Factors Associated with Knowledge, Attitudes, and Practices about Tuberculosis in Peruvians

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Abstract: *Objective*: To determine the factors associated with knowledge, attitudes, and practices (KAPs) about tuberculosis (TB) in the Peruvian population.

Materials and Methods: A cross-sectional, analytical study was carried out by conducting a virtual survey. The instrument that was used consisted of 4 sections: sociodemographic variables (9 questions), knowledge (23 questions), attitudes (9 questions), and practices (8 questions) about tuberculosis. Univariate and bivariate analyses and the Poisson regression model with robust variance were used to obtain crude and adjusted prevalence ratios (PRa).

Results: The sample consisted of 1284 participants. Regarding knowledge, attitudes, and practices about TB, an insufficient level was found in 47.97%, 50.3%, and 54.36% of the cases, respectively. The variables that increased the probability of having sufficient knowledge were sex, grade, area, family history, and history of having TB. While only the area and both antecedents were for attitudes. Finally, the age, degree, and history of TB were for the practices.

Conclusion: There are insufficient KAPs in around half of the population studied. In addition, there are differences according to the epidemiological characteristics, such as sex, age, academic degree, area, and family history of TB and having had this disease. Therefore, the importance of research in this field should be emphasized in the face of a disease that is related to the differences in the levels of these variables between different strata of the general population.

Keywords: Tuberculosis, Health Knowledge, Attitudes, Practice, Public Health (Source: MeSH NLM).

INTRODUCTION

Tuberculosis (TB) is one of the most contributing factors to morbidity and mortality worldwide, despite being preventable and treatable [1,2], therefore, the Sustainable Development Goals and the World Health Organization (WHO) have defined goals to reduce mortality from this disease by 95% and the incidence by 90% by 2035 [3]. Worldwide, the TB control program proposed a strategy to reduce this disease between 2015 and 2022 the mortality rate by 20%; however, to date, the cumulative reduction between these years has been 11% [4,5].

According to the WHO, in Latin America, between 2014 and 2018, the estimated incidence rate had a relative increase of 8.6%. Peru is one of the countries with the highest burden of TB cases [6] since the incidence rate is 88.8 inhabitants per 100,000 [7]. However, although the incidence rate has been decreasing in recent years, its aggressive forms have increased [8,9].

To prevent a greater number of cases of this disease, it is necessary to have the level of knowledge, attitudes, and practices (KAPs) in the general population and the factors that are associated with these. So, in this way, it seeks to promote the use of these results to generate and reinforce strategies for the fight against this disease in our country [10]. Therefore, this manuscript aims to determine the factors associated with TB KAPs in the Peruvian population.

METHODS

Study Design

Analytical cross-sectional study carried out through the distribution of a virtual survey from October 1 to December 17, 2021.

Population, Sample, and Selection Criteria

People who had a device with internet access and agreed to participate were included in the study, as well as those who reported residing in Peru. Those who did not complete the variables of interest in the questionnaire or answered incorrectly were excluded. A non-probabilistic consecutive sampling was carried out.

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Variables Definition

The instrument that was used to evaluate the sociodemographic characteristics and KAPs on TB consisted of four sections. The first section was general questions, which included 9 questions about Age (in years), sex (male, female), marital status (single, married, cohabiting, divorced, widowed), suffer from any chronic illness (yes, no), employment situation (independent worker, dependent worker, perfect work situation, retired, unemployed), Academic degree (complete primary, incomplete primary, incomplete secondary, complete secondary, incomplete higher, complete higher, incomplete postgraduate, complete postgraduate), To date the participant (is studying, stopped studying due to the pandemic, none of the above). In the last 30 days the participant has smoked (yes, no). In the last 30 days the participant has ingested alcohol (yes, no).

The knowledge section contained twenty-three questions with Yes or No response options. The section on attitudes towards TB had nine questions which were evaluated with a 5-option Likert scale ranging from Strongly disagree to Strongly disagree. according to the proposition. Finally, in the section on practices towards TB, 8 questions had Yes or No answer options.

Data Collection Procedure

The research team determined that data collection be carried out virtually. Subsequently, the survey was designed in Google form, carrying out strict quality control of the data collected through a pilot test. In addition, the online instrument was published on various social networks (WhatsApp, Facebook, and Twitter, among others) for the participants during the aforementioned period. Then, a database was built in the Microsoft Excel 2022 program, where the collected data was entered.

