

# How do laboratory technicians perceive their role in the tuberculosis diagnostic process? A cross-sectional study among laboratory technicians in health centers of Central Java Province, Indonesia

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**Purpose:** Detection of acid-fast bacilli in respiratory specimens serves as an initial pulmonary tuberculosis (TB) diagnosis. Laboratories are the essential and fundamental part of all health systems. This study aimed to describe how laboratory technicians perceived their own self and work. This included perceived self-efficacy, perceived role, perceived equipment availability, perceived procedures, perceived reward and job, and perceived benefit of health education, as well as level of knowledge and attitudes related to work performance of laboratory technicians.

**Methods:** This was a cross-sectional quantitative study involving 120 laboratory technicians conducted in Central Java. Interviews and observation were conducted to measure performance and work-related variables.

**Results:** Among 120 laboratory technicians, 43.3% showed fairly good performance. They complied with 50%–75% of all procedures, including sputum collection, laboratory tools utilization, sputum smearing, staining, smear examination, grading of results, and universal precaution practice. Perceived role, perceived self-efficacy, and knowledge of laboratory procedures were significantly correlated to performance, besides education and years of working as a laboratory technician. Perceived equipment availability was also significantly correlated to performance after the education variable was controlled.

**Conclusion:** Most of the laboratory technicians believed that they have an important role in TB patients' treatment and should display proper self-efficacy in performing laboratory activities. The result may serve as a basic consideration to develop a policy for enhancing motivation of laboratory technicians in order to improve the TB control program.

**Keywords:** laboratory technicians, perceived role, perceived self-efficacy, perceived job, perceived reward, tuberculosis

## Introduction

Pulmonary tuberculosis (PTB) is one of the most important health problems in the world. Indonesia ranks second with the highest number of tuberculosis (TB) cases in the world after India.<sup>1</sup> Almost 300,000 new cases were found in 2009, with more than half being smear-positive.<sup>2</sup> Central Java as one of the biggest provinces in Indonesia contributes ~35,000 new cases per year.<sup>3</sup>

The World Health Organization recommends detection of acid-fast bacilli (AFB) in respiratory specimens as the initial approach for PTB diagnosis. Laboratories, therefore, play an essential and fundamental role in all health systems. Reliable and timely results from laboratory examination are crucial elements in decision making of PTB diagnosis.

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However, laboratory services are often fragmented and gaining low priority with inadequate allocation of resources.<sup>4</sup>

Central Java Province implemented Directly Observed Treatment Short course strategy >10 years ago. Training and refreshing programs for TB health providers including doctors, nurses, and laboratory technicians were widely implemented. The implementation covered all of the health centers and lung clinics, and also some hospitals, in Central Java. Almost all TB health providers have already been trained during 2002–2006.<sup>2</sup> However, a previous study found that performance of TB health providers in many places were lacking.<sup>5</sup> Some patients revealed that health providers seemed to be reluctant to educate TB patients on how to provide good-quality sputum.<sup>5</sup>

Many studies have been conducted to examine the performance of TB health officers in Central Java. Dissatisfaction with their job, especially perceived role and workload, is strongly associated with their performance.<sup>6</sup> Given the fact that almost all laboratory technicians have been well trained, we hypothesize that the lack of good laboratory performance was caused by personal and person–organization relationship. Perceived organizational support (POS) theory suggests that to meet socioemotional needs and to determine the organization's readiness to reward increased work effort, employees should develop global beliefs concerning the extent to which the organization values their contributions and cares about their well-being.<sup>7,8</sup> Accordingly, employees showed a consistent pattern of agreement with various statements concerning the extent to which the organization appreciated their contributions and would treat them favorably or unfavorably in different circumstances. Given the fact that behavior is a function of different variables, the assumptions made in this study were based on several behavioral theories such as theory of planned behavior by Ajzen<sup>9</sup> and self-efficacy theory by Bandura.<sup>10</sup>

This study aimed to describe how laboratory technicians perceived their own self and works, including perceived self-efficacy, perceived role, perceived equipment availability, perceived procedures, perceived reward and job, and perceived benefit of health education, and how their perception relates to the TB diagnostic performance. Understanding the perception of laboratory technicians toward performance-related matters may help in the implementation of organizational redesign in order to increase performance.

