Under-Reported Tuberculosis Among Children: Subsample Analysis Indonesia Tuberculosis Inventory Study 2016-2017

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Abstract

Background: Indonesia has the third highest TB burden after India and China. TB disease in children reached an estimated one million worldwide, with 233,000 deaths due to TB in 2017. The study aimed to provide under-reporting TB in children <15 years.

Methods: Inventory TB study data were used for analysis. This perspective district-based study in Indonesia involves all health facilities in selected areas that have diagnosed and treated TB in children in the last three months. All cases of TB in children who were clinically diagnosed and bacteriologically confirmed and categorized as new cases or re-treated were included for analysis.

Results: Total cases of TB 23,320 in all group ages obtained by health care facilities from 23 districts/cities. Most TB cases occurred in the age group ≥ 15 (82%), while the remaining 18% were aged < 15 years. The under-reporting rate of TB <15 years was 54%. Under-reporting of TB in the age group < 15 years mostly in non-primary health care facilities (71%), for example, hospitals, clinics, general practitioners, and pediatricians, whereas the rest is from primary health care (19%).

Conclusion: Under-reporting of TB in children is still above 50%, especially in the 0-4 year age group. Under-reporting of TB in children mainly occurs in non-primary healthcare facilities. For this reason, the role of the regions, especially the health office, needs to supervise and guide hospitals, clinics, and private practitioners regarding the recording and to report TB in children to an integrated tuberculosis information system.

Keywords: tuberculosis, underreporting, inventory

Abstrak

Latar belakang*: Indonesia memiliki beban TB tertinggi ketiga setelah India dan China. Penyakit TB pada anak diperkirakan mencapai satu juta di seluruh dunia, dengan 233.000 kematian akibat TB pada tahun 2017. Penelitian ini bertujuan untuk mengetahui gambaran pelaporan TB pada anak <15 tahun.*

Metode*: Data studi inventarisasi TB di Indonesia digunakan untuk analisis. Studi ini dilakukan di 23 kabupaten di Indonesia pada tahun 2016-2017. Studi perspektif berbasis kabupaten di Indonesia melibatkan seluruh fasilitas kesehatan di daerah terpilih yang telah mendiagnosis dan mengobati TB pada anak dalam tiga bulan terakhir. Semua kasus TB pada anak yang didiagnosis secara klinis dan dikonfirmasi secara bakteriologis dan dikategorikan sebagai kasus baru atau diobati ulang dimasukkan untuk analisis.*

Hasil*: Total kasus TB 23.320 pada semua kelompok umur yang diperoleh dari fasilitas pelayanan kesehatan pada 23 kabupaten/kota. Kasus TB terbanyak pada kelompok umur ≥ 15 (82%), sedangkan sisanya pada kelompok umur < 15 tahun (18%). Under reporting TB anak kurang dari 15 tahun adalah 54%. Under-reporting TB anak terbanyak pada fasilitas pelayanan kesehatan non primer (71%) seperti rumah sakit, klinik, praktek dokter mandiri, sedangkan sisanya dari pelayanan kesehatan primer (19%).*

Kesimpulan*: Under-reporting TB pada anak masih di atas 50% terutama pada kelompok umur 0-4 tahun. Kurangnya pelaporan TB pada anak terutama terjadi di fasilitas kesehatan non primer. Untuk itu peran*

daerah khususnya dinas kesehatan perlu melakukan pengawasan dan pembinaan terhadap rumah sakit, klinik, dan praktek dokter mandiri terkait pencatatan dan pelaporan TB anak ke dalam sistem informasi TB yang terintegrasi.

***Kata kunci**: tuberkulosis, underreporting, inventaris*

INTRODUCTION

Tuberculosis (TB), a chronic infectious disease caused by the airborne transmission of Mycobacterium tuberculosis aerosolized droplets, is a serious global public health concern.[1] In 2021, 10.6 million people will contract tuberculosis, a 4.5% increase over the 10.1 million cases in 2020. Similarly, the TB incidence rate (new cases per 100,000 people per year) is anticipated to grow by 3.6% between 2020 and 2021.[1]

The World Health Assembly approved the "End T Strategy" of the World Health Organization (WHO) in May 2014, which seeks to achieve a 95% reduction in death attributable to tuberculosis and a 90% reduction in the occurrence of new cases by 2035, according to 2015 predictions[2]. In Indonesia, however, an estimated 969.000 (354 per 100,000) would contract tuberculosis in 2021, an increase of 8.7% from 2020. A rise in individuals with undiagnosed and untreated tuberculosis would increase TB-related fatalities.[1]