Statistical Analysis

The STATA version 17.0 program was used. Frequencies and percentages for the descriptive analysis determined the categorical variables. For the bivariate analysis, according to the stratification of sufficient and insufficient CAPs, the chi-square test of independence was performed. For the analysis and evaluation of the strength of association between the variables of interest, a generalized linear model of the Poisson family with robust variance was used. The association measure used was the crude (PRc) and adjusted (RPa) prevalence ratio with its respective 95% confidence interval (95%CI).

Ethical Aspects

The information collected did not violate the privacy and integrity of the participants, since during the investigation the confidentiality of the information obtained through the collection of anonymous responses from the surveys carried out through the aforementioned social networks was maintained. The investigation was carried out in compliance with the Declaration of Helsinki.

RESULTS

A total of 1284 participants were surveyed. 50.16% were female, and 61.53% were between 18 and 25 years old. 40.87% were in higher education. The area of greatest origin was Metropolitan Lima, representing 67.8% of the total. In addition, 92.29% of the participants had not had any family history of TB. Regarding knowledge, attitudes, and practices about TB, it was found that these had an insufficient level in 47.97%, 50.3%, and 54.36% of the cases, respectively.

When performing the bivariate analysis, statistically significant differences were found in having sufficient knowledge of TB concerning sex (p=0.044), area (p<0.001), family history (p<0.001), and having TB (p<0.001). Regarding attitudes, it was statistically significant with the area (p<0.001), family history (p=0.036) and having had TB (p<0.001). And concerning practices, this was only significant for age (p=0.027) and history of having had TB (p=0.002).

In the multivariate regression analysis, the variables that showed a statistically significant association concerning knowledge about TB were: sex (PRa=1.138; 95% CI 1.025-1.263, p=0.016), family history of TB (PRa=1.698, 95% CI 1.529-1.886, p<0.001), history of TB (aPR=1.480; 95% CI 1.291-1.696, p < 0.001), In addition, in the academic degree variable, there was a significant association with the higher academic degree (PR=1.121; 95%CI 1.019-1.439; p=0.029) and with postgraduate (PRa=1.326, 95%CI 1.04-1.689; p=0.022) with respect to participants with a primary academic degree. Finally, an association was also found in the area variable in participants from the Coast (PRa=1.222, IC95% 1.071-1.394, P=0.003) and participants from the Sierra (PRa=0.829; IC95% 0.700-0.980; p=0.029) against participants from Metropolitan Lima.

Table 1: Uni- and Bivariate Analysis of Characteristics Associated with the Level of Knowledge, Attitudes and Practices about Tuberculosis

Characteristics	Total n (%)	Knowledge			Attitudes			Practices		
		Insufficient n (%)	Sufficient n (%)	p*	Insufficient n (%)	Sufficient n (%)	p*	Insufficient n (%)	Sufficient n (%)	p*
Gender										
Female	644 (50,16)	332 (51,55)	312 (48,45)	0,044	334 (51,86)	310 (48,14)	0,265	360 (55,90)	284 (44,10)	0,267
Male	640 (49,84)	294 (45,94)	346 (54,06)		312 (48,75)	328 (51,25)		338 (52,81)	302 (47,19)	
Categorized age										
18 to 25 years old	790 (61,53)	393 (49,75)	397 (50,25)	0,095	398 (50,38)	392 (49,62)	0,740	451 (57,09)	339 (42,91)	0,027
26 to 45 years old	368 (28,66)	164 (44,57)	204 (55,43)		181 (49,18)	187 (50,82)		189 (51,36)	179 (48,64)	
46 to 66 years old	126 (9,81)	69 (54,76)	57 (45,24)		67 (53,17)	59 (46,83)		58 (46,03)	68 (53,97)	
Grade level										
Elementary school	217 (16,90)	123 (56,68)	94 (43,32)	0,063	113 (52,07)	104 (47,93)	0,750	106 (48,85)	111 (51,15)	0,240
Secondary	450 (35,05)	218 (48,44)	232 (51,56)		219 (48,67)	231 (51,33)		242 (53,78)	208 (46,22)	
High school	526 (40,87)	245 (46,58)	281 (53,42)		265 (50,38)	261 (49,62)		297 (56,46)	229 (43,54)	
Postgraduate	91 (7,09)	40 (43,96)	51 (56,04)		49 (53,85)0	42 (46,15)		53 (58,24)	38 (41,76)	
Area										
Metropolitan Lima	870 (678,76)	423 (48,62)	447 (51,38)	< 0,001	468 (53,79)	402 (46,21)	< 0,001	472 (54,25)	398 (45,75)	0,930
Coast (excluding metropolitan Lima)	170 (13,24)	62 (36,47)	108 (63,53)		90 (52,94)	80 (47,06)		93 (54,71)	77 (45,29)	
Highlands	191 (14,88)	107 (56,02)	84 (43,98)		73 (38,22)	118 (61,78)		102 (53,40)	89 (46,60)	
Jungle	53 (4,13)	34 (64,15))	19 (35,85)		15 (28,30)	38 (71,70)		31 (58,49)	22 (41,51)	
Family history of TB										
No	1178 (92,29)	608 (51,61)	570 (48,39)	< 0,001	603 (51,19)	575 (48,81)	< 0,001	644 (54,67)	534 (45,33)	0,461
Yes	99 (7,71)	18 (16,98)	88 (83,03)		43 (40,57)	63 (59,43)0		54 (50,94)	52 (49,06)	
History of TB										
No	1185 (92,29)	599 (50,55)	586 (49,45)	< 0,001	617 (52,07)	568 (47,93)	0,036	659 (55,61)	526 (44,39)	0,002
Yes	99 (7,71)	27 (27,27)	72 (72,73)		29 (29,29)	70 (70,71)		39 (39,39)	60 (60,61)	

