

Impact of the COVID-19 pandemic on laboratory diagnosis of tuberculosis in southern Brazil

Impacto da pandemia de COVID-19 no diagnóstico laboratorial de tuberculose no sul do Brasil

Impacto de la pandemia COVID-19 en el diagnóstico de laboratorio de la tuberculosis en el sur de Brasil

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ABSTRACT

Background and objectives: to understand the impact of the COVID-19 pandemic on tuberculosis (TB) diagnosis in different settings is essential to guide the establishment of appropriate TB control strategies. This study aimed to assess the influence of COVID-19 pandemic in laboratory diagnosis of TB in patients tested and diagnosed for TB. **Methods:** a data survey was carried out in the database of laboratories that perform TB diagnosis for the public health system in Rio Grande city (Rio Grande do Sul, Brazil). **Results:** there was a decrease of 1,368 to 735 (reduction of 46.3%) in the number of patients tested for TB in public diagnostic services in 2019 and 2020, respectively, and a decrease of 197 to 119 (reduction of 39.6%) in the number of new TB cases diagnosed. In contrast, the positivity rate was 14.4% in 2019 and 16.2% in 2020. Moreover, it was observed that the laboratory that performs the diagnostic service for Primary Health Care was the most affected, when compared to Tertiary Health Care. **Conclusion:** as a consequence of measures to control the spread of SARS-CoV-2, there was a reduction in TB testing and in the detection of new cases, especially in Primary Health Care, where patients with less need for hospitalization are received.

Keywords: COVID-19; Diagnosis; Health Services; Tuberculosis; SARS-CoV-2.

RESUMO

Justificativa e objetivos: compreender o impacto da pandemia COVID-19 no diagnóstico da tuberculose (TB) em diferentes locais é essencial para orientar o estabelecimento de estratégias adequadas de controle da TB. O objetivo deste estudo foi avaliar a influência da pandemia de COVID-19 no diagnóstico laboratorial de TB, em pacientes testados e diagnosticados com TB. **Métodos:** foi realizado um levantamento de dados no banco de dados de laboratórios que realizam diagnóstico de TB para o sistema público de saúde na cidade de Rio Grande (Rio Grande do Sul, Brasil). **Resultados:** houve redução de 1.368 para 735 (redução de 46,3%) no número de pacientes testados para TB nos serviços públicos de diagnóstico em 2019 e 2020, respectivamente, e redução de 197 para 119 (redução

de 39,6%) no número de novos casos de TB diagnosticados. Em contrapartida, a taxa de positividade foi de 14,4% em 2019 e 16,2% em 2020. Além disso, observou-se que o laboratório que realiza o serviço de diagnóstico para a Atenção Primária à Saúde foi o mais afetado, quando comparado com a Atenção Terciária à Saúde. **Conclusão:** como consequência das medidas de controle da disseminação do SARS-CoV-2, houve redução na testagem de TB e na detecção de novos casos, principalmente na atenção primária à saúde, onde são recebidos pacientes com menor necessidade de internação.

Descritores: COVID-19; Diagnóstico; Serviços de saúde; Tuberculose; SARS-CoV-2.

RESUMEN

Justificación y objetivos: comprender el impacto de la pandemia Covid-19 en el diagnóstico de tuberculosis (TB) en diferentes lugares es fundamental para orientar el establecimiento de estrategias adecuadas de control de la TB. El objetivo de este estudio fue evaluar la influencia de la pandemia de COVID-19 en el diagnóstico de laboratorio de TB, en términos de pacientes examinados y diagnosticados de TB. **Métodos:** los datos fueron recolectados de la base de datos de los laboratorios que realizan el diagnóstico de TB para el sistema público de salud en la ciudad de Rio Grande (Rio Grande do Sul, Brasil). **Resultados:** hubo una reducción de 1.368 a 735 (reducción del 46,3%) en el número de pacientes sometidos a pruebas de TB en los servicios públicos de diagnóstico en 2019 y 2020, respectivamente, y una reducción de 197 a 119 (reducción del 39,6%) en el número de nuevos casos de TB diagnosticados. Por otro lado, la tasa de positividad fue de 14,4% en 2019 y 16,2% en 2020. Además, se observó que el laboratorio que realiza el servicio de diagnóstico para la Atención Primaria de Salud fue el más afectado, en comparación con la Atención Terciaria de Salud. **Conclusiones:** como consecuencia de las medidas para el control de la propagación del SARS-CoV-2, hubo una reducción en las pruebas de TB y en la detección de nuevos casos, especialmente en la Atención Primaria de Salud, donde se encuentran los pacientes con menor necesidad de hospitalización.

