Proceedings of the International Conference on Industrial Engineering and Operations Management

Publisher: IEOM Society International, USA DOI: 10.46254/AP06.20250188
Published: August 5, 2025

Pharmamed Chatbot and Audiovisual Media: A Dual Strategy for TB Screening and Education in South Bogor

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Abstract

Tuberculosis (TB) remains a significant public health burden in Indonesia. This study aimed to implement and evaluate the effectiveness of a chatbot-based screening tool (Pharmamed) and audiovisual educational media in identifying and educating suspected TB cases at public health centers in South Bogor. A quasi-experimental pretest-posttest control group design was used to assess knowledge changes before and after the intervention. The study involved 103 respondents, mostly women aged 19–39 years with senior high school education. Screening via the chatbot identified 14 TB suspects and 89 non-suspects. The intervention group received structured audiovisual health education developed to improve public knowledge of TB prevention and control. Results showed a significant increase in knowledge levels, rising from 27.2% to 59.2% in the "good" category. Spearman test results indicated no significant relationship ($p > 0.05$) between the educational intervention and increased knowledge. Education level was the most influential factor compared to age, gender, or occupation. The findings demonstrate the practical potential of digital health tools—such as chatbot screening and audiovisual-based education—to support early TB detection, public awareness, and health behavior improvement. These approaches could be further developed and integrated into community-based national TB control strategies.

Keywords
Tuberculosis Screening, Pharmamed Chatbot, Audiovisual Media, Public Health Education, Digital Health.

1. Introduction

According to the Global Tuberculosis Report 2023, there are an estimated 969.000 new cases of tuberculosis in Indonesia. Indonesia occupies the second position in the world with the largest nuber of TB cases and makes one of the biggest challenges, so Indonesia demands te attention of all parties because of the high burden of morbidity and mortality. According to data from the Ministry of Health in 2023, West Java province occupies the top position as the region with the highest number of TB cases in Indonesia, reaching a percenteage of 91% of the annual TB cases finding target of 90%. Therefore, early detection is needed, so that it makes it easier to control TB cases. The chatbot innovation used to screen TB patients displays about TB symptoms, which can then be concluded that person is TB suspect or non-suspect TB. Based on his background, it is hoped that his chatbot screening (pharmamed) will be effective in the city of Bogor and can educate the public related to TB prevention through audiovisual/ video media. TB suspect screening was conducted at the South Bogor Regional Helath Center.

1.1 Objective

The purpose of this study as to screen TB suspects and non-suspect TB using chatbot (pharmamed) at the South Bogor Regional Helath Center. Test the level of knowledge of TB suspect and non-suspect patients TB using audiovisual media. Analyze the relationship between knowledge level and the provision of education on TB screening results. Analyze the influence of confounding factors on knowledge level.

2. Literature Review

Tuberculosis is a chronic infectious disease caused by the bacterium Mycobacterium tuberculosis. These bacteria have rod-shaped body parts and are acid-resistant, often called acid-resistant bacilli (BTA) (Kemenkes, 2019). Screening tests separate apparently healthy people into a group of people who could have the disease and a potential group of people who may be healthy. No screening test is intended to be diagnostic (Maulani, 2019). A chatbot is chat bot that is responsible for serving conversations with visitors, communicating in the most responsive way possible allowing visitors to receive reply messages for a short period of time (Ruspandi, 2017). Health education is an effort to conduct and educate the community so that people are able to take steps to maintain and improve their health levels (Notoatmodjo, 2018). Audiovisual media is a set of media that can display images and sound simultaneously and contains educational messages. This learning media consistes of more than one component so that it becomes a combination of seceral components to show sound and images at the same time (Ramli, 2012).

3. Methods

This type of research is descriptive quantitative with sampling techniques using accidental sampling techniques.

1. Prepare research instruments or tools to collect the data needed and conduct an Ethical Review letter.
2. Research Stage: Collecting respondent data which includes: name, age and gender of the patient and Request the respondent's willingness and sign an Informed Consent to become a respondent in this study
3. Carry out screening using a chatbot (Pharmamed) on patients who have agreed to become respondents
4. Provide pre-test questionnaires to groups of respondents who are suspected and non-suspect of TB
5. Provide education about the prevention and subsequent treatment of TB in the form of audiovisual media. And then provide post-test questionnaires after education is given to respondents.
6. End of Research: Recording of screening and questionnaire results and then analysis of research data

4. Data Collection

The number of respondents in this study was 103 respondents. This research was conducted from August 5 to September 7, 2024. The research was conducted at the Puskesmas in the South Bogor area, of which there are 5 Puskesmas, namely the South Bogor Puskesmas, Bondongan Puskesmas, Lawang Gintung Puskesmas, Cipaku Puskesmas, and Mulyaharja Puskesmas.

