

Determinant Indicators of Under-Reporting Case of Tuberculosis (A Mix Method Study)

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ABSTRACT

WHO estimates that nearly 40% of all patients with TB are under-reported to local or national TB surveillance programs every year. Indonesian TB *Jetset* (Research Network) in 2018 stated Indonesia ranked 2nd in the top ranking of tuberculosis case discovery, in Indonesia in 2017 the incidence of TB cases was 1,020,000, the number of cases detected was 710,000 or (70%), so that 310,000 or 30% undetected. This study aims to determine what influences the occurrence of under-reporting cases Hospital TB in Kudus and develop predictive index of under-reporting tuberculosis. Moreover, this study is expected to help eliminate the under-reporting cases 10% rate of tuberculosis that occurred in Kudus from the 44% proportion that occurred nationally based on the MDGs 2017 WHO targets and the targets of the national TB control program contained in the 2014 National Tuberculosis Control Guidelines. This study uses a mix-method of sequential explanatory design. In this quantitative study, we assessed nine indicators of unreported tuberculosis cases to determine how many indicators were associated with unreported cases. The number of samples in this quantitative study was 700 tuberculosis cases recorded at SITB DKK Kudus Regency and medical record data for tuberculosis cases in seven hospitals in Kudus. Meanwhile, qualitative research explores perceptions and information from medical personnel and hospital doctors regarding the reasons for choosing the underreporting case indicator. The number of informants in the qualitative research was 35 informants consisting of specialist doctors, general practitioners, nurses and hospital staff. Multilevel logistic regression analysis was performed for quantitative data, and content analysis for qualitative data. The findings of the quantitative and qualitative sections of the study were mixed in interpretation. The results showed that there were six indicators that affected under-reporting including: Competency of doctors in SITB was good (OR=0.09; CI95%= 0.05 to 0.17; p<001), Competence of health workers in SITB was good (OR=0.05; CI95% = 0.02 to 0.09; p<001), Commitment of health workers in SITB was strong (OR=0.13; 95% CI= 0.07 to 0.24; p<001), and AFB positive patient status (OR=0.35; 95% CI= 0.18 to 0.67; p=0.002). While the results of the qualitative research support the finding that most health workers and doctors who handle tuberculosis cases in hospitals in Kudus do not have SITB certificates, both nationally and regionally, only a few have attended training and have certificates. There is no integration between the SIM Hospital with SITB Hospital or DKK which causes the occurrence of under-reporting of high tuberculosis cases in Kudus. It can be concluded that there are six indices associated with underreporting cases of tuberculosis in Kudus Hospital.

Keywords: Hospital, Under-reporting, Tuberculosis.

INTRODUCTION

The vision of end Tuberculosis (TB) in 2035 will be difficult to achieve if TB incidence is still high and TB remains one of the top 10 causes of death in the world (World Health Organization, 2016). WHO estimates that around 40% of all TB cases are under-reported to local or national TB surveillance programs each year (Tollefson et al., 2016).

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Received: 2 January, 2022

Accepted: 18 March, 2022

Published: 16 May, 2022

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How to cite this article: Rusnoto, Murti B, Reviono, Widyaningsih V, Pamungkasari EP, Determinant Indicators of Under-Reporting Case of Tuberculosis (A Mix Method Study). *J Pharm Negative Results* 2022;13(2):13–22.

Access this article online

Quick Response Code:



Website:
www.pnrjournal.com

DOI:
10.47750/pnr.2022.13.02.003

Under reporting TB has a very large impact on TB control efforts because the presence and condition of the index cases are unknown, whether they are at home, at school, or at other places. work, hostel and others (Tollefson *et al.*, 2016). If you are in an active TB condition, it will certainly have an impact on uncontrolled TB transmission that continues to occur in the wider community and transmission of TB patients with smear positive (+) can infect 10-15 patients per year. Patients with smear positive + TB without treatment have a risk of living less than 8 years (Melosini *et al.*, 2012b).

