Covid 19: Risk factors and development of pulmonary TB in household contacts, Lima, Peru

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A R T I C L E   I N F O

A B S T R A C T

Objective: is to determine the risk factors associated with developing tuberculosis in household contacts of patients with pulmonary tuberculosis in the epidemiological context of the Covid 19 pandemic.

Methods: It is descriptive, analytical and cross-sectional, the population of index cases with tuberculosis is 53, and a sample of 59 household contacts of a health center of the Ministry of Health, in Lima, in the months of September and October 2021, two pre-established surveys were applied, one applied in the index case, and another to household contacts; for the association of risk factors, the Mantel and Haenszel Chi-square test was used.

Results: in the sociodemographic risk, shared housing, with a significance of 0.000; family support, with a significance of 0.006, considered P values < 0.05. Clinical factor, 27.5 % (11) of the index cases have type 2 diabetes mellitus, and 7.5 % (3) have malnutrition, and 7.5 % have alcoholism, 5 % have HIV/AIDS, arterial hypertension, and lack of application of isoniazid preventive therapy (IPT) are associated with a significance level of 0.001, (P < 0.05). Environmental risk, home lighting, hygiene and ventilation are associated with a significance level of 0.017, 0.002 and 0.011 respectively, with P < 0.05. index cases, more than 28 % were infected, 69.8 % were vaccinated; in contacts more than 13 % were infected, and vaccinated more than 47 %

Conclusion: shared housing, family support, associated diseases, lack of implementation of isoniazid preventive therapy (PTZ), home lighting, hygiene and ventilation were the most relevant associated with the development of tuberculosis. Tuberculosis is a global health crisis, attention should focus on controlling tuberculosis in areas where it continues to develop. Given that migration factors are a prevalent condition in the Americas, the focus must address health risk factors to improve health outcomes and care for TB patients in Peru.

1. Introduction

Tuberculosis (TB) remains a global health problem. Pulmonary tuberculosis is the thirteenth leading cause of death and is considered the infectious disease that causes the most deaths after Covid-19. The World Health Organization reports that in 2020, about 10 million people in the world were infected with TB: 5.6 million males, 3.3 million females and 1.1 million children. Multidrug-resistant (MDR) TB increases the crisis in public health and health security (WHO, Tuberculosis, 2021) (Tuberculosis pulmonary. Today and Tomorrow, 2015).

In Peru (2017) there were 31 518 reported cases out of 37,000 TB cases, the infected rate is 99.0/100 000 population, incidence is 86.7/100 000 population, and pulmonary TB is 53.0/100 000 new cases, 62.0 % (19,692) of these TB cases, 83 % are MDR, (Ministry of Health, 2017).

The threat of Covid − 19, which raised the epidemic curve, and the entry of the British and Brazilian variants. In January 2021, there were 894 deaths per week, reporting more than 1200 deaths in the week [6]. The problem of continuity of TB treatment in health centers and the Covid 19 pandemic have increased the risk factors of being infected by pulmonary TB in household contacts (DC), in this trend the question is: What are the risk factors associated with developing tuberculosis in household contacts of patients with pulmonary tuberculosis in the context of Covid 19?, the Justification is to contribute to the Sustainable Development Goals (SDGs) with the United Nations adopted in 2015, by 2030; one of its goals is to end the global tuberculosis (TB) epidemic (WHO, World TB Report, 2016), has a practical contribution in monitoring TB strategies in health centers (HC) that will allow measuring the risk attributes of developing pulmonary TB with priority in the poor and

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extremely poor population and promote self-care in the context of the pandemic. The objective is to determine the risk factors associated with developing tuberculosis in household contacts of patients with pulmonary tuberculosis in the context of the Covid 19 pandemic.

The impact of uncertainty and fear that threatens people affected by the disease since the beginning of the Covid 19 pandemic, by affecting the continuity of their treatment and its respective control, have generated limitations in the data collection process. Kiady, R, et al. [5] point out, that the most relevant factors of delay in the diagnosis of pulmonary TB, are the delay time due to tobacco smoke (OR: 3.6723), asthenia (OR: 5.4815), anorexia (OR: 2.9524), and hemoptysis (OR: 0.2406), knowledge of TB signs (OR: 0.164) and transmissions (OR: 0.243). Knowledge of these factors will reduce the delay. Castañeda, 2020 [3] conducted a study on "Characterization of TB in Mexico. Results: 56 % men; the most affected was 65 years or older.

