

Under-Reported of Tuberculosis Patients at Private Health Care Facilities in Indonesia

Kristina L Tobing¹, Feri Ahmadi¹, Oster Suriani Simarmata¹, Dian Perwitasari¹, Dina Bisara Lolong¹, Jonathan Marbun², Lamria Pangaribuan¹, Ina Kusrini³

¹ Researcher of National Institute of Health Research and Development (NIHRD), Ministry of Health, Indonesia

² Staff World Health Organisation (WHO), Indonesia

³ Researcher of Researcher of National Institute of Health Research and Development (NIHRD), Unit in Magelang Ministry of Health, Indonesia

ABSTRACT

Objectives: This study investigates the level of an under-reported tuberculosis patient in private health facilities in Indonesia.

Methods: The population of the study was private health care patients diagnosed or treated with tuberculosis. Samples were diagnosed tuberculosis patients or treated patients on January 1 until March 31, 2017, whether new patients, transfers, relapses, the patient is dropping out of treatment (default), a patient of failure, and another patient. Design of study cross-sectional. Variables collected to date of patient identity include name, age, full address, Population Identification Number, treatment, laboratory examination, laboratory results, type of tuberculosis drug. Under-reported tuberculosis is patients diagnosed and or treated but not reported to the national tuberculosis surveillance system.

Results: The total patient were 7,342 in the private health care facilities. The under-reporting tuberculosis case was from private health facilities (74.9%). Furthermore, the highest percentage of tuberculosis patients that were not reported was from non-hospitals such as clinics, practitioners, and private laboratories (98.9%), compared to private hospitals (71.4%).

Conclusions: The highest number of tuberculosis patients in private health facilities were recorded in hospitals compared to non-hospitals. The under-reporting rate was highest in private non-hospital facilities such as clinics, practitioners, and private laboratories compared to private hospitals.

Keywords: Private health facilities, tuberculosis, under reporting

Correspondence:

Kristina L Tobing

Researcher of National Institute of Health Research and Development (NIHRD), Ministry of Health, Indonesia

INTRODUCTION

Tuberculosis (TB) remains the leading cause of death from infectious disease among adults worldwide, with more than 10 million people becoming newly sick from tuberculosis each year, while 1.5 million people died from TB¹. The three countries with the highest estimated TB incidence rates were India (27%), China (9%), and Indonesia (8%)¹. For tackling this burden, the Government of Indonesia provides free TB treatment following the Directly Observed Treatment, Short-course (DOTS) strategy².

Many studies showed that DOTS increased the rate of compliance, reduced the recurrence of the disease, and prevented the development of multidrug resistance³. TB pandemic has become a global health priority, and as an important part of the Sustainable Development Goals (SDGs), whereas based on World Health Organization (WHO) End TB Strategy calls for an 80% reduction in the TB incidence rate and 90% reduction in the number of TB deaths between 2015 and 2030. The strategy calls for “government stewardship and accountability with monitoring and evaluation” and “eliciting full benefits of health and development policies and systems.” Furthermore, it is important to estimate the national and global burden of TB and calculate the necessary resources required for each country to combat the epidemic now and in the future⁴. Indonesia contributes to the number of TB patients globally, with 842,000 new TB patients every year⁵.

Despite increases in TB notifications, there is still a large gap between the number of new patients reported (7.0 million) and the estimated 10.0 million incident patient in 2018. This gap is due to a combination of under-reporting of the detected-patient and under-diagnosis (i.e. people with TB do

not access health care or are not diagnosed when they do)¹. WHO estimates almost 30% of all patients with tuberculosis (TB) are not reported to local or national TB surveillance program each year¹. TB under-reported can occur if patients are not diagnosed or are not reported to the national TB surveillance systems following diagnosis.

Under-reporting can result in inaccurate TB burden estimates. Additionally, delays in treatment initiation can prolong morbidity and increase subsequent transmission chances⁶. Many of the key principles of tuberculosis (TB) control are to develop a set of registries to capture information on patients evaluated for TB and then use the registries to monitor and evaluate the performance of early TB control programs. According to Dr. Karel Styblo, the most important step in organizing the basic components of the National Tuberculosis Program. This first step requires 1) political commitment on the part of the government, 2) a secure supply of drugs and materials, including a reserve stock, 3) a network of microscopy centers with a system of quality control, and 4) proper recording and reporting of patient⁷.

