

Tuberculosis treatment during the COVID-19 pandemic: actions offered and case profile



Tratamento da tuberculose durante a pandemia de COVID-19: ações ofertadas e perfil dos casos

Tratamiento de Tuberculosis durante Pandemia de COVID 19: acciones ofrecidas y perfil de casos

Luize Barbosa Antunes^a

Rubia Laine de Paula Andrade^b

Roberta Ramos Ribeiro^c

Aline Aparecida Monroe^b

Eduarda Signor^a

Aniele Silveira Machado de Oliveira Bianchini^c

Nayara Figueiredo Veira^c

Roxana Isabel Cardozo Gonzales^c

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ABSTRACT

Objective: To analyze the association between the provision of tuberculosis treatment actions and the sociodemographic and clinical characteristics of cases during the COVID-19 pandemic.

Method: Cross-sectional study conducted with data from secondary sources of 134 tuberculosis cases that underwent treatment in 2020 in the city of Pelotas, RS, Brazil. Data were analyzed using descriptive statistics, Chi-square test, and Fisher's exact test.

Results: The least frequently offered actions in the period were: three or more control smear microscopies (12.7%), smear microscopy at the end of treatment (16.7%), chest X-ray at sixth month (48.5%) and sputum culture (49%). The number of medical and nursing consultations did not reach six in 52.9% and 83.3% of cases, respectively. The lower offer of treatment actions was associated with: retreatment ($p<0.001$); comorbidities ($p=0.023$); HIV infection ($p<0.001$); mental disorder ($p=0.013$); illicit substance use ($p=0.018$); normal chest X-ray ($p=0.024$); and special treatment regimen ($p=0.009$).

Conclusion: After the COVID-19 pandemic, it is essential to invest in cases follow-up, especially those undergoing retreatment, with comorbidities, drug use, normal chest X-ray results, and special treatment regimens.

Descriptors: Tuberculosis. Therapeutics. COVID-19. Health services accessibility.

RESUMO

Objetivo: Analisar a associação entre a oferta de ações de tratamento para tuberculose com as características sociodemográficas e clínicas dos casos durante a pandemia da COVID-19.

Método: Estudo transversal, realizado com dados de fontes secundárias de 134 casos de tuberculose que realizaram tratamento em 2020 em Pelotas-RS. Os dados foram analisados por estatística descritiva, teste Qui-quadrado e exato de Fisher.

Resultados: As ações menos ofertadas no período foram: três ou mais baciloscopia de controle (12,7%), baciloscopia ao final do tratamento (16,7%), radiografia de tórax no sexto mês (48,5%) e cultura de escarro (49%). O número de consultas médicas e de enfermagem não atingiram seis em 52,9% e 83,3% dos casos, respectivamente. A menor oferta de ações de tratamento esteve associada à: retratamento ($p<0,001$); comorbidades ($p=0,023$); infecção por HIV ($p<0,001$); transtorno mental ($p=0,013$); uso de substâncias ilícitas ($p=0,018$); imagem de tórax normal ($p=0,024$); e esquema especial de tratamento ($p=0,009$).

Conclusão: Após a pandemia da COVID-19, é imprescindível investir no acompanhamento dos casos, principalmente daqueles em retratamento, com comorbidades, uso de drogas, radiografia normal e esquema especial de tratamento.

Descritores: Tuberculose. Terapêutica. COVID-19. Acesso aos serviços de saúde.

RESUMEN

Objetivo: Analizar la asociación entre la oferta de acciones de tratamiento para tuberculosis con las características sociodemográficas y clínicas de los casos durante la pandemia de COVID-19.

Método: Estudio transversal realizado con datos de fuente secundaria de 134 casos de tuberculosis que realizaron tratamiento en 2020 en Pelotas-RS. Los datos fueron analizados por estadística descriptiva, Chi-cuadrado y prueba exacta de Fisher.

Resultados: Las acciones ofertadas en el periodo fueron: radiografía de tórax al sexto mes (48,5%), cultivo de esputo (16,7%), tres o más microscopía de frotis (12,7%) y microscopía al final del tratamiento (16,7%). El número de consultas médicas y de enfermería no alcanzó seis en 52,9% y 83,3% de los casos, respectivamente. La menor oferta de acciones de tratamiento se asoció a: retratamiento ($p=0,001$); comorbidades ($p=0,023$); VIH ($p<0,001$); trastorno mental ($p=0,013$); uso de sustancias ilícitas ($p=0,018$); resultado normal de la radiografía de tórax ($p=0,024$); y régimen especial de tratamiento farmacológico ($p=0,009$).

Conclusión: Después de la pandemia de COVID-19, es esencial invertir en el seguimiento de los casos, especialmente aquellos en retratamiento, con comorbidades, radiografía normal y régimen de tratamiento especial.

Descriptores: Tuberculosis. Terapéutica. COVID-19. Accesibilidad a los servicios de salud.

^a Universidade Federal de Pelotas (UFPEL). Pelotas, Rio Grande do Sul, Brasil.

^b Universidade de São Paulo (USP). Escola de Enfermagem de Ribeirão Preto. Ribeirão Preto, São Paulo, Brasil.

^c Universidade Federal de Goiás (UFG). Goiânia, Goiás, Brasil.

