AFB smear positive 1+: a dominant factor in Pulmonary TB household transmission

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Abstrak

Latar belakang: *TBC menjadi masalah kesehatan dunia, termasuk Indonesia karena kasus baru TB paru terus meningkat. Penelitian ini mengkaji faktor dominant yang mempengaruhi penularan kontak serumah pasien TB paru.*

Metode: *Studi observasional dengan desain analitik cross sectional ini menggunakan populasi seluruh penderita dan anggota keluarga pasien TB paru di Puskesmas Kedundung tahun 2015 2016. Sampel sejumlah 52 orang dihitung menggunakan rumus besar sampel infinith dan diambil secara konsekutif. Variabel penelitian meliputi perilaku pencegahan, Gradasi BTA dan penularan kontak serumah. Pengumpulan data menggunakan lembar wawancara, lembar pengumpul data, sputum pot steril. Data dianalisis menggunakan uji Spearman Rank dan uji regresi logistik binary dengan tingkat signifikansi 0,05.*

Hasil: *Perilaku pencegahan (p=0.093), BTA positive 2+ (p=0.377) tidak berpengaruh terhadap penularan kontak serumah pasien TB paru, sedangkan BTA positive 1+ mempengaruhi penularan kontak serumah pasien TB paru (p= 0,007). Nilai Exp (B) BTA positif (1+) menunjukkan 12,144 artinya pasien BTA positif (1+) memiliki risiko 12,144 kali lebih tinggi menularkan ke kontak serumah dibandingkan dengan BTA positif (3+). Sedangkan pasien BTA positif (2+) memiliki risiko 3,328 kali menularkan ke kontak serumah dibandingkan dengan BTA positif (3+).*

Kesimpulan: *Pasien TB paru dengan pemeriksaan BTA positif (1+) menjadi faktor dominan yang mempengaruhi penularan kontak serumah pasien TB paru. Upaya komunikasi dan edukasi personal higiene, tingkat kepatuhan pengobatan pasien TB paru perlu ditingkatkan untuk menekan kejadian baru TB paru.* ***(Health Science Journal of Indonesia 2020;11(1):15-21)***

Kata kunci: *Gradasi BTA, TB Paru, Perilaku Pencegahan, Penularan Kontak Rumah Tangga*

Abstract

Background: Tuberculosis has become a global health problem, included in Indonesia, new cases of pulmonary TB increase continuously. This study examined the dominant factors that influenced the transmission of household contacts in pulmonary TB patients.

Methods: This observational study was a cross-sectional analytic design which used a population of all patients and family members of pulmonary TB patients at the Kedundung Health Center in 2015 until 2016. A sample of 52 people was counted using the infinith sample size formula and taken consecutively. Research variables include prevention behavior, AFB smear gradation, and household contact transmission. Collecting data used interview sheets, data collection sheets, sterile sputum pots. Data was analyzed by chi-square test and binary logistic regression test with a significance level of 0.05.

Results: Prevention behavior (p=0.093), AFB smear-positive 2+ (p=0.377) did not affect on household contact transmission in pulmonary TB patients, whereas AFB smear-positive 1+ affected household contacts transmission of pulmonary TB patients (p=0.007). The value of Exp (B), AFB smear-positive (1+) have a risk of 12.144 times transmitting to household contact when compared to AFB smear-positive (3+). Whereas patients with AFB smear-positive (2+) have a risk of 3,328 times transmitting to household contact when compared with AFB smear-positive 3+.

Conclusion: Pulmonary TB patients with AFB smear-positive (1+) was the dominant factor affecting household contact transmission. Communication and personal hygiene education efforts, the level of adherence in the treatment of pulmonary TB patients needs to be increased to suppress the new incidence of pulmonary TB. ***(Health Science Journal of Indonesia 2020;11(1):15-21)***

Keywords: AcidFast Bacilli (AFB) gradation, pulmonary TB, Prevention Behavior, Transmission of Household Contacts