The Indonesian government established a standardized nationwide system known as the SITT (*Sistem Informasi Tuberculosis Terpadu*/Integrated Tuberculosis Information System), a specific TB surveillance system for all health facilities to report confirmed TB patients². In 2016 the Ministry of Health issued a regulation emphasizing that every healthcare facility (both government and private) must record and report any TB incidents in stages⁸. According to SITT data, in 2016, there were 9,681 (77.6%) government health facilities that reported TB cases out of 12,475 recorded government health facilities. Meanwhile, only 582 (5.6%) of

the 10,374 health facilities reported TB cases. China's TBC under-reporting rate is 19.3%, meaning that only 19.3% of China's TBC patients are not reported⁹. The patient TB under-reporting rate in Kenya in 2013 was 20.7% that was indicated system still has under-reported²⁰. The results of this 2019 study in China found that more than a quarter of TB cases recorded in hospitals were not recorded in the national TB reporting system¹⁰.

In 2016-2017 the Research and Development Center for Public Health Efforts had conducted a TB inventory study in Indonesia to calculate the level of under-reporting of TB cases in the National TB surveillance system. The health care facilities that participated the most in this study were private ones (3,334) than the government ones (873). The number of private health facilities that participated the most by type was independent practice doctors (1,649) and clinics (1,438), while the number of hospitals and laboratories that participated in the study¹¹. Based on the number of private health facilities participating in the inventory study, the authors wanted to know how to underreport TB cases in the national TB information system at private health facilities. The purpose of this study is to describe the number of TB patients who have not been reported (under-reporting) at private health facilities¹¹.

MATERIAL AND METHODS

This study further analyzed TB Inventory Study (TB-IVS) data conducted in Indonesia in 2016-2017. The TB-IVS used a cross-sectional study design with stratified cluster probability proportional to size (PPS) sampling method and was conducted at all public and private healthcare facilities in 23 selected districts/cities in 15 selected provinces in Indonesia. The TB-IVS unit of analysis was all TB patients diagnosed and treated in public and private healthcare facilities in selected districts/cities in Indonesia. This article will specifically discuss the level of TB case under-reporting in private healthcare facilities¹¹.

The study population was private health care facility patients diagnosed with and treated for TB. The study samples were TB

patients diagnosed and treated at private healthcare facilities, including new patients, transfers, relapse, treatment dropout (default) patients, and treatment failure patients. All those diagnosed and or treated with TB from January 1 to March 31, 2017, which were sourced from the TB Inventory Study data, were further analyzed. Variables collected through questionnaires included: patient data, such as name, age, address, Population Identification Number (NIK), date of treatment, date of laboratory examination, laboratory results, type of TB drugs given. Private healthcare facilities consisted of hospitals, clinics, private practitioners, and private laboratories.

TB patients collected from private healthcare facilities were classified into bacteriologically confirmed TB patients and clinically diagnosed TB patients. In order to overcome the duplication of TB patient data, a remove duplication process was done. Furthermore, data matching with STATA 14 program was classified based on matched TB patients recorded in both the TB-IVS (for drug-sensitive TB) and SITT/e-TB Manager (for drug-resistant TB) records. The record linkage process was used to compare TB-IVS data results with routine reporting results in the National TB Surveillance System. A case was considered unmatched if it was not recorded in one of the recording systems. Under-reported TB was TB patient diagnosed and or treated but not reported to the National TB Surveillance System (SITT/e-TB manager). After obtaining the level of TB under-reporting in private facilities, under-reporting was calculated based on the type of health care facility, age group, sex, and region. Analysis performed using the STATA 14 program used univariate and cross-tabulation analysis.

RESULTS

The total number of private health facilities mapped and found by enumerators was 3,425 facilities. Of these, only 911 facilities participated, with 116 private hospitals, 417 clinics, 337 independent practicing doctors, and 41 laboratories (Table 1).

Table 1. Number of health service facilities enumerator data, eligible and participating.