(Charro Herrera, González Rodríguez, Hernández Faure, Vázquez, & Licea Sierra, 2020) in the study of TB, the results were: 80.1 % of TB cases were located in the lungs.

Isoniazid Preventive Therapy, (IPT) is chemoprophylaxis that can reduce the probability of developing TB when they do not yet have the disease (Fundamentals of Epidemiology, 2017). Coronavirus, is a disease caused by SARS-Cov-2 virus, which is Severe acute respiratory syndrome coronavirus 2, referred to the virus, coronavirus disease-19 (COVID-19) is referred to the same disease (WHO, 2021). Exposed, are the contacts who are close to or in coexistence with TB bacteria, in this case a time close to the index case with the disease. (CDC, What to Do If You Have Been Exposed To TB, s.f.).

Methods. the design is observational, descriptive, analytical and cross-sectional. The unit of analysis is the household contacts (DC) of the index cases (IC) of the TB program of a Health Center of the Ministry of Health, in a vulnerable population of San Juan de Lurigancho (SJL) Lima, Peru. Of the total 295 home contacts, the sample was 59 CDs, and of the index case (IC), the population is of census type, all index cases which are 53 participants with pulmonary TB. Two instruments were used, one to obtain information from the household contacts and the other for the index cases. The variables studied were.

Sociodemographic risk factors (SRF) included: age, gender, education, occupation, location of the housing area (urban, rural, and marginalized), housing sharing, family support. Clinical risk factors (CRF) included: diagnosis of the index case (sensitive TB, MDR), health status (cured, abandoned, in process), Isoniazid preventive therapy (IPT, associated diseases, control and home visit, medical consultation, nursing interview, and nutritional, clinical examination. Environmental risk factors (ERF): tenure of services (water, electricity, sewerage) number of people per room, housing hygiene (good, fair, poor) (Fundamentals of Epidemiology, 2017), ventilation (good, poor), development of pulmonary TB (exposed, not exposed) by daily exposure from home contact with the index case. The study was developed in the epidemiological context of the pandemic in a single cut-off, that is, at a single point in time, data were obtained from the index cases and contacts on whether or not they were infected with Covid 19, and whether or not they received the Covid 19 vaccine, through the information obtained from the index case and contacts, these data were associated with those exposed to developing tuberculosis. Data collection was done through online, telephone and face-to-face interviews in their homes, conducted by nursing students. First, 30 online, 20 telephone and 9 face-to-face contacts were made. Second, all contacts (59) were visited at their homes to collect environmental data. Acceptance of study participants was by informed consent. The **survey** was developed in the study process by the researchers with reference to the social determinants of TB, (Fernandez H. I, 2020), structured based on the theoretical model of pulmonary TB, containing the items of the two instruments. **Population and Sample**, the unit of analysis are the home contacts and the index cases (TB patients) of the TB program in a Health Center of the Ministry of Health in San Juan de Lurigancho (SJL) in Lima.

of Health. The interview was conducted with an adult contact who

was in the household, and in the case of minor contacts, an adult is the person who gave the information. Interviewers were trained for 2 days (4 h) prior to fieldwork. **Validation and reliability**: The instrument was validated through pilot testing in 21 contacts and 15 index cases in another health center with similar characteristics to the population under study. As a result, some questions of the instrument were readjusted, a well as the sociodemographic, clinical and environmental dimensions, and the categories of the indicators were modified in order to specify their measurement, and for reliability it was subjected to the internal consistency test through Cronbach's Alpha, obtaining a coefficient of 0.832, considered to be highly reliable. **Data analysis,** for data processing SPSS version 23 was used. The variables were coded and recoded to be captured and placed in the database. First, for the index case, the population parameters, simple and cumulative frequencies were found, and for the CDs, the sample statisticians were found, to determine the association of the risk factors for developing pulmonary TB in household contacts and to test the hypothesis, the Mantel and Haenszel Chi-square statistical test was used, with a confidence level of 95 % and a significance of 0.05 ($P < 0.05$). The frequency of daily and non-daily exposure of Household contact with the index case for developing TB (exposed, not exposed).