■ INTRODUCTION

Most of the global burden of tuberculosis (TB) is concentrated in developing countries. In the year 2019, 10 million people became ill from TB worldwide and 1.4 million died because of the disease. This compromises the goals proposed by the End TB Strategy, which proposes to eliminate the disease as a public health issue by 2035⁽¹⁾. These goals aim to reduce the incidence rate by 90% and reduce the number of deaths from TB by 95%⁽¹⁾. Due to the high global burden of the disease, Brazil also adopted this strategy through the National Tuberculosis Control Plan, aiming for the same purpose⁽²⁾.

The COVID-19 pandemic generated an immediate limitation in access to healthcare services, as it drastically affected the routine of health care. As a result of this context, there were important changes in TB indicators⁽³⁾.

In Brazil, a TB incidence rate of 37.2 cases/100 thousand inhabitants was recorded in 2018, 37.4 in 2019 and 31.6 in 2020. The TB mortality rate per 100 thousand inhabitants remained at 2.2 since 2016^(2,4,5). Given this scenario, the disease remains a challenge for the Unified Health System (*Sistema Único de Saúde – SUS*).

The emergency situation culminated in cuts in investments in primary actions, due to the need to reallocate financial resources required to fight the pandemic⁽⁶⁾. In this context, the Tuberculosis Control Program (TCP) suffered a withdrawal of resources to combat the disease, reversing years of progress⁽⁵⁾.

Brazil, even with a universal healthcare system and a national strategic plan to End TB, has presented difficulties in confronting the disease, not only because of the pandemic, but also due to the deep existing social inequalities, which were accentuated by the COVID-19 crisis⁽⁷⁾.

With the restructuring of public policies, reorganization of healthcare systems and the accentuation of social inequalities as a result of the pandemic, there was an impact on TB control actions^(4,6). A study shows significant drops in case notification and loss to follow-up of treated TB cases⁽⁸⁾. Another study conducted in South Africa shows that there was a 26% decline in the total number of cases that started treatment when compared to the pre-pandemic period, resulting in an increase in deaths from the disease⁽⁹⁾.

The existing literature points out to the impact of the pandemic on TB epidemiological indicators, such as case detection, treatment follow-up^(4,8), incidence⁽⁶⁾, mortality^(4,9), in addition to social impacts⁽⁶⁾ and in the organization of

healthcare services⁽¹⁰⁾. Among the latter, it is worth noting the need to advance in detailing the actions that were most affected during the pandemic period.

The evaluation of TB treatment actions offered in the context of the pandemic and their association with the sociodemographic and clinical characteristics of the cases, besides contributing substantially to the definition of strategies for the effective resumption of treatment actions for the disease heavily affected by the pandemic, may support in the organization of the healthcare service, to ensure access to treatment actions for all people with TB. Considering the need to intensify disease control actions to achieve the goals of eliminating TB as a public health problem in the country, in compliance with the disease elimination plan 2021-2025. In this sense, the study aimed to analyze the association between the provision of TB treatment actions and the sociodemographic and clinical characteristics of cases during the COVID-19 pandemic.

■ METHOD

This is a cross-sectional study using secondary data source, structured based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

It was conducted in a Reference Center for TB in the city of Pelotas, southern region of the state of Rio Grande do Sul, 261 km from the capital, with a population of 343,836 people in 2021⁽¹¹⁾, with a Human Development Index (HDI) of 0.739 in 2010⁽¹²⁾. In 2020, according to records, there were 274 cases of TB in the municipality, 170 of which were new cases⁽¹³⁾. The study was conducted in the city of Pelotas as it is considered one of the priority cities for disease control in Rio Grande do Sul, with a high incidence and mortality rate⁽⁵⁾. Furthermore, the Reference Center is the main service responsible for treating people with the disease in the municipality and region.

The non-random sample was constituted based on the following inclusion criteria: individuals over 18 years old, diagnosed with TB, followed up at the Reference Center for a minimum period of three months since the beginning of the pandemic, ensuring that participants had experienced the changes in the organization of health services and whose treatment was registered with a start and end date between June 2020 and March 2021, the second wave of the pandemic. The study period was selected because the country was experiencing the second wave at that time, and COVID-19 vaccination in some priority groups caused a new reorganization and access to healthcare services.

Only closed cases constituted the sample to identify which actions during the treatment and pandemic period were offered by the Reference Center. Cases of pulmonary and extrapulmonary TB were selected to comprise the study. As exclusion criteria, people deprived of liberty (PDL) and individuals who ended treatment at the service because of a change of diagnosis or transfer were considered. These criteria were considered due to the loss of follow-up of these cases by the healthcare service (change of diagnosis/transfer) and the particularities of monitoring the treatment of PDL and difficulty in accessing the medical records of people with TB in the prison system.

The variables related to the profile of people with TB included sociodemographic characteristics (gender, age group, occupation, education level, skin color, special populations, beneficiary of the income transfer program); clinical characteristics (type of admission to the outpatient clinic, comorbidities, HIV, diabetes, mental disorder, alcohol use, tobacco use, illicit drug use, initial chest x-ray result and diagnostic sputum smear microscopy result) and TB treatment (pharmacological treatment regimen). These variables constituted the independent variables of the study.