5. Results and Discussion

5.1 Numerical Results

5.1.1 Characteristics of Respondents

Data was collected based on demographic data to see the frequency and precentage of characteristics, namely age, gender, education, and occupation. Based on data on the characteristics of respondents can be seen in Table 1 below.

Table 1. Characteristics of Respondents

Age	**Amount (n=103)**	**Presentation (%)**
19-39 years old	63	61,2
40-59 years old	35	34
>60 years old	5	4,9
Gender		
Woman	90	87,4
Man	13	12,8
Education		
Elementary school	22	21,4
Junior high school	30	29,1
Senior high school	43	41,7
College	8	7,8
Occupation		
Housewife	64	62,1
Self -employed	2	1,9
Entrepreneur	7	7
Private employee	12	12
Civil servant	1	1
Not working	16	16
Other (retired)	1	1

Based on Table 1, it can be seen that out of 103 respondents, most of them are 19-39 years old, namely 63 respondents with percentage (61.2%). Respondents aged 40-59 years totaled 35 respondents with a percentage (34%) and respondents aged > 60 years totaled 5 respondents with a percentage (4.9%). More than half of the respondents were in the early adult age group (19-39 years), namely 63 respondents (61.2%). According to the Central Bureau of Statistics in (2023), the early adulthood age range has the largest population because it is the productive age in Indonesia. This is in accordance with this study, most respondents were in the age range of 19-39 years.

Based on Table 1, it can be seen that out of 103 respondents, most of them are female, as many as 90 respondents with percentage (87.4%). Male respondents totaled 13 people with a percentage of (12.8%). This is because the research was conducted during working hours so that most of the respondents who were at home were women. In addition, another influencing factor is the location of data collection, which is mostly carried out at posyandu, so that respondents who fill out questionnaires are dominated by women. In line with research conducted by Pramesty (2024) regarding community knowledge about TB disease, the most respondents who were willing to participate in the study were people with female gender.

Based on Table 1, it is known that of 103 respondents, most of the respondents' education levels were high school graduates as many as 43 people (41.7%), junior high school graduates as many as 30 people (29.1%), elementary school graduates as many as 22 people (21.4%), and undergraduate as many as 8 people (7.8%). This is in line with this study where the most respondents were at the level of high school education as many as 43 respondents (41.7%). Supported by Pramesty's research (2024) too, the majority of respondents who were most willing to take part in the research were people with high school / vocational school education. This is in line with this study, where the most respondents were at the high school education level as many as 43 respondents (41.7%).

Based on Table 1, most of the respondents' occupations were housewives (IRT) as many as 64 people (62.1%), self-employed as many as 2 people (1.9%), entrepreneurs as many as 7 people (6.8%), private employees as many as 12

people (11.7%), public employees as many as 1 person (1%), not working as many as 16 people (15.5%), and others, namely retired as many as 1 person (1%). The same thing was also mentioned in Sarani's research (2019), where the highest frequency of respondents' job characteristics was housewives. This is because housewives often have an important role in the family and community, especially in terms of health and education. Housewife have access to information about health and disease, including TB, through mass media, health counseling, and other resources. Some housewife are also involved in community health activities, such as posyandu, or other health groups that can change their knowledge and skills about health and disease. In accordance with the data collection in this study, which was mostly conducted at posyandu, most respondents were housewives.

5.1.2 TB Screening Results

This chatbot (Pharmamed) displays questions about the symptoms of TB. There are 7 questions that respondents can answer with a "YES" or "NO" answer. From the respondent's answer, a TB screening result of suspect or non-suspect is obtained. If the respondent gets a suspect result, they will be directed to contact a doctor at the nearest health care facility for further screening. If the respondent gets a non-suspect result, then the respondent does not have symptoms of TB, but still needs to apply clean and healthy living behaviors. Based on the screening results analyzed using chatbot media (Pharmamed) to see respondents who are TB-suspect and TB non-suspect can be seen in Table 2 below.