## Materials and methods

### Study design

This was a cross-sectional study. Study population consisted of >800 health centers from 35 districts in Central Java.

Sample size was calculated using a formula that estimates proportion. With 5% alpha and 1% precision, the minimum sample size was calculated to be 96.04. We added 20% of subjects to reduce the risk of nonresponse bias. There were overall 120 subjects included in the study.

Multistage sampling was performed to select samples from population. At the first stage, we randomly selected 20 out of 35 districts. The selected districts were as follows: Demak, Grobogan, Kendal, Salatiga, Semarang, Jepara, Kudus, Batang, Blora, Pekalongan, Tegal, Pemalang, Kebumen, Magelang, Temanggung, Wonosobo, Banyumas, Klaten, Sragen, and Sukoharjo. Then, we selected six health centers in each district by purposive sampling at the second stage. Criterion for selection of health centers was the implementation of sputum microscopy.

### Study subjects

Study subjects included 120 laboratory technicians from 120 health centers in Central Java: 43 laboratory technicians from Puskesmas Pelaksana Mandiri (PPM), 38 from Puskesmas Rajukan Mikroskopis (PRM), and 39 from Puskesmas Satelit (PS). PS does not possess complete laboratory facilities; they only make smear slides, and then send the slides to PRM for reading the results. PRM performs diagnosis of the slides from PS. Accordingly, PRM also conduct their own laboratory tests and diagnosis. Laboratory activities of PPM, on the other hand, are unrelated to PS and provide self-diagnostic services.

### Variables

Independent variables consisted of knowledge, attitude, and perception of laboratory technicians, while dependent variable was performance of laboratory technicians. We conducted interview using structured questionnaire to measure perception of laboratory technicians, and used observation to measure performance of laboratory technicians. Interview was conducted after office hours, while observation was done during office hours. Prior to the survey, we selected two graduate students as research assistants. In order to standardize fieldwork activities, we trained them to collect data (interview and observation).

### Data collection

Perception of laboratory technicians included perceived role, perceived self-efficacy, perceived benefit of health education, perceived procedure, perceived reward and punishment, knowledge of TB laboratory procedures, and attitude toward TB. Each variable was composite, which was derived from several questions. Perceived role was measured

by questions on laboratory technicians' awareness of their important roles in TB control program, their role to provide explanation on how to produce purulent sputum and assistance to TB patients to acknowledge disease, and sense of working in the laboratory as personal choice. Perceived self-efficacy measured self-confidence of laboratory technicians' capability of doing TB laboratory skills, including belief in capability to find AFB in specimens from TB suspects, belief in sufficient skills to work in the laboratory, and belief in following examination procedures correctly.

Perceived equipment availability included how laboratory technicians think of sufficiency or insufficiency of laboratory equipment, clarity of expiry date of reagents, quality of reagents, and belief that reagents affect diagnosis results. Perceived benefit included how laboratory technicians feel that their education to TB suspects/patients benefits TB diagnosis. Perceived benefit included the necessity to explain TB treatment to patients or observers. Perceived reward included questions on whether laboratory technicians feel appreciated, including proper incentive and other rewards for their laboratory works. Perceived job included the level of boredom in performing laboratory diagnosis of TB. Perceived procedures consisted of level of difficulty and possibility to follow TB laboratory procedures, keep distance from TB suspects to avoid infection, and how fatigue they felt doing AFB examination, visiting TB suspects who do not revisit on the second day of examination, and referring to the examined slides when unsure of the result.

Knowledge was measured by questions on procedure of TB examination, while attitude was evaluated from questions on self-valuation of their own work as laboratory technicians. The measure of knowledge was derived from ten questions on knowledge of laboratory procedures. The cutoff point of knowledge score was defined based on fixed category. Those who had at least 75% correct knowledge were categorized as having good knowledge, or otherwise poor. Attitude was measured based on how TB was perceived (a curable, inherited, or congenital disease), and necessity of TB suspects to seek early diagnosis and prompt treatment.

Performance of laboratory technicians was measured as a composite variable. The composite was derived from observation of the compliance of laboratory technicians with these following procedures: 1) sputum collection, 2) laboratory tools utilization, 3) sputum smearing, 4) staining, 5) smear examination, 6) grading of results, and 7) universal precaution practice. Total score of observation was then categorized into three groups – 1) <50%, 2) 50%–75%, and 3) >75% – referring to standard operating procedure (SOP) of TB laboratory examination.