Tuberculosis becomes a major health problem in the world with the rate of finding new pulmonary TB incidence was not decrease. The Global Report confirms that nearly half a million more cases of illness than previously thought, and 9 million people have contracted TB by 2013, while 1.5 million have died from around the world.[1] In 2019, data were reported by 202 countries and territories that account for more than 99% of the world's population and the estimated number of TB cases. Indonesia was one of 14 countries that have the three high-burden country lists for TB, TB/HIV and MDR-TB defined by WHO for the period 2016–2020, and their areas of overlap.[2] The total incidence of TB in Indonesia in 2018 reached 570.289.[2] This fact was very different from the previous year. The prevalence rate in Indonesia of all TB types is 272 per 100,000 population or about 680,000 cases. Incidence of new TB cases with a positive smear of 183 per 100,000 population or about 460,000 cases.[1]

At the national level, East Java Province was the second largest number of pulmonary TB findings under West Java Province.[3] In 2012, the Crude Death Rate (CDR) was 63,03% with the number of new cases (positive and negative) as many as 41,472 patients and the new AFB positive as much as 25,618 cases.[4] The city of Mojokerto in 2014 was highest in East Java with 348 new sufferers per 100,000 population and by 2015 (5), the highest-ranking was Pasuruan with 256 new cases per 100,000 population.[5] There were 5 (five) health centers working in the health Office of Mojokerto City, among others Kedundung Public Health Center, Wates Public Health Center, Blooto Public Health Center, Gedongan Public Health Center, and Mentikan Public Health Center. The Kedundung Public Health Center which has the most of TB cases.

The number of new adult TB patients at Kedundung Public Health Center from January 2013 to December 2015 tends to increase annually, excluding cases of extra TB and TB in children. In 2013 new adult pulmonary TB patients increased from the previous year to a total of 39 people. In 2014 new adult pulmonary TB patients increased from the previous year to a total of 40 people. In 2015 new adult pulmonary TB patients increased from the previous year to a total of 46 people.[5] In the year 2016 (January-June), 46 patients had pulmonary TB, and the number of AFB smear-positive +3 as many as 17 people, AFB smear-positive +2 of 16 people, and AFB smear-positive +1 as many as 13 people. The previous research discovered of pulmonary TB sufferers known as passive promotive case finding (passive patient discovery with active promotion) was required for all contacts of new positive AFB pulmonary TB patients with the same symptoms, should be sputum examined. An increase in the discovery rate of patients by 75% was obtained from families with positive AFB or Cure Rate, especially with AFB smear-positive (3+) were reached 66%, and the remaining 34% with AFB smear-positive (1+)(6). Therefore it is necessary to examine how much the AFB gradation smear-positive has influence transmission of household contacts in pulmonary TB patients.

METHODS

This study was an observational study with a cross-sectional analytic design. The population taken is TB patients and all family members of household contacts in Kedundung Public Health Center (PHC) Mojokerto on treatment from 2015-2016. A sample of 52 people was counted using the infinith large sample formula and taken consecutively based on the inclusion criteria include: willing to be a respondent, family members who have contacted as household to the patient continuously in a year and have never been examined and 2 people represents a family member. Independent variables include prevention behavior, AFB smear gradation, while the dependent variable is household contact transmission. Prevention behavior variables will be categorized into 2, i.e. "less" if the number of scores is less than the average value (mean), and "good" if more than the average value (mean). While household contact transmission variable is categorized into two, yes and no. Option "Yes" if there are family members who suffer from pulmonary TB (the test results show an AFB smear-positive), and "No" if there are not family member suffering from pulmonary TB (AFB smear-negative). Collecting data were use questionnaires, data collection sheets, sterile sputum pots. Research steps include: collect the name and phone number of TB patients in Kedundung PHC, contact the respondent 1 day before the visit, prepare the AFB sputum extraction tool, home visit accompanied by 1 officer from the PHC, give informed consent before the examination. To determine the diagnosis of TB in children by conducting a tuberculin test by the doctor of the PHC, if the TB score of the child is more than 6 then it is referred for treatment[(4)], the sputum taking during and tomorrow morning. This research involving 3 enumerators who had been trained. While the secondary data, taken from the medical record from Kedundung PHC Mojokerto, the data taken includes the positivity of the smear, structured

questionnaires, cameras for documentation, laptops, and stationery. The AFB smear gradation data of pulmonary TB patients, the prevention behavior of transmission, and the risk of pulmonary TB transmission at household contact were collected at the same time. The data were analyzed bivariate using a *chi-square test* and multivariate using *binary logistic regression* with a 95% confidence level. The questionnaire has been tested for validity and reliability, this study has passed the ethical clearance from the ethics commission of health research at the Medicine Faculty, Airlangga University, Surabaya with letter number 153/EC/KEPK/FKUA/2016.