*performed with the chi-square test of independence.
Source: Own elaboration.

Table 2: Poisson Regression Model with Robust Variance Fitted to Assess the Association between Characteristics and the Level of Knowledge, Attitudes and Practices about Tuberculosis

Characteristics	Knowledge			Attitudes			Practices		
	RPa	95% CI	p	RPa	95% CI	p	RPa	95% CI	p
Gender									
Male	Ref.			Ref.			Ref.		
Female	1,138	1,025 - 1,263	0,016	1,08	0,969 - 1,205	0,163	1,080	0,959 - 1,217	0,204
Categorized age									
18 to 25 years old	Ref.			Ref.			Ref.		
26 to 45 years old	1,035	0,914 - 1,170	0,589	1,021	0,984 - 1,167	0,752	1,228	1,065 - 1,417	0,005
46 to 66 years old	0,885	0,718 - 1,089	0,249	0,982	0,796 - 1,211	0,867	1,427	1,173 - 1,736	< 0,001
Grade level									
Elementary school	Ref.			Ref.			Ref.		
Secondary	1,174	0,988 - 1,395	0,067	1,076	0,911 - 1,271	0,388	0,943	0,799 - 1,113	0,491
High school	1,121	1,019 - 1,439	0,029	1,037	0,874 - 1,230	0,681	0,799	0,677 - 0,944	0,008
Postgraduate	1,326	1,04 - 1,689	0,022	0,974	0,739 - 1,284	0,852	0,690	0,518 - 0,918	0,011
Area									
Metropolitan Lima	Ref.			Ref.			Ref.		
Coast (excluding metropolitan Lima)	1,222	1,071 - 1,394	0,003	1,010	0,850 - 1,201	0,909	1,001	0,837 - 1,196	0,994
Highlands	0,829	0,700 - 0,980	0,029	1,297	1,134 - 1,483	< 0,001	0,992	0,838 - 1,173	0,923
Jungle	0,702	0,492 - 1,003	0,052	1,533	1,281 - 1,833	< 0,001	0,885	0,644 - 1,217	0,453
Family history of TB									
No	Ref.			Ref.			Ref.		
Yes	1,698	1,529 - 1,886	< 0,001	1,225	1,039 - 1,444	0,015	1,072	0,878 - 1,310	0,495
History of TB									
No	Ref.			Ref.			Ref.		
Yes	1,480	1,291 - 1,696	< 0,001	1,396	1,214 - 1,605	< 0,001	1,356	1,145 - 1,606	< 0,001

Adjusted for: sex, categorized age, academic grade, area, family history of TB and history of TB.
Source: own elaboration.

About attitudes towards TB, there was a statistically significant association with: family history of TB (PRa=1.225; 95%CI 1.039-1.444, p=0.015), history of TB (PRa=1.396; 95%CI 1.214-1.605; p<0.001), and with respect to belonging to the Sierra (PRa=1.297; 95%CI 1.134-1.481; p<0.001) and the Selva (PRa=1.533; 95%CI 1.281-1.833, p<0.001) compared to those from Metropolitan Lima.

