

Knowledge, Attitudes, and Perceptions of Tuberculosis in Indonesia: A Multi-Center Cross-Sectional Study

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Introduction: Tuberculosis (TB) is still a persistent health challenge in Indonesia and ranks high on the list of factors causing morbidity and mortality. Improving knowledge, attitudes, and perceptions (KAP) of the general community about TB can help to control the disease.

Purpose: This study aimed to examine the KAP about TB in Indonesian society and investigate their sociodemographic determinants.

Participants and Methods: An online cross-sectional survey in 34 provinces in Indonesia was carried out in June 2022. The scores of KAP were classified as low, moderate, and high. Bivariate and multivariate ordinal logistic regression were applied to identify the potential sociodemographic determinants of KAP. Adjusted odds ratio and 95% confidence interval (CI) for each determinant were provided.

Results: Among the 3205 participants, 56.4%, 91%, and 38% had high scores on knowledge, attitude, and perception, respectively. Independent determinants of high knowledge were age (26–35 years; adjusted odds ratio: 1.53 [95% CI: 1.19–1.97]), marital status (married; adjusted odds ratio: 1.18 [95% CI: 1.00–1.39]), and salary (middle income; adjusted odds ratio: 0.76 [95% CI: 0.63–0.93]). Independent factors associated with high scores in attitude and perception were the residence location (village; adjusted odds ratio: 0.76 [95% CI: 0.59–0.98]) and the occupation type (civil servant; adjusted odds ratio: 1.53 [95% CI: 1.09–2.13]), respectively.

Conclusion: Most Indonesians have a high knowledge and good attitude, although they have a moderate perception toward TB. Improving public awareness and health education with the right strategies is critical to reducing the country's TB burden.

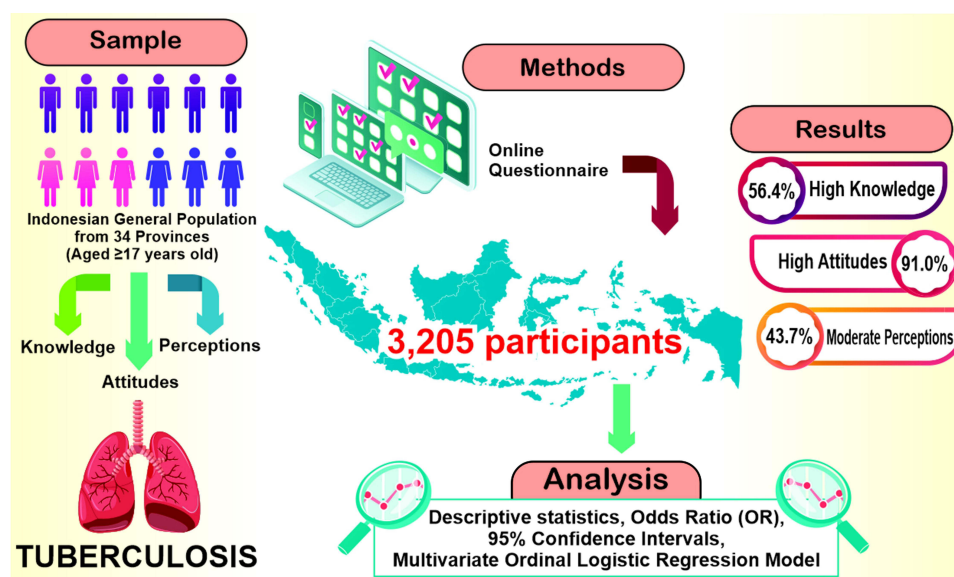
Keywords: tuberculosis, knowledge, attitude, perception, Indonesia

Introduction

The World Health Organization (WHO) aimed to achieve a 20% decrease in tuberculosis (TB) prevalence by the year 2020. However, the actual reduction amounted to only less than 10% as of 2021.¹ Likewise, Indonesia also strives to eliminate TB, but persistent and organized efforts are still needed to achieve the target.^{2,3} According to the Indonesian Ministry of Health, Indonesia must be free of TB by 2035. In 2021, Southeast Asia accounted for almost half of TB cases globally, reaching 4.82 million or 45.4%. Eight countries are responsible for around 66% of the global case total, with Indonesia (9.2%) ranking second after India. Furthermore, there were 969,000 TB cases in Indonesia in 2021 according to the Global TB report 2022, and 44% were found in the most populous regions, including East, West, and Central Java.⁴

Several factors cause TB cases to soar continuously, including the presence of Coronavirus disease (COVID-19), non-adherence to treatment, and lack of public understanding.^{5–7} Additionally, in low-middle-income nations, where TB remains prevalent, there are inadequate healthcare services, limited drug supply, not diagnosed/underdiagnosed cases,

Graphical Abstract



and a lack of reporting of suspected cases by the community due to insufficient information, all of which contribute to an increase in TB cases.^{8,9} Improving understanding of how TB is transmitted has the potential to mitigate misconceptions and biases, and simultaneously alleviate stigmatization.¹⁰ Various methods to improve knowledge, attitudes, and perceptions were reported to have an impact on reducing tuberculosis cases significantly.^{11–13} A field study in Flores (Indonesia) shows that individuals residing in rural areas had restricted information about the TB causes and transmission, leading to stigma in the community towards TB patients, and therefore, interventions were required to address this issue. TB knowledge in the community increased after several educational activities in the form of workshops, group meetings, monthly visits and observations, and informal discussions.¹¹ Continuing education processes are required to sustain the community's knowledge and behavior regarding TB.^{14–17}

Some studies have elucidated certain sociodemographic variables that are linked to the knowledge, attitudes, and perceptions (KAP) toward TB in several communities such as media exposure,^{18–20} age,^{19,20} education,^{19,20} wealth index,¹⁹ occupation,^{18,19} and living area,^{19,20} but investigations on the Indonesian general community are still scarce. Therefore, this study aimed to measure the KAP toward TB and their sociodemographic determinants among the Indonesian general community. This study might aid in developing effective community interventions to ensure prevention strategies are properly implemented.