TB disease that is not treated according to its natural history, after 5 years shows 50% will die, 25% will recover on their own with a high immune system, and 25% will become chronic cases that remain infectious. Unmonitored treatment will lead to drug resistance of TB. Other impacts are not only from the health aspect but also from the economy as well as other bad impacts, socially stigmatizing and even being ostracized by the community (Doyle *et al.*, 2002) reporting is believed to be incomplete. Through means of an analytical literature review, the authors synthesize current knowledge on the completeness of disease reporting and identify factors associated with reporting completeness. The review was limited to published studies, conducted in the United States between 1970 and 1999, that quantitatively assessed infectious disease reporting completeness. Thirty-three studies met the inclusion criteria. Reporting completeness, expressed between 0% and 100%, was treated as the dependent outcome variable in statistical analysis; disease, study location, time period, study design, and study size were treated as independent variables. Fifty-six distinct measures of reporting completeness were identified for 21 diseases. Reporting completeness varied from 9% to 99% and was most strongly associated with the disease being reported. The mean reporting completeness for acquired immunodeficiency syndrome, sexually transmitted diseases, and tuberculosis as a group was significantly higher (79%). It is clear that this under-reporting event will have an impact on increasing morbidity, disability, mortality and TB transmission in the community. Of course this will affect the achievement of the vision and goals of end TB 2035 with the goal of End the Global TB Epidemic 2035 (WHO, 2015).

WHO reports that in Indonesia in 2017 the incidence of TB cases was 403 per 100,000 population or around 1,020,000 new TB per year (WHO, 2017). The number of notified TB cases is 401,130 cases and The results of the 2017 TB Inventory Study showed that 310,000 cases (44%) had not been reported and 310,000 cases (30.4%) had not been detected (KEMENKES, 2014). Meanwhile, ministry of Health of the Republic of Indonesia in 2017, Central Java was the area with the 3rd highest coverage of tuberculosis case finding as follows; 1) West Java with (52,328 cases), 2) East Java (45,239 cases), and 3) Central Java with findings of 28,842 cases (Kemenkes, 2016).

In Central Java Province, the number of new cases of tuberculosis was found on average 76 per 100,000 in all cities and districts whereas in Magelang district was with 39.74 per

100,000 being the lowest detection rate among other districts and Kudus district with 52.87 per 100,000, so that this figure is still far below the National Minimum Service Standard (SPM) where the target is 100% (Central Java Health Office, 2015). The results of the report from the Kudus Regency Health Office (DKK) (2018) on all tuberculosis cases in Kudus according to before cleaning / after cleaning and recorded at SITRS as follows: Islamic Hospital (RSI) Sunan Kudus as many as 2,060 to 659 and recorded 57, Regional General Hospital (RSUD) dr. Loekmono Hadi as many as 644 to 426 recorded 52, Mardirahayu Hospital (RS) 3,213 to 1,353 recorded 61, Nurussyifa Hospital 264 to 245 recorded 76, Aisyiyah Hospital 521 to 360 recorded 52, Kumalasiwi Hospital 1,016 to 322 recorded 58, Kartika's Army Hospital (RST) was 39 to 39, recorded 13 of which were hospital data in Kudus 2018. Therefore, this study attempts to examine under-reporting case of tuberculosis and some indicators related to under-reporting.

METHOD

Design of Study

Mixed methods sequential explanatory design was carried out to assess the level of under-reporting and related indicators. The mixed methods design in this study is in the form of quantitative research followed by qualitative research where qualitative research is used to explain quantitative results (Steckler *et al.*, 1992). In this research design, the data to be collected first is quantitative data and analyzed, which is then followed by the collection and analysis of qualitative data.

Population and Samples

The population of this quantitative study were all tuberculosis cases from seven hospitals in Kudus including RSI Sunan Kudus, RSUD dr. Loekmono Hadi Kudus, Mardirahayu Hospital, Nurussyifa Hospital, Aisyiyah Hospital, Kumalasiwi Hospital, Kartika Husada Hospital with total of 7,792 cases in 2018 and 8,125 cases in 2019. The samples then were chosen based on openepi software with average odd ratio obtained from previous similar research (2.07) which included 700 sample cases and divided into two groups including 350 reporting group and 350 under-reporting group done randomly using fixed disease sampling. The research inclusion criteria were cases of tuberculosis patients having medical record data according to the code International Classification of Disease of the (ICD)-10 World Health Organization (WHO) code A15-A19, conducting self-examinations in primary and secondary health services in Kudus Regency within a period of 1 last year and not notified at SITB. Exclusion criteria for this study were relapsed or seriously ill tuberculosis patients and incomplete medical records.