Table 2. TB Screening Results Distribution of Puskesmas in South Bogor Region

Health Facility Name	**Number of *Suspect* TB**	**Number of non-*suspect* TB**	**The Total Number Of Respondents**
Lawang Gintung Health Center	4	16	20
Bogor Selatan Health Center	3	16	19
Bondongan Health Center	1	21	22
Cipaku Health Center	2	21	23
Mulyaharja Health Center	4	15	19
Total	14	89	103

Table 2 shows that 4 of them came from Lawang Gintung Health Center, 3 of them from South Bogor Health Center, 1 of them from Bondongan Health Center, 2 of them from Cipaku Health Center, and 4 others from Mulyaharja Health Center. Chatbot (Pharmamed) is one of the TB surveillance features developed by Pharmamed. Where this chatbot functions as a TB self-testing service. Based on Siswati's research (2023) conducted in Padang City health facilities, the discovery of suspected TB cases by screening using chatbot (Pharmamed) is relatively successful and innovative as digital health to get the results of examining patients with suspected TB and to guide the management of TB control programs. Out of 838 respondents, 91 people were found with suspected TB. This chatbot is considered effective in supporting early detection of TB and can help achieve national TB control targets. In line with this study, the screening chatbot (Pharmamed) proved effective in finding suspected TB cases in Bogor City, South Bogor region. Out of 103 respondents, 14 were found to be TB suspects.

5.1.3 Knowledge Level

In describing the level of knowledge using the pretest posttest method control group design to control the level of knowledge of respondents before and after treatment. This study involved two groups, namely the control group and the experimental group. The control group is a group that does not receive any treatment. The results of the level of knowledge in the control group can be seen in Table 3 below.

Table 3. Control Group Knowledge Level Results

Knowledge Level	Before		After	
	Amount (n)	Presentation (%)	Amount (n)	Presentation (%)
Good (>75%)	20	33,3	14	23,3
Fair (56-74%)	27	45	27	45
Poor (<55%)	13	21,7	19	31,7
Total	60	100	60	100

Based on Table 3 above, the level of knowledge of the control group was obtained as many as 60 respondents. At the level of knowledge of the control group before, good knowledge as many as 20 respondents (33.3%), sufficient knowledge as many as 27 respondents (45%), and less knowledge as many as 13 respondents (21.7%). At the level of knowledge of the control group after, good knowledge became 14 respondents (23.3%), sufficient knowledge as many as 27 respondents (45%), and less knowledge became 19 respondents (31.7%). The level of knowledge of the control group showed a sufficient category. This can be seen from the acquisition of the number of respondents who scored in the moderate category range (56-74%) was more than the other categories. There were differences in the level of knowledge of the control group after the good category decreased to 23.3% and in the poor category increased to 31.7%.

The treatment group is a group that receives education using audiovisual media. The results of the level of knowledge in the treatment group can be seen in Table 4 below.

Table 4. Results of Knowledge Level of Treatment Group

Knowledge Level	Before		After	
	Amount (n)	Presentation (%)	Amout (n)	Presentation (%)
Good (>75%)	28	27,2	61	59,2
Fair (56-74%)	56	54,4	42	40,8
Poor (<55%)	19	18,4	0	0
Total	103	100	103	100

Based on Table 4 above, the knowledge level of the treatment group was obtained as many as 103 respondents. At the level of knowledge of the treatment group before, good knowledge as many as 28 respondents (27.2%), sufficient knowledge as many as 56 respondents (54.4%), and less knowledge as many as 19 respondents (18.4%). At the level of knowledge of the treatment group after, good knowledge became 61 respondents (59.2%), sufficient knowledge became 42 respondents (40.8%), and less knowledge became none. The knowledge level of the treatment group showed a good category. This can be seen from the acquisition of the number of scores of respondents who are in the good category (>75%) has increased from 27.2% to 59.2% fifty nine point two percent. So it is known that after being given educational treatment shows that the average knowledge of respondents increased from moderate to good.

5.2 Graphical Results

5.2.1. Characteristics of Respondents

Data was collected based on demographic data to see the frequency and precentage of characteristics, namely age, gender, education, and occupation. Based on data on the characteristics of respondents can be seen graphical results in Figure 1 below.