Materials and Methods

Study Design and Setting

An online cross-sectional study conducted at multiple centers was carried out in June 2022 to measure the knowledge, perceptions, and attitudes (KAP) of the Indonesian community toward TB and investigate their sociodemographic determinants. Participants from 34 provinces in Indonesia (ie North Sumatra, Jakarta, Bali, Central Java, South Kalimantan, Papua, etc.) filled out an online questionnaire via a google form. The geographical areas of Indonesia were divided into three categories according to time zone (Figure 1).

Sample Size

The Indonesian population is estimated at 227 million in 2021.²¹ Participants were selected using a non-probability convenience sampling approach with a minimum sample size of 3000, based on Raosoft's sample size calculator, with

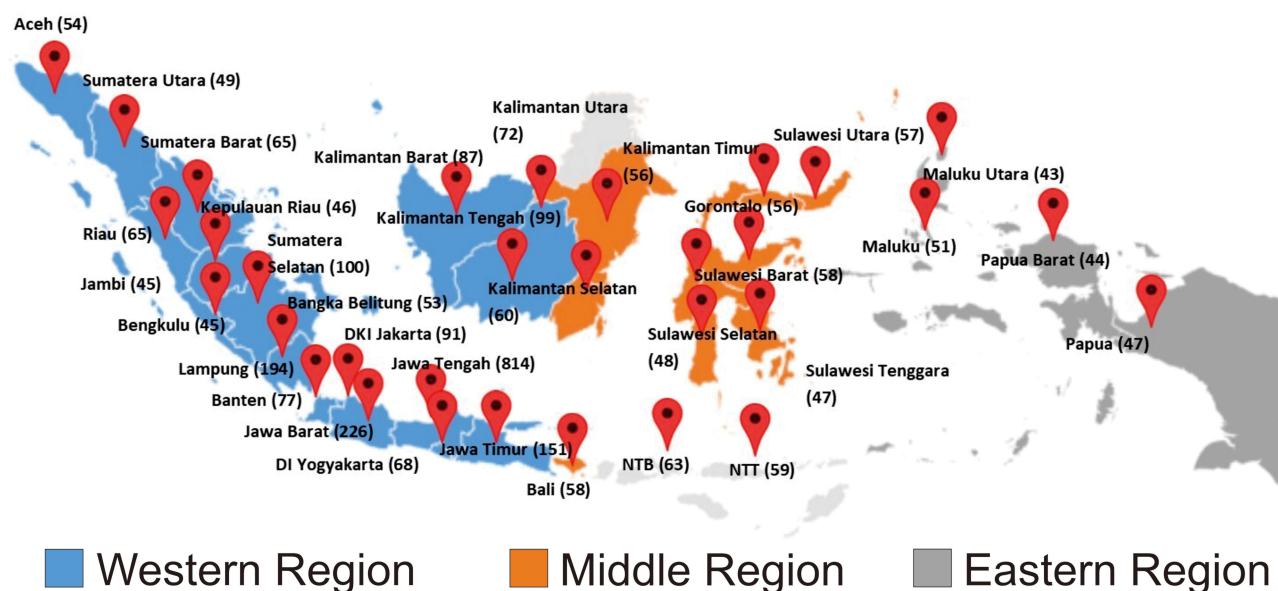


Figure 1 Data collection site of the cross-sectional study, 34 provinces in Indonesia.

a 95% confidence interval, 5% precision limit, and 1.0 design effect.²² The inclusion criteria were people aged ≥ 17 years old, possessed internet access and a communication tool, as well as consented to take part in the research. The exclusion criteria of this study were people who refused to give informed consent and could not answer all the questions in the google form. The variable “income” is classified based on the average minimum wage for workers in Indonesia. Low income is less than the worker’s minimum wage, which is two and a half million rupiah (<Rp. 2,500,000). Moderate income is between two and a half million to three million rupiah (Rp. 2,500,000 - Rp. 3,000,000). High income is more than three million rupiah (> IDR 3,000,000). The study was conducted on a voluntary basis, and any personal information provided by the participants remained confidential.

Ethics

The Health Research Ethics Committee of Universitas Harapan Bangsa (B.LPPM-UHB/956/05/2022) authorized the study in May 2022. All participants provided online informed consent obtained through the first section of the Google form. Participants were above the age of consent in Indonesia (Indonesian penal code article 287). Furthermore, to protect participants’ identities, measures were taken to ensure their anonymity. All methods were performed in line with the ethical principles of the Declaration of Helsinki.

Data Collection

Participants’ data from all provinces in Indonesia (34) were collected using the Google Form platform. The self-reported survey was circulated using social media channels, contact persons, and WhatsApp platforms. A 20-minute time frame was allotted for participants to fill out the questionnaires, and the answers are archived in an electronic database, which only the authors can access and download.