No	Health Service Facilities	Health facilities based on enumerator records	Health facilities Eligible	Health facilities Participate
1	Hospitals	156	116	116
2	Clinic	1.522	420	417
3	Practitioner	1.653	339	337
4	Laboratory	94	42	41
	Total	3.425	917	911

Source: Report SIV-TB di Indonesia

The total number of patient TB cases was 7,342 in the private sector. Most patients were found in males, were 15-54 years, which was in productive age, and many were in the Java-Bali

region. The highest number of TB patients recorded in private healthcare facilities were from hospitals (3,856) (Table 2).

Table 2. Number of TB Patients by demographic characteristics and type of private healthcare facilities (Analysis of 2016-2017 TB Inventory Study data)

Characteristics	Non-Laboratories			Laboratories	Total
	Hospital	Clinic	Practitioner	Private	
	n	n	n	n	
Age group					
<15 years	800	386	357	85	1.543
15-54	2048	795	697	470	4.010
55+	1008	267	199	230	1.704
Sex					
Male	2.170	825	638	464	4.097
Female	1.686	623	615	321	3.245
Region					
Sumatera	535	149	137	48	869
Java Bali	3.172	1.295	993	737	5.460
Others	149	4	123	0	276
Total	3.856	1.448	1.253	785	7.342

Table 3 shows the proportion of TB patients in public and private facilities reported and not reported to the National TB Program. Most of the under-reported TB patients came from

private healthcare facilities (74.9%) than public healthcare facilities (31.0%).

Table 3. Percentage of Reported and Under-reported TB Patient in Government and Private Healthcare Facilities (Analysis of 2016-2017 TB Inventory Study Data)

No.	Healthcare facilities	Reported		Under-reported	
		Percentage	CI 95%	Percentage	CI 95%
1	Government	69.0%	(0.630-0.743)	31.0%	(0.256-0.369)
2	Private	25.11%	(0.199-0.311)	74.9%	(0.688-0.800)

Table 4 shows the percentage of TB patients. It can be seen that the proportion of reported TB patients is very small in private non-hospital facilities (1.1%) and private hospitals (28.6%). The percentage of under-reported TB patients was higher in

private non-hospital facilities: including clinics, private practitioners, and laboratories (98.9%) compared to private hospitals (71.4%).

Table 4. Proportion of reported and under-reported TB patients in private healthcare facilities (hospitals and non-private hospitals) (Analysis of 2016-2017 TB Inventory Study data)

No	Types of private healthcare facilities	Reported		Under-reporting	
		Proportion	95%CI	Proportion	95% CI
1	Private Hospital	28.6 %	(0.208-0.379)	71.4%	(0.411-0.620)
2	Private Non-Hospital (Clinic, practitioner, Laboratories)	1.1 %	(0.004-0.020)	98.9%	(0.973-0.995)

Table 5 shows the percentage of TB patients not reported in hospitals and non-hospital based on their characteristics. The percentage of TB patients that were not reported on average was high in non-hospital healthcare facilities in both men and women, in the age group <15 years and ≥15 years, the average was 99%, and it was evenly high in Sumatera and Java-Bali.

The percentage of TB patient that were not reported in private hospitals in men and women was almost the same, in the age group <15 years, it was higher (74.3%) compared to the age group ≥15 years (70.7%), and it was higher in the Sumatera region (87.1%) compared to Java-Bali and Eastern Indonesia (68.4% and 74.8% respectively).

Table 5. Characteristics of Under-reported TB Patient in Private Healthcare Facilities (Hospitals and Private Non-Hospitals) by Age, Sex and Region (Analysis of 2016-2017 TB Inventory Study Data)

No	Characteristics	Private Hospitals		Private Non-Hospitals (clinics, private practitioners, laboratories)	
		Proportion	95% CI	Proportion	95% CI
	Sex				
1	Male	71.2%	0.615-0.792	98.3%	0.958-0.993
2	Female	71.6%	0.610-0.801	99.6%	0.987-0.998
	Age Group				
3	<15 years	74.3%	0.607-0.843	99.4%	0.978-0.998
4	≥15 years	70.7%	0.606-0.790	98.7%	0.966-0.995
	Region				
5	Sumatera	87.1%	0.564-0.972	99.2%	0.919-0.999
6	Java-Bali	68.4%	0.581-0.771	98.5%	0.965-0.993
7	Eastern Indonesia	74.8%	0.334-0.946	-	-