## Data analysis

Independent variables (knowledge, attitude, and perceived) were categorized into two groups. They were either categorized as poor and good, low and high, or boring and exciting. Dependent variable (performance of laboratory technicians) was categorized into three groups in accordance with the SOP of TB laboratory examination (<50%, 50%–75%, and >75% of SOP). Chi-square test was used to analyze the difference in proportions between groups at 5% significance level.

## Ethical approval

The study was approved by the Ethics Commission of Medical Research, Faculty of Medicine, Diponegoro University (N0 18/EC/FK-RSDK/2009). Written informed consent was obtained from all study participants.

## Results

Out of 120 laboratory technicians, more than half were females (64.2%). Mean age was  $36.23 \pm 8.000$  years. The proportion of young laboratory technicians (<30 years old) was the smallest, while middle and older technicians were equally distributed. Among them, more than half (56.7%) were analysts (Table 1). An analyst is the one with a 3-year academic education that focuses on laboratory skills. Non-analyst subjects in this study included those who graduated from high school, nurses, and those with environmental engineering and public health education backgrounds.

Mean years of working in health center was  $10.975 \pm 7.8193$ , while that of working as a laboratory technician was slightly less ( $8.184 \pm 5.8598$ ). Almost more than half of the laboratory technicians (45.0%) were working for >10 years in health center, but less than one-third were working as laboratory technicians for <10 years (Table 1).

## Performance of laboratory technicians

Most of the laboratory technicians (43.3%) had 50%–75% compliance with national SOPs of TB laboratory examination, including sputum collection, laboratory tools utilization, sputum smearing, staining, smear examination, grading of results, and universal precaution practice. However, we found that 21.7% of laboratory technicians were categorized as poor in sputum collection process (Table 2). Based on our observation, they did not provide information to TB suspects on how to produce a good-quality sputum, did not collect sufficient amount of sputum, and did not label the sputum pot.

**Table 1** Characteristics of laboratory technicians

Variables	Categories	n=120	Mean $\pm$ standard deviation	%	Minimum	Maximum
Age (years)	<30	30	36.23 $\pm$ 8.000	25.0	21	55
	30–40	46		38.3		
	>40	44		36.7		
Sex	Male	43	10.975 $\pm$ 7.8193	35.8	1	34
	Female	77		64.2		
Years of working in health center	<5	41	8.184 $\pm$ 5.8598	34.2	1	30
	5–10	25		20.8		
	>10	54		45.0		
Years of working as laboratory technician	<5	48	8.184 $\pm$ 5.8598	40.0	1	30
	5–10	37		30.8		
	>10	35		29.2		
Education	Analyst	68		56.7		
	Non-analyst	52		43.3		
Knowledge of laboratory procedures	Poor	32		26.2		
	Good	88		72.1		
Attitude	Poor	20		16.7		
	Good	100		83.3		
Perceived role	Low	18		15.0		
	High	102		85.0		
Perceived self-efficacy	Low	43		35.8		
	High	77		64.2		
Perceived equipment availability	Poor	26		21.7		
	Good	94		78.3		
Perceived procedure	Poor	24		20.0		
	Good	96		80.0		
Perceived benefit of health education	Poor	32		26.7		
	Good	88		73.3		
Perceived reward	Poor	79		65.8		
	Good	41		34.2		
Perceived job	Boring	63		52.5		
	Exciting	57		47.5		
Performance	<50%	24		20.0		
	referring SOP					
	50%–75%	52		43.3		
	referring SOP					
	>75%	44		36.7		
	referring SOP					

**Note:** The categorization of perceived variables was based on the answers in the questionnaire. The cutoff point for each variable according its mean was as follows: low, poor, or boring ( $\leq$  mean), or high, good, or exciting ( $>$  mean).

**Abbreviation:** SOP, standard operating procedure.

Unlike the process of sputum collection, more than half of the laboratory technicians had good practices in laboratory utilization (Table 2). They complied with the requirements of sputum pot and slides quality, equipment keeping and cleaning, and microscope maintenance. However, most of the laboratory technicians (95.8%) were poor in slide preparation process (Table 2). Many of them ignored the procedures such as preparing clean slides, and proper handling of stick, sand bottle, and flame. Sometimes, they also missed out coding the sputum samples or just left the stick after smearing.