2. Ethics review

The study was approved by Ethics of the Universidad Autónoma de Ica, through the Expert Review Board. The index cases and home contacts participated voluntarily and anonymously; the students who applied the field work were trained to collect the data and the application of the informed consent of the index cases and home contacts.

3. Results

In Fig. 1, **the risk exposure of developing pulmonary** TB is presented, of the 100.0 % (F = 59) of household contacts, 69.5 % (41) are exposed and 30.5 % (18) are not exposed.

It was found:

Q1: Sociodemographic risk factors are associated with developing tuberculosis in household contacts of patients with pulmonary tuberculosis in the epidemiological context of the Covid 19 pandemic.

Table 1, **Sociodemographic factors**, 52.5 % (31) of the household contacts (DC) were male and 47.5 % (28) were female. The majority of the contacts are between 26 and 45 years of age representing 44.1 % (26), followed by 15–25 years, with 18.6 % (11), between 6 and 14 years 10.2 % (6) and < 5 years 6.8 % (4).

In the area of housing, contacts in urban and rural areas, 52.5 % (31) and in human settlements (AAHH) 47.5 % (28).
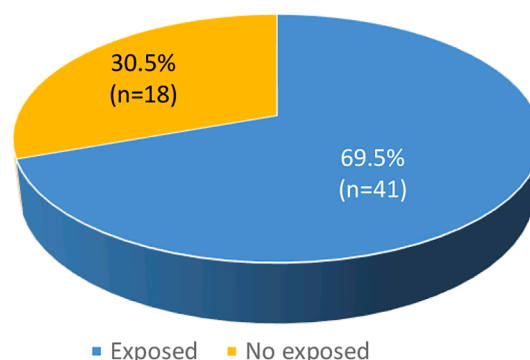
Exposure to risk of pulmonary TB from home contact

Fig. 1. Exposure to risk of pulmonary TB from home contact.

Table 1

Sociodemographic factor and exposure to developing TB.

Sociodemographic factor	Risk exposure	Value X^2	Significación asintótica (bilateral)							
	Exposed	No exposed	Total							
	F	%	F		%	F	%			
Gender	Male	21	51,2		10	55,6	31	52,5	,094[a]	0,491***
	Feminine	20	48,8		8	44,4	28	47,5		
	Total	41	100		18	100	59	100		
Age (years)	< 5	3	7,3		1	5,6	4	6,8	8,715[a]	0,069***
	6–14	4	9,8		2	11,1	6	10,2		
	15–25	4	9,8		7	38,9	11	18,6		
	26–45	19	46,3		7	38,9	26	44,1		
	Total	41	100		18	100	59	100		
Housing area	Urban, rural	23	56,1		5	27,8	28	47,5	4,023[a]	0,041
	human settlement	18	43,9		13	72,2	31	52,5		
	Total	41	100		18	100	59	100		
Shared housing with the CI	Yes	33	80,5		1	5,6	34	57,6	28,763[a]	0.000
	Not	8	19,5		17	94,4	25	42,4		
	Total	41	100		18	100	59	100		
Support	Yes	31	75,6		6	33,3	37	62,7	10,293[a]	0,006
Family to CI	Not	5	12,2		4	22,2	9	15,3		
	Indifference	5	12,2		8	44,4	13	22		
	Total	41	100		18	100	59	100		

In the housing shared by the contact and the index case, the finding was that If they share housing spaces 57.6 % (34), They do not share 42.4 % (25).

Regarding family support of the index cases, it was found that 62.7 % (37) of the index cases do receive family support, 15.3 % (9) do not receive support and 22.0 % (13) are indifferent. While 41 household contacts are exposed and 18 contacts are unexposed.

It was found that:

Q2: Clinical risk factors of index cases are associated with the development of tuberculosis in household contacts of patients with pulmonary tuberculosis in the context of the COVID 19 pandemic.

Table 2, **Clinical factor**, tuberculosis scheme of the index case and exposure to the risk of developing pulmonary tuberculosis, finding of the index case, the majority, with 81.1 % (43), have sensitive tuberculosis, and 18.9 % (10), have resistant tuberculosis (MDR).