The variables related to TB treatment actions received by TB cases (HIV testing, syphilis, hepatitis B and hepatitis C, chest x-ray at 2nd and 6th month, sputum culture, sputum smear microscopy for control, sputum at the end of treatment, medical consultations, nursing consultations and dispensing of anti-TB drugs) were used to compose the dependent variable of the study (greater offer and lower offer of TB treatment actions).

The data collection instrument was inserted into the RedCap platform (Research Electronic Data Capture) and consisted of three blocks: sociodemographic, clinical and treatment characteristics and health actions related to TB treatment. Sociodemographic and clinical characteristics were based on data collected in the notification form of the Notifiable Diseases Information System (*Sistema de Informação de Agravos de Notificação* – SINAN). The last block of questions was prepared based on the Manual of Recommendations of the National TB Control Program⁽²⁾ which recommends offering the following actions to people undergoing TB treatment: HIV testing, syphilis testing, hepatitis B and C testing at first month of treatment; sputum culture, blood glucose, liver and kidney function in the first month of treatment; chest x-ray at the second and sixth months of treatment; six or more smear microscopies for control; six or more medical consultations; six or more nursing consultations.

Data were collected in March 2021 from the Patient Registry Book and Treatment Follow-up of TB cases (official

instrument of the National Tuberculosis Control Program). Even when collecting secondary data, verbal consent was requested and recorded from eligible individuals for the study so that the researchers had access to their identification data and other personal information.

In data analysis, firstly, each health action was categorized into dichotomous responses, with a score of “zero” assigned to not offering the action and a score of “one” to receiving this action by the person with TB. However, for the variable “performing sputum smear microscopies for control”, the following scores were assigned: “zero” for no smear microscopy performed; “one” for one to two smear microscopies performed; and “two” for three or more smear microscopies performed. Furthermore, for the variables “drug dispensing” and “medical consultations” and “nursing consultations”, the following scores were assigned: “zero” for performing one to five dispensing/consultations and a score of “one” for performing of six or more dispensations/consultations during treatment.

From the scores considered for each action, the sum of these values was calculated for each person, generating a score based on the offer of TB treatment actions, totaling nine, the maximum score for extrapulmonary cases and 12 for pulmonary cases, since the sputum tests are only applicable to this group. From the descriptive analysis of the scores, the lowest offer was defined as values less than or equal to the median, that is, less than or equal to 6 for extrapulmonary and less than or equal to 8 for pulmonary. Scores above these medians were classified as greater offer. The median was chosen, since no studies were found that used the same methodology proposed in this research project, as well as to not use an arbitrary cut-off point.

Subsequently, a descriptive analysis of the variables was conducted, using relative and absolute frequency distribution, as well as measures of central tendency (mean and median), variability (interquartile range) and minimum and maximum values. The association between the lower and greater offer of treatment actions and sociodemographic, clinical and treatment variables was tested using the Chi-square or Fisher’s exact test. For the variables that showed a statistically significant association in the tests, a standardized and adjusted residue analysis was conducted, so that residues above 1.96 indicated a positive association (+) and residues below -1.96, a negative association (-). For all analyzes performed, a statistical significance level of 5% was adopted.

This study complied with the ethical precepts of research involving human beings established by Resolution 466/12 and obtained a favorable opinion (no.4,573,360) from the Research Ethics Committee on March 4, 2021.

RESULTS

From June 2020 to March 2021, the treatment of 193 people at the TB Reference Center in the municipality of Pelotas was terminated. Thirteen cases were excluded due to changes in diagnosis, fifteen due to transfer, thirty-one due to belonging to the prison system, totaling 134 cases participating in the study. From these, 74.6% (100) had the pulmonary form, 23.9% (32) the extrapulmonary form and 1.5% (2) a combination of both forms.

In follow-up exams, the majority underwent tests for HIV, syphilis, hepatitis B and C. Chest radiography was requested in the second month of treatment for most pulmonary TB cases, in the sixth month it was performed for about half of both pulmonary and extrapulmonary cases. For people with pulmonary TB, sputum culture was performed by approximately half of them, few performed three or more sputum smears for control and at the end of treatment.

During visits to the service, regardless of the clinical form, the majority underwent “one to five” nursing consultations and “six or more” dispensing of anti-TB drugs. In medical consultations, around 50% of both pulmonary and extrapulmonary TB had “six or more” treatment consultations (Table 1).

Regarding the number of sputum smear microscopies performed for control in treatment of the pulmonary form,

the mean was below one. The mean number of medical consultations and drug dispensing were similar between the groups with pulmonary and extrapulmonary TB clinical forms, but higher in relation to nursing consultations (Table 2).

Regarding the scores about the actions offered during the treatment, 50% (67) of the participants obtained values that classified them as the lower offer and 50% (67) as the greater offer. It is noteworthy that there was no significant association between sociodemographic characteristics and the classification of the offer to people during TB treatment (Table 3).

The new case was associated with a greater offer of actions during TB treatment, while retreatment (recurrence and reentry after abandonment) was associated with a lower offer. The presence of comorbidities, HIV infection, mental disorder, and use of illicit drugs were associated with lower actions during TB treatment.