Study Instrument

We used a validated questionnaire developed by Kusuma et al 2022 which involved 25 items for three latent variables: knowledge, attitudes, and perception toward TB.²³ The survey form included ten items related to knowledge, six items regarding the attitude, and nine items concerning TB perception (please see the [Supplementary Material](#)). For the knowledge related items, participants were expected to choose “True” or “False”, which translated to a score of 1 and 0, respectively; the maximum sum score is 10. The answers to the attitude and perception related items were in the form of a 5-point Likert-type scale graded from 1 to 5. The least and most appropriate responses were assigned a score of “1” and

“5”, respectively, with the other response options falling in between. Some of the items were negative; therefore, the scores were reversed. The attitude section had a score range of 6 to 30, with a minimum and maximum possible score. For the perception section, the total scoring system ranged from a minimum score of 9 to a maximum score of 45. The knowledge, attitude, and perception indices were converted to a scale of 0 to 100 to represent the worst and best possible scores. The formula used to calculate the total score was as follows: $[(\text{obtained score} - \text{lowest possible score}) / (\text{maximum possible score} - \text{minimum possible score})] \times 100$. The scores for each domain were scaled positively, meaning that higher scores indicate a better/higher quality of knowledge, attitude, and perception. The domain score was calculated by taking the mean score of the items within that domain.^{24,25} Scores falling within the ranges of less than 50%, 50–70%, and greater than 70% were grouped as indicating low, moderate, and high levels of knowledge, attitude, and perception, respectively.^{26,27}

Data Analysis

The analysis of the data was performed using the Statistical Package for Social Sciences® version 26.0. (IBM Inc., Chicago, USA). Sociodemographic characteristics are presented in terms of frequencies and percentages using descriptive statistics, and outcomes data were displayed using means and standard deviations. Ordinal logistic regression analysis was utilized to examine the relationships between sociodemographic variables and KAP. Potential factors that showed an association with TB KAP at a significance level of $p < 0.1$ in the bivariate analysis were included in the multivariate ordinal logistic regression analysis. The resulting odds ratios (OR) and 95% confidence intervals were derived, and statistical significance was considered achieved at a p-value less than 0.05.

Results

Sociodemographic Characteristics

As presented in Table 1, among the 3205 participants, 72.9% had no history of TB infection. More than half were women (60.9%), and most participants (37.3%) were aged 17 to 25. The education level with the highest percentage was high school (33.9%), while the lowest was Doctorate (8.6%). Moreover, students occupied the highest percentage (30.7%), followed by private employees (15.7%). About 57.8% of the participants were unmarried, 48.5% had low income, and 50.8% lived in rural areas. Western Indonesia had the most participants, with a percentage of 72.8%.

Table 1 Sociodemographic Characteristics of the Study Participants

Variables		N (3205)	Percentage (%)
TB History	No	2338	72.9
	Yes	867	27.1
Sex	Male	1253	39.1
	Female	1952	60.9
Age in years	17–25	1195	37.3
	26–35	674	21.0
	36–45	395	12.3
	46–55	273	8.5
	56–65	216	6.7
	>65	452	14.1
Educational status	Basic School	545	17.0
	High school	1088	33.9
	Bachelor	865	27.0
	Masters	431	13.4
	Doctorate	276	8.6

(Continued)

Table 1 (Continued).

Variables		N (3205)	Percentage (%)
Marital status	Married	1353	42.2
	Never Married	1852	57.8
Occupation	Entrepreneur	305	9.5
	Student	985	30.7
	Farmer	205	6.4
	Civil servant	327	10.2
	Lecturer	366	11.4
	No job/dependent	314	9.8
	Private employees	504	15.7
	Others	199	6.2
Monthly Income	Low Income	1553	48.5
	Middle Income	731	22.8
	High Income	921	28.7
Residence	Village	1628	50.8
	City	1577	49.2
Region	Western	2332	72.8
	Middle	688	21.5
	Eastern	185	5.8

Knowledge, Attitude, and Perception

According to [Table 2](#), the majority of respondents had a high level of knowledge, representing 56.4% of the total participants, and only about 14% had a low level of knowledge. About 97% correctly answered that “TB is curable” and “sputum tests are used for its diagnosis”, as shown in [Figure 2](#). Based on [Table 3](#), most participants had high attitude

Table 2 Potential Determinants of TB Knowledge Score

Variables		TB Knowledge Score (N=3205)			P-value	OR CI 95%
		Low	Moderate	High		
Total Study Population		437 (13.6)	961 (30.0)	1807 (56.4)		
TB History	No	92 (21.1)	258 (26.8)	517 (28.6)	<0.01	0.81 (0.69–0.94)
	Yes	345 (78.9)	703 (73.2)	1290 (71.4)		Ref.
Sex	Male	181 (41.4)	387 (40.3)	685 (37.9)	0.11	0.89 (0.78–1.02)
	Female	256 (58.6)	574 (59.7)	1122 (62.1)		Ref.
Age in years	17–25	211 (48.3)	424 (44.1)	560 (31.0)	<0.01	0.75 (0.61–0.92)
	26–35	60 (13.7)	162 (16.9)	452 (25.0)	<0.01	1.70 (1.34–2.16)
	36–45	48 (11.0)	99 (10.3)	248 (13.7)	0.02	1.37 (1.05–1.80)
	46–55	35 (8.0)	70 (7.3)	168 (9.3)	0.08	1.30 (0.96–1.75)
	56–65	23 (5.3)	58 (6.0)	135 (7.5)	0.04	1.39 (1.01–1.92)
	>65	60 (13.7)	148 (15.4)	244 (13.5)		Ref.
Educational	Basic School	71 (16.2)	160 (16.6)	314 (17.4)	0.94	0.99 (0.74–1.31)
	High school	185 (42.3)	373 (38.8)	530 (29.3)	<0.01	0.70 (0.54–0.90)
	Bachelor	103 (23.6)	233 (24.2)	529 (29.3)	0.35	1.14 (0.87–1.49)
	Masters	42 (9.6)	115 (12.0)	274 (15.2)	0.10	1.28 (0.95–1.73)
	Doctorate	36 (8.2)	80 (8.3)	160 (8.9)		Ref.

(Continued)

Table 2 (Continued).