Regarding the health status of the index case, 86.8 % (46) are in the process of treatment, 9.4 % (5) are cured, 3.8 % (2) dropped out of treatment.

As for the administration of Isoniazid Preventive Therapy (IPT) in home contacts, 61.0 % (36) did not receive ITP, while only 39.0 % (23) did receive IPT.

The associated diseases of the index case, 45.3 % (24) had no pathology, followed by 24.5 % (13) had Diabetes Mellitus Type 2, and in a lower percentage HIV/AIDS with 9.4 % (5), the same had malnutrition, alcoholism 7.5 % (4), and 3.8 % (2) had arterial hypertension.

The tuberculosis scheme, health status and associated diseases, as a clinical factor of the index case with tuberculosis, is not associated with exposure to the risk of developing pulmonary tuberculosis in household contacts, because the significance levels are higher than 0.05 (P greater than 0.05).

It was tested:

Q3: Environmental risk factors are associated with the development of tuberculosis in household contacts of patients with pulmonary tuberculosis in the context of the COVID 19 pandemic.

Table 3, **Environmental factor**: electricity, water and sewage services of the contact household, 72.9 % (43) do have electricity, water and light services, and 27.1 % (16) do not. In the lighting of the home, 74.6 % (44) is direct, and 25.4 % (15) is indirect.

Regarding home hygiene, 61.0 % (36) is good, 32.2 % (19) is regular, and 6.8 % (4) is bad.

Consequently, the environmental factor is associated with the development of pulmonary TB in household contacts, according to house lighting, house hygiene and house ventilation (Table 3), because the significance levels are 0.412, 0.017, 0.002, and 0.011, being < 0.005

Table 2

Index Case Clinical factor and risk exposure.

Clinical factor	Risk exposure	Value X^2	Asymptotic significance (bilateral)							
	Exposed	Not exposed	Total							
	F	%	F		%	F	%			
TB	Sensitive	30	75,0		13	100,0	43	81,1	4,006[a]	0,043
	Resistant (MDR)	10	25,0		0	0,0	10	18,9		
	Total	41	100,0		13	100	53	100		
Health situation (current)	Cured	2	5,0		3	23,1	5	9,4	4,712[a]	0,095***
	Abandonment	1	2,5		1	7,7	2	3,8		
	In process	37	92,5		9	69,2	46	86,8		
	Total	40	100		13	100	53	100		
Isoniazid preventive therapy- IPT (contacts)	Yes	10	24,4		13	72.2	23	39,0	12,031[a]	0,001
	Not	31	75,6		5	27,8	36	61,0		
	Total	41	100		18	100	59	100		
Enfermedades asociadas	No pathology	20	50,0		4	30,8	24	45,3	6,135[a]	0,293***
	VIH/SIDA	2	5,0		3	23,1	5	9,4		
	Diabetes mellitus type 2	11	27,5		2	15,4	13	24,5		
	Malnutrition	3	7,5		2	15,4	5	9,4		
	HT	1	2,5		1	7,7	2	3,8		
	Alcoholism	3	7,5		1	7,7	4	7,5		
	Total	39	100		14	100	53	100		

Table 3

Environmental factor and exposure to TB risk of contacts.

Environmental factor	Risk exposure	Value X2							
		Exposed	Not exposed	Total		Asymptotic significance			
		F	%	F	%	F	%	(bilateral)	
Services: electricity, water and sewerage	has	29	70,7	14	77,8	43	72,9	0,314a	0,412
	Does not have	12	29,3	4	22,2	16	27,1		
	Total	100,0		100,0		59	100,0		
Lighting (windows)	Direct	27	65,9	17	94,4	44	74,6	5,393a	0,017***
	Indirect	14	34,1	1	5,6	15	25,4		
	Total	41	100,0	18	100,0	59	100,0		
House hygiene	Good	31	75,6	5	27,8	36	61,0	12,811a	0,002***
	Regular	9	22,0	10	55,6	19	32,2		
	Bad	1	2,4	3	16,7	4	6,8		
	Total	41	100,0	18	100,0	59	100,0		
Room ventilation	Good	30	73,2	18	100,0	48	81,4	5,936a	0,011***
	Bad	11	26,8	0	0,0	11	18,6		
	Total	41	100,0	18	100,0	59	100,0		

(P < 0.05).