DISCUSSION

Recording and reporting are elements in TB surveillance that can illustrate a country's TB prevention and control program's status and progress. The recording and reporting of TB patients cannot be separated from the national TB surveillance system (SITT/e-TB manager)¹². In countries where tuberculosis is endemic, health and surveillance systems are usually weak, with underdiagnosis and under-reporting common¹³. The study results were 21,320 TB patients obtained from all public and private healthcare facilities from 23 selected districts/cities across 15 selected provinces in Indonesia⁹. In that period, most TB cases came from public health care facilities (69,4%) compared to the private sector (34,6%). The highest number of TB patients in this study were in the age group of 15-54 years, whose infection primarily infects people in the age group 15-59 years old (85%)⁹.

Underreporting TB in Indonesia in 2017 was 41%, which means that 41% of TB patients from public and private health facilities were not reported in the national TB surveillance system. If there are 21,320 patients of tuberculosis recorded throughout health care facilities, there are about 8,741 patients not recorded in the national TB surveillance system¹¹. China's TB reporting system is better than ours; China's TB under-reporting rate is 19.3%, meaning that only 19.3% of China's TB patients are not reported¹².

This study indicates that a significant number of TB diagnosed in private hospitals were not accurately reported at the national level. Similar findings have been found in other countries. Three pillars comprise the End TB Strategy: 1) Integrated Patient-Centered Care and Prevention; 2) Bold Policies and Supportive Systems, and 3) Intensified Research and Innovation. Some studies reported that over a quarter of TB patients recorded in the internal hospital records were not entered into the national TB reporting systems¹⁴. There is also evidence that India has a long history of its Health Management Information and Evaluation System (HMIES). Though it has well served its purpose of administrative reporting, the system has failed to provide relevant and sufficient information to health services users, planners, and policymakers as available information are fragmented, incomplete, and sometimes inconsistent¹⁵. Similarly, evidence showed Namibia and Thailand suffer from a lack of national data standardization and accessibility and might not accurately report the number of confirmed TB patients¹⁶.

Almost all data sources for a country revealed discrepancies between notifications, prevalence, and cause of death data in some countries (e.g., the incidence model showed a pattern in under-reporting of notification data, which increased with age). In many high-tuberculosis-burden settings, tuberculosis patients treated in the private sector are not notified; barriers to notification include, but are not limited to, confidentiality concerns, ignorance of reporting procedure, and scarcity of time¹⁷. Studies conducted at the University Hospital of Pisa in Italy for ten years (1999-2008) obtained an average under-reporting rate of 69,4% and decreased every year (68% in 1999, and 48% in 2008). Like a similar patient in Italia as expected, the underreporting rate was higher for patients treated in Day Hospital and patients with a TB code in the second or following position of the HDR, TBC under-reporting rate was 48% a year¹⁸. The patient TB under-reporting rate in Kenya in 2013 was 20,7% that was indicated system still has under-reported²⁰. Research results in China in 2015 were obtained from 5.606 patients with TB who were found in health facilities; only 1082 (19,3%) were not reported to the TB Information Management System (TBIMS)¹².

Different situations in Korea which have Clinicians who do not follow the guidelines are less likely to notify their patients. The number of physicians who did not follow the TB diagnosis and treatment guidelines may be higher, resulting in reporting might be differences¹⁹. On the other hand, underreporting was significantly lower for patients with more severe diseases (like patients with cavitary lung lesions) or smear-positive patients¹⁹. However, they may be most relevant for countries where substantial under-reporting is expected because reporting of TB is not mandatory or is mandatory but not enforced, or due to a large private or non-NTP public sector with weak or no linkages to the official TB surveillance system²⁰. The level of TB under-reporting found was context-dependent, ranging around 15% in European countries, 20% in Africa, 30% in the Eastern Mediterranean region, and 50% in Asia with a large private sector. These data have all informed national estimates of TB disease burden²¹.