Variables		TB Knowledge Score (N=3205)			P-value	OR CI 95%
		Low	Moderate	High		
Total Study Population		437 (13.6)	961 (30.0)	1807 (56.4)		
Marital status	Married	143 (32.7)	355 (36.9)	855 (47.3)	<0.01	1.62 (1.41–1.86)
	Never Married	294 (67.3)	606 (63.1)	952 (52.7)		Ref.
Occupation	Entrepreneur	41 (9.4)	77 (8.0)	187 (10.3)	0.38	1.17 (0.82–1.67)
	Student	190 (43.5)	341 (35.5)	454 (25.1)	<0.01	0.65 (0.48–0.87)
	Farmer	36 (8.2)	59 (6.1)	110 (6.1)	0.38	0.84 (0.58–1.23)
	Civil servant	31 (7.1)	75 (7.8)	221 (12.2)	0.01	1.58 (1.11–2.25)
	Teacher or Lecturer	45 (10.3)	94 (9.8)	227 (12.6)	0.25	1.22 (0.87–1.72)
	No job/dependent	28 (6.4)	98 (10.2)	188 (10.4)	0.32	1.19 (0.84–1.69)
	Private employees	39 (8.9)	158 (16.4)	307 (17.0)	0.16	1.26 (0.91–1.74)
	Others	27 (6.2)	59 (6.1)	113 (6.3)		Ref.
Monthly Income	Low Income	228 (52.2)	523 (54.4)	802 (44.4)	<0.01	0.62 (0.53–0.73)
	Middle Income	114 (26.1)	199 (20.7)	418 (23.1)	<0.01	0.73 (0.60–0.89)
	High Income	95 (21.7)	239 (24.9)	587 (32.5)		Ref.
Residence	Village	248 (56.8)	502 (52.2)	878 (48.6)	<0.01	0.81 (0.70–0.92)
	City	189 (43.2)	459 (47.8)	929 (51.4)		Ref.
Region	Western	315 (72.1)	713 (74.2)	1304 (72.2)	0.15	0.81 (0.60–1.08)
	Middle	104 (23.8)	193 (20.1)	391 (21.6)	0.19	0.81 (0.59–1.11)
	Eastern	18 (4.1)	55 (5.7)	112 (6.2)		Ref.

Abbreviations: OR, odds ratio; CI, confidence interval.

scores (91%). About 95% of the participants agreed that “the community should recognize the correct and appropriate TB information.” Moreover, 93% stated that “Avoiding TB sufferers is the best attitude to prevent transmission” and that “TB education activities are needed in the community” (Figure 3). Table 4 indicates that most participants (about 82%) had good scores in perception consisting of 43.7% and 38% in moderate and high levels, respectively. According to

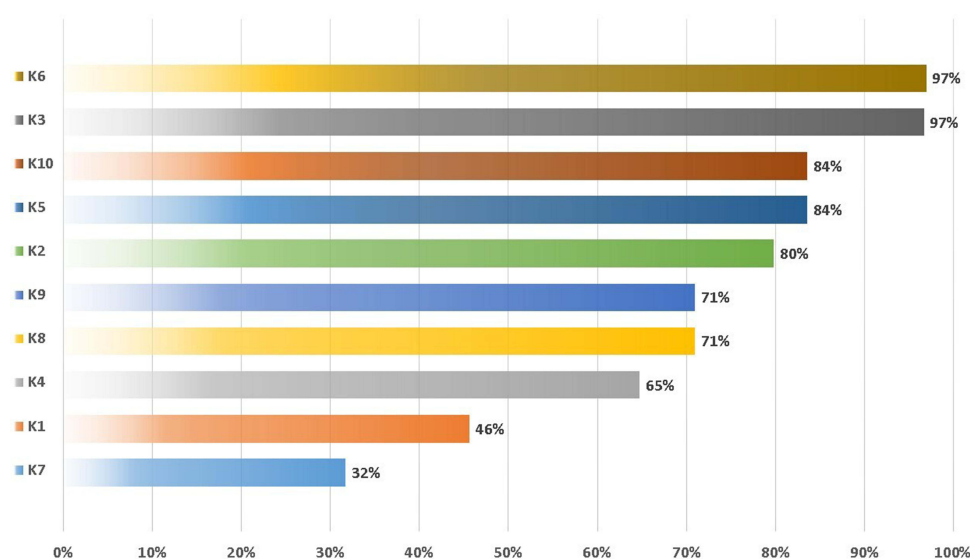


Figure 2 Response patterns to questions about the knowledge of TB. The data presented here is question specific and not compared with any demographic characteristic.