The absence of radiological changes on the initial chest x-ray was associated with lower actions offered during TB treatment. The special pharmacological treatment regimen was associated with the lowest score, opposite to that observed in the basic regimen. The variables diabetes, alcohol use and tobacco use were not associated with any of the classifications of actions offered in TB treatment (Table 4).

Table 1 – Actions offered during the treatment of tuberculosis cases at a reference service, according to the clinical form of the disease (n=134). Pelotas, Rio Grande do Sul, Brazil, 2021

Variable	Pulmonary*	Extrapulmonary
	n(%)	n(%)
HIV testing		
Yes	89 (87.3%)	28 (87.5%)
No	13 (12.7%)	4 (12.5%)
Syphilis testing		
Yes	75 (73.5%)	26 (81.5%)
No	27 (26.5%)	6 (18.8%)
Hepatitis B testing		
Yes	79 (77.5%)	27 (84.4%)
No	23 (22.5%)	5 (15.6%)

Table 1 – Cont.

Variable	Pulmonary*	Extrapulmonary
	n(%)	n(%)
Hepatitis C testing		
Yes	78 (76.5%)	27 (84.4%)
No	24 (23.5%)	5 (15.6%)
Chest X-ray at 2nd month		
Yes	87 (85.3%)	21 (65.6%)
No	15 (14.7%)	11 (34.4%)
Chest X-ray at 6th month		
Yes	52 (51%)	13 (40.6%)
No	50 (49%)	19 (59.4%)
Sputum culture [#]		
Yes	50 (49%)	--
No	52 (51%)	--
Sputum smear microscopy for control [#]		
Zero	56 (54.9%)	--
One to two	33 (32.4%)	--
Three or more	13 (12.7%)	--
Sputum smear microscopy at the end of treatment [#]		
Yes	17 (16.7%)	--
No	85 (83.3%)	--
Medical consultations		
One to five	54 (52.9%)	16 (50%)
Six or more	48 (47.1%)	16 (50%)
Nursing consultations		
One to five	85 (83.3%)	26 (81.3%)
Six or more	17 (16.7%)	6 (18.8%)
Dispensing of anti-TB drugs		
One to five	28 (27.5%)	6 (18.8%)
Six or more	74 (72.5%)	26 (81.3%)

Source: Prepared by the authors.

Percentage presented per column; *Includes two cases of pulmonary+extrapulmonary TB cases; [#]n=102, as this question was not applicable to extrapulmonary TB cases.

Table 2 – Means of sputum smear tests for control, medical and nursing consultations and dispensing of anti-TB drugs (n=134). Pelotas, Rio Grande do Sul, Brazil, 2021

Variable	Pulmonary				Extrapulmonary			
	Mean	Median (IQR)	Min.	Max.	Mean	Median(IQR)	Min.	Max.
Sputum smears tests for control [#]	0.9	0(0-2)	0	7	--	--	--	--
Medical consultations	5.3	5(4-7)	0	13	5.5	5.5(2-8)	1	11
Nursing consultations	2.5	1(1-4)	0	9	2.1	1.5(0-3.5)	0	7
Dispensing of anti-TB drugs	5.7	6(5-6)	1	12	5.9	6(6-6)	2	12

Source: Prepared by the authors.

IQR – Interquartile range; Min. – Minimum; Max. – Maximum

[#]n=102, as this question was not applicable to extrapulmonary TB cases

Table 3 – Sociodemographic characteristics of people with tuberculosis treated at a reference service (n=134). Pelotas, Rio Grande do Sul, Brazil, 2021

Variable	Lower Offer	Greater Offer	p-value
	n(%)	n(%)	
Gender*			
Female	23 (53.5%)	20 (46.5%)	0.579
Male	44 (48.4%)	47 (51.6%)	
Age group*			
18 to 24 years old	13 (41.9%)	18 (58.1%)	0.335
25 to 39 years old	20 (58.8%)	14 (41.2%)	
40 to 59 years old	26 (54.2%)	22 (45.8%)	
60 years old or more	8 (38.1%)	13 (61.9%)	

Table 3 – Cont.

Variable	Lower Offer	Greater Offer	p-value
	n(%)	n(%)	
Occupation** (n=115)#			
Retired	12 (60.0%)	8 (40.0%)	
Self-employed	15 (60.0%)	10 (40.0%)	
Home/Student	3 (50.0%)	3 (50.0%)	0.419
Employed	15 (38.5%)	24 (61.5%)	
No occupation	12 (48.0%)	13 (52.0%)	
Education level** (n=131)#			
Not literate	3 (75.0%)	1 (25.0%)	
Incomplete elementary	48 (53.3%)	42 (46.7%)	
Complete elementary	4 (50.0%)	4 (50.0%)	0.396
High School	8 (34.8%)	15 (65.2%)	
Complete higher education	2 (33.3%)	4 (66.7%)	
Skin color*			
White	45 (53.6%)	39 (46.4%)	
Black/Brown	22 (44.0%)	28 (56.0%)	0.284
Special population*			
Yes	6 (60.0%)	4 (40.0%)	
No	61 (49.2%)	63 (50.8%)	0.511
Government income transfer program beneficiary**			
Yes	5 (71.4%)	2 (28.6%)	
No	62 (48.8%)	65 (51.2%)	0.441

Source: Prepared by the authors.