Palabras clave: COVID-19; Diagnóstico; Servicios de salud; Tuberculosis; SARS-CoV-2.

INTRODUCTION

In January 2020, SARS-CoV-2 virus, the etiologic agent of COVID-19, was first described after being isolated from pneumonia patients in Wuhan, China.¹ Almost two years after, COVID-19 cases reported worldwide exceed 259 million, and more than 5.1 million deaths by the disease have been confirmed.² On the other hand, tuberculosis (TB), caused by the bacillus *Mycobacterium tuberculosis*, is an ancient infectious disease that remains as a public health concern worldwide. For several years, TB has been considered the leading cause of death from a single infectious agent, and it is estimated that in 2019 it affected about 10 million individuals and led to 1.4 million deaths.³

It is recognized that COVID-19 pandemic has been causing health, social and economic impacts since the beginning of 2020. Thus, authorities are engaged in controlling the spread of SARS-CoV-2, and for this, several measures were implemented at the beginning of the pandemic, such as physical distancing, limitation of movement of people, and reallocation of human and financial resources from other diseases to the COVID-19 response. In this context, some of these strategies adopted affected, in general, the routine of health services. In addition to supply and infrastructure reallocation for the COVID-19 response, there were changes in access and admission of patients to health services to support the demand of COVID-19.^{3,4}

In Europe, diagnostic laboratories already reported a significant decrease in the number of samples received for TB diagnosis, when compared to the pre-pandemic years.⁵ This reflect in the reduction of the number of patients tested for TB, and as result, there is an impact

in the number of TB cases diagnosed and reported, as described in early 2020 in countries such as Nigeria,⁶ Uganda,⁷ South Korea,⁸ China,⁹ Sierra Leone,¹⁰ and Brazil.¹¹ In a study carried out by Stop TB Partnership, an international agency that works in the fight against TB, it is estimated that the accumulation of undiagnosed and, consequently, not adequately treated TB cases during the COVID-19 pandemic generates a setback of years in the fight against TB, resulting, in the future, in an increase in disease incidence and mortality.¹²

Considering that undiagnosed TB cases contribute to the transmission chain of *M. tuberculosis*, and that monitoring TB cases is important for disease control programs,^{3,12} it is emphasized the importance of understanding the impact of the COVID-19 pandemic on TB diagnosis in different settings, in order to guide the establishment of appropriate TB control strategies. In this regard, this study aimed to assess the influence of the COVID-19 pandemic in laboratory diagnosis of TB in a setting with high burden of TB and COVID-19 in patients tested and diagnosed for TB.

METHODS

Study design

A cross-sectional study was performed at TB diagnosis services in the public health care system of the city of Rio Grande, state of Rio Grande do Sul, Brazil. To understand the impact of COVID-19 on laboratory diagnosis of TB, the number of patients tested for TB, number of new TB cases diagnosed and positivity rate in 2019 and 2020 were compared.

Study setting

Rio Grande is a port city located in the extreme south of Brazil, with an estimated TB incidence of 77.6 new cases per 100,000 inhabitants in 2018. Rio Grande is one of the priority cities for TB control in Rio Grande do Sul, a state with TB incidence rate above the average of Brazil. In 2018, TB incidence for Rio Grande do Sul and for Brazil were 45.4 and 37.2 new cases per 100,000 inhabitants, respectively, and in 2020, incidences were lower (38.9 and 31.6 new cases per 100,000 inhabitants, respectively).^{13,14} In relation to Brazil, the country ranks among the 30 countries with a high burden for TB and for TB-HIV co-infection, remaining a priority for disease control by the World Health Organization.³