Globally, the reported percentage of TB cases in children ranges from 3 to 25 percent.[3] Due to their compromised immune systems, children are a high-risk category for tuberculosis. Children's tuberculosis is distinct and presents different challenges than TB in adults. The study's results in Pakistan were obtained under-reporting TB in children 78%. It means up to 78% of all child TB cases are not reported to the national TB surveillance system.[4] WHO estimates that around 40% of tuberculosis (TB) patients are not annually reported to local or national TB surveillance.[5] In 2015, just 9% of all tuberculosis cases confirmed by TB programs were in children.[6] There were an estimated 1,020,000 cases of tuberculosis in 2016. However, only 360,565 were reported. Based on recorded cases, 9% are youngsters with tuberculosis (32,604).[7]

Following Minister of Health Regulation No. 67, 2016, all healthcare facilities are required to record and report TB incidences in stages. First-level health facilities (fasilitas kesehatan tingkat pertama-FKTP), such as primary health care (Puskesmas), clinics, and private general practitioners (DPM), as well as advanced referral health facilities (fasilitas kesehatan rujukan tingkat lanjutan-FKRTL), such as public and private hospitals, lung hospitals (rumah sakit paru-RSP), and Community Lung Health Centers (balai kesehatan paru masyarakat-BKPM). Particularly for health facilities with direct access (online) to the Integrated TB Information System (Sistem Informasi TB Terpadu- SITT), TB cases would be reported directly.[8]

In 2017, the Center for Research and Development for Public Health, National Institute of Health Research and Development (NIHRD) MoH, conducted a national TB inventory study to find out the under-reporting of TB in Indonesia. The level of TB underreporting can indicate the gap between the diagnosis and reporting of TB cases.[9] Based on available data from the results of the TB inventory study, the authors conducted further analysis of the underreporting of TB in the group <15 years in Indonesia. This article aims to get an overview of the TB underreporting rate in children <15 years.

METHODS

The Study Design

This study was a nationwide-based cross-sectional study. This study was a national cluster-based, prospective study targeting all facilities in the selected study areas that diagnose and treat childhood TB in Indonesia. TB Inventory Study was conducted in 23 districts/cities in 15 provinces in 2017. The list of health facilities was obtained from the Ministry of Health's Data and Information Center, district health offices, and medical associations. Table 1 describes the groups of health facilities involved in the study of the area. Health facilities that have had patients diagnosed or treated with TB in the past three months since mapping is considered eligible to be involved in the study.

The Population and Sample

The study population included all child TB cases diagnosed and treated in public and private health facilities in selected districts/cities. A healthcare facility is an instrument or premises used to organize healthcare programs, including promotive, preventive, curative, and rehabilitative efforts, carried out by the central and regional/local governments, the private sector, and community groups.

Table 1. Health Facilities in TB Inventory Study

No	Public	Private
1	Primary Health Care (Puskesmas)	Private practitioners
2	DOTS clinics in public hospitals	Medical Centers (BKM)
3	Specialist clinics in general hospitals (internal medicine, pediatrics, obstetrics, HIV, pulmonology, and other clinics)	Private hospitals (DOTS clinics, specialist clinics, outpatient clinics)
4	Outpatient department/general consultation service in public hospitals (if DOTS clinics are not available or facilities are not connected to DOTS), including Maternal and Child Health (KIA) service	Private university hospitals (DOTS clinics, specialist clinics, outpatient clinics)
5	Inpatient departments in hospitals	Inpatient departments in hospitals
6	Clinics at correctional facilities	NGO clinics
7	Clinics at detention facilities	Occupational health clinics
8	Military hospitals (DOTS clinics, specialist clinics, outpatient clinics)	Private laboratories
9	University hospitals (DOTS clinics, specialist clinics, outpatient clinics)	
10	State-owned enterprise (BUMN) hospitals (DOTS clinics, specialist clinics, outpatient clinics)	
11	Regional health laboratories	

Source: MoH of Indonesia, Tuberculosis Inventory Study 2016-2017

In these study areas, we collected data on cases diagnosed by all healthcare providers within these areas for a specified period, followed by record linkage to the electronic, case-based National Tuberculosis Program (NTP) database.[9]

All eligible facilities from sampled districts were enumerated and invited to participate in the study.