Meanwhile, the population of this qualitative study were all medical officers including those in charge of the tuberculosis program, pulmonary specialists, general practitioners, laboratory assistants from seven hospitals in Kudus Regency including RSI Sunan Kudus, RSUD dr. Loekmono Hadi,

Mardirahayu Hospital, Nurussyifa Hospital, Aisyiyah Hospital, Kumalasiwi Hospital, and Kartika Husada Hospital were 109 people. The inclusion criteria for the study were medical officers who were registered with tuberculosis patient data and registered at the SITB of the Kudus District Health Office based on code A15-A19. The research exclusion criteria were medical officers who did not have adequate work experience or less than 2 years.

Data Collection

In the quantitative study, researcher used notification of tuberculosis cases through SITB, Kudus District Health Office, SITB data and medical record data for tuberculosis cases from 7 hospitals in Kudus including RSI Sunan Kudus, RSUD dr. Loekmono Hadi Kudus, Mardirahayu Hospital, Nurussyifa Hospital, Aisyiyah Hospital, Kartika Husada Hospital, and Kumala Siwi Hospital based on code A15-A19 ICD-10. And in the qualitative study, in depth interview was done to obtain the data and analyzed using content analysis. After both quantitative and qualitative data were obtained, mix analysis was done to explain the result of the research.

Data Analysis

Data analysis from quantitative data used univariate, bivariate, and multivariate. Univariate analysis describes the characteristics of respondents. Bivariate analysis presents the standard OR percentage which corresponds to a significance level of 5%. Multivariate analysis using regression analysis through STATA computer software version 16 was done to find associated factors of under-reporting. Then the qualitative data were later analyzed by content analysis to obtain in depth analysis about associated factors found in the quantitative data.

RESULT

Quantitative Result

The percentage of general characteristics of research subjects aged 26-50 years is 583 (83%) compared to research subjects aged 1-25 years, namely 117 (17%) and those aged 50 years and over are 169 (24%) more than those aged 50 years and over. aged 1-25. The research subjects who work as entrepreneurs are mostly in RSUD 71 (44%) and the Kumala Siwi Hospital is the least, namely 11 research subjects who work as entrepreneurs. Research subjects who work as students or students with a percentage of at least 4 (13%) are in Nurussyifa Hospital while RSUD is a hospital that dominates the most percentage, namely 41 (25%) research subjects who work as students or students. The PNS profession is a profession with at least 30 (32%) subjects from the total of the seven hospitals. Kumala Siwi and Nurussyifa Hospitals

Demographic data

<i>Gender</i>	<i>Total (N=700)</i>	<i>Percentage</i>
Male	235	34%
Female	465	66%
<i>Age</i>		
1-25 Years	117	17%
26-50 Years	415	59%
50 Years Old and	168	24%
<i>Occupation</i>		
Student	142	20%
Civil Servant	30	4%
Employees	224	32%
Self-employed	304	43%

Bivariate analysis

<i>Group</i>	<i>Status Under-reportingTB cases</i>						<i>OR</i>	<i>P</i>
	<i>Reported</i>		<i>Not reported</i>		<i>Total</i>			
<i>Variable</i>	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>		
Total	350		350		700			
<i>Pension</i>								
No	155	47.70	170	52.30	325	100	0.80	0.20
Yes	195	52	180	48	375	100		
<i>Sarpras</i>								
No	50.87	49.13	174	168	342	100	0.93	0.65
Full	50.8149.19		176	182	358	100		
<i>Network RS</i>								
Less	49.45	181	185	50.55	366	100	0.95	0.76
Good	169	50.60	165	49.40	334	100		