COVID-19 cases were first reported in Rio Grande in March 2020, one month after the first confirmed case in Brazil. Throughout 2020, 7805 COVID-19 cases and 170 COVID-19 deaths were reported (Figure 1).¹⁵ To contain the spread of the SARS-CoV-2 virus, social distancing measures were implemented in the municipality, including restriction of access to public places and non-essential commercial services, at the end of March 2020, after confirmation of the first SARS-CoV-2 cases in Rio Grande, and in early July, with the increase in the number of deaths from COVID-19. Moreover, as a way of limiting the movement of people and avoiding agglomerations, there was also a reduction in the number of public transport available and the suspension of routine medical care in health units.

Regarding laboratory diagnosis of TB, the study was conducted in laboratories that perform TB diagnosis for Primary and Tertiary Health Care of the public health care system of Rio Grande: the Municipal Laboratory of Clinical Analysis and the Mycobacteria Laboratory from the *Hospital Universitário Dr. Miguel Riet Corrêa Jr.*, respectively. These laboratories are responsible for diagnosing approximately 80% of TB cases reported in the city.¹⁶ During the COVID-19 pandemic, there were no changes in the workflow of these laboratories and the availability of laboratory supplies and equipment, as they were not relocated for the COVID-19 response. However, the technicians who performed TB diagnoses reported a reduction in the demand for the services provided.

Data collection

The database of the laboratories included in the study were accessed, after authorization by the technicians in charge of TB diagnosis. Data referring to the number of patients tested for TB and new TB cases diagnosed were collected. These are secondary data recorded in the database of these laboratories during the TB diagnosis routine. In this study, patients with at least one sample sent for TB diagnosis, with positive results by microbiological methods (microscopy, culture and/or GeneXpert® MTB/RIF – Cepheid, USA), were considered new TB cases.