Table 4, **Sarcov2 - Covid 19**: Index cases (IC) 71.7 % (38) were not infected by Sarcov 2 - Covid 19, and 28.3 % (15) were infected.

Among household contacts who were infected by Sarcov 2 - Covid 19, 86.4 % (51) were not infected and 13.6 % (8) were infected.

Regarding vaccinated index cases against Covid 19, at the time of the study, 69.8 % (37) were vaccinated and 30.2 % (16) were not vaccinated.

Among the vaccinated household contacts, 52.5 % (31) were not vaccinated and 47.5 % (28) were vaccinated.

Finally, hypothesis testing was performed using Mantel and Haenszel's chi-square test to test the association between sociodemographic and environmental risk factors and the development of TB in household contacts, with the clinical factor which was significant was the diagnosis of the type of TB, and the Mantel and Haenszel's chi-square test showed that this association is statistically significant.

4. Discussion

The determination of the presence of risk factors for developing pulmonary TB in household contacts does not presuppose the certainty that the disease will develop, but there is a probability that the event will occur.

The variables of sociodemographic, clinical and environmental risk factors were contrasted with the variable of exposure to the risk of developing pulmonary TB through the Mantel and Haenszel Chi-square

Table 4

Covid 19 and TB risk exposure of index case and Home Contacts.

Sarcov2 - Covid 19	Risk exposure						
		Exposed	No exposed	Total			
		F	%	F	%	F	%
Index Cases	Infected	11	27,5	4	30,8	15	28,3
	Not Infected	29	72,5	9	69,2	38	71,7
	Total	40	100,0	13	100,0	53	100,0
infected contacts (CD)	Infected	4	9,8	4	22,2	8	13,6
	Not Infected	37	90,2	14	77,2	51	86,4
	Total	41	100,0	18	100,0	59	100,0
Vaccine (CI)	Vaccinated	26	65,0	11	84,6	37	69,8
	Not vaccinated	14	35,0	2	15,4	16	30,2
	Total	40	100,0	13	100,0	53	100,0
Vaccine (contact)	Vaccinated	22	53,7	6	33,3	28	47,5
	Not vaccinated	19	46,3	12	66,7	31	52,5
	Total	41	100,0	18	100,0	59	100,0

statistical test, to contrast the hypothesis, with a confidence level of 95 %, and a significance level of 0.05 (P < 0.05).

Sociodemographic risk factors associated with developing tuberculosis in household contacts, the majority were male between 26 and 45 years exposed to the risk factor, population within the productive group, findings similar to the statement of the WHO, 2021, which states that most TB patients are adults of productive age, and male sex, it is inferred that all age groups are at risk and that a high percentage of cases and deaths occur in developing countries, such as Peru. Likewise, the results are like those reported by Rodriguez, H. et al, 2020; Charro H, Gonzalez R, et al; they find that the most affected are men, aged 25 to 45 years, and 45 to 54 years. However, in the results found, age and sex are not associated with the development of pulmonary TB in household contacts.

In the area of housing of the contacts was more relevant the location in the urban and rural area, followed by the human settlements (AAHH) located among the exposed and is associated with the probability of developing pulmonary TB with a significance level is 0.041, being<0.05 (P < 0.05). Likewise, that a high percentage, the living space is shared between the contact and the index case and is located among the exposed and is associated with the risk of developing pulmonary TB, with a significance level of 0.000, being<0.05 (P < 0.05). According to Alarcón V., Alarcón, Figueroa, et al. 2017, TB in Peru, addressing the social determinants of health, is a challenge for TB control and the WHO "End TB" strategy, the country is immersed in this concern. Likewise, in the last 2 years, among the five departments with the highest incidence of TB, Lima has the highest incidence (MINSA D. G., 2016).

The family support to the index cases according to the contact, it is found that a large percentage receive support from their family, a minimum of them is indifferent and are among those exposed.

In effect the indicator is associated with the risk of developing pulmonary TB in contacts, with a significance level of 0.006, being<0.05 (P < 0.05) similar findings to the study by Castro C, Camarena M, Fernandez I. 2020, family support for adherence to TB treatment.