Group	Status Under-reporting TB cases						OR	P
	Reported		Not reported		Total			
	N	%	N	%	N	%		
Commitments RS								
Weak	100	47.17	112	52.83	212	100	0.97	0.32
Strong	250	48.77	238	51.23	488	100		
Commitments health workers								
Weak	24.85	82	248	75.15	330	100	0.12	<0.001
Strong	72.77	27.56	102	26.8	370	100		
Competence Doctor								
Less than	66	18.70	287	81.30	353	100	0.05	<0.001
Good	284	81.84	63	18.16	347	100		
Competence of health workers								
Less	55	15.24	306	84.76	361	100	0.02	<0.001
Good	295	87.03	44	12.97	339	100		
Status TCM								
Negative	201	41.28	286	58.72	487	100	0.30	<0.001
Positive	149	73.71	5	26.29	213	100		
TB type								
Pulmonary	273	79.30	67	19.70	340	100	14.9	<0.001
Extra	77	21.39	283	78.61	360	100		

are hospitals that do not have 0 (0%) research subjects who work as civil servants, while Aisyah Hospital is the hospital that contributes the most research subjects who work as civil servants. the percentage of general characteristics of the research subjects of tuberculosis cases with negative TCM was 487 (70%) greater than that of positive TCM cases or 213 (30%). It can be concluded that the case data of research subjects mostly have negative TCM than *positive* TCM. While the case data subjects with extrapulmonary TB were 360 (51%) greater than 340 (49%). This shows that most of the case data from the health office and seven hospitals in Kudus are extra-pulmonary TB.

Tuberculosis patients with retired status have 0.80 times the possibility of their cases not being reported at SITB, hospitals with good facilities and infrastructure have 0.93 times the *possibility* of their cases not being reported at SITB. Hospitals that have good networks have 0.80 times the possibility of their cases not being reported at SITB. Hospitals with strong commitments were 0.97 times less likely to have their cases not reported at SITB. Health workers with good commitment

are 0.20 times less likely to have their cases not reported at SITB and doctors with good competence are 0.05 times less likely to have their cases not reported at SITB. Tuberculosis patients with positive TCM have 0.30 times the possibility of their cases not being reported at SITB. the type of extra pulmonary tuberculosis has a probability of 14.90 times the case is not reported at SITB.

Multilevel Analysis

TB patients who were examined by doctors with good competence were less likely to be reported than those examined by doctors with less competence (OR = 0.09; 95% CI = 0.05 to 0.17; p <001). TB patients whose information was recorded by health workers with good competence were less likely to be reported than recorded by health workers with less competence (OR = 0.05; 95% CI = 0.02 to 0.09; p <001). TB patients served by highly committed health personnel were less likely to be reported than those served by weakly committed health personnel (OR = 0.13; 95% CI = 0.07 to 0.24; p <001). TB patients with smear positive were less

Table 1: Multilevel analysis toward indicators relating to under-reporting

<i>Independent variable</i>	<i>Odds Ratio</i>	<i>Confidence Interval 95%</i>		<i>P</i>
		<i>Lower bond</i>	<i>Upper bond</i>	
Fixed Effect (Level 1):				
Doctor's competence (Good)	0.09	0.05	0.17	<0.001
Medical Staff 's competence (Good)	0.05	0.02	0.09	<0.001
Medical staff's commitment (Strong)	0.13	0.07	0.24	<0.001
Smear (Positive)	0.35	0.18	0.67	0.002
TB types(Ekstra-Pulmoner)	15.45	8.08	29.51	<0.001
Constan	13.24	5.54	31.66	<0.001
Random Effect (Level 2):				
Hospital				
Variant (Constanta)	0.42		0.07	2.35
N observation	700			
Groups (RS)	7			
N observation/ Group (RS)	Min= 24			
	Mean= 100			
	Maks= 181			
Log likelihood	-152.87			
LR test vs. logistic regression	p=0.009			
p (all)	<0.001			
Inh8ugtraclass correlation (ICC)	11.24%	2.20%	41.62%	

likely to be reported than smear negative (OR = 0.35; 95% CI = 0.18 to 0.67; p = 0.002). Extra-pulmonary TB patients were more likely to go unreported than pulmonary TB (OR = 15.45; 95% CI = 8.08 to 29.51; p <0.001). Intraclass correlation shows that the influence of hospital institutional contextual factors explains 11.24% of the variation in the incidence of unreported TB cases (ICC = 11.24%; 95% CI = 2.20% to 41.62%). ICC = 11.24% exceeds the rule of thumb regarding the contextual influence which is considered quite large, namely ICC = 8-10%.