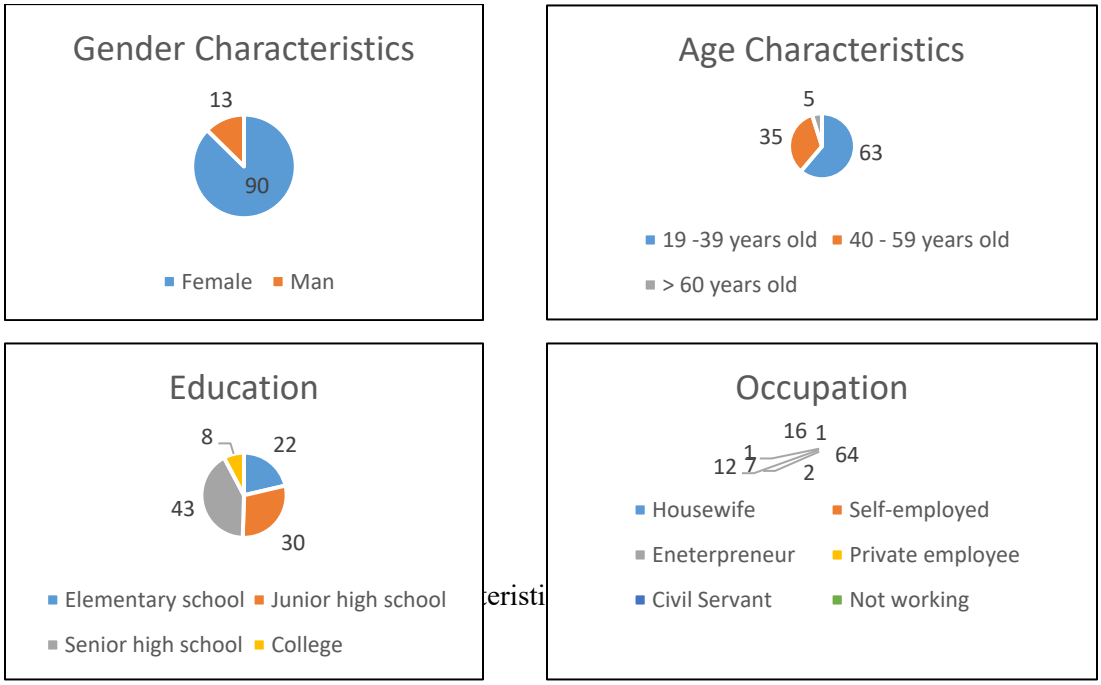

Figure 1. Characteristics of respondents

As explained in Table 1 it can be seen that out of 103 respondents on Figure 1, most of them are 19-39 years old, namely 63 respondents with percentage (61.2%). Respondents aged 40-59 years totaled 35 respondents with a percentage (34%) and respondents aged > 60 years totaled 5 respondents with a percentage (4.9%). More than half of the respondents were in the early adult age group (19-39 years), namely 63 respondents (61.2%). Most of them are female, as many as 90 respondents with percentage (87.4%). Male respondents totaled 13 people with a percentage of (12.8%). Most of the respondents' education levels were high school graduates as many as 43 people (41.7%), junior high school graduates as many as 30 people (29.1%), elementary school graduates as many as 22 people (21.4%), and undergraduate as many as 8 people (7.8%). Most of the respondents' occupations were housewives (IRT) as many as 64 people (62.1%), self-employed as many as 2 people (1.9%), entrepreneurs as many as 7 people (6.8%), private employees as many as 12 people (11.7%), public employees as many as 1 person (1%), not working as many as 16 people (15.5%), and others, namely retired as many as 1 person (1%).

5.2.2. TB Screening Results

Based on the screening results analyzed using chatbot media (Pharmamed) to see respondents who are TB-suspect and TB non-suspect can be seen in Figure 2 below.

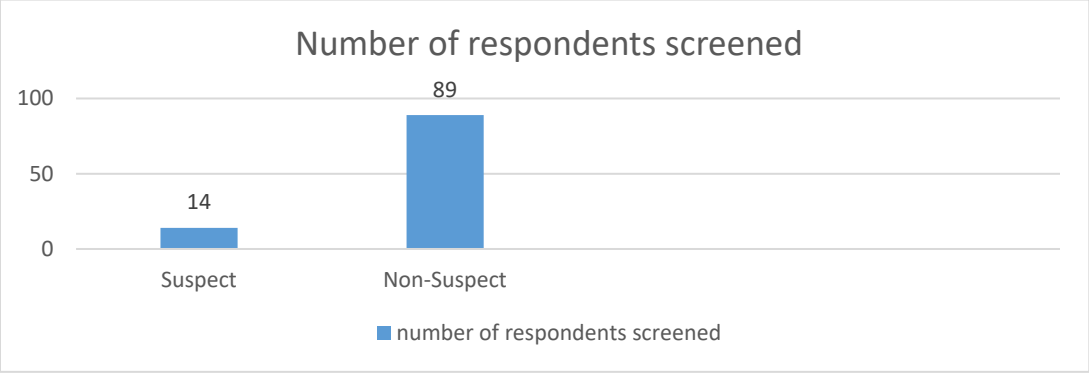

Figure 2. TB Screening Results

Figure 2 shows the results of chatbot screening from 103 respondents obtained as many as 14 respondents suspected TB (13.6%) and as many as 89 respondents (86.4%) who were non-suspect TB.

5.2.3. Knowledge Level

In describing the level of knowledge using the pretest posttest method control group design to control the level of knowledge of respondents before and after treatment. The results of the level of knowledge in the control group can be seen in Figure 3 and Figure 4 below.