Based on TB patients' surveillance data, we can identify the epidemic, situation, and TB characteristics to find the solution. For example, the data found TB patients to be more common in men (56.4%) than in women (43.6%). Results of epidemiological studies in Albania suggested that 63.2% of TB patients were in men²². The Indonesia Basic Health Research (Riskesdas) 2013 revealed that men were 10% more likely to

get TB compared to women²³, while the results of *Riskesdas* 2018 showed the prevalence of new TB in men was slightly higher (0.5%) than in women (0.4%)²⁴. Likewise, the results of Rukmini's research in 2010 stated that males had 1.6 times more risk of getting TB compared to female²⁵. In India, the first effort to initiate disease surveillance was undertaken before Independence Day. The main purpose was to identify various epidemics that would help in determining a treatment solution. Thus, situations necessitated the collection and maintenance of such information regularly in the hospitals. After the independence, the demand for having periodic information on diverse aspects of socio-economic, health, and other aspects of the population has increased, and it is expected to grow with the country's progress. With the epidemiological changes taking place in India, there will be a growing requirement for more information on the planning of health services to facilitate informed decision-making for the country's benefit²⁶. Bangladesh, particularly from household surveys and health facility assessments. Data utilization practices also exist, with wide acceptability of survey results informing policy, program review, and course corrections²⁷. Despite high data availability from multiple sources, the country's capacity for providing regular updates of major global health estimates remains low. Major challenges include limited human resources, capacity to generate quality data, and multiplicity of data sources, where discrepancy and lack of linkages among different data sources (local sources and between local and global estimates) present emerging challenges for interpretation of the resulting estimates²⁷. Similarly, Indonesia has many sources of household and facility data available. However, it is facing many problems that include limited human resources and data accuracy. Only a quarter of the number of personnel needed is available to manage the SITT in health facilities in Indonesia's geographic and electronic data capture. TB under-reporting in Indonesia in 2017 was 41%. It means that 41% of TB patients in public and private facilities were not reported to the National TB Surveillance System. If there are 21,320 TB patients recorded in all health facilities, there are around 8,741 patients not recorded in the National TB Surveillance System. As many as 74.9% of TB patients in the private sector were under-reported. In comparison, the level of under-reporting in public healthcare facilities was 31%. The under-reported TB patient in private healthcare facilities came mostly from non-hospitals (clinics, private practitioners, and laboratories), which was as high as 98.9% compared to 71.4% from private hospitals¹¹. In hospital private healthcare facilities (clinics, private practitioners, and laboratories), the average TB under-reporting rate was high for men and women and all age groups; in Sumatera and Java-Bali regions, the TB under-reporting rate in non-hospital private healthcare facilities (98%-99%). It is a concern for the District Health Offices to improve further the recording of TB patients' recording to private clinics, practitioners, and private laboratories in their respective working areas. TB under-reporting in non-hospital private healthcare facilities in the eastern Indonesia region was not obtained, this was because, at the time of data collection, there were no eligible non-hospital private healthcare facilities, or in other words, there was no TB patient diagnosed and or treated in private facilities. The high level of under-reporting in private healthcare facilities must concern the local government, especially the district/city health offices. Most

private healthcare facilities are not involved with the national TB program. Most private healthcare facilities have not yet implemented a directly observed treatment short-source (DOTS) program, especially in private clinics, practitioners, and laboratories private.

According to 2016 SITT data, the number of private healthcare facilities that reported TB patients only 2,5 % (582) of 10,374 recorded healthcare facilities in the system. The result of the Patient Pathway Analysis (PPA) Study in Indonesia in 2017 that not all treated TB patients were recorded in the standard national recording system (SITT/e-TB manager), especially from the practitioners in private facilities and private hospital's private clinic²⁸.