Table 3 Potential Determinants of TB Attitude Score

Variables		TB Attitude Score (N=3205)			P-value	OR CI 95%
		Low	Moderate	High		
Total Study Population		18 (0.6)	70 (8.4)	2917 (91.0)		
TB History	No Yes	4 (22.2) 14 (77.8)	76 (28.1) 194 (71.9)	787 (27.0) 2130 (73.0)	0.78	1.04 (0.79–1.36) Ref
Sex	Male Female	8 (44.4) 10 (55.6)	114 (42.2) 156 (57.8)	1131 (38.8) 1786 (61.2)	0.23	0.86 (0.67–1.10) Ref.
Age in years	17–25	4 (22.4)	129 (47.8)	1062 (36.4)	0.11	0.74 (0.51–1.08)
	26–35	3 (16.7)	36 (13.3)	635 (21.8)	0.09	1.49 (0.94–2.38)
	36–45	4 (22.2)	26 (9.6)	365 (12.5)	0.68	1.11 (0.68–1.83)
	46–55	0 (0.0)	23 (8.5)	250 (8.6)	0.98	1.01 (0.59–1.73)
	56–65	4 (22.2)	21 (7.8)	191 (6.5)	0.18	0.69 (0.41–1.18)
	>65	3 (16.7)	35 (13.0)	414 (14.2)		Ref.
Education	Basic School	3 (16.7)	58 (21.5)	484 (16.6)	0.43	0.82 (0.51–1.34)
	High school	7 (38.9)	110 (40.7)	971 (33.3)	0.51	0.86 (0.55–1.35)
	Bachelor	4 (22.2)	52 (19.3)	809 (27.7)	0.10	1.49 (0.92–2.43)
	Masters	3 (16.7)	25 (9.3)	403 (13.8)	0.16	1.48 (0.85–2.59)
	Doctorate	1 (5.6)	25 (9.3)	250 (8.6)		Ref.
Marital status	Married Never Married	7 (38.9) 11 (61.1)	87 (32.2) 183 (67.8)	1259 (43.2) 1658 (56.8)	<0.01	1.56 (1.21–2.02) Ref.
Occupation	Entrepreneur	5 (27.8)	27 (10.0)	273 (9.4)	0.61	0.85 (0.46–1.56)
	Student	5 (27.8)	117 (43.3)	863 (29.6)	0.21	0.72 (0.43–1.21)
	Farmer	0 (0.0)	18 (6.7)	187 (6.4)	0.88	1.06 (0.53–2.09)
	Civil servant	0 (0.0)	16 (5.9)	311 (10.7)	0.06	1.97 (0.98–3.96)
	Teacher or Lecturer	1 (5.6)	17 (6.3)	348 (11.9)	0.05	1.95 (0.99–3.85)
	No job/dependent	2 (11.1)	29 (10.7)	283 (9.7)	0.79	0.92 (0.50–1.70)
	Private employees	1 (5.6)	32 (11.9)	471 (16.1)	0.23	1.44 (0.79–2.63)
	Others	4 (22.2)	14 (5.2)	181 (6.2)		Ref.
Monthly Income	Low Income	10 (55.6)	149 (55.2)	1394 (47.8)	0.03	0.72 (0.54–0.97)
	Middle Income	1 (5.6)	58 (21.5)	672 (23.0)	0.75	0.94 (0.66–1.35)
	High Income	7 (38.9)	63 (23.3)	851 (29.2)		Ref.
Residence	Village	11 (61.1)	159 (58.9)	1458 (50.0)	<0.01	0.69 (0.54–0.89)
	City	7 (38.9)	111 (41.1)	1459 (50.0)		Ref.
Region	Western	11 (61.1)	195 (72.2)	2126 (72.9)	0.95	0.98 (0.58–1.67)
	Middle	5 (27.8)	61 (22.6)	622 (21.3)	0.71	0.89 (0.51–1.59)
	Eastern	2 (11.1)	14 (5.2)	169 (5.8)		Ref.

Abbreviations: OR, odds ratio; CI, confidence interval.

Figure 4, the two items with the highest percentage score on perception were P3 and P2. Participants disagreed that “TB sufferers’ families should not participate in any function” (79%), and that “TB sufferers are disgusting” (78%). The lowest score (45%) was on P1 (*participants feel uncomfortable around people with TB*).

Determinants of TB Knowledge, Attitude, and Perception Score

Population type (people with TB history or not), age, level of education, marital status, type of employment, monthly salary, and place of residence were potentially associated with TB knowledge in bivariate analysis, as presented in Table 2. Meanwhile, several identified potential determinants for TB attitude were age, marital status, occupation,

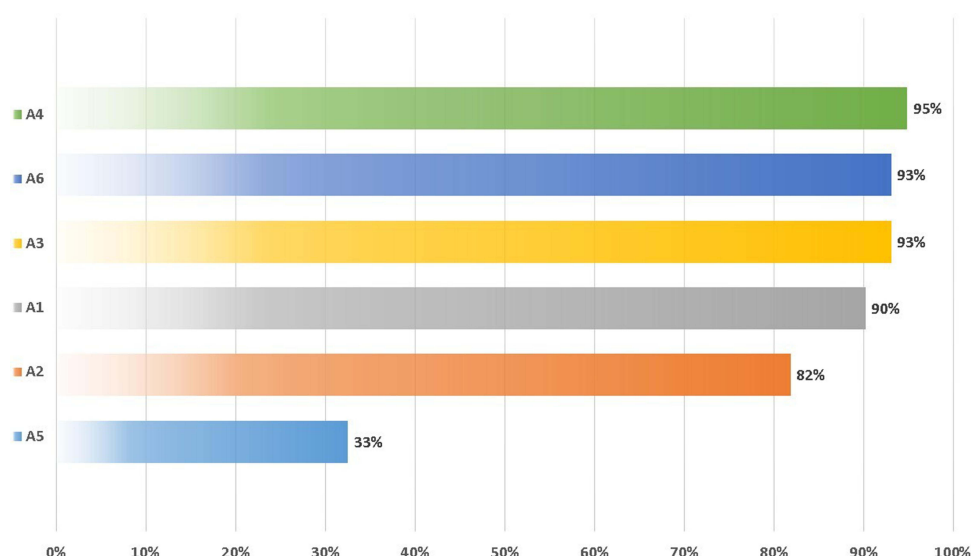


Figure 3 Response patterns to questions about the attitude toward TB. The data presented here is question specific and not compared with any demographic characteristic.

monthly income, and residence (Table 3). Lastly, as shown in Table 4, age, marital status, and occupation were the only potential factors associated with TB perception.

