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Center for Tropical Medicine, Faculty of Medicine, Universitas Gadjah Mada in collaboration with Indonesian Society of Tropical Medicine and Infectious Disease (PETRI)
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Training of Sputum Microscopy Improves the Smear Quality and Slide Positivity Rate for Pulmonary Tuberculosis Diagnosis

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ABSTRACT
Introduction: Microscopic examination of sputum is a key component of the diagnosis of pulmonary tuberculosis. The accuracy of this method is influenced by quality of laboratory and human resources. Indonesia is one of endemic country for pulmonary tuberculosis. Efforts to improve the quality of microscopic examination are needed, including training of human resources.

Objectives: To determine impact of microscopic examination training to smear quality and slide positivity rate.

Methods: This work is an analytic quasi experimental research. The research was involved 18 laboratory technician. Subjects were divided into experimental and control group, which was consisting 9 technicians in each group. The differences of smear quality and slide positivity rate were analyzed by using independent t-test and Mann-Whitney test with 95% of Confident Interval.

Results: Training increased the knowledge of laboratory technician (40.7 points) and the smear quality. Specimen quality was increased 90 points, staining 84.4, cleanness 85.6, thickness 91.1, smear size 88.9, evenness 87.8 and increase the average of smear readings score test 22 points. The mean of smear quality and slide positivity rate of the experimental group were higher than control group. Statistical test of smear quality between eksperimental group with control group were: specimen quality p=0.03, staining quality p=0.03, cleanness p=0.02, thickness p<0.001, size p<0.001, good evenness p<0.001, and slide positivity rate p=0.02

Conclusion: The mean of smear quality and slide positivity rate of the experimental group were higher than control group. There were significant differences of smear quality and slide positivity rate between experimental group with control group at 3 months after training.

Keywords: training, sputum microscopy, smear quality, slide positivity rate, tuberculosis

INTISARI

Tujuan: Mengetahui pengaruh pelatihan terhadap kualitas sediaan dan slide positivity rate.
**Metode:** Rancangan penelitian adalah analitik *quasi experiment post-test control design* dengan eksperimen berupa pelatihan mikroskopi selama 5 hari. Subyek penelitian sebanyak 18 petugas mikroskopi dibagi menjadi kelompok eksperimen dan kontrol dengan *purposive sampling*. Perbedaan kualitas sediaan dan *slide positivity rate* kelompok dilatih dan tidak dilatih dianalisis dengan *independent t test* dan Mann-Whitney 3 bulan setelah pelatihan.

**Hasil:** Pelatihan meningkatkan rerata skor tes pengetahuan sebesar 40,7 point, pembuatan sediaan yang baik : spesimen 90, pewarnaan 84,4, kebersihan 85,1, ukuran 88,9, kerataan 87,8 dan rerata skor pembacaan sediaan 22 poin. Pada 3 bulan sesudah pelatihan, rerata persentase sediaan yang berkualitas baik dan *slide positivity rate* kelompok dilatih lebih tinggi dibandingkan kelompok tidak dilatih. Hasil uji statistik antara kelompok dilatih dengan kelompok tidak dilatih : kualitas spesimen p=0,03, kualitas pewarnaan p=0,03, kebersihan p=0,02, ketebalan p<0,01, ukuran p<0,01, kerataan p<0,01, dan *slide positivity rate*p<0,02.

**Simpulan:** rerata persentase sediaan berkualitas baik dan *slide positivity rate* pada kelompok dilatih lebih tinggi dibandingkan kelompok tidak dilatih. Terdapat perbedaan rerata persentase sediaan berkualitas baik dan *slide positivity rate* yang bermakna antara kelompok dilatih dengan kelompok tidak dilatih pada 3 bulan sesudah pelatihan mikroskopi.

**Kata kunci:** pelatihan mikroskopi, kualitas sediaan, *slide positivity rate*, tuberkulosis.

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**INTRODUCTION**

Tuberculosis (TB) control programs aimed to decrease the morbidity and mortality of this disease in Indonesia. It was targeted to decrease the morbidity and mortality by 50% in 2015. The long term goal of TB control is that TB will not be a public health problem in 2050.

Culture of *Mycobacterium tuberculosis* from sputum is a gold standard of pulmonary tuberculosis diagnosis. However, *M. tuberculosis* culture has several pitfalls e.g. time consuming, expensive, and need a special facilities. Sputum microscopy is a powerful method to diagnose pulmonary tuberculosis which can be carried out in limited resources laboratory. A quality control and monitoring system should be implemented for this method. Training is one of important components of laboratory management and it may useful to maintain and improve the quality of technicians performance for sputum microscopy of pulmonary TB.