The clinical risk factor associated with developing tuberculosis in household contacts, in relation to the type of TB of the index case, the most relevant findings are that they have sensitive TB, resistant TB (MDR), which are associated with the development of TB in contacts, because in the treatment process they make resistance, when compared with the author Mamani M. 2019, and Alcívar-S. et al., 2018, had as internal factors to MDR patients, who in less than one year of treatment made resistance to treatment; Kiady, R, et al. [5] point out, that the MDR patient, makes resistance due to inadequate control and compliance with individualized treatment, a fact that is a risk that the person affected by TB makes resistance with the risk of continuing to infect contacts or other people.

The health situation of the index cases of TB, the most relevant finding was that more than half are in the process of treatment, few

patients are cured and there are index cases that have abandoned treatment, the latter are exposed to the risk of their contacts developing TB. However, the health status of the index case is not associated with exposure to risk or with the probability of developing pulmonary TB, with a significance level of 0.095, being greater than 0.05 ($P < 0.05$), which allows us to find a difference with the Castañeda M. 2020 study, where a high percentage of patients were cured, not being a risk of developing TB.

The results of the Preventive Therapy with Isoniazid (IPT), in household contacts and among them there are minors, almost all did not receive the IPT and only a minimum percentage of people received the IPT and are exposed to the development of tuberculosis, due to the importance of this chemoprophylaxis that MINSA, 2017, the Preventive Therapy with Isoniazid, has the high probability of reducing the development of TB in children and adults who may be getting infected, who do not yet develop the disease, the standard in Peru recommends the application the IPT to children under 5 years, and contacts under 19 years, which according to the results this standard is not met.

Diseases associated with TB in the index case (patients), half were found without associated pathology, more than a quarter had Diabetes mellitus type 2, and about a tenth had malnutrition and alcoholism, HIV/AIDS, hypertension, and were among those exposed, similar findings found by Castañeda M. et al, 2020, who evidenced the relevant comorbidity of TB is diabetes, smokers, while in the study no smokers were found in the results, similar to Alarcón (Alarcón V., Alarcón, Figueroa, & Mendoza-Ticona, 2017) [2 5]. In 2019, in Peru, it is confirmed that the comorbidity of the total number of TB cases is Diabetes and HIV (MINSA, Perfil de la tuberculosis en Perú - Mapa epidemiológico, 2019). Indeed, it allows reflection on the social impact generated by index cases is that most index cases are economically active population groups, are the breadwinners of their families, the risk of their household contacts, and live in vulnerable areas that increase poverty in the country.

The type of TB according to the treatment scheme, health status and associated diseases, as a clinical factor of the index case with TB, is not associated with exposure to the risk of developing pulmonary TB, because the significance levels are higher than 0.05 ($P < 0.05$). In this factor the most relevant is the lack of provision of preventive therapy with Isoniazid- IPT in home contacts and are exposed to the risk factor of developing TB with a significance level of 0.001, being lower than 0.05 ($P < 0.05$) with greater relevance in minors, explains that it is not being fulfilled. In effect, the Ho is rejected, and the study hypothesis is accepted (Table 3).

Environmental risk factors associated with developing tuberculosis in household contacts, a relevant percentage of contacts and index case have electricity, water, and sewage services, they are exposed, and more than a quarter do not have these services, when compared with Maldonado - Bazalar et al., 2016, indicate that they do not have some services, like the results found.

Natural lighting in the dwellings of the contacts stands out among the exposed, more than two thirds of the dwellings have direct lighting and one third indirect, while in the non-exposed almost all have direct lighting, results like those of Fernández Montalvo, 2020, that environmental factors are a risk for tuberculosis.

The hygiene of the housing among the exposed is good, and among the non-exposed, more than half of the hygiene is regular, it can be inferred that the area of location of the houses as urban and rural area, despite their vulnerability maintain hygiene.

In ventilation of the housing of household contacts among those exposed is good, they have windows, but in some cases, these windows are multipurpose, findings different from the author (Hernández Mahecha G M. A., 2017) argues that the lack of lighting and ventilation in housing are associated with the development of tuberculosis in household contacts.

