

## Impacts of Covid-19 on tuberculosis: an integrative review

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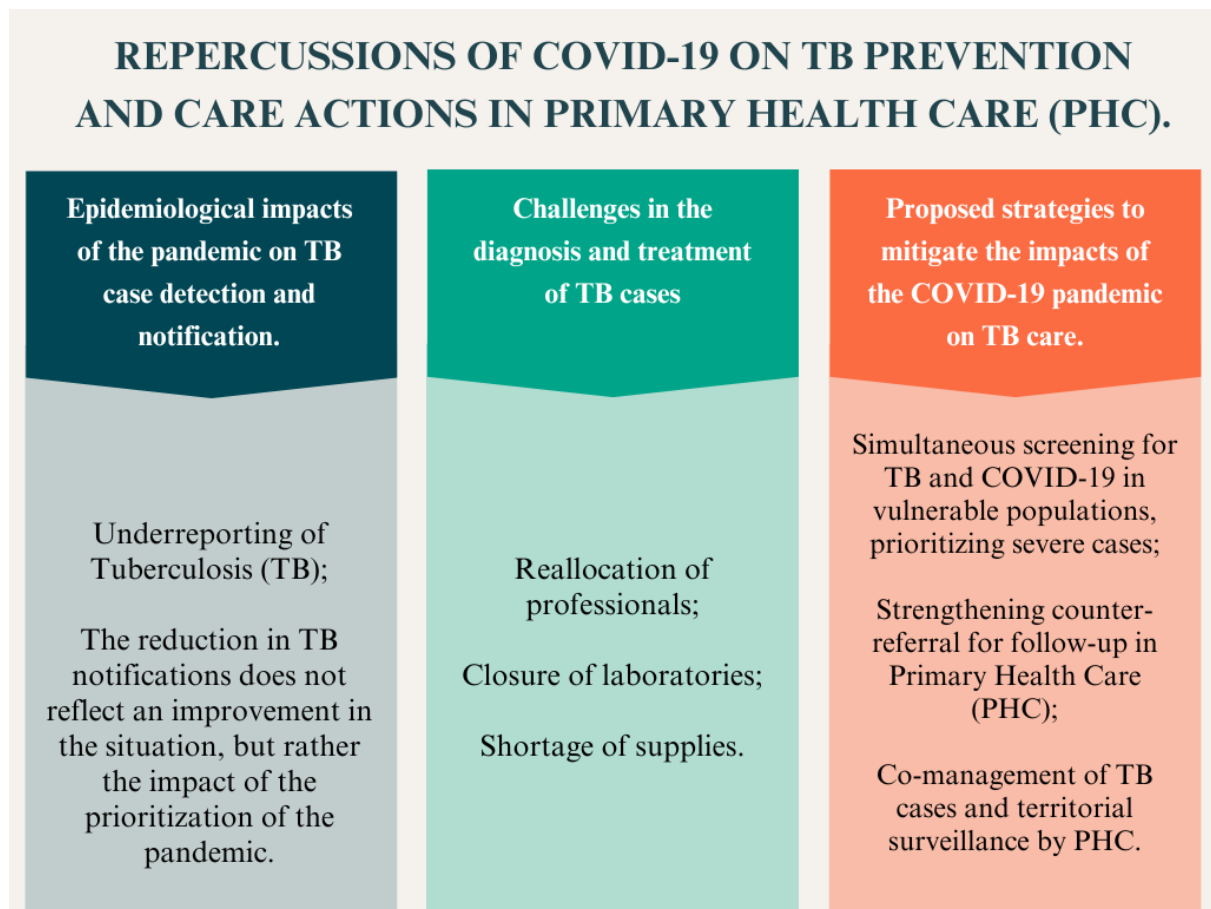
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### Graphical Abstract



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## Abstract

The objective of this review was to identify and describe how the Covid-19 pandemic affected tuberculosis (TB) prevention and care actions within Primary Health Care (PHC). This is an integrative literature review conducted through the databases Embase, MEDLINE, Scopus, Web of Science, and LILACS. Primary studies available in full, published between 2020 and 2023 in English, Portuguese, or Spanish, were considered. Review articles and publications belonging to the grey literature were excluded. The database search identified 339 publications. After meeting the previously established criteria, eleven articles were selected for full reading and analysis. It was found that the onset of the Covid-19 pandemic directly interfered with the goals and achievements obtained over the past decades in the fight against TB, in addition to increasing the vulnerabilities in TB prevention and care actions within PHC due to the scarcity of human and material resources that were redirected to meet the demands of Covid-19, which directly impacted unfavorable treatment outcomes for the disease. These results highlight the importance of reassessing strategies and implementing public policies that strengthen the response to TB control, while also pointing to the need for new studies on the changes in the epidemiological profile of the disease during the pandemic, as well as analyzing the strategies adopted by health services to ensure the continuity of TB care during this period.