Qualitative Eesult

The results of the indept interview regarding the competence of doctors that most of them are non-pulmonary specialists and have never attended SITT/SITB training and reporting and do not have national or regional certificates. The results of the in-depth interview regarding the commitment of health workers (nurses) that nurses have handled TB cases according to the protocol set by the hospital, but most have not attended training and received SITT/SITB certificates. The results of the in-depth interview regarding the negative TCM status of TB patients who were not reported at SITT, in other words, most of the negative TCM cases had been reported. Hospitals in Kudus Regency have diagnosed TB (Extra Pulmonary) but there are hospitals that do not diagnose Extra Pulmonary TB at all, no cases of tuberculosis are not reported or in other words all cases are reported at SITT and

doctors and TB officers have the authority to report TB cases in hospital. The results of the indepth interview regarding the context of the hospital for under-reporting tuberculosis cases, the majority of hospitals already have adequate facilities and infrastructure in diagnosing and reporting TB cases, but there is no integrated system between the hospital SIM and the SITT of the health office.

DISCUSSION

From the results of this study, it was stated that there was an effect of the type of tuberculosis in TB patients on the incidence of unreported cases where extra-pulmonary TB patients were 15.45 times more likely to be unreported than pulmonary TB. This is in line with research conducted by (deVries et al., 2012)central and western regions of China in 2015. PRIMARY AND SECONDARY OUTCOME MEASURES Under-reporting was calculated as the percentage of patients with TB not reported to TB Information Management System (TBIMS which stated that among 37,820 cases identified, 21,611 (57.1%) were reported to the Korean TB surveillance system. Another study also stated that of the 592 TB cases included in the study, 85 (14.4%) were not reported. The percentage of unreported cases per health care center ranged from 0-45.2% (Morales-Garcia et al., 2015). Then it was strengthened by the results of qualitative research that there were fewer cases of extrapulmonary tuberculosis reported than pulmonary tuberculosis. The results of the indept interview

<i>THEME</i>	<i>CATEGORIES</i>	<i>CODES</i>
Doctor's competence	Specialist	... dokter paru (R1) ... dokter bedah (R2,3,4) ... dokter anak (R6,7) ... dokter umum (R8-15)
	Attend the training	... ikut pelatihan... (R5, 9) ... belum pernah ikut ... (R1-15, selain 5 dan 9)
	Attend the report	... ikut dalam prosesnYes ... (R11,14) ... No mengikuti prosesnYes ... (R1-10, 12,13,114,15)
	Diagnosis assessment	... sesuai TCM atau BTA (R1) ... sesuai TCM dan atau Tes Mantoex (R2-4) ... TCM dan atau radiologi/biopsy (R8-15)
	Nurse's competence	Expert ... perawat penata/ners (R16-20) ... perawat pelaksana vokasi (R21-28)
Komitmen Nakes (Non Medis)	Attend SITB training	... ikut pelatihan nasional (R16,17) ... ikut sosialisasi DKK (R18-26) ... No pernah ikut (R27,28)
	doing SITB reporting	...petugas input data TB (R16,20,22,23,25,27,28) ... petugas pelapor TB (R17,18,19,21,24,26)
	Doing work procedure of reporting	...sudah sesuai ... (R16-26,R29-33) ... No tau SOP ... (R34) ... kadang No sesuai ... (R27,28,35)
TCM	Documentation	...sudah terdokumentasikan ... (R16-28, R30-35) ... kadang No terdokumentasi ... (R29)
	Reporting case to SITB	... sudah dilaporkan ... (R16-22, R29-34) ... kadang No dilaporkan ... (R23-28, R35)
	Positive	... Yes..(R5) ... No ... (R11-15)
Type of TB	Negative	Yes (R7) No (R8)
	Pulmonary TB	... sudah dilaporkan ada Yesng belum
Hospital	Extra pulmonary TB	Ekstra paru sudah dilaporkan ... (R13) Ekstra paru belum sepenuhnyaYes ... (R10)
	Facilities	... sudah good ... (R29,30,32,) ... masih Less ... (R31,33) ... cukup ... (R34,35)
	Room networking	...sudah good... (R16,17,18,20,21,22,23,24,25,26) ...masih Less... (R19) ...cukup... (R27)
	Integrative system (SIM and SITB)	... belum ... (R16-28)