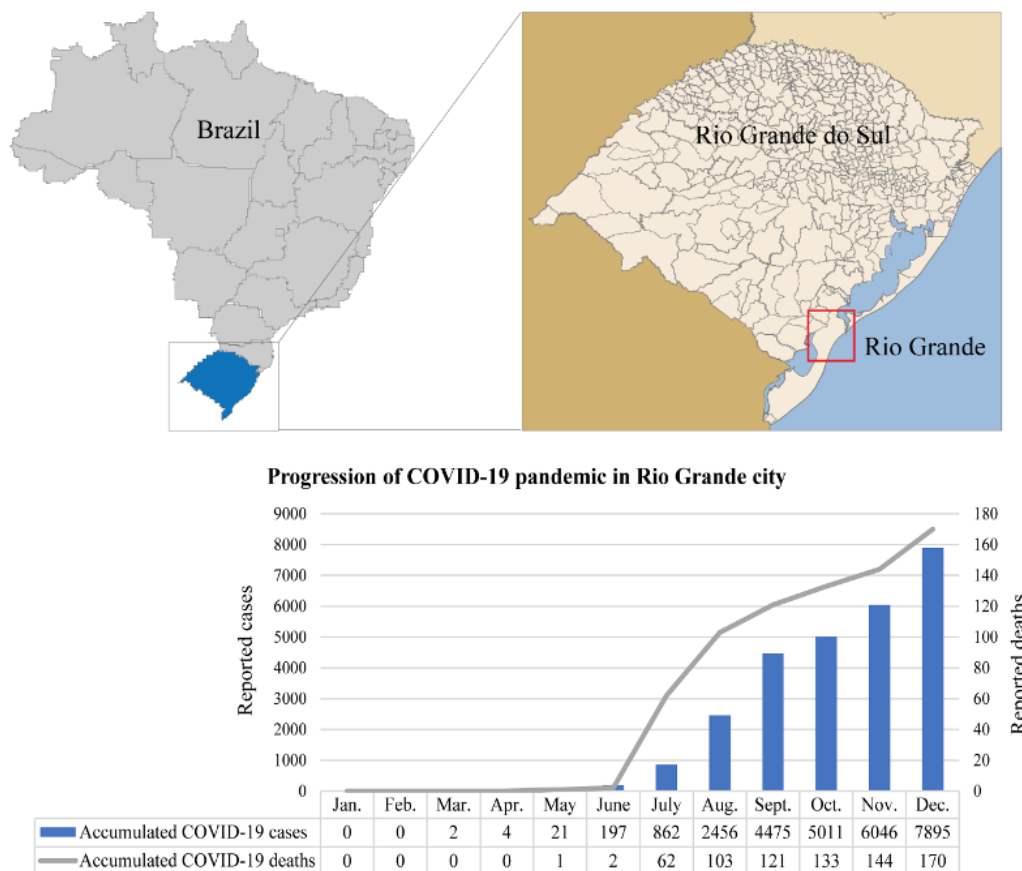


Figure 1. Rio Grande location, and number of COVID-19 cases and deaths in the city.¹⁵

Statistical analysis

The collected data were tabulated in an Excel® spreadsheet (Microsoft, USA), and comparative analyzes between the 2019 and 2020 data were performed in the same software. The percent variation in the number of patients tested and positive for TB was estimated using the 2019 data as reference. The percent variation was calculated as follows: number of patients tested/positive in 2020 subtracted by the number of patients tested/positive in the reference year (i.e., 2019), divided by the number of patients tested/positive in the reference year. The resulting value was multiplied by 100. Furthermore, the positivity rate (percentage of TB positive patients among tested patients) of 2019 and 2020 was determined and compared.

Ethical aspects

The study was approved by the Municipal Nucleus

of Education in Collective Health (NUMESC), from Rio Grande Municipal Health Department (acceptance number 004/2021). This study is a part of a larger research that was approved by the Research Ethics Committee of the *Universidade Federal do Rio Grande* (acceptance number 5.535.421).

RESULTS

The number of patients tested for TB, number of new TB cases diagnosed, diagnostic positivity rate in 2019 and 2020 and percent variation of patients tested and positives for TB in the municipal laboratory, hospital laboratory and both laboratories are represented in Tables 1, 2 and 3, respectively. The number of tested and positive patients for TB in association with COVID-19 cases and deaths progression in the municipality are represented in Figure 2.

Table 1. Number of patients tested for TB, number of new TB cases diagnosed, diagnostic positivity rate in 2019 and 2020 and percent variation of patients tested and positives for TB in the municipal laboratory.

Month	2019			2020			Variation of patients tested	Variation of new cases
	Patients tested	New cases	Positivity rate	Patients tested	New cases	Positivity rate		
Jan.	75	15	20.0%	62	5	8.1%	-17.3%	-66.7%
Feb.	64	9	14.1%	26	6	23.1%	-59.4%	-33.3%
Mar.	46	7	15.2%	71	5	7.0%	54.4%	-28.6%
Apr.	72	5	6.9%	45	4	8.9%	-37.5%	-20.0%
May	135	10	7.4%	36	3	8.3%	-73.3%	-70.0%
June	199	16	8.0%	26	6	23.1%	-86.9%	-62.5%
July	52	5	9.6%	49	3	6.1%	-5.8%	-40.0%
Aug.	59	11	18.6%	31	7	22.6%	-47.5%	-36.4%
Sept.	70	8	11.4%	45	7	15.6%	-35.7%	-12.5%
Oct.	66	10	15.2%	26	6	23.1%	-60.6%	-40.0%
Nov.	48	4	8.3%	36	5	13.9%	-25.0%	25.0%
Dec.	62	13	21.0%	20	4	20.0%	-67.7%	-69.2%
Total	948	113	11.9%	473	61	12.9%	-50.1%	-46.0%

Table 2. Number of patients tested for TB, number of new TB cases diagnosed, diagnostic positivity rate in 2019 and 2020 and percent variation of patients tested and positives for TB in the hospital laboratory.