Sample Selection

This study will describe the under-reporting of TB in children aged <15 years. All pediatric TB patients in health facilities who met the criteria will take as a sample. Child TB cases are all child TB patients registered in health facilities, including new patients, transfer-out patients (with no history of previous treatment), relapse patients, treatment after loss to follow-up patients (default), treatment after failure patients, and other cases. Some definitions of child TB cases above are as follows: 1. New patients are patients who have never been treated for child TB or have taken anti-TB drugs for less than one month (4 weeks); 2. Relapse patients have previously been treated for child TB, were declared cured or treatment completed, and are now diagnosed again with positive Acid Fast Bacillus (AFB) testing (smear and culture); 3. Treatment after loss to follow-up patients (treatment after default patients) are patients who have previously been treated for TB, have discontinued the treatment for two months or more, and are now diagnosed with positive Acid Fast Bacillus (AFB); 4. Treatment after-failure patients have child TB-positive results of their sputum examination or who become TB-positive again in the fifth month or later of their treatment. Child TB cases are classified into two categories: Bacteriologically confirmed TB and clinically diagnosed TB.

Public healthcare facilities include hospitals, universities, medical organizations, social security hospitals, army hospitals, and primary health care (puskesmas). Private healthcare facilities include private hospitals, teaching hospitals and universities, clinics/general practitioners, health facilities managed by NGOs, and informal healthcare providers. Private laboratories were also included in the study.

Case Definition

All pediatric TB cases, diagnosed clinically or bacteriological confirmation and categorized as new cases or re-treatment, are analyzed. Bacteriologically confirmed pediatric TB cases involve biologically positive specimens with smear, culture, or rapid diagnostic microscopes such as GeneXpert *Mycobacterium tuberculosis* and resistance to rifampin (MTB/RIF) testing. Clinical pediatric TB cases are cases of childhood TB that are clinically diagnosed without bacteriological confirmation but have been diagnosed with active TB by a physician or other medical practitioner. These include cases of pediatric TB diagnosed with X-ray abnormalities or suggestive histology extrapulmonary cases with laboratory confirmation.

Data Collection Tools and Procedures

The data collection team maps healthcare facilities in selected districts in the first phase. Public and private healthcare facilities and laboratories that meet the criteria will be revisited for TB patient data collection. The data enumerator team uses the form to complete patient data, including the patient's full name, full contact address (with mobile phone number), age, gender, referral source, specimen number examined, test results, final diagnosis, and attending physician. In treating pediatric TB in hospitals, these registers are placed at all entry points of pediatric TB patients, such as children, pediatricians, pulmonologists, and medical personnel. Then all the forms the officer has filled out are sent to the data management team. Furthermore, editing and entry, and data cleaning are carried out.

Data Quality Assurance (DQA)

Each record was cross-checked from the hard copy for deletion inconsistency between the hard and soft documents to ensure the data was valid. The DQA process for cross-examination of registers is completed after the end of the study period.

Data Management and Analysis

All pediatric TB cases from the government, private healthcare facilities, and private laboratories are inputted into one server. The de-duplication stage was performed in the probabilistic matching by comparing the following variables: from each case: first name, father's name, surname/surname, place of residence, gender, age, and name of health facility. If a case name is found, the research team carries a multi-match manual review (one case matches too many) to remove duplicates. Data analysis was performed for all TB cases in the age group < 15 years. Under-reporting child TB cases are defined as cases that are diagnosed and treated but not reported to the National TB Surveillance System (Sistem Informasi Tuberculosis-SITB). The record-linkage process is used to compare the data result of the study and the data from the routine reporting in the National TB surveillance system. This method confirms that all recorded cases are unique or unduplicated with STATA 13.

Ethical Considerations

The ethics approval letter was obtained from the National Institute of Health Research and Development Ethics Commission, Ministry of Health. Inform consent was given to government, private, and laboratory healthcare facilities but not patients because the study was based on a review of records, and there needed to be an intervention for pediatric TB patients. The ethics committee ignored the consent of the patient. The data is stored in electronic registers with protected codes. Only the principal investigator or authorized person can access the data for analysis.

RESULTS

TB cases reached 23,320 cases for all groups of age obtained from all existing healthcare facilities in 23 districts/cities in Indonesia in 2017. Figure 1 shows the total number of TB cases based on group age. Most TB cases occurred in the age group ≥15 years (82%), while the remaining 18% (3,793) were in the age group <15 years.