**Keywords:** Covid-19. Tuberculosis. Primary Health Care. Public Health.

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## INTRODUCTION

Tuberculosis (TB) has had a lasting and significant epidemiological impact on a global scale, having been the leading cause of death by a single infectious agent for decades, until it was surpassed by Covid-19. In 2022, it is estimated that 10.6 million people were affected by TB, resulting in approximately 1.3 million deaths, making it a major public health challenge, especially in developing countries such as Brazil<sup>1</sup>.

The Covid-19 pandemic further exacerbated the vulnerabilities in TB control by redirecting resources and attention from health services to combat the new disease, which had a devastating impact both in Brazil and globally. This unprecedented health crisis, with millions of Covid-19 infections and deaths, also compromised the treatment of other diseases, such as TB<sup>1</sup>.

However, even before the Covid-19 pandemic, TB management within this level of care already showed weaknesses concerning the principles of continuity and comprehensiveness of care. Among these were the reduced frequency of home visits focused on TB, which led to gaps in user engagement and hindered proper treatment follow-up<sup>2,3</sup>. Additionally, the high turnover and scarcity of human and financial resources to support

health surveillance activities, as well as the lack of materials and supplies for diagnostic testing, further hindered the fulfillment of PHC attributes<sup>4</sup>.

Due to the long-standing existence of TB, the importance of Primary Health Care (PHC) in prevention and care actions for people affected by this disease is emphasized, as it serves as the main entry point for users into the Unified Health System (SUS) and is responsible for coordinating care and organizing the Health Care Network (HCN)<sup>3</sup>.

Thus, PHC must establish a bond with the community, involving the family throughout the care process, as well as evaluating contacts, considering the susceptibility of the transmission chain and the influence of their participation in addressing the disease and ensuring adherence to treatment<sup>3-6</sup>.

This scenario highlights shortcomings in the diagnosis and treatment of TB, which were exacerbated by the onset of the Covid-19 pandemic, imposing even more challenges due to the overburdened health system and compromising the achievements made over the past decades in TB control, such as the 18% reduction in notifications worldwide in 2020<sup>1</sup>.

In this context, it is also necessary to con-

sider the risk of TB/Covid-19 coinfection, as the difficulties in diagnosing and treating TB were intensified, leading to underdiagnosis and, consequently, underreporting, which could impact TB incidence and mortality rates<sup>7</sup>.

The challenges imposed by Covid-19 and its repercussions on TB prevention and care actions underscore the need for research on this topic, especially within PHC, considering

that financial resource investment during the pandemic was primarily directed toward hospital and high-complexity care, with a particular focus on private health units<sup>8</sup>. Therefore, the objective of this review was to identify and describe how the Covid-19 pandemic affected TB prevention and care actions within PHC, according to national and international scientific literature.

## METHODOLOGY

This is an integrative literature review with a descriptive analysis of the results obtained. The choice of this methodological format is justified by its ability to provide an understanding of how the Covid-19 pandemic affected TB prevention and control actions within PHC, through the inclusion of different types of primary studies, such as descriptive, cross-sectional, and qualitative studies, which broadens the knowledge of this scenario in various global contexts<sup>9</sup>.

Accordingly, this review was conducted through six steps: formulation of the guiding question, selection of databases, establishment of inclusion and exclusion criteria, database search, analysis of studies for selection based on eligibility criteria, and synthesis of the results found<sup>9</sup>.

To formulate the guiding question, "How did the Covid-19 pandemic affect TB prevention and care actions within PHC?", the PICO strategy was used, following the recommendations of The Joanna Briggs Institute (JBI)<sup>10</sup>, where P (problem) corresponded to the pandemic caused by Covid-19, I (intervention) to TB prevention and care actions, and Co (context) to PHC.

The search terms for this review were obtained through Health Sciences Descriptors (DeCS) in English, Portuguese, and Spanish, as well as Medical Subject Heading (MeSH) and Embase Subject Heading (Emtree) in English, including their respective synonyms, which were combined using the boolean operators

AND and OR.

The literature search was conducted in February 2024 by an independent researcher, accessing the journal portal of the Coordination for the Improvement of Higher Education Personnel (CAPES) through remote access via the Federated Academic Community (CAFe). The databases used were: Embase, Medical Literature Analysis and Retrieval System Online (MEDLINE), Scopus, Web of Science, and the Latin American and Caribbean Health Sciences Literature (LILACS) accessed through the Virtual Health Library.