Finally, regarding the variables associated with the practices, the different ones that were statistically significant were: history of TB (PRa=1.356, 95% CI 1.145-1.606, p<0.001), age between 26 and 45 years (PRa=1.228, 95%CI 1.065-1.417, p=0.005) and between 46 to 66 years old (PR=1.427; 95%CI 1.173-1.736; p<0.001) concerning people between 18 to 25 years old. Finally, in the academic degree variable, there was an association between participants with a higher degree (PRa=0.799, 95%CI 0.677-0.944, p=0.008) and in participants with a postgraduate degree (PRa=0.690, 95%CI 0.518-0.918, p=0.011) compared to people who have a primary academic degree.

DISCUSSION

The studies carried out globally and in Latin America about the KAPs in TB cover different population groups, mainly students of health sciences or people living with the infection [11-15], nevertheless, the number of manuscripts whose study population was the general population is limited.

In China, they carried out a study on people over 65 years of age, where the variables that had a significant association with the level of knowledge about TB were having a history of TB and relatives with a history of this disease [16], which contrasts with the results of our investigation. While in a study carried out in Colombia, they reported that the level of knowledge about TB is influenced by age, where it was found that the most correct responses were found in the population over 30 years of age [17], unlike in our work, the most significant number of correct answers was found between 18 and 25 years of age; in addition, significant differences with age were found only with practices related to TB but no association with knowledge or attitudes.

The general population should have knowledge about this disease to improve and to manage communication and educational strategies related to the prevention, detection, and control of TB [18]. Poor

TB knowledge was shown in one study to be associated with decreased ability to prevent TB; in addition, it be related to prolonged delays in seeking health care at home in the presence of symptoms associated with this pathology [19]. While in studies carried out in Lesotho, Nigeria, India, and Pakistan, the general knowledge about the disease in men was very low compared to the women surveyed, taking into account concepts about the cause, signs, symptoms, mode of transmission and treatment of TB [20-22], which coincides with the results obtained in our study; these results are likely related to the level of education of the participants surveyed.

In the study carried out in Lesotho, a statistically significant association was found between the attitudes of the respondents towards TB with the age, sex and academic degree of the participants surveyed [22], while in ours, no association was found with these variables, but with the presence of a personal and family history of TB. On the other hand, in Nigeria a study was carried out in which nurses participated, finding that the only factor with a significant association in relation to TB practices was the work experience of nurses [23]. As a result of this research, age was positively associated with TB practices. A probable explanation is that the older people are, the better behaviors aimed at preventing this disease due to the increased risk of suffering from it as age increases [24].

In the case of internships, a study carried out in The Gambia did not obtain statistically significant results by sex, in contrast to our results; otherwise, concerning the place of origin. Additionally, said work found that the inhabitants of rural areas were more likely to consider self-medication and consulting traditional healers as well as religious leaders [25]. In addition, it was obtained as a result that more than half of the participants had insufficient practices against TB, which suggests that a more significant number of activities are needed in TB awareness campaigns, regardless of educational background or economic resources in a population, these strategies are important to add to the control of this disease [26,27].

The results obtained in this work can be used to design a broader investigation that allows directing the implementation of different strategies for the prevention of TB. Although the findings are relevant, it is essential to highlight the limitations of the study, mainly the process of data collection, since they were taken only once and virtually.

The following limitations must be taken into account. The survey was disseminated virtually, so there was no control over people filling out the survey. In turn, having used a non-probabilistic sample, it may not be representative of the Peruvian population; however, this is a first step in the study of the KAPs related to this disease, so it could be an advantage e to know the behavior of these variables.

CONCLUSION

There are insufficient KAPs in about half of the population studied. In addition, there are differences according to the epidemiological characteristics, such as sex, age, academic degree, area and family history of TB and having had this disease. Therefore, the importance of research in this field should be emphasized in the face of a disease that is related to the differences in the levels of these variables between different strata of the general population.

Therefore, it is essential to carry out future studies to explore the factors associated with KAPs on TB in depth. In addition, the implementation of health education and health promotion activities for the general population aimed at transmitting and treating this disease is recommended.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHORSHIP CONTRIBUTIONS

The authors participated in the genesis of the idea, project design, data collection and interpretation, analysis of results, and preparation of the manuscript of this research paper.