Percentage presented per row; *Chi-square; **Fisher's exact test; #n smaller, due to losses caused by the absence of this information in the medical records.

Table 4 – Clinical and treatment characteristics of people with tuberculosis attended at a reference service(n=134). Pelotas, Rio Grande do Sul, Brazil, 2021

Variable	Lower Offer	Greater Offer	p-value
	n(%)	n(%)	
Type of entry to the outpatient clinic*			
New case	23 (33.3%)-	46 (66.7%)+	
Retreatment	19 (79.2%)+	5 (20.8%)-	<0.001
Transfer	25 (61.0%)	16 (39.0%)	
Comorbidities*			
Yes	53 (56.4%)+	41 (43.6%)-	0.023
No	14 (35.0%)-	26 (65.0%)+	
HIV*			
Yes	18 (90.0%)+	2 (10.0%)-	<0.001
No	49 (43.0%)-	65 (57.0%)+	
Diabetes*			
Yes	5 (31.3%)	11 (68.8%)	0.110
No	62 (52.5%)	56 (47.5%)	
Mental disorder**			
Yes	7 (100%)+	0-	0.013
No	60 (47.2%)-	67 (52.8%)+	
Alcohol use*			
Yes	20 (64.5%)	11 (35.5%)	0.065
No	47 (45.6%)	56 (54.4%)	
Tobacco use*			
Yes	33 (53.2%)	29 (46.8%)	0.488
No	34 (47.2%)	38 (52.8%)	

Table 4 – Cont.

Variable	Lower Offer	Greater Offer	p-value
	n(%)	n(%)	
Use of illicit substances*			
Yes	19 (70.4%)+	8 (29.6%)-	0.018
No	48 (44.9%)-	59 (55.1%)+	
Result of initial chest x-ray** (n=107)#			
Suspicion	47 (46.1%)-	55 (53.9%)+	0.024
Normal	5 (100%)+	0-	
Result of diagnostic sputum smear microscopy**(n=77)#			
Positive	34 (46.6%)	39 (53.4%)	0.125
Negative	0	4 (100%)	
Pharmacological treatment regimen for TB*			
Basic	56 (46.3%)-	65 (53.8%)+	0.009
Special	11 (84.6%)+	2 (15.4%)-	

Source: Prepared by the authors.

Percentage presented per row; *Chi-square; **Fisher's exact test; #n smaller, after excluding participants who did not perform the test.

DISCUSSION

The research data highlighted a reduced number of healthcare actions offered to people with clinical characteristics, such as the presence of comorbidities, HIV infection, mental disorder, use of illicit drugs, retreatment for TB and the need for special pharmacological regimens over first-line treatment, making the therapeutic plan complex⁽¹⁴⁾. The study results indicate the difficulty of the service in maintaining assistance to people with chronic conditions and requiring special monitoring in view of the reorganization of the healthcare system to cope with COVID-19 and the implementation of disease prevention measures that hindered provision and receipt of healthcare actions⁽¹⁵⁾.

The association of multimorbidity with a lower number of treatment follow-up actions exposes significant weaknesses in healthcare, due to the association of this condition with unfavorable TB treatment outcomes⁽¹⁶⁾. This result is also corroborated in other research⁽¹⁷⁾.

Among the morbidities presented, mental disorder and use of illicit drugs were associated with a lower number of treatment follow-up actions, probably due to the difficulty in maintaining the bond between the team and users, since the pandemic context weakened this dynamic, due to the recommendations for social distancing and, additionally, the redeployment of healthcare professionals to face the health emergency. This may have contributed to these individuals not feeling welcomed by the healthcare system,

and to non-adherence to health actions, essential for the continuation of long-term pharmacological treatment, as is the case of TB⁽¹⁸⁾.

A study identified the use of illicit drugs as a risk factor for unfavorable outcomes in TB treatment (death, abandonment and treatment failure)⁽¹⁹⁾. The consumption of illicit drugs represents a major challenge for global health, since the use of such substances can increase the social vulnerability of individuals, in addition to the harmful interaction of these drugs with the body of the individual with TB⁽¹⁹⁾ and the difficulty of health professionals with this population due to the fragility of the bond and treatment adherence⁽²⁰⁾.

TB-HIV co-infection is widely investigated and potentially threatening to the patient, as HIV makes its carrier susceptible to TB infections and complications due to the immunodeficiency caused by the virus in the body^(18,21,22). In this study, people with HIV received fewer healthcare actions compared to people who do not carry the virus.

The combination of the amount of drugs ingested in the treatment for both diseases, the occurrence of side effects resulting from the interaction and precarious health conditions, often presented by these patients, and the improvement of TB symptoms contribute to the discontinuance of treatment^(21,22).

The association of unchanged results in the chest X-ray at diagnosis and the lower offer of treatment actions, may be related to the false conception that the absence of changes is associated with mild, non-bacillary forms of the disease and favorable treatment outcomes for TB^(23,24).

Exams to monitor the clinical evolution and contact with the user during visits to the service allow identifying risk factors for the worsening of the case or abandonment of pharmacological treatment, allowing to intervene satisfactorily in the treatment⁽²⁵⁾.