The search expression used in the databases for this literature review was formulated using the following descriptors and their respective synonyms: "Covid-19," "Tuberculosis," and "Primary Health Care," in Portuguese, English, and Spanish for LILACS, and in English for the other databases. Based on the combination of the descriptors with the boolean operators "AND" and "OR," the following expression was formulated: "Covid-19" AND "Tuberculosis" AND "Primary Health Care."

As inclusion criteria, primary studies available in full, published between 2020 and 2024 in English, Portuguese, or Spanish, were considered. Review articles and publications belonging to the grey literature, such as monographs, theses, and dissertations, were excluded.

The results were exported to the Rayyan QCRI platform<sup>11</sup> for duplicate verification and subsequently selected through the reading and analysis of titles and abstracts by two indepen-

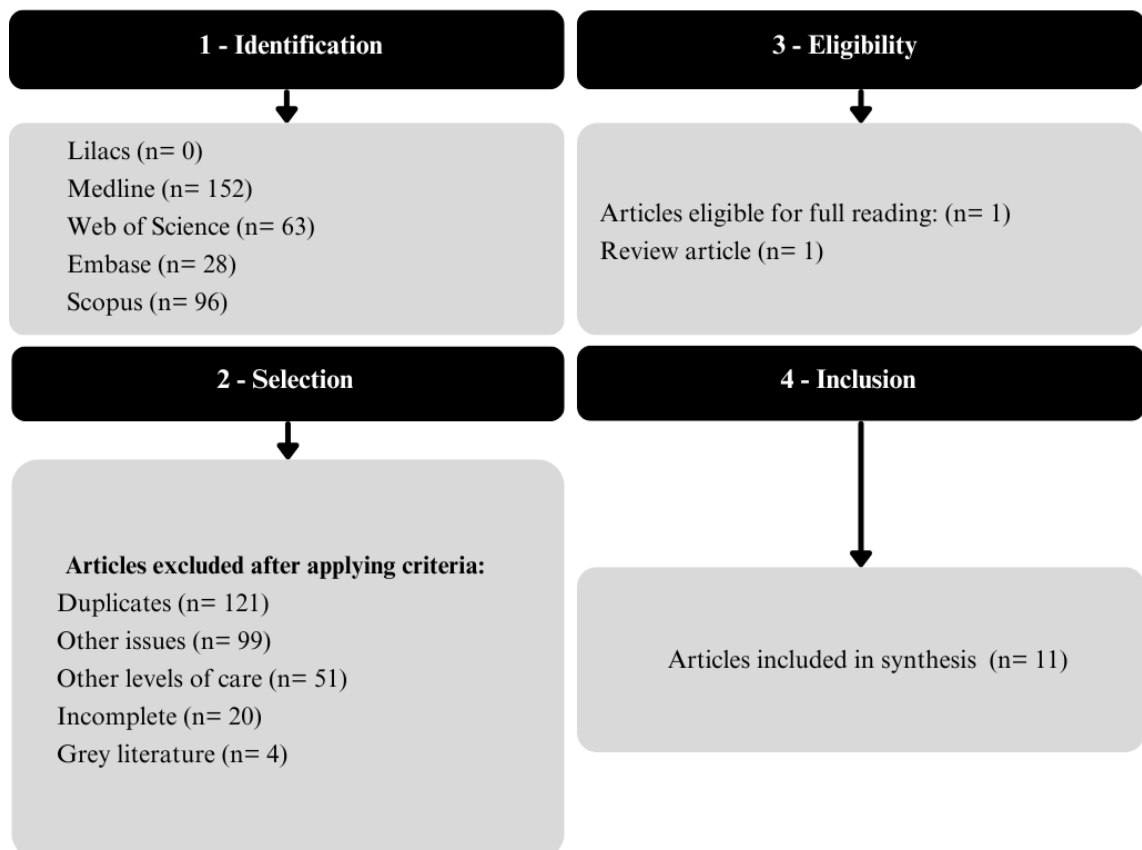
dent researchers, considering the eligibility criterion, that is, how the Covid-19 pandemic affected TB prevention and care actions within PHC. Conflicts were resolved by a third evaluator.

The results were presented in a matrix summarizing the included studies, detailing the authors, year and country of publication, objective, type of study, and main results, which were obtained through data extraction.

## RESULTS

A total of 339 publications were found in the databases, of which 121 were excluded for being duplicates, 32 for being review articles, 51 for addressing levels of care other than PHC, 99 for covering other topics (Covid-19 without association with TB, diagnostic tests for other diseases, prostate

cancer, influenza, Covid-19 vaccine acceptance, percutaneous coronary intervention, HIV, diabetes mellitus, Pneumocystis pneumonia, and chronic respiratory disease), 21 for being incomplete, and 4 for being grey literature, leaving 11 articles for full reading (Figure 1).