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REFERENCES

[1]   Álava Villafuerte MJ, Guallpa Lema DF, Figueroa Parrales AA, Saltarén Pérez KK, Delgado Macías JC, Zambrano Carranza LE. Estrategias frente a la reaparición de la tuberculosis. Polo del Conocimiento: Revista científico - profesional 2019; 4(1): 3-17.
https://doi.org/10.23857/pc.v4i1.847

[2]   Cardona P-J. Pathogenesis of tuberculosis and other mycobacteriosis. Enferm Infecc Microbiol Clin (Engl Ed) 2018; 36(1): 38-46.
https://doi.org/10.1016/j.eimc.2017.10.015

[3]   Ledesma JR, Ma J, Vongpradith A, Maddison ER, Novotney A, Biehl MH, *et al*. Global, regional, and national sex differences in the global burden of tuberculosis by HIV status, 1990-2019: results from the Global Burden of Disease Study 2019. The Lancet Infectious Diseases 2022; 22(2): 222-41.
https://doi.org/10.1016/S1473-3099(21)00449-7

[4]   Global tuberculosis report 2021 [Internet]. [citado el 31 de enero de 2023]. Disponible en: https://www.who.int/publications-detail-redirect/9789240037021

[5]   Swaminathan N, Perloff SR, Zuckerman JM. Prevention of Mycobacterium tuberculosis Transmission in Health Care Settings. Infect Dis Clin North Am 2021; 35(4): 1013-25.
https://doi.org/10.1016/j.idc.2021.07.003

[6]   Ranzani OT, Pescarini JM, Martinez L, Garcia-Basteiro AL. Increasing tuberculosis burden in Latin America: an alarming trend for global control efforts. BMJ Glob Health 2021; 6(3): e005639.
https://doi.org/10.1136/bmjgh-2021-005639

[7]   Buscar - OPS/OMS | Organización Panamericana de la Salud [Internet]. [citado el 31 de enero de 2023]. Disponible en: https://www.paho.org/es/search/r?keys=tuberculosis+Per%C3%BA

[8]   MINSA - DPCTB : Portal de Información [Internet]. [citado el 14 de abril de 2022]. Disponible en: http://www.tuberculosis.minsa.gob.pe/DashboardDPCTB/Dashboard.aspx

[9]   GBD 2015 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet 2016; 388(10053): 1545-602.
https://doi.org/10.1016/S0140-6736(16)31678-6

[10]   Alarcón V, Alarcón E, Figueroa C, Mendoza-Ticona A. Tuberculosis en el Perú: Situación epidemiológica, avances y desafíos para su control. Revista Peruana de Medicina Experimental y Salud Pública 2017; 34(2): 299-310.
https://doi.org/10.17843/rpmesp.2017.342.2384

[11]   Quispe-Prieto S, Caipa-Ramos M, Salas-Hallasi S, Salvador-Oré K, Romani F. Prácticas y conocimientos sobre prevención primaria de tuberculosis en estudiantes universitarios de ciencias de la salud en la región Tacna, Perú. Anales de la Facultad de Medicina 2019; 80(4): 475-81.
https://doi.org/10.15381/anales.v80i4.16931

[12]   Al Khalili S, Al Yaquobi F, Al Abri B, Al Thuhli K, Al Marshoudi S, Al Rawahi B, *et al*. Assessing Oman's knowledge, attitude and practice regarding tuberculosis: a cross-sectional study that calls for action. Int J Infect Dis 2022; 124(Suppl 1): S4-11.
https://doi.org/10.1016/j.ijid.2022.06.002

[13]   Essar MY, Rezayee KJ, Ahmad S, Kamal MA, Nasery R, Danishmand TJ, *et al*. Knowledge, Attitude, and Practices Toward Tuberculosis Among Hospital Outpatients in Kabul, Afghanistan. Front Public Health 2022; 10: 933005.
https://doi.org/10.3389/fpubh.2022.933005

[14]   Shrestha SK, Bhattarai RB, Joshi LR, Adhikari N, Shrestha SK, Basnet R, *et al*. Knowledge, Attitude, and Practices on Drug-Resistant Tuberculosis Infection Control in Nepal: A Cross-Sectional Study. Tuberc Res Treat 2021; 2021: 6615180.
https://doi.org/10.1155/2021/6615180