During the pandemic, monitoring TB cases through clinical assessment becomes relevant from an epidemiological point of view, due to the movement restriction measures imposed by health authorities and the housing and basic sanitation conditions typical of TB endemic areas, and recently COVID-19^(6,10). Therefore, identifying the association of special pharmacological regimens with lower scores of healthcare actions in TB treatment highlights the challenges faced by services in monitoring cases of greater clinical complexity⁽²⁶⁾.

Another condition that imposes the adoption of the special regimen is resistance to first-line drugs, which is challenging for TB control worldwide^(1,2). Moreover, the drugs that make up the special regimen are potentially toxic and have a worse prognosis, requiring prolonged treatment^(1,26).

In the city of Pelotas, it is important to highlight that people in these conditions require periodic evaluations at a

tertiary reference service located in Porto Alegre, which may result in fewer actions carried out in the Pelotas healthcare service. This information was not identified during the collection of secondary source data, a fact that reinforces the need for new studies to evaluate this connection.

Given the length and complexity of pharmacological treatment, it is recommended that these people make at least the same number of visits and follow-up exams at the regional reference center recommended for people undergoing treatment with a basic regimen⁽²⁾ which was not observed in the study.

The need to reorganize the healthcare system in the context of the pandemic hindered to monitor people with TB, especially in complex cases⁽¹⁵⁾.

Conducting a greater number of health actions for participants admitted to the reference center as "new cases" indicates prioritization over other types of entry into the service, evidenced by several studies that associate the "new case" with greater access to health actions during pharmacological treatment, which results in the cure of individuals⁽²⁶⁾.

On the other hand, studies link "recurrence" and "reentry" after abandonment, generating unfavorable treatment outcomes and worsening health conditions, sometimes resulting in the development of multidrug-resistant TB, abandonment and death⁽²⁷⁾.

One study aimed to analyze the factors associated with cases of recurrence, identifying an association of this type of entry with multimorbidity, lower access to health actions during treatment, the need for hospital admissions, and an unfavorable treatment outcome⁽²⁸⁾.

It is essential to guarantee access to health actions in the TB treatment, especially for people who re-enter the service after abandonment and relapses, given the possibility of becoming ill with severe forms of TB, the development of multidrug-resistant strains, difficulty in adherence to pharmacological treatment and death.

The relationship between sociodemographic characteristics associated with the lower number of TB treatment actions can be explained by the impact of the pandemic on these populations, which were disproportionately affected, since poverty and lack of access were intensely worsened by the pandemic scenario⁽²⁹⁾. In this sense, the study has demonstrated the importance of social determinants of health and the close relationship between TB and the spread and mortality from COVID-19 in areas⁽³⁰⁾.

It is noteworthy that although the study was conducted in a municipality, the healthcare service where the participants were monitored has important relevance in the region's healthcare network, in addition to serving the municipal population, it also acts as a regional reference for TB.

A limitation of this study is the reliance on data from secondary sources since they cannot be checked, and the recording of actions carried out by healthcare professionals may have been forgotten due to the demands on the service, arising from the COVID-19 pandemic period. It is recommended that new studies be conducted with primary data (quantitative and qualitative) involving health professionals and patients monitored during the pandemic and post-pandemic, to broaden the understanding of the topic investigated and identify possible advances, new demands/needs of healthcare services in the post-pandemic context.

■ CONCLUSION

The results of the study showed that, during the COVID-19 pandemic, there was an association with a lower supply of TB treatment actions for people undergoing retreatment, with comorbidities, HIV infection, mental disorder, use of illicit drugs, and in use special pharmacological regimens.

Stands out the relevance of addressing socioeconomic, clinical and treatment characteristics during the follow-up process of people with TB, due to their influence on the provision of health actions, adherence, and treatment outcome. This study can generate subsidies to establish strategies to face new health emergencies. The study findings allow to support the planning of actions within the scope of healthcare services to combat the disease in the post-pandemic period.

From the perspective of the disease control and elimination policy as a public health issue, the study highlights the need to strengthen effective healthcare service planning, to enable people with TB to access all planned treatment actions, to achieve a cure and significant advances in the goals proposed for eliminating the disease.

In the post-pandemic scenario, to achieve tuberculosis control goals, it is essential to invest in monitoring retreatment cases, with comorbidities, drug use, normal x-rays and a special treatment regimen.