The multivariate ordinal logistic regression model indicated that age (26–35 years; aOR: 1.53 [95% CI: 1.19–1.97]), marital status (married; aOR: 1.18 [95% CI: 1.00–1.39]), and salary (middle income; aOR: 0.76 [95% CI: 0.63–0.93]) were significantly associated with higher TB knowledge scores (Table 5). At the same time, only the residence variable

Table 4 Potential Determinants of TB Perception Score

Variables		TB Perception Score (N=3205)			P-value	OR CI 95%
		Low	Moderate	High		
Total Study Population		587 (18.3)	1399 (43.7)	1219 (38.0)		
TB History	No	151 (25.7)	376 (26.9)	340 (27.9)	0.33	0.93 (0.80–1.08) Ref.
	Yes	436 (74.3)	1023 (73.1)	879 (72.1)		
Sex	Male	226 (38.5)	543 (38.8)	484 (39.7)	0.58	1.04 (0.91–1.19) Ref.
	Female	361 (61.5)	856 (61.2)	735 (60.3)		
Age in years	17–25	264 (45.0)	538 (38.5)	393 (32.2)	0.04	0.81 (0.66–0.99)
	26–35	95 (16.2)	292 (20.9)	287 (23.5)	0.03	1.27 (1.02–1.59)
	36–45	65 (11.1)	166 (11.9)	164 (13.5)	0.21	1.17 (0.91–1.51)
	46–55	47 (8.0)	107 (7.6)	119 (9.8)	0.15	1.23 (0.93–1.63)
	56–65	37 (6.3)	89 (6.4)	90 (7.4)	0.33	1.16 (0.86–1.58)
	>65	79 (13.5)	207 (14.8)	166 (13.6)		Ref.
Education	Basic School	97 (16.5)	233 (16.7)	215 (17.6)	0.43	1.11 (0.85–1.46)
	High school	239 (40.7)	480 (34.3)	369 (30.3)	0.26	0.87 (0.68–1.11)
	Bachelor	139 (23.7)	365 (26.1)	361 (29.6)	0.10	1.24 (0.96–1.59)
	Masters	62 (10.6)	194 (13.9)	175 (14.4)	0.14	1.24 (0.94–1.64)
	Doctorate	50 (8.5)	127 (9.1)	99 (8.1)		Ref.
Marital status	Married	221 (37.6)	579 (41.4)	553 (45.4)	<0.01	1.24 (1.09–1.42) Ref.
	Never Married	366 (62.4)	820 (58.6)	666 (54.6)		

(Continued)

Table 4 (Continued).

Variables		TB Perception Score (N=3205)			P-value	OR CI 95%
		Low	Moderate	High		
Total Study Population		587 (18.3)	1399 (43.7)	1219 (38.0)		
Occupation	Entrepreneur	58 (9.9)	122 (8.7)	125 (10.3)	0.28	1.20 (0.86–1.69)
	Student	208 (35.4)	448 (32.0)	329 (27.0)	0.59	0.92 (0.69–1.23)
	Farmer	38 (6.5)	97 (6.9)	70 (5.7)	0.99	1.00 (0.69–1.44)
	Civil servant	41 (7.0)	136 (9.7)	150 (12.3)	<0.01	1.59 (1.14–2.22)
	Teacher or Lecturer	59 (10.1)	152 (10.9)	155 (12.7)	0.08	1.33 (0.96–1.85)
	No job/dependent	55 (9.4)	134 (9.6)	125 (10.3)	0.28	1.20 (0.86–1.68)
	Private employees	86 (14.7)	225 (16.1)	193 (15.8)	0.34	1.16 (0.85–1.58)
	Others	42 (7.2)	85 (6.1)	72 (5.9)		Ref.
Monthly Income	Low Income	307 (52.3)	678 (48.5)	568 (46.6)	0.16	0.89 (0.77–1.04)
	Middle Income	116 (19.8)	322 (23.0)	293 (24.0)	0.41	1.08 (0.90–1.29)
	High Income	164 (27.9)	399 (28.5)	358 (29.4)		Ref.
Residence	Village	294 (50.1)	707 (50.5)	627 (51.4)	0.55	1.04 (0.91–1.18)
	City	293 (49.9)	692 (49.5)	592 (48.6)		Ref.
Region	Western	425 (72.4)	1017 (72.7)	890 (73.0)	0.38	0.88 (0.66–1.17)
	Middle	129 (22.0)	308 (22.0)	688 (21.5)	0.24	0.83 (0.61–1.13)
	Eastern	33 (5.6)	74 (5.3)	185 (5.8)		Ref.

Abbreviations: OR, odds ratio; CI, confidence interval.

(village; aOR: 0.76 [95% CI: –0.59–0.98]) was significantly associated with a good TB attitude score. Meanwhile, only the occupation variable (civil servant; aOR: 1.53 [95% CI: 1.09–2.13]) remained a statistically significant variable associated with the high scores on perception.

Discussion

This study is the first quantitative research evaluating the KAP of the Indonesian population regarding TB using big data (n=3205) from around Indonesian provinces. It is also the first to investigate the sociodemographic determinants of KAP

