorce-limited laboratory setting.[4,8-13]

When a person with little knowledge of microscopic TB diagnosis techniques work in laboratory, he/she may give false results of TB diagnosis due to human factors. Therefore, it is imperative that government provide adequate training for laboratory technicians and their supervisors (medical doctors).[13,14]

This laboratory training in microscopic TB diagnosis rundown is listed in Table 2. The classroom seat formation was in comfortable space, where every three to four participants shared a long desk, which enabled them to listen to the lecturers during lectures, and discuss with each other in discussion sessions. In laboratory, participants were divided into groups where every group consisted of eight to nine participants to maintain learning environment. Each group was accompanied by a national-approved tutor.

Method of learning process for this training was adult learning method with student-centered approach. Participants were given printed module of sputum smear preparation when they registered for training. Reading module and listening to lectures were meant to prepare participants for laboratory works. Lectures were made interactive, so that participants could share their experiences, or, to some extent, seek answers to the problems they faced in their workplaces. Discussion sessions were meant to increase retention of knowledge. Lastly, participants practiced their knowledge in laboratory sessions. The whole process was repeated on the second day of training.[15-18]

Well-prepared participants were more likely to successfully acquire skills and gain maximum possible benefit from the laboratory learning process. Eventually, participants retention of knowledge would be greatest when they applied their knowledge or taught other laboratory technicians in their own laboratories.[19-21]

In this research, variance of participants pretest scores was 4.00 which indicate that their knowledge varied greatly before training. However, participants posttest mean was 8.70 and the variance was 1.34, which was more equivalent compared to their pretests variance result. With Pearson correlation coefficient 0.45, we can conlude that regardless their level of knowledge before training, participants can achieve relatively equivalent results after training.[22]

Significant difference ($p<0.05$) between pre- and posttest scores indicated that the learning method was effective and that the training was very helpful in improving participants knowledge in microscopic laboratory techniques. Higher knowledge would result in better performance in laboratory. Therefore, providing adult learning method with student-centered approach training on laboratory techniques may improve sensitivity of sputum smear analysis in TB diagnosis.

CONCLUSIONS

Adult learning method with student-centered approach can improve participants knowledge in laboratory techniques in microscopic TB diagnosis. Regardless their level of knowledge before training, participants can achieve relatively equivalent results after training.

ACKNOWLEDGEMENT

The authors thank Dicky Bagus Widhyatmoko, MD., Elita Devina, MD., Dewi Retnoningsih, MD., Neneng Dewi Kurniati, MD., Dian Rachmawati, MD., Lidya Handayani, MD., and Novita Arbianti, MD., for their cooperation in organizing this training, as well as all training participants who have become our respondents in this study.

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