[15]   Dorji T, Tshering T, Wangdi K. Assessment of knowledge, attitude and practice on tuberculosis among teacher trainees of Samtse College of Education, Bhutan. PLoS One 2020; 15(11): e0241923.
https://doi.org/10.1371/journal.pone.0241923

[16]   Wang Y, Gan Y, Zhang J, Mei J, Feng J, Lu Z, *et al*. Analysis of the current status and associated factors of tuberculosis knowledge, attitudes, and practices among elderly people in Shenzhen: a cross-sectional study. BMC Public Health 2021; 21(1): 1163.
https://doi.org/10.1186/s12889-021-11240-7

[17]   Figueroa J, Hoyos D, Rodas A, Luna L, Salamanca L, Valencia S, *et al*. Conocimientos sobre la tuberculosis en usuarios del transporte masivo en Santiago de Cali, Colombia. Interdisciplinary Journal of Epidemiology and Public Health 2019; 1.
https://doi.org/10.18041/2665-427X/ijeph.2.5636

[18]   Lukac D, Garaycochea O, Taype-Rondan A, Luque Bustamante L, Mujica-Vasquez A, Zamora D. [Knowledge and perception about tuberculosis among public transport workers in Lima, Peru]. Medwave 2016; 16(10): e6629.
https://doi.org/10.5867/medwave.2016.10.6629

[19]   Muñoz-Sánchez AI, Rubiano-Mesa YL, Saavedra-Cantor CJ. Measuring instrument: knowledge, attitudes and practices of people with pulmonary tuberculosis. Rev Latino-Am Enfermagem [Internet] 2019 [citado el 31 de enero de 2023]; 27.
https://doi.org/10.1590/1518-8345.2608.3086

[20]   Mustafa T, Shahzad Y, Kiani A. A survey of knowledge, attitude, and practices of private retail pharmacies staff in tuberculosis care: study from Dera Ismail Khan City, Pakistan. J Pharm Policy Pract 2018; 11: 7.
https://doi.org/10.1186/s40545-018-0134-1

[21]   Almalki ME, Almuqati FS, Alasmari R, Enani MJ, Bahwirith AA, Alloqmani AA, *et al*. A Cross-Sectional Study of Tuberculosis Knowledge, Attitude, and Practice Among the General Population in the Western Region of Saudi Arabia. Cureus 14(10): e29987.

[22]   Luba TR, Tang S, Liu Q, Gebremedhin SA, Kisasi MD, Feng Z. Knowledge, attitude and associated factors towards tuberculosis in Lesotho: a population based study. BMC Infectious Diseases 2019; 19(1): 96.
https://doi.org/10.1186/s12879-019-3688-x

[23]   Akande PA. Knowledge and practices regarding tuberculosis infection control among nurses in Ibadan, south-west Nigeria: a cross-sectional study. BMC Health Services Research 2020; 20(1): 280.
https://doi.org/10.1186/s12913-020-05156-y

[24]   Alotaibi B, Yassin Y, Mushi A, Maashi F, Thomas A, Mohamed G, *et al*. Tuberculosis knowledge, attitude and practice among healthcare workers during the 2016 Hajj. PLoS One 2019; 14(1): e0210913.
https://doi.org/10.1371/journal.pone.0210913

[25]   Bisallah CI, Rampal L, Lye M-S, Mohd Sidik S, Ibrahim N, Iliyasu Z, *et al*. Effectiveness of health education intervention in improving knowledge, attitude, and practices regarding Tuberculosis among HIV patients in General Hospital Minna, Nigeria - A randomized control trial. PLoS One 2018; 13(2): e0192276.
https://doi.org/10.1371/journal.pone.0192276

[26]   Balogun MR, Sekoni AO, Meloni ST, Odukoya OO, Onajole AT, Longe-Peters OA, *et al*. Predictors of tuberculosis knowledge, attitudes and practices in urban slums in Nigeria: a cross-sectional study. Pan Afr Med J 2019; 32: 60.
https://doi.org/10.11604/pamj.2019.32.60.14622

[27]   Antolinez-Figueroa C, Jiménez-Chala E-A, Caguazango-Atiz P-C, Urrego-Parra HN, Cantor-Cutiva L-C, Muñoz-Sánchez A-I. Conocimientos, actitudes y prácticas en vpacientes con tuberculosis: una revisión sistemática de literatura. Rev Investig Innov Cienc Salud 2022; 4(1): press.
https://doi.org/10.46634/riics.77