Month	2019			2020			Variation of patients tested	Variation of new cases
	Patients tested	New cases	Positivity rate	Patients tested	New cases	Positivity rate		
Jan.	30	11	36.7%	28	12	42.9%	-6.7%	9.1%
Feb.	28	8	28.6%	22	8	36.4%	-21.4%	0.0%
Mar.	31	6	19.4%	39	10	25.6%	25.8%	66.7%
Apr.	28	3	10.7%	18	0	0.0%	-35.7%	-100.0%
May	33	8	24.2%	17	3	17.7%	-48.5%	-62.5%
June	35	6	17.1%	17	2	11.8%	-51.4%	-66.7%
July	46	4	8.7%	14	2	14.3%	-69.6%	-50.0%
Aug.	42	2	4.8%	17	5	29.4%	-59.5%	150.0%
Sept.	38	6	15.8%	30	4	13.3%	-21.1%	-33.3%
Oct.	45	10	22.2%	19	4	21.1%	-57.8%	-60.0%
Nov.	33	13	39.4%	18	4	22.2%	-45.5%	-69.2%
Dec.	31	7	22.6%	23	4	17.4%	-25.8%	-42.9%
Total	420	84	20.0%	262	58	22.1%	-37.6%	-31.0%

Table 3. Number of patients tested for TB, number of new TB cases diagnosed, diagnostic positivity rate in 2019 and 2020 and percent variation of patients tested and positives for TB in both laboratories.

Month	2019			2020			Variation of patients tested	Variation of new cases
	Patients tested	New cases	Positivity rate	Patients tested	New cases	Positivity rate		
Jan.	105	26	24.8%	90	17	18.9%	-14.3%	-34.6%
Feb.	92	17	18.5%	48	14	29.2%	-47.8%	-17.7%
Mar.	77	13	16.9%	110	15	13.6%	42.9%	15.4%
Apr.	100	8	8.0%	63	4	6.4%	-37.0%	-50.0%
May	168	18	10.7%	53	6	11.3%	-68.5%	-66.7%
June	234	22	9.4%	43	8	18.6%	-81.6%	-63.6%
July	98	9	9.2%	63	5	7.9%	-35.7%	-44.4%
Aug.	101	13	12.9%	48	12	25.0%	-52.5%	-7.7%
Sept.	108	14	13.0%	75	11	14.7%	-30.6%	-21.4%
Oct.	111	20	18.0%	45	10	22.2%	-59.5%	-50.0%
Nov.	81	17	21.0%	54	9	16.7%	-33.3%	-47.1%
Dec.	93	20	21.5%	43	8	18.6%	-53.8%	-60.0%
Total	1368	197	14.4%	735	119	16.2%	-46.3%	-39.6%