Although most of the laboratory technicians often ignored the smear preparation process, they were good in slide fixation and performing staining (72.5% and 52.5%,

respectively; Table 2). They perceived this as the most important part of the process. Therefore, they tried to comply with the procedures, including heating, decolorization, and counterstaining. However, Table 2 shows that most of the laboratory technicians were poor in reading the result (80.0%) and universal precaution practice (70.0%).

Performance was closely related to education and years of working as laboratory technicians, with  $P$ -values of 0.00 and 0.01, respectively (Table 3). Laboratory technicians who graduated as analyst and worked in laboratory for  $>10$  years were more likely to comply with SOP of laboratory practices. Unexpectedly, age showed no correlation to performance ( $P=0.936$ ). Proportion of young and older age groups who

**Table 2** Knowledge, attitudes, perception, and performance of laboratory technicians

Variables	Categories	n=120	%
<b>Knowledge</b>			
Amount of sputum required for TB examination (mL)	1–3	25	20.8
	>3–5	32	26.7
	>5–7	4	3.3
	Do not know	59	49.2
Slide fixation must be upon direct fire	Yes	15	12.5
	No	103	85.8
	Do not know	2	1.7
Does not need fixation in drying slides	Yes	16	13.3
	No	102	85.0
	Do not know	2	1.7
Process of Ziehl Nelsen staining	Yes	104	86.7
	Do not know	16	13.3
Addition of fuchsin carbol for staining	Yes	100	83.3
	No	1	0.8
	Do not know	19	15.8
AFB colored red	Yes	105	87.5
	No	1	0.8
	Do not know	14	11.7
Slide was dried upon direct fire after staining	Yes	6	5.0
	No	98	81.7
	Do not know	16	13.3
Use of binocular microscope with ×100 objective lens magnification	Yes	95	79.2
	No	8	6.7
	Do not know	17	14.2
<b>Attitudes</b>			
TB is curable	Agree	115	95.8
	Neither agree nor disagree	3	2.5
	Disagree	2	1.7
TB is inherited	Agree	1	0.8
	Neither agree nor disagree	9	7.5
	Disagree	110	91.7
TB is congenital	Agree	4	3.3
	Neither agree nor disagree	9	7.5
	Disagree	107	89.2
TB suspect must seek physician for early diagnosis and prompt treatment	Agree	106	88.3
	Neither agree nor disagree	5	4.2
	Disagree	9	7.5
<b>Perceived</b>			
Perceived role: have an important role in TB suspect's sputum examination	Agree	116	96.7
	Neither agree nor disagree	4	3.3
Perceived role: must provide explanation to TB suspect on how to produce purulent sputum	Agree	97	80.8
	Neither agree nor disagree	9	7.5
	Disagree	14	11.7
Perceived role: help TB patients to acknowledge their disease status	Agree	119	99.2
	Neither agree nor disagree	1	0.8
Perceived role: working in laboratory became personal choice	Agree	80	75.0
	Neither agree nor disagree	13	10.8
	Disagree	17	14.2
Perceived role: obligatory to obtain good-quality sputum	Agree	105	87.5
	Neither agree nor disagree	9	7.5
	Disagree	6	5.0
Perceived role: sometimes fail to obtain good-quality sputum due to resources limitation	Agree	4	28.3
	Neither agree nor disagree	9	7.5
	Disagree	77	64.2
Perceived self-efficacy: belief in capability to detect AFB	Agree	76	63.3
	Neither agree nor disagree	20	16.7
	Disagree	24	20.0
Perceived self-efficacy: have been trained and believe to have sufficient laboratory skills	Agree	75	62.5
	Neither agree nor disagree	16	13.3
	Disagree	29	24.2
Perceived self-efficacy: doubt in correctness of examination procedures	Agree	29	24.2
	Neither agree nor disagree	20	16.7
	Disagree	71	59.2
Perceived equipment availability: insufficient laboratory equipment	Agree	54	45.0
	Neither agree nor disagree	10	8.3
	Disagree	56	46.7
Perceived equipment availability: expiry date of some reagents	Agree	22	18.3
	Neither agree nor disagree	18	15.0
	Disagree	80	66.7
Perceived equipment availability: certain of the quality of reagents	Agree	86	71.7
	Neither agree nor disagree	13	10.8
	Disagree	21	17.5
Perceived equipment availability: unclear expiry date	Agree	56	46.7
	Neither agree nor disagree	15	12.5
	Disagree	49	40.8
Perceived equipment availability: quality of reagent influences diagnosis	Agree	112	93.3
	Neither agree nor disagree	5	4.2
	Disagree	3	2.5
Perceived procedures: too complicated	Agree	10	8.3
	Neither agree nor disagree	14	11.7
	Disagree	96	80.0
Perceived procedures: avoid infection	Agree	68	56.7
	Neither agree nor disagree	12	10.0
	Disagree	40	33.3
Perceived procedures: AFB examination is tiring	Agree	23	19.2
	Neither agree nor disagree	11	9.2
	Disagree	96	71.7
Perceived procedures: TB remains curable even if the diagnosis is too late	Agree	99	82.5
	Neither agree nor disagree	17	14.2
	Disagree	4	3.3
Perceived procedures: the SOP of TB program is impossible to be followed	Agree	9	7.5
	Neither agree nor disagree	6	5.0
	Disagree	105	87.5
Perceived procedures: home visit when patients do not come on the second day of sputum examination	Agree	66	55.0
	Neither agree nor disagree	18	15.0
	Disagree	36	30.0
Perceived procedures: refer to other laboratory for unconvincing result	Agree	77	64.2
	Neither agree nor disagree	7	5.8
	Disagree	36	30.0