■ REFERENCES

- World Health Organization. Global tuberculosis report 2020. Geneva: WHO; 2020 [cited 2023 Jul 03]. Available from: <https://www.who.int/publications-detail-redirect/9789240013131>
- Ministério da Saúde (BR). Secretaria de Vigilância em Saúde. Departamento de Vigilância das Doenças Transmissíveis. Manual de recomendações para o controle da tuberculose no Brasil. Brasília, DF: Ministério da Saúde; 2019 [cited 2023 Jul 03]. Available from: https://bvsm.sau.gov.br/bvs/publicacoes/manual_recomendacoes_controle_tuberculose_brasil_2_ed.pdf
- Glaziou P. Predicted impact of the COVID-19 pandemic on global tuberculosis deaths in 2020. MedRxiv [Preprint]. 2020. doi: <https://doi.org/10.1101/2020.04.28.20079582>
- Ministério da Saúde (BR). Secretaria de Vigilância em Saúde. Boletim epidemiológico: tuberculose. Brasília, DF: Ministério da Saúde; 2020 [cited 2023 Jul 03]. Available from: <https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/boletins/epidemiologicos/especiais/2020/boletim-tuberculose-2020-marcas-1.pdf@@download/file/boletim-tuberculose-2020-marcas-1.pdf>
- Ministério da Saúde (BR). Secretaria de Vigilância em Saúde. Boletim epidemiológico: tuberculose. Brasília, DF: Ministério da Saúde; 2021 [cited 2023 Jul 03]. Available from: https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/boletins/epidemiologicos/especiais/2021/boletim-tuberculose-2021_24.03
- McQuaid CF, McCreesh N, Read JM, Sumner T, Houben RM, White RG, et al. The potential impact of COVID-19-related disruption on tuberculosis burden. *Eur Respir J*. 2020;56(2):2001718. doi: <https://doi.org/10.1183/13993003.01718-2020>
- Hino P, Yamamoto TT, Magnabosco GT, Bertolozzi MR, Taminato M, Fornari LF. Impact of COVID-19 on the control and reorganization of tuberculosis care. *Acta Paul Enferm*. 2021;34:eAPE002115. doi: <https://doi.org/10.37689/acta-ape/2021AR02115>
- Lestari T, Kamaludin, Lowbridge C, Kenangalem E, Poespoprodjo JR, Graham SM, et al. Impacts of tuberculosis services strengthening and the COVID-19 pandemic on case detection and treatment outcomes in Mimika District, Papua, Indonesia: 2014–2021. *PLOS Glob Public Health* 2022;2(9):e0001114. doi: <https://doi.org/10.1371/journal.pgph.0001114>
- Mutyambizi C, Dunlop J, Maluleke C, Ranoto L, Chetty T, Ndou R, et al. Effect of COVID-19 on HIV, tuberculosis, and prevention of mother-to-child transmission of HIV indicators in Mopani district, South Africa. *S Afr Med J*. 2021;111(12):1181–9. doi: <https://doi.org/10.7196/samj.2021.v111i12.15822>
- Gupta A, Singla R, Caminero JA, Singla N, Mrigipuri P, Mohan A. Impact of COVID-19 on tuberculosis services in India. *Int J Tuberc Lung Dis*. 2020;24(6):637–9. doi: <https://doi.org/10.5588/ijtld.20.0212>
- Instituto Brasileiro de Geografia e Estatística [Internet]. Índice de Desenvolvimento Humano. Brasília, DF: IBGE; 2022 [cited 2023 Jul 03]. Available from: <https://cidades.ibge.gov.br/brasil/sp/registro/pesquisa/37/30255?tipo=grafico>
- Instituto Brasileiro de Geografia e Estatística [Internet]. Censo: 2010. Brasília, DF: IBGE; 2010 [cited 2023 Jul 03]. Available from: <https://www.ibge.gov.br/cidades-e-estados>
- Ministério da Saúde (BR). Ofício Circular nº 5/2020/CGDR/DCCI/SVS/MS. Orientações sobre as ações de manejo e controle da tuberculose durante a epidemia do COVID-19 [Internet]. Brasília, DF: Ministério da Saúde; 2020 [cited 2023 Jul 03]. Available from: https://www.gov.br/aids/pt-br/central-de-conteudo/copy_of_portarias/2020/oficio-circular-no-5-2020-cgdr-dcci-svs-ms/view
- Nguipdop-Djomo P, Rodrigues LC, Smith PG, Abubakar I, Mangtani P. Drug misuse, tobacco smoking, alcohol and other social determinants of tuberculosis in UK-born adults in England: a community-based case-control study. *Sci Rep*. 2020;10(1):5639. doi: <https://doi.org/10.1038/s41598-020-62667-8>
- Mendes EV. O lado oculto de uma pandemia: a terceira onda da COVID-19 ou o paciente invisível [Internet]. Brasília, DF: Consensus; 2020 [cited 2023 Jul 03]. Available from: <https://www.conass.org.br/biblioteca/o-lado-oculto-de-uma-pandemia-a-terceira-onda-da-covid-19-ou-o-paciente-invisivel/>
- Soares LN, Spagnolo LML, Tomberg JO, Zanatti CLM, Cardozo-Gonzales RI. Relationship between multimorbidity and the outcome of the treatment for pulmonary tuberculosis. *Rev Gaúcha Enferm*. 2020;41:e20190373. doi: <https://doi.org/10.1590/1983-1447.2020.20190373>
- Souza ASS, Faerstein E, Werneck GL. Multimorbidade e uso de serviços de saúde em indivíduos com restrição de atividades habituais: estudo pró-saúde. *Cad Saúde Pública*. 2019;35(11):e00155118. doi: <https://doi.org/10.1590/0102-311x00155118>