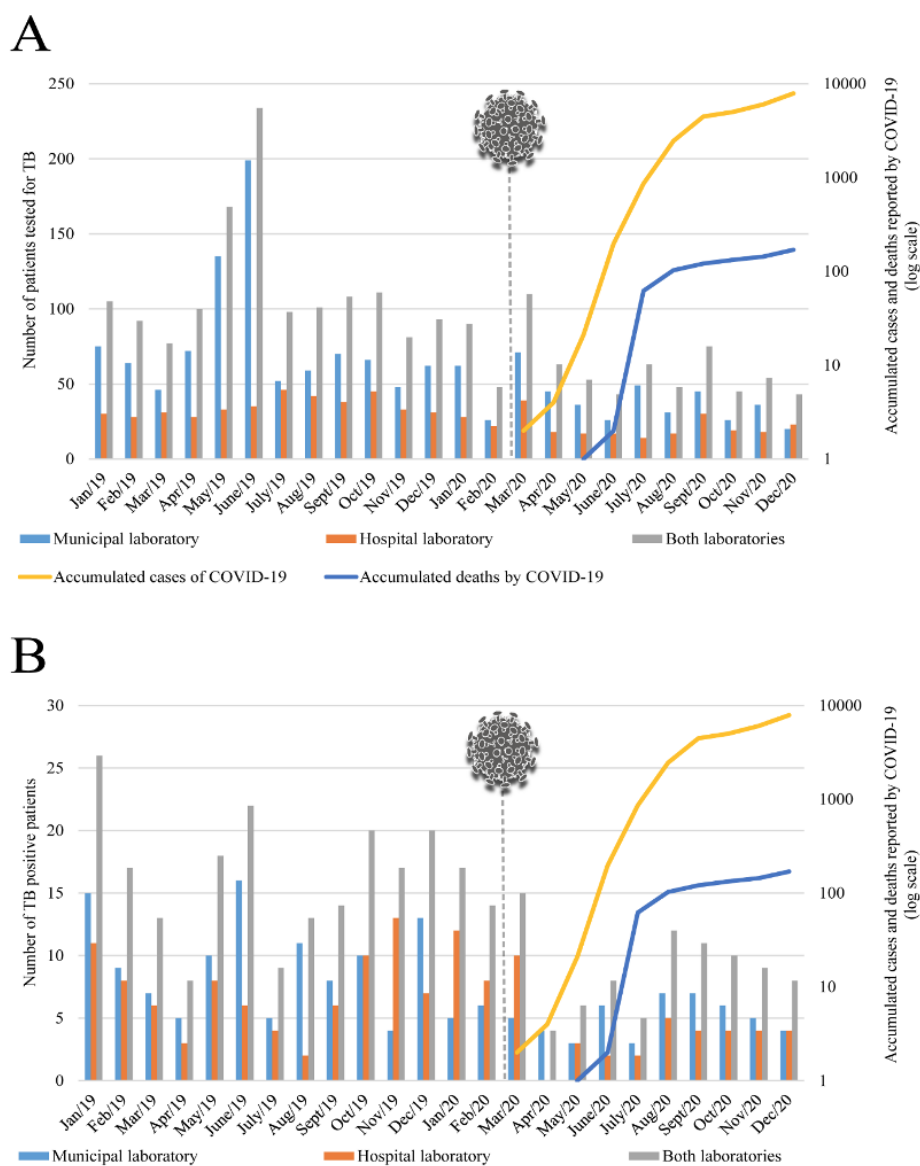


Figure 2. (A) Number of patients tested for TB in municipal and hospital laboratories and both laboratories, in 2019 and 2020, and accumulated reported cases and deaths by COVID-19. (B) Number of TB positive patients in municipal and hospital laboratories and both laboratories, in 2019 and 2020, and accumulated reported cases and deaths by COVID-19. Dashed grey line indicates the first reported COVID-19 case in Rio Grande.

Patients tested for tuberculosis

In March 2020, the month when the first COVID-19 case was reported in Rio Grande, there was a 42.9% increase in the total number of patients tested for TB compared to 2019 (77 patients in 2019 to 110 patients in 2020). This increase was of 54.4% in the municipal laboratory (46 patients in 2019 to 71 patients in 2020) and 25.8% in the hospital laboratory (31 patients in 2019 to 39 patients in 2020). In the following months of COVID-19 pandemic, from April to December, there was a decrease in the number of patients tested in both laboratories, also compared to 2019. June and July had the highest reduction in the number of patients tested in the municipal laboratory (199 patients in 2019 to 26 patients in 2020, representing a decrease of 86.9%) and hospital laboratory (46 patients in 2019 to 14 patients in 2020, representing a decrease of 69.6%), respectively. In the municipal laboratory, the number of patients tested for TB in 2019 and 2020 was 948 and 473, respectively, representing a decrease of 50.1%. In the hospital laboratory, 420 and 262 patients were tested for TB in 2019 and 2020, respectively, representing a decrease of 37.6%. A total decrease of 46.3% in the number of patients tested for TB in 2020 compared to 2019 was observed in public TB diagnostic services (1,368 and 735 patients, respectively).

New tuberculosis cases

In March 2020, compared to March 2019, there was a 15.4% increase in the total number of new TB cases diagnosed. In the following months, there was a reduction in the number of new TB cases diagnosed, except August in the hospital laboratory (increase of 150%) and November in the municipal laboratory (increase of 25%). There was a total decrease of 197 to 119 (reduction of 39.6%) in the number of new TB cases diagnosed in public TB diagnostic services in 2019 and 2020, respectively. Also, 113 and 61 new TB cases were diagnosed by the municipal laboratory (reduction of 46%), and 84 and 58 new TB cases by hospital laboratory (reduction of 31%).