that some hospitals in Kudus Regency have diagnosed TB (extra pulmonary) but there are hospitals that do not diagnose extra pulmonary TB at all, there are no cases of tuberculosis that are not reported or in other words all cases are reported at SITT and doctors and TB officers who has the authority to report TB cases in hospitals. The study also found an association between unreported cases and extrapulmonary TB and smear-negative TB, whose diagnosis may be delayed or without histology or microbiological culture. Nonetheless, reporting TB cases to the public health department is important to identify affected patients immediately so as to reduce transmission, to calculate incidence accurately, and also to identify TB index cases (deVries *et al.*, 2012) central and western regions of China in 2015. PRIMARY AND SECONDARY OUTCOME MEASURES Under-reporting was calculated as the percentage of patients with TB not reported to TB Information Management System (TBIMS).

There was an effect of the patient's smear status on the incidence of unreported cases where TB patients with smear positive were 0.35 times less likely to be unreported than smear negative. This is in line with research conducted by (Díez *et al.*, 2005) which stated that smear positive TB patients were more infectious, so case reporting and contact tracing were very important. Then from the results of qualitative research it is also strengthened that patients with positive smears are easier to report cases at SITT because of complete data from examination to diagnosis. This is in line with research conducted by (Pang *et al.*, 2015) few studies have been done to determine the rate of mixed infections of *Mycobacterium tuberculosis* in China. Methods: In this study, we used the standard 24-loci MIRU-VNTR method to genotype the representative *M. tuberculosis* isolates from the national drug-resistant survey conducted in China. A total of 3248 *M. tuberculosis* complex (MTBC) in their research that one of the factors associated with under reporting of TB cases is AFB status. the results of the indept interview stated that there is no diagnosis of AFB negative status of TB patients who have not been reported in SITT. Therefore, tuberculosis patients with smear positive will be reported greater than smear negative. From the results of studies on the relationship between unreported cases and extra pulmonary TB and smear-negative TB whose diagnosis may be delayed or without histology or microbiological culture. This is similar to another study conducted by (Tollefson *et al.*, 2016) which examined the under-reporting of sputum smear positive tuberculosis cases in Kenya which stated that smear negative TB cases were often not reported because microbiological culture in smear samples was delayed and possibly due to the fact that providers thought that transmission is lower among these cases and reporting TB cases to the public health department is important to identify affected patients immediately so as to reduce transmission, to calculate incidence accurately and also to identify TB index cases. Smear-positive TB patients are more contagious so case reporting and contact tracing are very important and easy to implement and the study found that 9.4% of smear-positive

cases were not reported and lower than the rate described in other studies.