**Source:** Adapted from Aromataris & Munn (2020).

**Figure 1** - Flowchart of the stages of article selection for this integrative literature review. Porto Velho, Rondônia, 2024.

Among the articles included in the study, most were published in 2023<sup>12-15</sup> in countries with a high TB burden, such as Brazil, South Africa, and India<sup>14-22</sup>. The studies were predominantly cross-sectional<sup>13,16-17,20,22</sup> (Table 1).

Regarding the main results on the impact of the Covid-19 pandemic on TB prevention

and care actions within PHC, the studies highlighted the repercussions related to TB laboratory diagnosis actions<sup>13-15,17,19,20-22</sup>, treatment<sup>13,17-18</sup>, follow-up<sup>16-17</sup>, human resources in health services<sup>18</sup>, and actions to mitigate the impacts of the Covid-19 pandemic on the TB epidemiological scenario<sup>19</sup> (Table 1).

**Table 1** - Summary matrix of the articles selected for this integrative literature review, Porto Velho, Rondônia, 2024.

Authors/year	Country of publication	Objective	Type of study	Main results
Fei <i>et al.</i> , 2020	China	To analyze the reporting, follow-up examinations, and treatment outcomes of TB cases during the Covid-19 pandemic.	Cross-sectional	<p><b>TB DIAGNOSIS AND REPORTING</b></p> <p>Reduction in the number of reported TB cases in 2020. Decrease in the percentages of confirmed laboratory tests and in the percentages of migrant cases. Shortage of TB laboratory reagents and anti-TB drugs during the pandemic.</p> <p><b>TB MONITORING</b></p> <p>Reduction in the percentage of TB patients who underwent sputum testing within one week after two months of treatment and after completing the full course of treatment. Increase in the number of TB patients who postponed or missed their follow-up examinations. Increased difficulty in accessing healthcare facilities due to intermunicipal travel restrictions and fear of contracting Covid-19 among users.</p> <p><b>TB TREATMENT RESULTS</b></p> <p>Increase in recovery delays compared to previous years.</p>
Sharma, Khokhar, 2021	India	To study the burden, risk factors, and perceptions of Covid-19 among TB patients.	Cross-sectional	<p><b>TB DIAGNOSIS</b></p> <p>Lack of requests for diagnostic tests for both diseases.</p> <p><b>TB TREATMENT</b></p> <p>Delay in the initiation of TB treatment.</p> <p><b>TB MONITORING</b></p> <p>Increase in TB severity and complications.</p>

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Authors/year	Country of publication	Objective	Type of study	Main results
Yadav <i>et al.</i> , 2021	India	To summarize the current evidence, predictive models, and recommendations regarding the impact of Covid-19 on various aspects of TB treatment.	Descriptive	<p><b>TB TREATMENT</b></p> <p>Reduction in the supply of anti-tuberculosis drugs. Reduction in patient demand for treatment. Reduction in patient follow-up during treatment. Reduction in home delivery of medications and performance of DOT. Increase in the difficulty of starting treatment.</p> <p><b>HUMAN RESOURCES IN HEALTH SERVICES</b></p> <p>Deployment of frontline healthcare professionals to Covid-19 field tasks, reducing TB control efforts.</p>
Manhica <i>et al.</i> , 2022	Mozambique	To inform decision-making and efficiently mitigate the adverse impacts of Covid-19 in Mozambique and other similar settings.	Descriptive	<p><b>ACTIONS TO MITIGATE THE IMPACTS OF COVID-19 ON THE EPIDEMIOLOGICAL SCENARIO OF THE DISEASE AND TB FOLLOW-UP ACTIONS</b></p> <p>Telephone follow-up (to monitor medication adherence, side effects, and provide counseling). Hiring of professionals. Long-term prescriptions for anti-TB medications and spacing of in-person consultations to reduce outpatient visits, as a way to lower costs for patients, minimize overcrowding in health units, and reduce unnecessary contact between healthcare professionals.</p> <p><b>EPIDEMIOLOGICAL ASPECTS</b></p> <p>Disruptions in healthcare delivery, which were more prominent among men than women in the three quarters following the first Covid-19 case. Reduction in the incidence of all forms of TB among men.</p>
Mutyambizi <i>et al.</i> , 2022	South Africa	To document the outcomes of an innovative approach to combining workflows for TB and Covid-19.	Descriptive	<p><b>SIMULTANEOUS CASE DETECTION</b></p> <p>The model enabled the simultaneous detection of Covid-19 and TB cases based on the presentation of signs and symptoms. Increase in TB test requests during the rise in Covid-19 cases.</p>
Souza <i>et al.</i> , 2022	Brazil	To evaluate the influence of the Covid-19 pandemic on TB laboratory diagnosis in patients tested and diagnosed with TB.	Cross-sectional	<p><b>LABORATORY DIAGNOSIS OF TB</b></p> <p>Increase in the total number of patients tested for TB after the first Covid-19 case in March. Reduction in the total number of patients tested for TB in the months following the start of the pandemic. Reduction in the positivity rate in 2020.</p>