Positivity rate

In March, there was a reduction in the positivity rate in 2020 (13.6%) compared to 2019 (16.9%). In the months with the highest reduction in the number of patients tested, the positivity rate increased: in the municipal laboratory, the positivity rate was 8% in June 2019 and 23.1% in June 2020, while in the hospital laboratory, the positivity rate increased from 8.7% in July 2019 to 14.3% in July 2020. Furthermore, in the months in which there was an increase in the number of TB positive patients, the positivity rate also showed an increase: in the hospital laboratory, the positivity rate was 4.8% in August 2019 and 29.4% in August 2020, while in the municipal laboratory, the positivity rate increased from 8.3% in November 2019 to 13.9% in November 2020. In both laboratories the positivity rate was 14.4% in 2019 and 16.2% in 2020. In the municipal laboratory, it was 11.9% and 12.9%, while in the hospital laboratory, it was 20% and 22.1% in 2019 and 2020, respectively.

DISCUSSION

The first pillar of the END TB Global Strategy comprises "Integrated, people-centered care and prevention, aiming at early and universal access to diagnosis and treatment of all forms of TB"³. However, health system overload due to COVID-19, as well as restrictions needed to limit SARS-CoV-2 transmission, resulted in severe reductions in the availability and access to health services for detection and treatment of TB cases.^{4,17}

Challenges in TB management during the pandemic have been observed especially in low- and middle-income countries, such as Brazil.¹¹ Brazil showed a reduction in the total number of TB reporting in the three levels of health care, with a sharp drop in tertiary care, in 2020 compared to 2019.¹³ In addition to already being a country with a high burden of TB, Brazil was considered the epicenter of COVID-19 in 2020.¹⁸

Our results showed a significant reduction in the number of patients tested and positive for TB in 2020, during the COVID-19 pandemic, in comparison to 2019. In opposition to what was observed in Brazil,¹³ we reported the highest reduction in the number of TB patients diagnosed in the municipal laboratory, which belongs to Primary Health Care, in relation to the hospital laboratory, which belongs to Tertiary Health Care. In Brazil, there is great heterogeneity among regions, including socioeconomic heterogeneity, which is reflected in the accessibility of regional health services.¹⁹ Thus, the impact of the COVID-19 pandemic on the health system in each region has been different; therefore, the importance of epidemiological investigation to understand the health situation in different regions of the country stands out.

Regarding the number of patients tested monthly, it was observed that the months of 2020 with the largest variation of patients tested, compared to 2019, were June (-86.9%) and July (-69.6%), in municipal and hospital laboratories, respectively. It is important to emphasize that, during this period, there was an increase in reporting of COVID-19 cases and deaths in Rio Grande, resulting in the adoption of physical distancing strategies and limitation of the movement of people, which diffculted people's access to TB services of diagnosis and treatment. Furthermore, in the absence of severe symptoms, the population was discouraged from seeking health services, to avoid crowding and the social stigma given the similarity of some symptoms of COVID-19 and TB.^{3,4}

We also observed that in March 2020, when the first COVID-19 case was reported in Rio Grande city, there was an increase of 42.9% and 15.4% in the total number of patients tested for TB and new TB cases diagnosed, respectively, in relation to March 2019. De Souza et al. (2020) reported a 17.8% increase in reporting of TB cases over the same period in the state of Bahia, Northeastern Brazil.¹¹ One month of increase in reported TB cases, coinciding with the first COVID-19 cases, followed by months of decrease, when compared to the same period in 2019, coinciding with the advance of the pandemic, was a pattern observed in all regions of Brazil.²⁰ We hypothesize that the increase in the number of patients tested for TB and

new TB cases diagnosed has occurred due to lack of knowledge about the COVID-19 at the beginning of the pandemic and the similarity in symptoms with TB. It is known that suspected COVID-19 and TB cases have fever and/or similar respiratory symptoms, such as difficulty breathing, cough and chest pain.²¹ Thus, patients who presented these symptoms may have been referred for TB diagnosis.