Variables	Categories	n=120	%
Perceived benefit: observer plays an important role for TB suspect	Agree	106	90.0
	Neither agree nor disagree	8	7.6
	Disagree	4	3.3
Perceived benefit: unnecessary to explain TB treatment to patients and observer	Agree	20	16.7
	Neither agree nor disagree	8	6.7
	Disagree	92	76.7
Perceived reward: incentives are not in accordance with workload	Agree	37	30.8
	Neither agree nor disagree	28	23.4
	Disagree	55	45.8
Perceived reward: no rewards	Agree	27	22.5
	Neither agree nor disagree	17	14.2
	Disagree	76	63.3
<b>Performance</b>			
Sputum collection	Not in accordance with SOP	26	21.7
	In accordance with SOP	94	78.3
Laboratory equipment usage	Not in accordance with SOP	55	45.8
	In accordance with SOP	65	54.2
Slide preparation	Not in accordance with SOP	115	95.8
	In accordance with SOP	5	4.2
Slide fixation	Not in accordance with SOP	33	27.5
	In accordance with SOP	87	72.5
Slide staining	Not in accordance with SOP	57	47.5
	In accordance with SOP	63	52.5
Reading the result	Not in accordance with SOP	96	80.0
	In accordance with SOP	24	20.0
Universal precaution	Not in accordance with SOP	84	70.0
	In accordance with SOP	36	30.0

**Note:** The categorization of perceived variables was based on the answers in the questionnaire. The cutoff point for each variable according its mean was as follows: low, poor, or boring ( $\leq$  mean), or high, good, or exciting ( $>$  mean).

**Abbreviations:** TB, tuberculosis; AFB, acid-fast bacilli; SOP, standard operating procedure.

complied  $<50\%$  with SOP was equally distributed (21.6% and 21.1%, respectively). Similar pattern occurred in middle and older age groups who complied 50%–75% with SOP.

## Knowledge and attitude toward TB

Knowledge and attitude of laboratory technicians, as well as their perception (role, self-efficacy, equipment availability, procedure, reward, and job), and their correlation with working performance are shown in Table 3. The majority (72.1%) of laboratory technicians were categorized as having good knowledge of TB laboratory procedures (Table 1). Knowledge was significantly related to performance ( $P=0.000$ ). However, unusual pattern occurred among those who had good knowledge. Proportion of poor performance was higher in laboratory technicians with good knowledge (84.6%) compared to those with poor knowledge (Table 3).

Most of the laboratory technicians (83.3%) had good attitude toward TB (Table 1). They recognized that TB is curable and not inherited. They also agreed that TB suspects should seek physicians for early diagnosis and treatment (Table 2).