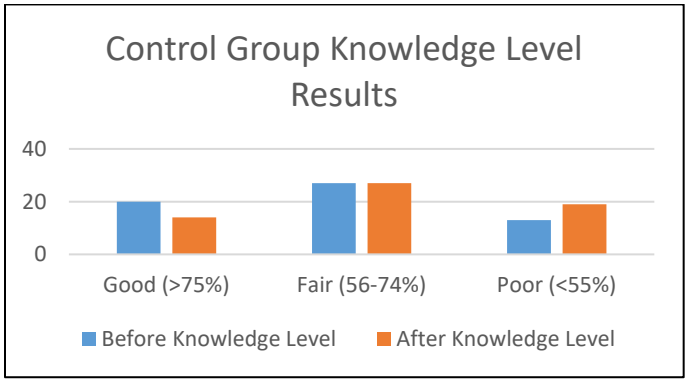

Figure 3. Control Group Knowledge Level Results

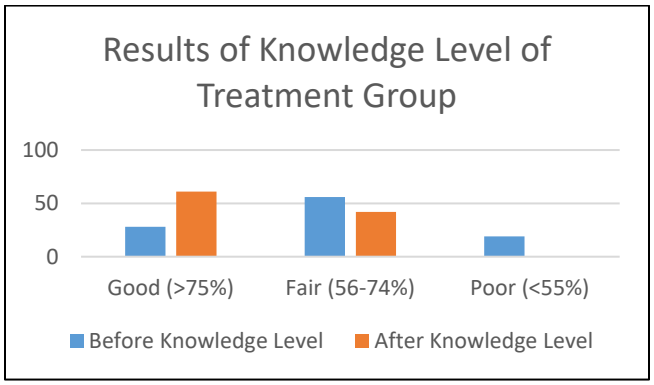

Figure 3. Results of Knowledge Level of Treatment Group

As explained in Table 3 above, In Figure 3 shows the level of knowledge of the control group was obtained as many as 60 respondents. At the level of knowledge of the control group before, good knowledge as many as 20 respondents (33.3%), sufficient knowledge as many as 27 respondents (45%), and less knowledge as many as 13 respondents (21.7%). At the level of knowledge of the control group after, good knowledge became 14 respondents (23.3%), sufficient knowledge as many as 27 respondents (45%), and less knowledge became 19 respondents (31.7%). The level of knowledge of the control group showed a sufficient category. This can be seen from the acquisition of the number of respondents who scored in the moderate category range (56-74%) was more than the other categories. There were differences in the level of knowledge of the control group after the good category decreased to 23.3% and in the poor category increased to 31.7%. Based on Figure 4 above, the knowledge level of the treatment group was obtained as many as 103 respondents. At the level of knowledge of the treatment group before, good knowledge as many as 28 respondents (27.2%), sufficient knowledge as many as 56 respondents (54.4%), and less knowledge as many as 19 respondents (18.4%). At the level of knowledge of the treatment group after, good knowledge became 61 respondents (59.2%), sufficient knowledge became 42 respondents (40.8%), and less knowledge became none. The knowledge level of the treatment group showed a good category. This can be seen from the acquisition of the number of scores of respondents who are in the good category (>75%) has increased from 27.2% to 59.2% fifty nine point two

percent. So it is known that after being given educational treatment shows that the average knowledge of respondents increased from moderate to good.

5.3 Proposed Improvements

In the Pharmamed chatbot system's personal data only includes name, age, and address so that with data integration, the TB chatbot (Pharmamed) screening is expected to include filling in the Population Identification Number (NIK), making it easier for the health center to access patient information more quickly and accurately. If

5.4 Validation

5.4.1. Wilcoxon test

From the results of the score of the level of knowledge before and after in the control group and the treatment group to see the comparison of the average score of the level of knowledge using the Wilcoxon test. In this test, the effect of the relationship between the two groups can be seen in Table 5 below.

Table 5. Comparison of Average Knowledge Level Scores

Knowledge Level Score Comparison	**Groups**	***Meank Rank***	**P.*value***
	Treatment	43,50	0,001
	Control	13,50	0,001