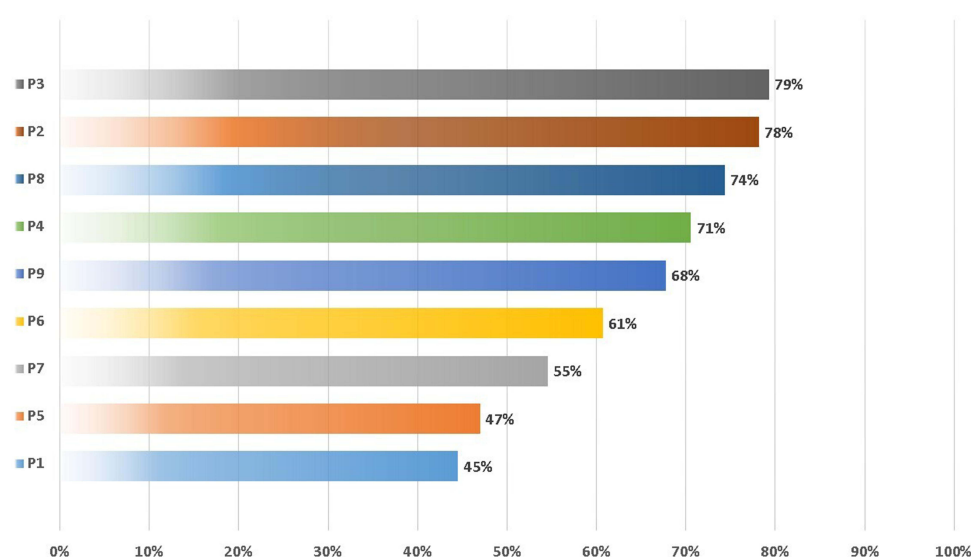


Figure 4 Response patterns to questions about the perception toward TB. The data presented here is question specific and not compared with any demographic characteristic.

Table 5 Independent Determinants of TB Knowledge, Attitude, and Perception Score

Variable		Knowledge		Attitude		Perception	
		P-value	aOR (95% CI)	P-value	aOR (95% CI)	P-value	aOR (95% CI)
TB History	No Yes	0.13	0.88 (0.74–1.04) Ref.	-	-	-	-
Age in years	17–25 26–35 36–45 46–55 56–65 >65	0.74 <0.01 0.06 0.12 0.06	0.96 (0.75–1.23) 1.53 (1.19–1.97) 1.29 (0.99–1.70) 1.27 (0.94–1.71) 1.37 (1.99–1.90) Ref.	0.89 0.27 0.86 0.87 0.16	1.03 (0.67–1.60) 1.31 (0.81–2.09) 1.05 (0.63–1.74) 0.95 (0.55–1.65) 0.68 (0.40–1.17) Ref.	0.13 0.11 0.37 0.21 0.41	0.84 (0.67–1.05) 1.21 (0.96–1.52) 1.12 (0.87–1.45) 1.20 (0.90–1.59) 1.14 (0.84–1.55) Ref.
Education	Basic School High school Bachelor Masters Doctorate	0.94 0.99 0.40 0.45	0.99 (0.74–1.32) 0.99 (0.75–1.33) 1.13 (0.85–1.50) 1.13 (0.83–1.54) Ref.	-	-	-	-
Marital status	Married Never Married	0.04	1.18 (1.00–1.39) Ref.	0.13	1.26 (0.93–1.69) Ref.	0.65	1.03 (0.89–1.20) Ref.
Occupation	Entrepreneur Student Farmer Civil servant Teacher/ Lecturer No job/ dependent Private employees Others	0.59 0.36 0.48 0.08 0.63 0.31 0.23	1.10 (0.77–1.58) 0.85 (0.61–1.19) 0.87 (0.59–1.28) 1.38 (0.96–1.98) 1.09 (0.77–1.55) 1.20 (0.84–1.72) 1.22 (0.88–1.71) Ref.	0.52 0.38 0.83 0.11 0.10 0.70 0.35	0.82 (0.44–1.51) 0.77 (0.44–1.37) 1.08 (0.54–2.14) 1.79 (0.89–3.62) 1.79 (0.91–3.55) 0.88 (0.50–1.64) 1.33 (0.72–2.45) Ref.	0.32 0.44 0.91 0.01 0.12 0.21 0.28	1.19 (0.85–1.67) 1.13 (0.83–1.54) 1.02 (0.71–1.47) 1.53 (1.09–2.13) 1.30 (0.94–1.81) 1.24 (0.88–1.73) 1.19 (0.87–1.62) Ref.
Monthly Income	Low income Middle income High income	0.27 <0.01	0.90 (0.75–1.08) 0.76 (0.63–0.93) Ref.	0.93 0.92	0.99 (0.71–1.37) 0.98 (0.68–1.41) Ref.	-	-
Residence	Village City	0.07	0.88 (0.77–1.01) Ref.	0.03	0.76 (0.59–0.98) Ref.	-	-

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; Ref, reference.

on TB. The results illustrate that 56.4%, 91%, and 38% of the participants had high TB knowledge, attitudes, and perception, respectively.

The highest knowledge about TB is that the disease can be cured, and the diagnosis is accessible using a sputum test. This is consistent with studies carried out in North Mecca and Ethiopia.^{14,15} However, almost all participants stated that TB treatment could be achieved through adequate rest without taking medication, and 71% indicated that the duration of the treatment is between one to two weeks. One-third of the participants opined that using herbal medicine with TB drugs can improve treatment outcomes. According to a previous study, the inadequate knowledge regarding the disease and its treatment is a contributory factor to the non-compliance of the treatment regimen.²⁸ Furthermore, individuals with limited knowledge about TB frequently resort to self-administration of medication and consulting traditional healers, which can result in suboptimal diagnosis and treatment.¹⁶

We found that 65% and 46% of the respondents agreed that TB could be transmitted through breast milk and viral infection causes the disease, respectively. This is in line with a study in Africa reporting that people often have inaccurate information about the causes and modes of TB transmission.¹⁷ While the participants exhibit some basic knowledge about

TB, their understanding of the disease's transmission, treatment, and prevention needs to be improved. This insufficiency in knowledge could lead to a delay in identifying and treating individuals who are suffering from the disease.²⁹