**Table 3** Performance of laboratory technicians by individual characteristics and behavior determinants

Characteristics and behavior determinants	Compliance with SOP			P-value
	<50%	50%–75%	>75%	
Characteristics				
Age (years)				
<30	21.6	17.8	21.1	0.936
31–40	17.8	42.2	47.4	
>40	21.1	40.0	31.6	
Education				
Non-analyst	34.6	44.2	21.2	0.000
Analyst	8.8	42.6	48.5	
Years of working in health center				
<5	22.0	43.9	34.1	0.750
5–10	20.0	52.0	28.0	
>10	18.5	38.9	42.6	
Years of working as laboratory technicians				
<5	25.0	39.6	35.4	0.010
5–10	18.9	62.2	18.9	
>10	14.3	28.6	57.1	
Behavior determinants				
Knowledge				
Poor	12.1	46.7	41.1	0.000
Good	84.6	15.4	0.0	
Attitude				
Poor	25.0	55.0	20.0	0.238
Good	19.0	41.0	40.0	
Perceived role				
Low	44.4	55.6	0.0	0.001
High	15.7	41.2	43.1	
Perceived self-efficacy				
Low	31.8	40.9	27.3	0.030
High	13.2	44.7	42.1	
Perceived equipment availability				
Poor	38.5	34.6	26.9	0.029
Good	14.9	45.7	39.4	
Perceived procedures				
Poor	27.3	40.9	31.8	0.150
Good	18.4	43.9	37.8	
Perceived benefit of health education				
Poor	21.9	43.8	34.4	0.932
Good	19.3	43.2	37.5	
Perceived reward				
Poor	20.3	43.0	36.7	0.994
Good	19.5	43.9	36.6	
Perceived job				
Boring	23.8	39.7	36.5	0.504
Exciting	15.8	49.4	36.8	

**Abbreviation:** SOP, standard operating procedure.

Nevertheless, unlike knowledge, attitude had no statistical correlation to performance (Table 3).

## Perceived role

The vast majority (85.0%) of laboratory technicians had good perceived role (Table 1). Most of them agreed that they have an important role in examining sputum, and providing

explanations on how to produce good-quality sputum. It seemed that a feeling of obligation to obtain a good-quality sputum had already been internalized in their daily life, since working in laboratory was believed as their own choice. They believed that they had helped TB suspects to figure out their health status (Table 2). Perceived role was significantly correlated to performance ( $P=0.001$ ). Most laboratory technicians with compliance of 50%–75% and 75% with SOP were among those who had high-perceived role. On the other hand, none of those with low perceived role complied >75% with SOP (Table 3).

### Perceived self-efficacy

More than half (64.2%) of the laboratory technicians had high self-efficacy (Table 1). Most of them (63.3%) believed that they were capable of finding AFB in sputum because they were trained and had sufficient skills to work in laboratory (62.5%). However, we also found that sometimes, laboratory technicians doubted their examination. In some cases, they were unsure of whether their examination was correct or in accordance with the procedures (Table 2). In addition to perceived role, Table 3 also shows that perceived self-efficacy was significantly correlated to performance ( $P=0.030$ ). Most of the laboratory technicians with high self-efficacy showed fair (44.7%) and good (42.1%) performances, whereas those with low self-efficacy mostly showed poor (31.8%) and fair (40.9%) performances.

### Perceived equipment availability

Most of the laboratory technicians (71.7%) considered that they were supported by good laboratory equipment. Regardless that the proportion of laboratory technicians who agreed and disagreed about laboratory sufficiency was almost equal, most of them believed in the quality of reagents, which were distributed by provincial or district health office. They thought that recheck mechanism was unnecessary. Nevertheless, some of them admitted that sometimes, expiry date on reagent was unclear, or sometimes, they examined sputum inappropriately due to the limitation of resources (Table 2).

In accordance with the results obtained, perceived equipment availability was also found to be statistically correlated to performance ( $P=0.029$ ). The proportion of good performance (>75% compliance with SOP) was higher in those who had good perceived equipment availability (39.4%) than those with poor perceived equipment availability (26.9%). Similar pattern was also seen among those who complied 50%–75% with SOP, that is, proportion of those with good perceived equipment availability was higher than those with poor perceived equipment availability (Table 3).