The Wilcoxon signed-rank test was conducted to determine if there was a significant difference between the scores before and after treatment. Based on the results in Tabel 5, it shows that there are 86 respondents who have increased scores (positive ranks) with a mean rank of 43.50, there are no respondents in the negative rank, and there are 17 respondents who have no change or experience the same pretest and posttest scores (ties). The 2-tailed asymp.sig value is 0.001 (<0.05) which means that there is a statistically significant difference between the pretest and posttest scores in the treatment group. While in the control group there were 26 people with a mean rank of 13.50 on the negative rank. Meanwhile, there were no respondents who had a posttest score higher than the pretest on the positive rank, and there were 34 respondents who had the same pretest and posttest scores (ties). The 2-tailed asymp.sig value is 0.001 (<0.05), thus there is a significant difference between the pretest and posttest in the control group even though the direction of the difference shows a decrease in scores. The advantage of audiovisual media in this study is that it displays animated videos with sound as an explanation of the content of the video. The video explains what TB is, the causes of TB, the symptoms of TB, who is at risk of TB, the characteristics of TB suspects, environmental factors that can cause someone to get TB, TB testing, TB treatment stages, and TB prevention efforts. This media is able to make learning interesting, so that it is more easily understood by the community as education about TB. This is also supported by Purba's research (2022) on Counseling with Video Media to Increase Knowledge about Tuberculosis Prevention Efforts at SD INPRES Bertingkat PERUMNAS 1 WAENA, which shows that health education using lecture methods and video media focusing on tuberculosis prevention provides a good intervention. The researcher also presented a video about TB education.
https://drive.google.com/file/d/13LhpEKZJBniDS613cVFFnZngLyTEIbmQ/view?usp=drivesdk.

5.4.2 Spearman test

TB screening using chatbot media aims to analyze the picture of TB cases so that the screening results can show how many people are said to be TB suspects and non-suspects. Education aims to assess the level of public knowledge about TB disease. After knows the TB screening results, it is seen whether there is a relationship between the level of knowledge and the provision of education from the TB chatbot screening results. Data on the relationship between level of knowledge and provision of education on screening results can be seen in Table 6 below.

Table 6. The Correlated Effect of TB Screening Results on Knowledge Levels

Screening Results	**Knowledge Levels Before Treatment**						**Value *sig 2-tailed correlation***	**Knowledge Levels After Treatment**						**Value *sig 2-tailed correlation***
	Good		**Fair**		**Poor**			**Good**		**Fair**		**Poor**		
	n	**%**	**n**	**%**	**n**	**%**		**n**	**%**	**n**	**%**	**n**	**%**	
Suspect	6	42,9%	5	35,7 %	3	21,4%	0,138 (>0,05)	9	64,3 %	5	35,7 %	0	0	0,097 (>0,05)
Non-*suspect*	22	24,7%	51	57,3 %	16	18%	0,532 (>0,05)	52	58,4 %	37	41,6 %	0	0	0,677 (>0,05)

It can be seen from Table 6 that there were 14 respondents who were suspected of TB, with a level of knowledge before, good knowledge was 6 people (42.9%), sufficient knowledge was 5 people (35.7%), and knowledge was lacking there were 3 people (21.4%). At the level of knowledge after, there were 9 people with good knowledge (64.3%) and 5 people with sufficient knowledge (35.7%). In non-suspect TB as many as 89 respondents, with the level of knowledge before, there were 22 people (24.7%) with good knowledge, 51 people (57.3%) with moderate knowledge, and 16 people (18%) with poor knowledge. The level of knowledge after, good knowledge 52 people (58.4%) and sufficient knowledge 60 there are 37 people (41.6%). The correlation effect aims to determine the correlation between screening results and knowledge level, where the test uses the Spearman test. In the correlation test between the level of knowledge before and after the provision of education on the results of suspect TB using audiovisual media there is no correlation effect because it is seen from the 2-tailed correlation sig value obtained which is 0.138 and 0.097 (>0.05). And on non-suspect results there is no correlation effect seen from the sig value of 2-tailed correlation obtained, namely 0.532 and 0.677 (>0.05). From the results of suspect and non-suspect screening, the results show that there is no effect correlation between the level of knowledge and the provision of education on the results of TB screening. In Aminah's study (2023), the number of suspected TB cases or case detection rate did not meet the expected target. This is due to the low awareness of the community, especially families of TB patients, to check themselves at the health center. Although education and counseling programs on TB at puskesmas are routinely conducted twice a year, the level of public awareness to get themselves examined-especially for TB suspects-is still relatively low. In line with this study, the results of TB screening on community knowledge levels are influenced by several factors. One of the main causes is the reluctance to go to the health center. Environmental factors such as housing density, house humidity, ventilation area, house lighting, house floor, and house temperature, as well as behavioral factors such as smoking habits, and history of house contact also support the possibility of TB suspect cases (Siregar, et al., 2023).

5.4.3 Logistic regression test

The distribution factors of respondent characteristics can be distinguished based on age, gender, education, and occupation which can be seen in Table 7 below.