Moreover, about 71% of the participants agreed that discontinuing TB medicines may increase the risk of resistance and severity. The Center for Disease Control and Prevention National Center for HIV/AIDS, Viral Hepatitis, STD, and TB stated that non-adherence to treatment culminates in increased drug resistance and transmission in the community. Initially, patients were identified to have *M. tuberculosis* that was not susceptible to at least one primary medication used to treat TB. When non-adherence to treatment continues, the bacteria might develop multi drug-resistant TB (MDR-TB).³⁰ The low level of knowledge within the community may result in underutilization of healthcare services, delayed diagnosis, and non-compliance with treatment. Therefore, promoting health awareness among the community is indispensable in enhancing their knowledge and understanding of TB.²⁹

In this study, most participants had good scores on some attitude statements, such as the community must be acquainted with the correct and appropriate information; avoiding people with TB; and health education activities are needed in the community. According to a previous preliminary qualitative study, the respondents were willing to receive relevant education about a new intervention to improve TB treatment and expressed their willingness to endorse the government's health promotion initiatives.³¹ Regarding perception, almost half of the participants (45%) feel uncomfortable around people with TB. This is similar with the findings in Ghana wherein the community also pointed out that TB patients should not be seen in the community nor allowed to attend any public function because they can infect others.³⁰ The general public's discomfort is motivated by issues of discrimination that arise against TB sufferers and generally occur in poor areas.³² A prior study outlined various factors related to this discrimination, including germaphobia, a connection between TB and other forms of prejudice such as impoverishment, low caste, and inappropriate behavior, and a belief that TB is a God's punishment.³³

TB knowledge was markedly higher among participants aged 26–35 as opposed to those aged >65. According to a research study focusing on socio-demographic factors that impact the level of TB knowledge among patients in Rajshahi City, Bangladesh, it was found that patients between the ages of 21 and 35 were significantly more likely to possess adequate knowledge about TB than those who were under 20 years old.²⁹ The finding of our study is also consistent with research from India stating that around 52% at the age of 21–30 years have correct knowledge about TB.³⁴ It might be because young people are open to receiving information and have a good motivation in sharing knowledge.

We also found that middle income is less likely to have a higher TB knowledge score than high income. These results corroborate the prior research indicating that higher socioeconomic status is linked with higher level of health literacy.³⁵ According to a previous study in South Africa, high-income level participants have good knowledge of TB.³⁵ Studies in Ethiopia also stated that low-income communities experience challenges such as limited access to education, substandard housing, insufficient nutrition, and overcrowding, which may contribute to the spread of TB.¹⁵

Our result stated that married status increased the likelihood of having higher knowledge than never married. In line with a study from Lesotho, the participants who were married/cohabitating or had been previously married/cohabitating were 42% more likely to have higher knowledge of TB than those who were never married/cohabitating. One possible reason for this could be that married individuals have more opportunities to discuss TB with their partners.³⁶ Other studies reported that those who have experienced marriage are expected to have more cautious behavior and hence they avoid physical contacts with TB patients.^{37,38}

The findings of this study also indicate that individuals residing in rural areas have a less favorable attitude compared to their urban counterparts. There are notable differences between rural and urban populations in terms of their cultural habits, socioeconomic and demographic characteristics, and access to healthcare services. To optimize the effectiveness and efficiency of tuberculosis control interventions, it is imperative to consider the unique needs and challenges of both rural and urban populations.^{15,39,40} In a rural community in southwest Ethiopia, the primary means of obtaining information about TB is through close family, while mass media, including radio and television, are secondary sources of information.^{41,42} According to the findings, the practice of exchanging health information among community members can be employed to disseminate information and develop strategies to raise public awareness. This could be particularly advantageous in nations where community health workers reside and operate within their communities. Moreover, individuals who had access to mass media were 33% more likely to possess sufficient knowledge about TB and 31%

more likely to exhibit a favorable attitude towards TB than those without media exposure.³⁶ These outcomes imply that the media can serve as a critical function in enhancing people's overall knowledge and attitudes regarding TB.

Our results also found that among the type of jobs, a civil servant had better perceptions compared to other occupations. This is comparable with the findings in a study from Equatorial Guinea in which respondents having a jobs that provided high remuneration demonstrated lower levels of stigma associated with TB compared to those who did not have paid employment.⁴³

There are certain limitations to this research. First, although the study has enough power, the study could be more representative if a greater sample had been selected for the cross-sectional survey. The population of Indonesia is more than 270 million people and there are still groups of people who lack internet connectivity, limiting the reach of research. In this study, we recruited participant from 34 provinces in Indonesia by collaborating with professional organizations in each province that have extensive networks for data collection. Therefore, we can collect quite a large number of participants who can be considered representative of the target population. Second, this study used a self-reported questionnaire and therefore, may be biased by social desirability. However, several efforts were made to minimize this potential. We used a valid and reliable questionnaire, and we stated in the questionnaire that data are analyzed and presented anonymously. This can minimize social desirability bias since participants' identities are unknown.

Even though it has limitations, these findings are worth for developing TB education initiatives and have the potential to aid the Indonesian government in reducing TB cases within the country. The strength of this study lies in bringing about evaluation of the overall influencing factors of knowledge, attitude, and perception, and providing expectations about government intervention. People can access information to increase their knowledge about TB not only with open access to the internet but also from local governments, such as health centers, pharmacies, and medical professional organizations. Pharmacies have a significant potential to make a meaningful contribution to TB control endeavors. Their accessibility and widespread use by communities in many high-burden countries make them a valuable resource. Awareness of TB among medical personnel and their role in educating TB can also have an impact on increasing public awareness about TB.

Conclusion

Our study showed the general community in Indonesia have a high knowledge and attitude although they have moderate perception toward TB. The results of this study can be helpful for developing TB education initiatives for the community and to help the government in decreasing the prevalence of TB. Strengthening awareness programs and health education in the general population is essential to combat TB in the country.

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Disclosure

The authors declare that there is no conflict of interest in this work.

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