18. Chaves Torres NM, Quijano Rodríguez JJ, Porras Andrade PS, Arriaga MB, Netto EM. Factors predictive of the success of tuberculosis treatment: a systematic review with meta-analysis. *PLoS One*. 2019;14(12):e0226507. doi: <https://doi.org/10.1371/journal.pone.0226507>
19. Lackey B, Seas C, Van der Stuyft P, Otero L. Patient characteristics associated with tuberculosis treatment default: a cohort study in a high-incidence area of Lima, Peru. *PLoS One*. 2015;10(6):e0128541. doi: <https://doi.org/10.1371/journal.pone.0128541>
20. Sousa LO, Mitano F, Lima MCRAA, Sicsú AN, Silva LMC, Palha PF. Short-course therapy for tuberculosis: a discourse analysis. *Rev Bras Enferm*. 2016;69(6):1089-98. doi: <https://doi.org/10.1590/0034-7167-2016-0330>
21. Massavrov S, Akopyan K, Abdugapparov F, Ciobanu A, Hovhanessyan A, Khodjaeva M, et al. Risk factors for unfavorable treatment outcomes among the human immunodeficiency virus-associated tuberculosis population in Tashkent City, Uzbekistan: 2013-2017. *Int J Environ Res Public Health*. 2021;18(9):4623. doi: <https://doi.org/10.3390/ijerph18094623>
22. Zheng Z, Nehl EJ, Zhou C, Li J, Xie Z, Zhou Z, et al. Insufficient Tuberculosis treatment leads to earlier and higher mortality in individuals co-infected with HIV in Southern China: a cohort study. *BMC Infect Dis*. 2020;20(1):873. doi: <https://doi.org/10.1186/s12879-020-05527-0>
23. Yadav AK, Mehrotra AK, Agnihotri SP, Swami S. Study of factors influencing response and outcome of Cat-IV regimen in MDRTB patients. *Indian J Tuberc*. 2016;63(4):255-61. doi: <https://doi.org/10.1016/j.ijtb.2016.09.013>
24. Prajapati K, Mishra V, Desai M, Solanki R, Naik P. Treatment outcome of patients having extensively drug-resistant tuberculosis in Gujarat, India. *Int J Mycobacteriol*. 2017;6(3):289-95. doi: https://doi.org/10.4103/ijmy.ijmy_59_17
25. Alves JD, Arroyo LH, Arcoverde MAM, Cartagena-Ramos D, Berra TZ, Alves LS, et al. Magnitud de los determinantes sociales en el riesgo de mortalidad por tuberculosis en el Centro-Oeste de Brasil. *Gac Sanit*. 2020;34(2):171-8. doi: <https://doi.org/10.1016/j.gaceta.2019.01.004>
26. Safaev K, Parpieva N, Liverko I, Yuldashev S, Dumchev K, Gadoev J, et al. Trends, characteristics and treatment outcomes of patients with drug-resistant tuberculosis in Uzbekistan: 2013-2018. *Int J Environ Res Public Health*. 2021;18(9):4663. doi: <https://doi.org/10.3390/ijerph18094663>
27. Soares VM, Almeida IN, Figueredo LJA, Haddad JPA, Oliveira CSF, Carvalho WS, et al. Factors associated with tuberculosis and multidrug-resistant tuberculosis in patients treated at a tertiary referral hospital in the state of Minas Gerais, Brazil. *J Bras Pneumol*. 2020;46(2):e20180386. doi: <https://doi.org/10.36416/1806-3756/e20180386>
28. Rodrigues IC, Vendramini SHF, Ponce MAZ, Ruffino-Neto A, Souza NG, Chiaravalloti Neto F, et al. Recidiva da tuberculose: fatores associados em um grupo de vigilância epidemiológica de São Paulo. *Rev Eletr Enf*. 2017;19:a06. doi: <https://doi.org/10.5216/ree.v19.42694>
29. Santana JM, Lana CNA, Souza GB, Souza LMS. Determinantes sociais da saúde e óbitos por Covid-19 nos estados da região Nordeste do Brasil. *Rev Bras Saude Funcional*. 2020;11(1):18-29. doi: <https://doi.org/10.25194/rebrasf.v8i2.1305>
30. Kumar MS, Surendran D, Manu MS, Rakesh PS, Balakrishnan S. Mortality due to tb-COVID-19 coinfection in India. *Int J Tuberc Lung Dis*. 2021;25(3):250-1. doi: <https://doi.org/10.5588/ijtld.20.0947>

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■ **Authorship contribution:**

Formal analysis: Luize Barbosa Antunes, Rubia Laine de Paula Andrade, Roxana Isabel Cardozo Gonzales.

Conceptualization: Luize Barbosa Antunes.

Data curation: Luize Barbosa Antunes, Rubia Laine de Paula Andrade, Roxana Isabel Cardozo Gonzales.

Writing – original draft: Luize Barbosa Antunes, Rubia Laine de Paula Andrade, Roxana Isabel Cardozo Gonzales.

Writing – review & editing: Roberta Ramos Ribeiro, Aniele Silveira Machado de Oliveira Bianchinie, Nayara Figueiredo Vieira, Eduarda Signor.

Investigation: Luize Barbosa Antunes.

Methodology: Luize Barbosa Antunes, Rubia Laine de Paula Andrade, Roxana Isabel Cardozo Gonzales.

Supervision: Roxana Isabel Cardozo Gonzales.

Validation: Aline Aparecida Monroe, Roxana Isabel Cardozo Gonzales, Rubia Laine de Paula Andrade.

Visualization: Luize Barbosa Antunes, Rubia Laine de Paula Andrade, Roxana Isabel Cardozo Gonzales.

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■ **Corresponding author:**

Roberta Ramos Ribeiro

E-mail: robertaribeiro@discente.ufg.br

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