The research results at clinics and private practice physicians in Ethiopia obtained as much as 80% of physicians practice not recording TB (Eighty percent of the PPs did not keep TB register)²⁹, this will affect TB reporting to the national surveillance system. The national TB surveillance system implementations the recording and reporting of TB patients from public health centers (*Puskesmas*) and hospitals that have implemented stages starting in districts and provinces. Every healthcare facility that provides is captured and treated according to the standard national recording and reporting format. Recording and reporting start from the basic health facilities. Based on health Ministry Degree number 67, 2016, it is stated that all healthcare facilities, both public and private, must record and report every TB case in stage recording to the applicable regulations. Specifically, for health care facilities that have direct (online) access to an integrated tuberculosis information system (SITT/e-TB manager), these healthcare facilities will independently report TB cases directly to the SITT/e-TB manager.

CONCLUSIONS

TB under-reporting was much higher in the private sector than that in the public sector. Mostly the number of TB patients were from private hospitals. The percentage of TB patients that were not reported to the National TB Surveillance System was higher in non-hospital private healthcare facilities (clinics, independent doctor practices, and laboratories). In Sumatera and Java-Bali regions, the under-reporting of TB in non-hospitals (clinics, *DPM*, and independent laboratories) is almost one hundred percent. Probably the higher under-reporting among private health service providers is due to the lack of human resources.

LIMITATIONS

This study has somewhat limited accuracy, when sampling design did not include Papua and West Papua provinces. Both provinces are huge, with difficult geographic condition, electricity and logistic issues that can affect the reporting system.

ETHICS STATEMENT

The 2017 Inventory Study National TB was approved by the ethics committee of the National Institute of Health Research and Development.

CONFLICT OF INTEREST

The authors have no conflicts of interest associated with the material presented in this paper.

ACKNOWLEDGEMENT

We would like to express our gratitude to all NIHRD researchers and NTP staffs who contributed in developing the protocol until finalizing the results; and National and Provincial/Districts level Health staff in helping in field activities. We also gratefully acknowledge WHO consultants and KNCV staff who had provided technical assistants and Global Fund and TB Alliance for financial support for this study.

AUTHOR CONTRIBUTIONS

Conceptualization: KLT, FA, DBL. Data collection: OSS, FA, KLT, Formal analysis: MNF, KLT, DBL. Funding acquisition: None. Methodology: KLT, OSS, DBL. Project administration: MS. Writing – original draft: KLT, DBL, FA. Writing – review & editing: KLT, DBL, DP, JM, LP, IK. Submission: DP