There is an effect of doctor's competence in the Tuberculosis Integrated Information System (SITT) on the incidence of unreported cases where TB patients who are examined by doctors with good competence have 0.09 times less chance of not being reported than being examined by doctors with less competence. This is in line with Melosini's research (Melosini *et al.*, 2012a), which examined the evaluation of underreporting tuberculosis in central Ttaly by means of record linkage. Then from the results of this qualitative study, it also supports that doctors with good competence have a small chance of cases being handled not being reported at SITT. The results of the indept interview regarding the competence of doctors showed that doctors at hospitals in Kudus were in accordance with their expertise, although there were a few who had not. In addition, doctors at the hospital had carried out examinations according to the diagnosis and case management, but there was one respondent who stated that it was not in accordance with the diagnosis and case management procedures and doctors at the hospital in Kudus had not carried out the diagnosis according to the results of the examination as many as 2 respondents. The rest of them stated that the doctor had carried out the diagnosis according to the results of the examination. The results of the indept interview also stated that doctors at the hospital in Kudus already knew the process and procedure for reporting cases. From the results of qualitative research, it is stated that the correct diagnosis and case management procedures and understanding of case reporting procedures and based on the results of the study also state that doctors with good competence can carry out examination procedures and diagnose cases correctly so that it is unlikely that cases will not be reported at SITT. The results of this study are reinforced by the results of a study conducted by (Gidado, 2019) which stated that heavy workloads and poor incentives affect the competence of doctors in being responsible for reporting TB cases. The results of the study were in two Chinese hospitals and contributed to the rate of under-reporting of cases and similar findings have been reported in Namibia, India and Bangladesh where lack of physician competence contributed to under-reporting (Zhou *et al.*, 2019). Research conducted by (Fatima *et al.*, 2017) stated that more than three quarters of the 8 million registered doctors in India are involved in private medical practice. The results of the study revealed that private doctors with low incomes in big cities in India have less knowledge in diagnosing and treating TB and lack of awareness and perception about public health services available for TB control. This study reveals gaps and weaknesses in the reported practice of private doctors in treating pulmonary TB, the most important and persistent problem of public health problem in India and the need for organized efforts to involve private doctors in disease control programs where their curative function can contribute significantly (Lambo *et al.*, 2011).

There is an effect of the competence of health workers in the Tuberculosis Integrated Information System (SITT) on the incidence of unreported cases where TB patients whose information is recorded by health workers with good competence are 0.05 times less likely to be unreported than those recorded by health workers with less competence. In other words, health workers who have less competence are more likely to have their cases reported at SITT. While the results of the qualitative research also support that health workers with good competence have a small chance of cases being handled not being reported at SITT. The results of the indept interview regarding the competence of health workers that health workers in hospitals are able to carry out and manage sputum specimens well. In addition, health workers in hospitals always maintain communication and interaction with patients and health workers in hospitals take actions according to doctor's directions. The results of the indept interview also stated that the health workers at the hospital did not experience any problems in reporting cases. The results of the qualitative study also support that nurses who have good competence have a tendency to report TB cases to SITT well. In the results of qualitative research, it is stated that competent nurses are shown by the quality of attitudes, motives, nurses' insights, interpreting skills, the ability to accept something new, mind maturity, and self-assessment in handling tuberculosis cases in hospitals. And the conclusion from the qualitative research which was carried out using the in-dept interview method stated that health workers with good competence have the ability to report tuberculosis cases well as well. Arisandi's research results (2011) also state that there is a relationship between TB officer training and the quality of TB services with a correlation coefficient (ρ_s) of 0.50 which means that the relationship is quite strong. Likewise with the results of research by Suharjana (2005), that the lack of training for paramedical officers has an effect on the low results of TB patient discovery activities. In contrast to the results of Syafe'i's (2006) research, it shows that there is no significant relationship between training and all officers' performance variables, including training.

Based on the results of this study, it shows that there is an effect of commitment of health workers in the Integrated Tuberculosis Information System (SITT) on the incidence of unreported cases where TB patients served by health workers with strong commitments are 0.13 times less likely to be unreported than those served by health workers with strong commitments. weak commitment. While the results of the qualitative research also support that health workers with a strong commitment have a small chance of cases being handled not being reported at SITT. The results of the indept interview regarding the commitment of health workers (nurses) that nurses have handled TB cases in accordance with the protocol set by the hospital. In addition, nurses always document the results of tuberculosis patient care that has been given and nurses have carried out reciprocal responses to patients. Furthermore, the results of the indept

interview stated that the evaluation of the performance of handling TS cases by TB officers at the hospital had been carried out well and the recording and reporting system of TB cases had been carried out properly by nurses at the hospital. Qualitative research showed that the commitment of TB laboratory personnel with good category with competency of tuberculosis cases was reported to SITT correctly. The results of qualitative research also support that TB cases handled by officers who have a good commitment will be well reported to SITT. This is in line with the research of (Melosini *et al.*, 2012a) which states that several reasons can be considered to explain the under-reporting rate due to the lack of commitment by health workers in dealing with tuberculosis cases in the first case, some units have not notified their TB cases and, in general, there is poor communication between the different UHP units and the Sanitation Office as indicated by the incomplete overlap between the two different registers.