RESULTS

The results of this study include univariate, bivariate and multivariate analysis

AFB Gradation Smear-Positive Of pulmonary TB Patients

Table 1. The Distribution of the AFB Gradation Smear-Positive of Pulmonary TB Patients at Kedundung Public Health Center Mojokerto

AFB Gradation	Amount	%
1+	9	17.3
2+	4	7.7
3+	39	75
Total	52	100

Table 1 shows the majority of respondents belong to the AFB smear-positive 3+, as many as 39 people (75%).

Prevention Behavior of Household Contacts Transmission in Pulmonary TB Patients

Table 2. The Distribution Of Prevention Behavior To Household Contacts in Pulmonary TB Patients at Kedundung Public Health Center Mojokerto

Behaviour	Amount	%
Less	22	42.3
Good	30	57.7
Total	52	100

Table 2 shows the most respondents behaved good in prevention of household contact transmission (57.7%).

Household contacts Transmission of Pulmonary TB patients

Table 3. The Household Contacts Transmission Of Pulmonary TB Patients At Kedundung Public Health Center Mojokerto

Household contacts Transmission	Amount	%
Yes	41	78.8
No	11	21.2
Total	52	100

Table 3 shows the majority of respondents experienced of household contacts transmission (78.8%).

Crosstabulation AFB Gradation Smear-Positive And Household contact Transmission of Pulmonary TB patients

Table 4. The AFB Gradation Smear-Positive And Household Contacts Transmission Of Pulmonary TB Patients At Kedundung Public Health Center Mojokerto

AFB Gradation Smear-Positive	Household Contacts Transmission				Total	%	Chi-Square Test
	Yes	%	No	%			P-value
1+	3	5,8	6	11,5	9	17,3	0,001
2+	3	5,8	1	1,9	4	7,7	
3+	35	67,3	4	7,7	39	75	
Total	41	78,9	11	21,1	52	100	

Table 4 showed 67,3 AFB smear-positive (3+) experienced household contacts transmission. Bivariate analysis show *p-value* 0,001, there is correlation between AFB gradation smear-positive with household contacts transmission of pulmonary TB patients.

Prevention Behavior with Household contacts Transmission of Pulmonary TB patients

Table 5. Prevention Behavior And Household Contacts Transmission Of Pulmonary TB Patients At Kedundung Public Health Center Mojokerto

Prevention Behavior	Household Contacts Transmission				Total	%	Fisher's exact Test
	Yes	%	No	%			*P-value*
Less	21	40,4	1	1,9	22	42,3	0,016
Good	20	38,5	10	19,2	30	57,7	
Total	41	78,9	11	21,1	52	100	

Dominant Variable Affecting The Household Contact Transmission of Pulmonary TB Patient at Kedundung Public Health Center Mojokerto

Table 6. Multivariate Analysis Factors Affecting Household Contacts Transmission Of Pulmonary TB Patients At Kedundung Public Health Center Mojokerto

Variables	B	S.E	Wald	df	Sig.	Exp (B)
AFB Gradation			7,423	2	0,024	
(1+)	2,497	0,921	7,352	1	0,007	12,144
(2+)	1,202	1,360	0,782	1	0,377	3,328
Prevention Behaviour (Less)	-1,940	1,156	2,818	1	0,093	0,144
Constant	-1,569	0,573	7,493	1	0,006	0,208

Table 5 showed 40,4% less prevention behaviour experienced household contacts transmission and 19,2% good prevention behavior not experienced household contacts transmission. Bivariate analysis of prevention behavior and household contacts transmission show *p-value* = 0,016. It means there is a correlation between two variables.

Table 6 showed the dominant variable influence the household contacts transmission of a pulmonary TB patients is AFB Gradation Smear-positive (1+) (p= 0,007). The logistic regression test using *Backward Stepwise* (Wald) method, explain the AFB Smear-positif 1+ consistently correlated with household contacts transmission of Pulmonary TB patients. Therefore pulmonary TB patients who had AFB smear-positive 1+ were at risk of 12,144 times to transmit to household contact if compared to the reference group (AFB smear-positive 3+).