Another relevant fact evidenced in our study was the increase of 150% and 25% in the number of patients positive for TB in August at the hospital laboratory and in November at the municipal laboratory. During this same period, there was no increase in the number of patients tested, but a reduction. However, it is important to highlight that in these months, there was an increase in the positivity rate in the hospital (4.8% in August 2019 to 29.4% in August 2020) and the municipal (8.3% in November 2019 to 13.9% in November 2020) laboratories. When observing the total positivity rate in TB diagnostic services in 2019 and 2020 (14.4% and 16.2%, respectively), a similar phenomenon can also be observed. This was observed even with a reduction in the total number of patients tested and patients positive for TB in 2020 because the reduction in the number of patients tested was greater than the reduction in the number of new TB cases in that year. In the municipal laboratory, the positivity rate increased from 11.9% in 2019 to 12.9% in 2020. In the hospital laboratory, the positivity rate increased from 20% in 2019 to 22.1% in 2020.

The hospital laboratory, where the highest increase in the positivity rate occurred, only it diagnoses patients admitted to the hospital. Thus, it is possible that for both cases, especially in the hospital laboratory, there were an increase in the positivity rate due to referral only of patients who had prolonged and/or aggravated symptoms suggestive of TB or COVID-19, needing hospitalization. In addition to this, TB can be considered a risk factor for COVID-19, aggravating the morbidity and mortality of the disease.²¹ Thus, increased positivity rate in the hospital laboratory, especially in August, due to the increase in TB cases detected, may be due to cases with TB/COVID-19 co-infection that required hospitalization. However, TB/COVID-19 coinfection was not investigated in the present study, as it was outside the scope of this study.

In our study, we did not assess the full scenario of how the COVID-19 pandemic affects TB response. This can be considered a study limitation. We do not take into account, for instance, possible treatment interruptions and co-infection of people with TB and COVID-19. However, a modelling study that performed a conservative estimate, considering TB detection only, suggested that if the COVID-19 pandemic led to an overall 25% reduction in expected TB detection in 3 months, we can expect an increase of 13% in deaths from TB.¹²

Between 2020 and 2025, health care service disruption worldwide as a consequence of the COVID-19 pandemic could lead to an additional 6.3 million cases and 1.4 million additional TB deaths.¹² Our results showed an overall alarming reduction of 46.2% in the number of patients tested in 2020 compared to 2019. TB cases not

diagnosed by the laboratories included in the study due to a reduction in testing, as they do not receive adequate treatment, will negatively impact TB control in southern Brazil. In view of this, it will be possible to see that the adverse responses of restrictions in health systems to control SARS-CoV-2 transmission will last beyond the COVID-19 pandemic.

Thus, considering that the COVID-19 pandemic is still ongoing and its effects will be visualized in the long term, it is recommended that studies including a longer period of time and assessing different aspects of TB care be carried out. As a limitation, the present study includes an analysis of a relatively short period, as an analysis was carried out only one year before and during the pandemic. Despite this limitation, it is believed that the results obtained will provide immediate answers to guide the adoption of TB control strategies in the studied setting, as well as in other priority settings for TB control.

Finally, it is important highlight that in the laboratories included in the study, there was no interruptions in TB diagnostic services provided during the COVID-19 pandemic, as well as in acquisition of laboratory supplies. In the municipality, there was strategic planning for creating a diagnostic service for COVID-19, including the creation of a laboratory with an appropriate biosafety level focused on molecular diagnosis of this disease only. Thus, no reallocation of staff, supplies and equipment from TB to COVID-19 in terms of laboratory diagnosis. Therefore, it is assumed that the impact of the pandemic on laboratory diagnosis of TB is due to factors external to TB laboratories, such as absence of patients with suspected TB in health facilities.

In conclusion, as a consequence of measures to control the spread of SARS-CoV-2, there was a reduction in TB testing and in detecting of new cases, especially in Primary Health Care, where patients with less need for hospitalization are received. This study was carried out at a setting with high TB burden and high incidence of COVID-19, and showed the negative influence of COVID-19 pandemic in TB diagnosis. Thus, 2020 data, in addition to guiding the necessity of adoption of public policies for TB control, emphasizes the importance of maintaining and strengthening TB services during the pandemic and in the following years, so that missed diagnoses are recovered.

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All authors have approved the final version to be published and are responsible for all aspects of the work, including ensuring its accuracy and integrity.