Table 7. Effect of confounding factors on knowledge level

Coufounding Factors	**Knowledge Levels**
	P.*value*
Age	0,457
Gender	0,279
Education	0,0012
Occupation	0,349

It can be seen in Table 7, the logistic regression test shows the influence of the age factor, the p.value obtained is 0.457 (>0.05), so age does not have a significant effect on the level of knowledge of respondents. In gender, the p.value obtained is 0.279 (>0.05) then gender has no significant effect on the level of knowledge of respondents. In education, the p.value obtained is 0.0012 (<0.05), so education has a significant effect on the level of knowledge of respondents. And at work p.value obtained 0.349 (>0.05) then work has no significant effect on the level of knowledge of respondents. Based on the age factor, it shows that age has no significant effect on the level of knowledge. This is because various other factors such as education, access to information, and counseling media have more influence on the level of knowledge. WHO often emphasizes that effective health education should be accessible to all age groups. Although the study did not directly address the effect of age on knowledge levels, it showed that effective health education can improve TB knowledge across age groups. Factors such as educational methods, media used, and frequency of counseling are more influential in improving community knowledge about TB. Gender also did not have a significant effect on the level of knowledge in this study. In general, although there are some differences in how men and women obtain or access information, factors such as education, information-seeking habits, and level of involvement in health extension programs have a greater impact on the level of knowledge about TB than gender. Education has a significant effect compared to other factors, because the higher a person's level of knowledge, the easier it is for them to receive information, resulting in more knowledge. Conversely, a low level of education can hinder the development of a person's attitude towards new values that are introduced. The college level knowledge score is indeed the highest level of education, but the respondents involved in this study were not as many as at the high school level, namely 43 out of 103 respondents. Therefore, it can be concluded that the higher a person's level of education, the more knowledge they have. This is also supported by Maemunah's research (2023) that educational factors have an important role, where the higher a person's level of education, the more information he can receive. In line with this study, the level of education has a major influence on the ability of patients, especially in receiving information about diseases, including TB. Occupational factors also had no significant effect on the level of knowledge. Several studies have shown that occupation does not have a significant relationship with knowledge about TB. This may be due to several factors, such as access to information, education, and environment. Involvement in health activities such as posyandu, as in this study, affects knowledge about TB. However, it should be noted that certain occupations, such as health workers, may have a higher association with TB knowledge due to more intensive exposure to health information and training, in line with Nortajulu's study (2022).

6. Conclusion

Based on the results of this study, the following conclusions were obtained:

1. The implementation of chatbot TB screening (Pharmamed) at the South Bogor Regional Health Center resulted in findings from 103 respondents, as many as 14 who suspected TB and 89 who were non-suspect TB.
2. Based on the level of knowledge after the treatment group there was an increase that showed a good category from a percentage of 27.2% to 59.2%.
3. There is no correlation between the level of knowledge and the provision of education on the results of TB screening chatbot (Pharmamed) at Puskesmas South Bogor Region (p>0.05).
4. The confounding factor of education affects the level of knowledge compared to the confounding factors of age, gender, and occupation which have a p.value (<0.05).

References

Aminah, S., Siregar, M. T., Lendawati, Strengthening the Role of TB Cadres in Improving TB Suspect Findings in Panjang Selatan Village, Bandar Lampung City, *Journal of Health Services*, vol. 4 no. 3, pp. 66-74, 2023.

Harefa, K., Utama, I., Brahmana, E.N., Wandra, T., Sitorus, J.E.M., Siagian, T.M, The Effect of Counseling with the Lecture Method on Improving the Treatment Behavior of Tuberculosis Patients at Lotu Health Center in 2023, Journal of Public Health, vol. 7 no.3, pp. 16062-16071, 2023.

Indonesian Ministry of Health, *National Guidelines for Tuberculosis Management Medical Services*. Jakarta: Ministry of Health of the Republic of Indonesia, 2019.

Maemunah, N., Metrikayanto, D.N., Helly, C, Providing Education Through Animation About Pulmonary Tuberculosis (TB) on the Knowledge of Elementary School Children of Merjosari 02 Malang City, *Mesenchephalon Health Journal*, vol. 7, no. 1, pp. 46-55, 2021.

Maulani, J, Health Application Using Epidemiology Method Screening Test for CV.Annisa Employees, *Scientific Journal of "Technologia"*, vol. 10, no. 1, pp. 10-16, 2019.

Nortajulu, B., Susianti, S., Hermawan, D, Factors Associated with Lung TB Cure, *Journal of Professional Nurse Research*, vol. 4, no. 4, pp. 1207-1216, 2022.