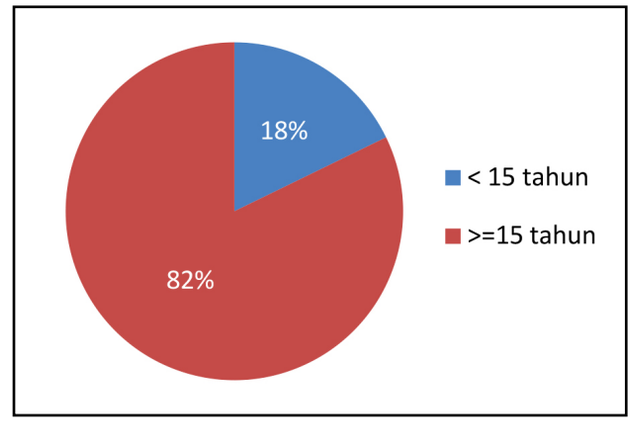

Table 2 shows the distribution of TB cases in the child based on group age and origin of healthcare facilities. Most TB cases in children were in the age group 0-4 years (53%) and 5-9 years (32%), a total of 3,793 cases. Next is the child TB case mostly comes from hospitals (50%) and puskesmas (31%), the rest from others (19%) such as clinics, private practitioners, and laboratories.

Table 3 shows the TB cases in children based on TB case determination. Part of large child TB was determined based on clinical diagnostic results (97.5%), and the rest was the result of confirmed bacteriological diagnosis (2.5%).

Table 4 shows the under-reporting level of TB in children based on age groups and facilities' health. TB is underreported to rate in child age group <15 years by 54%. Most under-reporting of TB for children comes from non-primary healthcare facilities such as hospitals, clinics, private practitioners, and specialists 71%, whereas the rest are from primary healthcare (19%).

Table 2. TB Cases in Children Based on Age Group and Origin Health Facilities (n = 3,793)

Variable	n	%
Age Group		
0-4 years	2017	53
5-9 years	1230	32
10-14 years	546	15%
Health Facilities		
Hospital	1,897	50
Primary Health Centers	1,176	31
Other (clinic, private practitioners, laboratory)	720	19

Table 3. TB Case in Children Age Group and Types of Diagnosis (n=3,793)

Age group	Diagnosis Type							Total
	Bacteriological				Total	Clinical Diagnosis		
	Smear Positive		Smear Negative					
	n	%	n	%	n	n	%	
0-4	17	0.2	1	2.6	18	1.999	14,4	2.017
5-9	20	0.3	1	2.6	21	1.209	8,7	1.230
10-14	53	0.7	3	7.9	56	490	3,5	546

Table 4. Under-reporting TB Cases of Children by Health Facilities and Age Group

Characteristics	%	95% CI
Age < 15 years	54	44-64
Age Group < 15 years		
0 – 4	56	46–66
5 – 9	52	40 – 65
10 – 14	51	37–65
Health Facilities		
Primary Health Care	19	12 – 27
Non-Primary Health Care*	71	57–81

*hospitals, clinics, private practitioners

DISCUSSION

Tuberculosis in children is an essential factor that needs attention. Based on the results of this study, it was found that there were still 18% of the 23,320 total TB cases in children aged >15 years in 23 urban districts in Indonesia. In 2015 the proportion of TB in children in Indonesia among all TB cases notified in the national TB program was 9%,[10] whereas 15% were in developing countries. It indicates a rise in childhood TB cases compared to the previous year. According to the World Health Organization, in 2006, the percentage of TB cases in childhood ranged from 3% to >25%.[11]

According to the study's findings, the prevalence of tuberculosis among children in each age group is greater than fifty percent, with the highest rate among children aged 0 to 4 years (53%). Children under five are most susceptible to pulmonary tuberculosis,

with risk factors for exposure to secondhand smoke. Children are a high-risk category for tuberculosis (TB) due to their immature immune systems, which make them extremely susceptible to infection. Children's immune systems have yet to form and function.[12] Another study stated that of <1 year infected with TB, 43% of them will become sick with TB, and if infected at 1-5 years old, 24% would become ill with TB.[13] Therefore, it is indispensable for toddlers to pay attention so that they are not infected with TB germs. If a TB patient in the family and you have children under five, they should be immediately examined and treated.

Compared to other healthcare facilities, the study found that TB in children mostly came from hospitals. Up to 50% of pediatric tuberculosis cases come from hospitals, the remainder from public health facilities (31%) and medical centers like clinics, general practitioners' offices, or specialists (19%). It demonstrates that, as opposed to a health center or other healthcare facilities, children with TB-like symptoms are more likely to select a hospital for their treatment. The national routine TB surveillance system can be strengthened by early identification of pediatric TB cases and accurate reporting, which also enables precise tracking of advancements made toward TB prevention and treatment goals.