DISCUSSIONS

The risk of household contact transmission of pulmonary TB patients is influenced by exposure levels with droplets. Pulmonary TB patients with AFB smear-positive provide a greater risk of transmission than pulmonary TB patients with AFB smear-negative.[7] Transmission sources are AFB smear-positive, at the time of coughing or sneezing, patients spread the germs in the form of droplet nuclei, once a cough can produce about 3000 sputum droplets.[8] Transmission occurs in a room where sputum drips for a long time, ventilation can reduce the amount of droplet, while direct sunlight can kill germs.[9] Droplets can last for several hours in a dark and humid place. The transmission of a patient is determined by the number of germs that are removed from the lungs. The higher degree of AFB Gradation smear-positive of sputum examination results, the more contagious the patient. Factors that allow a person to be exposed to a TB germ are determined by the concentration of the spark in the air and the duration of the air.

Bivariate analysis showed the AFB gradation smear-positive correlates with household contact transmission of pulmonary TB patients. Pulmonary TB patients with AFB gradation of BTA 3 + / 2 + / 1 + (10), may affect the household contacts transmission, the higher of AFB gradation smear-positive will potential give higher transmission. Most of the transmission occurred in the intermediate household contact on the AFB gradation smear-prositive 3 + patients. Some theories explain the gradation 3 + as the highest level of AFB as the main factor of transmission. It happens because the behavior of prevention of transmission by pulmonary TB patients to household contacts in the good category, evidenced from cross-tabulation table showed several pulmonary TB patients with AFB gradation smear-positive 3+ have good prevention behavior

of household contacts transmission. Pulmonary TB patients with AFB gradation smear-positive 3+ mostly live with 3 household contacts, the factors found during the study could affect pulmonary TB patients AFB gradation smear-positive 3+ is mostly transmitted by household contacts.

The prevention behavior of pulmonary TB patients correlates with household contact transmission. This preventive behavior is an individual health action aimed at preventing the emergence of pulmonary TB disease.[11] Behavior is influenced by two factors: external factors and internal factors. External factors or stimuli include environmental factors, both physical and non-physical in the form of social, cultural, economic, political, and others.[12] One's behavior consists of knowledge, attitudes, and actions. The lack of knowledge of pulmonary tuberculosis patients about the mode of transmission, the hazards, and how pulmonary TB treatment will affect the attitudes and actions, and the behavior of a person. Uncertainty about the mode of transmission and low behavior can lead to higher transmission, and otherwise, this is a risk factor for transmission of pulmonary TB.

Health behavior is a basic response to a stimulus associated with illness and disease, health care system, food, and environment. This limit has two main elements, namely the response or stimulus or stimulant. Response or human reaction either passive (knowledge, perception, and attitude), or active (real action). Stimulus or stimulation can consist of 4 (four) main elements namely, illness and disease, health, and environmental services system.[13]

The spread of pulmonary tuberculosis is one of them caused by the transmission of household contacts that have a strong contribution[14], the prevention behavior will be done by the patient itself to prevent pulmonary TB transmission. The result of the study[9] states that pulmonary tuberculosis transmission can occur due to the effect of household contacts, so the prevention behavior of pulmonary TB patients plays an important role in suppressing the transmission and spread of pulmonary tuberculosis disease.

The identification of household contacts transmission was known from the laboratory test of household contact sputum, the most dangerous source of transmission is adult pulmonary tuberculosis patients and adults who suffer from pulmonary tuberculosis with cavities (hole in the lungs). Such cases are highly infectious and can transmit the disease through coughing, sneezing and conversation. The more frequent exposure and length of contact, the greater likelihood of transmission. Source of transmission for infants called close contacts are his or her parents, a housemate or a frequent visitor and often[15,16] interacting are people who live together every day and every time with pulmonary TB sufferers, such as family, friends, and co-workers.

The results of this study are largely following the behavioral theories already stated, that there is a significant relationship between the prevention behavior of pulmonary tuberculosis patients with household contact transmission, where most transmission of household contact is low with the prevention behavior of pulmonary TB patient transmission.