REFERENCE

1. WHO. Global Tuberculosis Report. 2019.
2. Ministry of Health R of I. Regulation of the Minister of Health of the RI Number: 565/MENKES/PER/III/2011 regarding the National Strategy for Control of TB in Indonesia 2010-2014. 2011.
3. Yin J, Yuan J, Hu Y, Wei X. Association between directly observed therapy and treatment outcomes in multidrug-resistant tuberculosis: A systematic review and meta-analysis. *PLoS One*. 2016;11(3):1–14.
4. World Health Organization. First WHO Global Ministerial Conference Ending TB in the Sustainable Development Era: A Multisectoral Response [Internet]. 2017 [cited 2019 Jan 28]. p. 16–7. Available from: http://www.who.int/tb/features_archive/Moscow_Declaration_to_End_TB_final_draft_ENGLISH.pdf. ri (2019)
5. WHO. Global tuberculosis report 2018. Geneva: World Health Organization; 2018. Licence: CC BY-NC-SA 3.0 IGO. 2018.
6. Uplekar M, Weil D, Lonnroth K, Jaramillo E, Lienhardt C, Dias HM, et al. Viewpoint WHO 's new End TB Strategy. *Lancet*. 2015;6736(15):1–3.
7. Enarson DA. Principles of IUATLD collaborative tuberculosis programmes. Vol. 66, *Bulletin of the International Union Against Tuberculosis and Lung Disease*. 1991. p. 195–200.
8. Ministry of Health R of I. Regulation of the Minister of Health, RI Number 67 Year 2016. 2019.
9. Triningtias AY, Haifa T, Putri K, Ilmu D, Masyarakat K, Kedokteran F, et al. Pulmonary Tuberculosis Distribution Pattern In The Kelurahan Utama Of South Cimahi District In 2018. *Med Kartika J Med Heal*. 2019;2(2):98–109.
10. Zhou D, Pender M, Jiang W, Mao W, Tang S. Under-reporting of TB cases and associated factors: A case study in China. *BMC Public Health*. 2019;19(1):1–9.
11. National Institute Health Research and Development M of HR. Inventory StudyTuberculocis in Indonesia 2016–2017. 2018.
12. Li T, Shewade HD, Soe KT, Rainey JJ, Zhang H, Du X, et al. Under-reporting of diagnosed tuberculosis to the national surveillance system in China: An inventory study in nine counties in 2015. *BMJ Open*. 2019;9(1).
13. World Health Organization. Global Tuberculosis Report 2016. World Health Organization. 2016.
14. Uplekar M, Weil D, Lonnroth K, Jaramillo E, Lienhardt C, Dias HM, et al. WHO's new end TB strategy. *Lancet*. 2015;385(9979):1799–801.
15. V.K. Tiwari, Kuldeep Kumar, Sherin Raj T.P. PDK. Standards, Frameworks and Practices in Health Management Information and Evaluation Systems (HMIES) in Australia and India: Lessons for Future Transition in India? *J Heal Manag*. 2016;18(1).
16. N. Arakawa, RN, MSN, BSN, PHN. K.Ota RN, PHN, PhD, L. Piyabnadtikul RN, PhD & M.Ishikawa BE, ME P. Construction and usability of community health nursing database in rural north-eastern Thailand. *Int Counc Nurses*. 2018;515–23.
17. Uplekar M, Atre S, Wells WA, Weil D, Lopez R, Migliori GB, et al. Mandatory tuberculosis case notification in high tuberculosis-incidence countries: Policy and practice. *Eur Respir J [Internet]*. 2016;48(6):1571–81. Available from: <http://dx.doi.org/10.1183/13993003.00956-2016>
18. Melosini L, Vetrano U, Dente FL, Cristofano M, Giralardi M, Gabbrielli L, et al. Evaluation of underreporting tuberculosis in Central Italy by means of record linkage. *BMC Public Health*. 2012;12(1):1–6.
19. Hong SJ, Park YS, An H, Kang SM, Cho EH, Shin SS. Factors leading to under-reporting of tuberculosis in the private sector in Korea. *Int J Tuberc Lung Dis*. 2012;16(9):1221–7.
20. Sismanidis C, Glaziou P, Bloss E, Hest R van, Fatima R, Hoa NB, et al. Understanding and addressing the tuberculosis case detection gap: national inventory studies to improve estimates of incidence and strengthen surveillance.
21. World Health Organization, World Health Organization (WHO), WHO, WHO - World Health Organization, World Health Organization. Global Tuberculosis Report. Geneva: World Health Organization; 2015.
22. Mataj E, Shehi A, Dervishi G, Mataj S. Epidemiology of Tuberculosis (TB) in Albania 1998-2009. 2015;5(10):26–32.
23. National Institute Health Research and Development M of HR. Basic Health Research (Riskesdas 2013). 2013.
24. National Institute Health Research and Development M of HR. Basic Health Research Main Result 2018 [Internet]. 2018. Available from: http://www.depkes.go.id/resources/download/info-terkini/materi_rakorpop_2018/Hasil_Riskesdas_2018.pdf
25. Rukmini, Chatarina U. Incidence of Adult Pulmonary TB in Indonesia (Analysis of Basic Health Research Data, 2010). *Heal Syst Res Bull*. 2011;14(4):320–31.
26. Pandey A, Roy N, Bhawsar R, Mishra RM. Health Information System in India: Issues of Data Availability and Quality. *Demogr India*. 2010;39(1):111–28.
27. Zunaid K, Tahsina T, Iqbal A, Binte N, Kanti S. Production and use of estimates for monitoring progress in the health sector : the case of Bangladesh. *Glob Health Action*. 2017;10(1).
28. TB TC, KNCV, USAID. Tehnical Instruction for the Implementation of District / City Based Public Private Mix in Challenge TB Assisted Areas. 2018.
29. Shimeles E, Aseffa A, Yamuah L, Tilahun H, Engers H. Knowledge and practice of private practitioners in TB

control in Addis Ababa. Int J Tuberc Lung Dis.
2006;10(10):1172–7.