Only 2.5% of pediatric TB diagnoses are based on bacteriologically confirmed, 97.5% depending on clinical symptoms. TB in children aged 0-4 years is 99.1% based on clinical diagnosis. Another study found that 89% of pediatric TB cases were diagnosed clinically and chest X-rays.[4] TB diagnosis by confirmation bacteriological is challenging when performed on children due to children's limitations in extracting sputum.

Several studies have shown a high prevalence of TB in children, but generally without confirmation of positive acid-fast bacteria (BTA) tests. It is because children often have difficulty removing quality sputum. WHO recommends combining clinical, non-microbiological, and microbiological approaches to determine latent and active TB in children.[14] The Ministry of Health reported in 2016 that it is challenging to collect TB surveillance and epidemiology data on children due to several issues, including the difficulty in diagnosing children, the rise in extrapulmonary TB in children, the lack of standardized case definitions, and the priority given to childhood TB in comparison to adult TB. In addition, the increasing number of drug-resistant cases in adults can result in a source of infection for children.[14]

Under Reporting TB in Children

Results of our study found the highest level of under-reporting TB tall in the age group <15 years (54%) compared to age ≥15 years (39%). Under-reporting TB in general (all ages) is 41%. Under-reporting TB in children is the number of pediatric patients aged <15 years diagnosed with TB cases but not reported to the National TB Surveillance managed by the NTP at Information System on TB (SITB). It indicates that up to 54% of TB cases in children in healthcare facilities are not registered and reported to the tuberculosis information system controlled by NTP. The underreporting rate of tuberculosis among Indonesian children is marginally lower than that of Chinese children (58.3%).[15] A Pakistani research found that 78% of tuberculosis cases in youngsters went unreported. In Indonesia, the detection of underreported tuberculosis cases is influenced by service, laboratory quality, human resource commitment, and infrastructure for reporting TB cases.[7]

Our study indicated that most non-primary healthcare facilities, such as hospitals, clinics, and private practitioners, underreport TB in children. The overall percentage hit 71%. It indicates that up to 71% of child TB cases not reported to SITB originate from hospitals, clinics, and private practitioners. This study did not distinguish between public and private hospitals; thus, these blend private hospitals, government clinics, and private practitioners. In 64 facilities, another study identified 985 cases of undiagnosed TB in children that were not reported.[16]

Several reasons contribute to the substantial underreporting of tuberculosis in children from non-primary healthcare facilities. According to research conducted in Yogyakarta, private health facilities do not disclose tuberculosis cases due to a lack of awareness regarding reporting TB cases and knowledge regarding policies.[17] In many countries, private healthcare facilities play a significant role in diagnosing and treating tuberculosis, particularly as children's initial point of care. According to Asyifa Yakop's study, private health service facilities

supplied the majority of tuberculosis (TB) care in Pakistan in 2021. Many private service providers refer children suspected of having tuberculosis to a laboratory for further testing, but these TB cases are rarely reported to NTP.[18] It can contribute to underreporting of tuberculosis in children in NTP.

The study revealed that the underreporting of TB in children at Puskesmas was 19%. The documentation and reporting of tuberculosis cases at Puskesmas are higher than at other healthcare facilities. Therefore, underreporting of TB in children is the lowest compared to other healthcare facilities. It is likely owing to the need for all Puskesmas to report all TB cases detected and treated to the District Health Offices' TB manager. Documenting and reporting TB cases in children, including suspicions, TB cases in children, treatment, examination of contacts, and isoniazid preventive therapy (INH). All children getting INH treatment for tuberculosis must be recorded and reported promptly, completely, and precisely.[10]

Meanwhile, research in the Lima Puluh Kota District of West Sumatra revealed that the achievement of finding TB cases in children had not yet reached the target due to the following factors: there were still officers, both doctors and TB managers, who had not been trained on child TB; there were no policies, supporting facilities, or investigation of TB contacts in child TB case screening.[19]

Later, it will impact how SITB records and reports cases of TB in children. To ensure that child TB cases are documented and reported to SITB, the Ministry of Health must collaborate more closely with public and private hospitals, clinics, and general practitioners. Unregistered and unreported TB cases can enable resistant TB a potential to thrive and raise the number of child TB cases in the community.

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