### Perceived procedures

The vast majority of respondents showed good perceived procedures (Table 1). Most of them disagreed to the opinion that laboratory procedures were complicated and difficult to be followed. Three-fourth of them disagreed that AFB examination was tiring, and most of them believed that it was not impossible for laboratory technicians to comply with the TB laboratory procedures. Laboratory technicians' knowledge of the procedures was also found to be good. Most of them acknowledged that they have to visit the TB patients when they did not return on the second day of sputum examination. They also agreed that they have to refer to higher laboratory when they are unsure of the result (Table 2). Statistically, perceived procedures showed no correlation to performance. The proportion of laboratory technicians who complied <50%, 50%–75%, and >75% with SOP among those with both poor and good perceived procedures was almost equal (Table 3).

### Perceived reward and job

Reward system in health center was perceived poorly by the laboratory technicians. More than half (65%) admitted that they were poorly rewarded for their hard work. One-third revealed that they never received proper incentive during their period of working. Perhaps, this was one of the reasons why most laboratory technicians feel bored of their job despite the belief that they were working in laboratory by their own choices (Table 2). There was no significant correlation of these two variables with working performance (Table 3).

### Discussion

POS theory reflects the quality of the relationship between the employees and organization by measuring the extent to which employees believe that the organization values their contributions and cares about their welfare.<sup>8,11,12</sup> According to this theory, attitude and behavior of employees are determined by whether they perceived that the organization treats them favorably or unfavorably.<sup>8</sup> Perceptions that the organization, an individual works for, supports and cares about him/her are positively related to work attendance, job performance, citizenship behaviors, and job satisfaction.<sup>7,8,11</sup>

Nevertheless, the discussion in this paper was not merely based on a single theory of Eisenberger et al (POS)<sup>12</sup> but also involved behavioral theories such as theory of planned behavior of Ajzen<sup>9</sup> and socio-cognitive theory of Bandura.<sup>10</sup> Theory of planned behavior of Ajzen distinguished three kinds of salient beliefs: behavioral beliefs which are assumed to influence attitudes toward the behavior, normative beliefs which constitute the underlying determinants of subjective

norms, and control beliefs which provide the basis of perceptions of behavioral control.<sup>9</sup>

This study found that almost half (40%) of the laboratory technicians in this study showed fairly good performance. At bivariate level, performance was closely associated to education, years of working as laboratory technicians, perceived role, and perceived self-efficacy, while correlation of POS in terms of perceived procedures, perceived equipment availability, perceived benefit of health education, and perceived reward to performance was not statistically significant (Table 3).

In terms of perceived role, there were more laboratory technicians who showed fair and good performance among those who had high-perceived role, whereas among those who had low perceived role, none of them showed good performance (Table 3). This result practically supported the theory of planned behavior especially with respect to subjective norms. According to Ajzen, socially expected mode of conduct (subjective norm, or perceived role in this research) has an important place in social and behavioral research. Therefore, subjective norm is operationalized as a global perception of social pressure either to comply with the wishes of others or not.<sup>9</sup> According to this theory, laboratory technicians who believed that they had an important role in patients' treatment were more likely to perform better than those who had lower perceived role.

Perceived self-efficacy plays an important role in this study. Among those who had high self-efficacy, most of them showed fairly good and good performance, whereas among those who had low self-efficacy, most of them showed poor and fair performance (Table 3). The finding supports the theories of Bandura and other scholars who studied on self-efficacy. According to Bandura, perceived self-efficacy is concerned with judgments of how well one can execute courses of action required to deal with prospective situations. He argued that people's behavior is strongly influenced by their confidence in their ability to perform it. Self-efficacy beliefs can influence choice of activities, preparation for an activity, effort expended during performance, as well as thought patterns and emotional reactions.<sup>10</sup> Given that, perceived self-efficacy exerts its influence on motivational, affective, and selection process<sup>7</sup>. The stronger is the perceived self-efficacy, the higher are the goal challenges people set for themselves, and the firmer is the commitment to them.<sup>10,13,14</sup>