The prevention behavior of pulmonary TB patients can be influenced by age, most patients aged > 60 years have good preventive behavior. There are several reasons behind this behavior because patients want to have a long life, want to stay productive, and want to be independent (do not want to bother other family members). Besides, they are more trusting about certain information provided by health workers without proving it first.[11]

According to this research the prevention behavior of pulmonary TB patients affected by education factors, because most of the pulmonary TB patients with high education are well behaved. The person who has higher education will easier to adsorb and respond to the information to be applied in daily activities.

But the result of this research shows the AFB smear-positive 1+ was significantly affected by household contact transmission. This is contrary to existing theories. Rheegandono et al reported their research that of 7 pulmonary TB patients with AFB gradation smear-positive 3+ have transmitted to 2 by 3 people (42,9%) of family members and pulmonary TB patients with AFB gradation positive 2+ could transmit to 1 person (14,3%) of family members. Whereas pulmonary TB patients with AFB gradation smear-positive 1+ did not transmit to their family members.[6]

While the smear-positive smear 3+ has more germs than BTA positive 1+, but not significantly affect the transmission of household contacts of patients with pulmonary TB. And it was different from Rachman et al research, he states that the positive smear gradation in pulmonary TB patients is one of the keys of pulmonary TB, because the transmission of

pulmonary TB is determined by the number of germs released from the lungs of pulmonary TB patients, the higher the positivity of the AFB smear gradation, the more infectious the patient is.[17] But according to this research, the number of germs at the AFB gradation smear-positive 1+ is greater than the AFB smear-positive 2+ which reaches only 1-10 BTA in 100 fields of view. Researchers think that the germs of AFB gradation smear-positive 1+ are found in a wider area of 100 visual fields, although the number of germs found is less than AFB smear-positive 2+ and 3+.

Besides, other factors influence the transmission of pulmonary TB on household contact, namely the condition of the humidity of the room of the house, the risk of contracting depends on the level of exposure to sputum (droplet nuclei), the room where sputum droplet for a long time, whether there is ventilation, the presence of direct sunlight, lighting, room humidity, long exposure to germs[8] lighting, air humidity, behavior.[18] Other factors that affect the transmission is the frequency of contact with the patient, age, occupancy density, immune system, education, occupation, behavior.[19, 20]

According to the observation of the health behavior of pulmonary TB patients and their families. Most people with pulmonary TB with AFB gradation smear-positive 1+ living in a house that does not meet the requirements of a healthy home, one of which is lack of ventilation and lighting, most of the transmission occurred in the household contact because the behavior of prevention of transmission by pulmonary tuberculosis patients against home contact is not all good. Preventive behavior did not affect the transmission of household contact. The absence of preventive behavior variables in the final model of binary logistic regression test can be due to computerized prevention behavior variables considered as confounding or confounding variables affecting the relationship between independent and dependent variables.

TB patient with AFB smear-positif (1+) as the dominant factor influences household contact transmission according to the logistic regression test using *Backward Stepwise* (Wald) method. This result came as the logistic regression test using the *Enter* method. Pulmonary TB patients who had AFB gradation smear-positive 1+ were at risk of 12,144 times to transmit to household contact if compared to the reference group (AFB smear-positive 3+). At the final result of binary logistic regression AFB smear-positive 2+ was not significantly influence the household contact transmission of pulmonary TB. An AFB smear-positive 3+ was not entering into the logistic regression model because it became a reference group so can not be explained more.

Indeed the results of this study are very contradictory to existing theories, but the conditions and facts that exist in the field can change previous findings. But related to the sample size that may only be 52 peoples, and using a non-parametric test which certainly does not require data normality, therefore there are many limitations in this study that might be corrected in subsequent studies.

In conclusion, most of the smear-positive gradation of a pulmonary tuberculosis patient in Kedundung Public Health Center was AFB 3+, behavior prevention of pulmonary tuberculosis patient mostly good, there is the transmission of household contacts of a pulmonary tuberculosis patient, there is a relation between AFB gradation smear-positive of pulmonary tuberculosis patient with household contact transmission, there is a correlation between the prevention behavior of pulmonary tuberculosis patients with the transmission of household contact, AFB smear-positive (1+) become dominant factor related to household contact transmission of pulmonary TB patient in Kedundung public health center.

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