Notoatmodjo, S, *Behavioral Science Health*, Jakarta: Rineka Cipta, 2018.
Pramesty, D.A., Nofrika, F, Community Knowledge about Tuberculosis Disease in RW 001 Pulogebang East Jakarta March-April 2024 Period, *Scientific Journal of Applied Pharmacy & Health*, vol. 2, no. 3, pp. 44-58, 2024.
Purba, E.R.V., Ruben, S.D., Mebri, E, Counseling with Video Media Increases Knowledge about Tuberculosis Prevention Efforts at Elementary School INPRES Bertingkat PERUMNAS 1 WAENA, *Jayapura Poltekkes Journal*, vol. 14, no. 2, pp. 215-226, 2022.
Ramli, M, *Media and Learning Technology*, Banjarmasin: Antasari press Banjarmasin, 2012.
Ruspandi, R., Benedictus, Wowor, H., Sambul, A, Design of Helpdesk Chatbot for Integrated Information System of Sam Ratulangi University, *EJournal of Informatics Engineering*, vol. 11, no. 1, pp. 1-7, 2017.

Sarani, M., Yudanes, I.B.N., Susanti, R.W, The Effect of Counseling on Knowledge of Patients with Pulmonary Tuberculosis at the Regional General Hospital of East Kolaka Regency, *Journal of Nursing*, vol. 3, no. 1, pp. 30-35, 2019.
Siswati, S. Giatri, E. Safitri, Y, Identification of Tuberculosis Suspects Using Pharmamed Chatbot Based on Health Services in Padang City, *Journal of Community Health*, vol. 9, no. 2, pp. 379-385, 2023.
Siregar, A.P., Farashati, I.J., Syafira, C.A., Febrina, D, Epidemiological Concept of Tuberculosis Disease Occurrence, *Journal of Health and Medical Research*, vol. 3, no. 3, pp. 462-470, 2023.

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Dewi Oktavia Gunawan is a lecturer in the Pharmacy Study Program, Faculty of Mathematics and Natural Sciences, Pakuan University, Bogor, Indonesia. In 2006, she earned a pharmacist degree, and in 2015, she earned a Master of Pharmacy degree from the Faculty of Pharmacy, Ahmad Dahlan University, Yogyakarta, Indonesia, with her thesis entitled Quality-Adjusted Life Years (QALYs) of Tuberculosis Patients in the Intensive and Advanced Phases at PKU Muhammadiyah Hospital, Bantul, Indonesia. As a lecturer, her interest in teaching and research activities is to integrate teaching materials with research results so that they can be more relevant. Her research focuses on pharmacology, clinical and community pharmacy research which includes research on drug use evaluation, drug information services and drug counseling, health program development, and analysis of treatment effectiveness. She is currently active as a field supervisor at the Community Health Center and Pharmaceutical Wholesalers in the Pharmacist Professional Education Study Program, Faculty of Mathematics and Natural Sciences, Pakuan University. Apart from being an academic, he is also active in the Ardhya Garini Foundation organization, Atang Sendjaja Air Force Base branch in Bogor as the Head of Human Resource Development which oversees Kindergarten, Elementary School, Junior High School and Vocational School, as well as managing his own pharmacy as the pharmacist in charge of the pharmacy in Bogor Regency, Indonesia.

Stefanus Nofa is a Pharmaceutical and Healthcare Tech Leader specializing in Sales, Marketing and Business Development experiences in Pharmaceutical Company, Clinic and Wellness/ Healthcare. He earned his Bachelor's degree in Pharmaceutical Science and Pharmacist, Pharmaceutics and Drug Design from Institut Teknologi Bandung. During his time at Institut Teknologi Bandung his was activitied and societes as a Lab Assistant (1991-1995) and

actived participating in the Pharmacy Student Association (1995-1997). He was also once a vice chairman in Lavender Foundation Indonesia (Oct 2014- Sep 2018) and his was also too as a chairman of Information Media and Communication in the Insitut Teknologi Bandung Pharmacy Alumni Association (Sep 2016- Sep 2021). He has been a part time as a guest lecturer in Indonesian College of Pharmacy (Feb 2017), as a health tech consultant and speaker in GWS Care (Jun 2019), and he was also as a chairman of Indonesian Pharmacy Informatics Association (PIFI) (Jan 2022). His career journey has been fueled by a passion for driving growth in dynamic world of pharmaceuticals and healthcare with 14 years his spent honing his expertise at Kalbe Farma, a leading pharmaceutical player, he gained a deep understanding of the industry landscape. In the course of his career he has also been as a board member of Indonesian Pharmacy Entrepreneurs. He is currently working as Managing Director, who was previously as a Director of Operations at Roxy Pharmacy, Jakarta, Indonesia.