There is an influence of hospital institutional contextual factors on the incidence of unreported cases where the intraclass correlation shows that the influence of hospital institutional contextual factors explains 11.24% (greater than 8-10%) variations in the incidence of unreported TB cases. The results of the qualitative study also strengthen that hospital management greatly determines whether or not tuberculosis cases are reported at SITT. The results of the indept interview stated that the implementation of TB case services in hospitals was in accordance with law number 25 of 2009, besides that the hospital had carried out several efforts to overcome public service constraints in the implementation of tuberculosis case services in hospitals. Furthermore, the hospital has carried out appropriate procedures to obtain TB case services (inpatient and outpatient) at the hospital and the facilities at the hospital are adequate both in terms of parking lots, medical equipment, etc. in serving TB cases. The results of the indept interview also stated the mechanism for complaints/complaints from patients due to dissatisfaction with TB case services at home. Research conducted by (Hong *et al.*, 2012) stated that the second main factor associated with under-reporting is the hospital's health information management system. The study found that Chinese hospitals use different operating systems to record patient information and transfer information to various TB reporting systems. Using different reporting systems, hospitals collect different information about TB patients and cases, making uniform data difficult to collect at the national level. Like China, health information management systems in many low- and middle-income countries are fragmented and often include multiple vertical systems designed to meet the requirements of national governments or international organizations/donors. As a result, the same problem exists in other low- and middle-income countries. For example, in Indonesia, the reporting forms in each health center are different, which results in missing data and hinders the data standardization process.

CONCLUSION

There is under-reporting of tuberculosis cases in seven hospitals in Kudus where the data on the SIM Hospital is not the same as the case data in the SITT Hospital and the DKK of Kudus Regency. TB cases were less likely to go unreported if the Competency of SITT Doctors were good (OR=0.09; CI95%= 0.05 to 0.17; p<001), Competencies of SITT Health Workers were good (OR=0.05; CI95%= 0.02 to 0.09 ; p<001), Strong commitment of health workers in the SITT (OR=0.13; 95% CI= 0.07 to 0.24; p<001), and positive TCM status of the patient (OR=0.35; 95% CI= 0.18 to 0.67; p=0.002). TB cases were more likely to be underreported if the TB type was extra pulmonary (OR=15.45; 95% CI=8.08 to 29.51; p<0.001). There is an influence of hospital institutional contextual factors on the incidence of unreported cases (ICC = 11.24%). In other words, there are variations in the incidence of unreported TB cases between hospitals related to hospital organizational-institutional factors. There is no influence of Pension, Facilities and Infrastructure, Hospital Network and Hospital Commitment factors on the incidence of TB cases not reported in the SITT at the individual level. Health workers and doctors who handle tuberculosis cases in hospitals in Kudus mostly do not have a national or regional SITT certificate, there are only a few who have attended training and have certificates 5. There is no integration between the Hospital SIM and the Hospital SITT or DKK which causes the occurrence of under-reporting of high tuberculosis cases in Kudus district.

Recommendation for further study deals with 1) Improving the competency of SITT Doctor certification in the Integrated Tuberculosis Information System (SITT); 2) Improving the competence of SITT certification of Health Workers in the Integrated Tuberculosis Information System (SITT). 3) Strengthening the Commitment of Health Workers in the Integrated Tuberculosis Information System (SITT), 4) Supervising reporting if the TB negative patients in this study were found to be prone to underreporting, 5) Closely monitoring reporting if the Extrapulmonary TB patients in this study were found to be prone to underreporting, and 6) Increasing the support of factors at the Hospital Institutional level to support the reporting of TB cases more strongly and consistently.

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