In Purbalingga district, sputum microscopy of pulmonary TB was conducted at 24 laboratories. Five technicians were trained by National Tuberculosis Programs (NTP) in 2011-2012, 12 technicians in 2003-2009. Seven technicians have not trained yet. Slide Positivity Rate (SPR) in 2011 and 2012 are 9.1% and 8.9% respectively. The quality control audit conducted in 2011 found that there were 73.4% poor smear quality and 11.5% with poor staining process. In 2012 it was reported that all of the laboratories had poor smear quality.

Based on that data, it is important to study the effect of sputum microscopy of pulmonary TB training to the smear quality and slide positivity rate.

**MATERIALS AND METHODS**

Eighteen laboratory technicians were enrolled in 5 days sputum microscopy of pulmonary TB training conducted on 25-29 Juni 2013. The subjects were divided into experimental group and control group evenly. The subjects were technicians which have not trained yet and not working in the others laboratories.

Pre–post test evaluation was conducted before and after training. The parameters which were evaluated for smear quality were: sputum quality, staining quality, smear cleaness, smear thickness, smear size, and smear evenness. Specimen which
were used for smear quality test were cross checked with Lot Quality Assurance System (LQAS) recorded in TB 12. Each laboratory received 17 suspected TB positive smear.

Slide positivity rate was evaluated 3 months after training. Specimens for slide positivity rate test of each peripheral laboratory were 51 suspected preparations recorded in TB 04, that have the same identity number with the specimen for smear quality test. Data were analyzed by independent t-test, independent t-test unequal, and Mann-Whitney test with 95% CI.

RESULTS AND DISCUSSION

Three months after training, the smear quality and slide positivity rate of the experimental group were higher than control group. Statistical test for the difference of smear quality between experimental group with control group were: specimen quality p=0.03, staining quality p=0.03, cleanness p=0.02, thickness p<0.001, size p<0.001, good evenness p<0.001, and slide positivity rate p=0.02. Table 1 shows the evaluation result of smear quality and slide positivity rate.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre-post training difference</th>
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<tbody>
<tr>
<td></td>
<td>Experiments group</td>
<td>Control group</td>
<td></td>
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<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Sputum quality</td>
<td>94.7</td>
<td>3.5</td>
<td>74.6</td>
<td>23.7</td>
</tr>
<tr>
<td>Staining quality</td>
<td>96.7</td>
<td>3.1</td>
<td>91.5</td>
<td>6.6</td>
</tr>
<tr>
<td>Smear cleanness</td>
<td>95.4</td>
<td>3.9</td>
<td>88.2</td>
<td>7.2</td>
</tr>
<tr>
<td>Smear thickness</td>
<td>92.8</td>
<td>7.1</td>
<td>64</td>
<td>28.3</td>
</tr>
<tr>
<td>Smear size</td>
<td>99.3</td>
<td>1.9</td>
<td>39.2</td>
<td>30.7</td>
</tr>
<tr>
<td>Smear evenness</td>
<td>91.5</td>
<td>5.9</td>
<td>30</td>
<td>29.6</td>
</tr>
<tr>
<td>Slide positivity rate</td>
<td>14.4</td>
<td>4.8</td>
<td>8.7</td>
<td>4.1</td>
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</tbody>
</table>

* Independent t test unequal
** Mann-withney test
*** Independent t test

Training is a process to improve skills and to help achieve the objectives of the organization. Training is a systematic process to change the behavior of the employee’s, related with skills and competence. Sputum microscopy for TB training is part of the effort to encourage TB laboratories fulfill the needs of TB control program, and important to improve the accuracy of diagnosis process.

Our result was in parallel with previous studies. It was reported from Kinhansa in 2007 that there was a significant growing skills of participants in the preparation of smear, staining, and the smear examination between before and after training.

A study in Mexico, which was started by external quality assessment laboratory for microscopic examination by LQAS method and continued with the training, have been shown that training able to enhance the capabilities of technician based on the smear quality and consensus results of smear reading.

Training and retraining study in Tanzania showed that training was able to enhance the smear quality, staining techniques, and smear reading. It was conceived by based on the results of research to the smear quality for microscopic and readings results.

Training of sputum microscopy for TB was able to improve the quality of preparations and the quality of the staining significantly in Taiwan. Training has also been able to lower the Low Negative False (LNF) thereby increasing slide positivity rate. The low slide
positivity rate largely caused by training who are not adequate thus causing low quality material\(^\text{10}\).

Training of sputum microscopy for TB was needed in order to improve the skills of technician to prepare a high quality of smear that eventually result to improvement of slide positivity rate. A poor smear quality causes false positive or false negative and decline the positivity rate\(^\text{12,13}\).

**CONCLUSION**

The smear quality and slide positivity rate of the experimental group were higher than control group. There were significant differences of smear quality and slide positivity rate between experimental groups with control group after 3 months.

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10. No issue or volume

11. Pagination in roman numerals

12. Type of article indicated as needed
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14. Article retracted

15. Article containing comment

16. Article in comment

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34. **In press**

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36. **Monograph in electronic format**

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