Health officers, including laboratory technicians, are expected to work their best for a better service to public health. Training is important to improve laboratory skills. Our study showed that most laboratory technicians convinced

themselves as having adequate skills for performing laboratory TB examination due to the experience and training. In interview, we met only one laboratory technician who was not trained. Our study was in accordance with that of Nørgaard et al which showed that training improves self-efficacy.<sup>15</sup> POS theory also highlighted the importance of reward system. Based on social exchange theory, POS theory suggested that there is a positive relationship between reward system and employee's performance. Many studies found that paying incentives can improve performance of a facility and can increase job satisfaction, staff motivation, or patient satisfaction.<sup>11,12,16,17</sup>

Unexpectedly, perceived reward had no correlation effect in this study (Table 3). Almost half of the laboratory technicians disagreed that they have been well paid for their job. More than half also disagreed that they have been rewarded fairly for their jobs. There was no difference in performance among those who had good and poor perceived reward. This implied that regardless of the reward system, laboratory technicians would still perform their job regularly. This should be a positive finding for program managers in Central Java Province, since laboratory technicians' performance did not depend on incentives and other kind of rewards for performing their job. This could also be seen as a success of program independency from donor funding. As a matter of fact, Central Java as well as other provinces in Indonesia has been supported by donor funding in TB control program. This finding showed that temporary cessation of Global Fund in 2007 seems to have had only little effect on laboratory networks, since they keep working regardless of the availability of incentives.

POS theory in this study was also proved in the case of perceived procedure and perceived equipment availability. According to Ajzen's theory, perceived behavioral control refers to people's perception of the ease or difficulty of performing the behavior of interest. The more resources and opportunities individuals believe they possess, and the fewer obstacles or impediments they anticipate, and the greater their perceived control over the behavior.<sup>9</sup> In this study, perceived equipment availability showed a significant correlation to performance after education level was controlled. Laboratory technicians who were graduated from analyst academy were more likely to have had better perceived equipment availability compared to those who were non-analysts.

Unfortunately, this pattern cannot be applied to perceived procedures. Although education was controlled, perceived procedures have no significant correlation to the performance of laboratory technicians. It should be noted that most of the laboratory technicians believed that it was not difficult



to perform a good-quality TB diagnosis. Therefore, the unexpected result in statistics was perhaps due to their lack of understanding of the correct procedure of TB laboratory diagnosis, since most of them were having poor knowledge.

Although training and refreshing program of TB health care provider including physicians, nurses, and laboratory technicians has been widely conducted in Central Java Province during 2003–2006, a surprising result on level of knowledge in TB laboratory procedures should be a concern. Moreover, those who had good knowledge mostly showed poor performance. After years of working as laboratory technicians was controlled, the significance was getting greater. Among those who had good knowledge, the more they were working in health center as laboratory technicians, the higher was the likelihood of showing poor performance.

Unlike previous variables, although attitudes toward TB of most laboratory technicians were good, there was no statistical evidence of relationship between two variables. Although education, years of working as laboratory technicians, and knowledge were controlled, there was no significant evidence supporting the association. This was opposed to Ajzen's theory that attitudes toward the behavior reflect the individual's global positive or negative evaluations of performing a particular behavior. In general, the more favorable is the attitude toward the behavior, the stronger is the individual's intention to perform it.<sup>9,18</sup>

Intentions to perform behaviors of different kinds can be predicted with high accuracy from attitudes toward the behavior, subjective norms, and perceived behavioral control, and these intentions, together with perceptions of behavioral control, account for considerable variance in actual behavior. Attitudes, subjective norms, and perceived behavioral control are shown to be related to appropriate sets of salient behavioral, normative, and control beliefs about the behavior.<sup>9,19–21</sup>

## Conclusion

Performance of laboratory technicians in this study was mainly correlated to age, years of working as laboratory technicians, and education. Among POS variables, only perceived role and perceived self-efficacy were significantly correlated to performance, while other variables such as attitude toward TB, perceived equipment availability, perceived procedure, perceived reward, and perceived job failed to show evidence.

This study brings an understanding for the TB program to prepare laboratory technicians with not only good knowledge and motivation but also awareness of their important role in the diagnosis of TB.

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## Author contributions

All authors contributed toward data analysis, drafting and revising the paper, and agree to be accountable for all aspects of the work.

## Disclosure

The authors report no conflicts of interest in this work.

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