Indeed, the environmental factor, is associated with the development of pulmonary TB in household contacts, according to housing illumination, housing hygiene and housing ventilation, with a significance

level of 0.017, 0.002, 0.011 respectively, being<0.05 ($P < 0.05$). The null hypothesis is rejected, and the study hypothesis is accepted (Table 3).

Sarcov2 - Covid 19: It is analysed on the basis that the study was developed in the epidemiological context of the Covid 19 pandemic, the index cases among those exposed and not exposed to develop tuberculosis, more than a third were infected with Sarcov2, although more than half were vaccinated against Covid 19, and more than a third had not yet received the vaccines, because at the time of the study, the country was vaccinating according to established age groups.

Among household contacts, 2 out of 10 contacts were infected with Sacov2 and the majority were exposed, although more than half had received the Covid 19 vaccine and were among the exposed.

In fact, the analysis of the association of Covid 19 of being a risk of developing tuberculosis in those exposed, is made from the results, that due to the sanitary emergency determined by the Government to comply with the restrictions to stay in their homes, and to prioritize the attention of Covid 19, being postponed the health care to people affected by tuberculosis, to make early diagnosis and capture new cases, generating a probable increase of people infected by tuberculosis.

Consequently, the impact is a challenge that TB is related to risk factors such as social, demographic, clinical and environmental determinants. However, health policy in the country focuses on the treatment of the disease, leaving intervention actions in the social context, iniquity, injustice, social environment, quality of life and public health, inequality in health is a priority issue of social justice without intervention, to prevent these differences that affect the poorest. [4].

In fact, sociodemographic, clinical, and environmental risk factors are associated with developing pulmonary tuberculosis in household contacts in the epidemiological context of the Covid 19 pandemic in Lima, Peru.

Health identifies inequalities, and social inequalities generate poverty problems and therefore have repercussions on health, the results of tuberculosis are also supported by Alarcón [1] (Josilene Dália Alves, 2020). Implications for practice include specific controls identified on risk factors for tuberculosis.

Despite the fact that Peru has many programs for prevention and treatment, however, the pandemic has been one of the constraints in which tuberculosis patients, who live with household contacts who mostly suffer from these risk factors, do not benefit from these programs.

5. Conclusions

- The population of index cases was 53, and the household contacts were a sample of 59 contacts out of 295, mostly male, between 26 and 45 years of age, with a secondary school level of education, and occupation in productive age (cases of elementary and university students).
- The most relevant sociodemographic risk factors are the location of the dwelling in urban and rural areas, the space of the dwelling is shared between the contact and the index case with TB; and family support are associated with the development of pulmonary TB in household contacts, with significant relevance.
- The clinical factor of the index case, with the most significant relevance being comorbidities such as type 2 diabetes mellitus, malnutrition, and alcoholism; and in household contacts the most relevant was the failure to provide Isoniazid preventive therapy - IPT is associated with the development of pulmonary TB in household contacts.
- The environmental factors with significant relevance were direct illumination of the dwelling, regular to good hygiene of the dwelling, and ventilation of the dwelling with multipurpose windows associated with the development of pulmonary TB in household contacts.
- Socioeconomic, clinical, and environmental factors are associated with the development of pulmonary TB in household contacts in the epidemiological context of the Covid-19 pandemic.

- Tuberculosis is a global health crisis, attention should focus on controlling tuberculosis in areas where it continues to develop. Given that migration factors are a prevalent condition in the Americas, the focus must address health risk factors to improve health outcomes and care for TB patients in Peru.
- Tuberculosis is at risk of becoming a disease that cannot be cured, due to drug resistance and poorly administered disease control and surveillance programs.

6. Recommendations

- Health services should carry out mass screening campaigns for diabetes mellitus, malnutrition, alcoholism, risk factors associated with developing pulmonary TB in household contacts, and in the context where they live with priority in minors, and the administration of Isoniazid Preventive Therapy - IPT.

- Strengthen educational programs in basic and university schools in epidemiological surveillance through Covid 19 and infectious diseases such as tuberculosis.

Because of the study, a question for further research has been generated regarding the knowledge of risk factors in the delay of early diagnosis of pulmonary tuberculosis in university students, for early diagnosis, control, and prevention of the disease.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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