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Authors/year	Country of publication	Objective	Type of study	Main results
Calixto; Pantoja; 2023	Peru	To determine the characteristics and frequency of tuberculosis patients over 18 years old, pre-pandemic (2019) and during the Covid-19 pandemic (2020), at a health center in Lima, Peru.	Descriptive, retrospective study	<p><b>TB REPORTING</b></p> <p>There was a reduction in the number of TB case notifications, resulting in more undetected and untreated cases.</p> <p><b>TB OUTCOMES</b></p> <p>There was an increase in TB mortality rates during the pandemic, possibly due to loss of treatment follow-up or higher coinfection rates with HIV and diabetes.</p>
Williams <i>et al.</i> 2023	Eswatini	To describe the impact of the COVID-19 pandemic on TB services and the different approaches adopted by healthcare professionals to ensure the continuity of TB service delivery in Eswatini.	Cross-sectional	<p><b>REPORTING</b></p> <p>There was a reduction in TB case notifications during the pandemic compared to previous periods, due to difficulties in accessing healthcare services and the reallocation of resources in response to Covid-19. The disruption of active TB case notification activities contributed to this reduction.</p> <p><b>DIAGNOSIS</b></p> <p>During the peak of the pandemic, TB diagnostic services were affected due to the prioritization of Covid-19 over other conditions. Measures to limit the spread of Covid-19 hindered patients' access to healthcare services for diagnosis, either through the suspension or limitation of these actions, resulting in a reduction in the number of TB cases reported and in the capacity to process and analyze samples for diagnosis.</p> <p><b>TREATMENT</b></p> <p>The disruption of TB services due to the pandemic included the suspension or limitation of treatment and follow-up care. Available human and clinical resources were reassigned to provide Covid-19-related services, further reducing TB treatment capacity. The lack of medications, reduced facility hours, and movement restrictions also contributed to reduced access to treatment.</p> <p><b>OUTCOME</b></p> <p>During the pandemic, there was an increase in mortality rates among TB patients, along with a higher likelihood of unfavorable outcomes. Limited access to care and the socioeconomic impact of the pandemic contributed to unfavorable outcomes among TB patients, including an increase in mortality rates and a reduction in the quality of care.</p>

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Authors/year	Country of publication	Objective	Type of study	Main results
Heunis <i>et al.</i> , 2023	South Africa	To address the need for evidence on the impact of Covid-19 on essential health services in the Free State province.	Descriptive, retrospective study	<p><b>TB DIAGNOSIS AND TREATMENT</b></p> <p>The disruption of screening, treatment, and support activities due to the reallocation of human and physical resources in response to Covid-19 led to a reduction in case notifications, delays in diagnosis, and delays in starting treatment for the disease.</p> <p><b>REPORTING</b></p> <p>There was a reduction in TB case notifications during the pandemic, especially during infection peaks, although some countries managed a recovery in the following months as a result of government efforts or the easing of Covid-19-related <b>restrictions</b>.</p>
Dlangalala, Musekiwa, Mashamba-Thompson, 2023.	South Africa	To evaluate the effects of Covid-19 on TB diagnostic services within PHC, aiming to optimize these services for health crises such as Covid-19.	Descriptive, retrospective study	<p><b>DIAGNOSIS</b></p> <p>During the Covid-19 pandemic, TB investigation and case confirmation services in eThekweni were affected, with a reduction in case investigation and notification. After the first peak of the pandemic, there was a substantial increase in TB cases, but diagnostic confirmation remained in decline until the end of the observation period.</p>
Huria <i>et al.</i> , 2024	Indonesia	To examine the disruptions caused by the Covid-19 pandemic in TB services within private healthcare in three countries — India, Indonesia, and Nigeria.	Cross-sectional	<p><b>TB DIAGNOSIS</b></p> <p>During the pandemic, individuals preferred to seek care at private community healthcare facilities (formal or informal), where diagnostic capacity is limited, leading to greater delays in starting treatment.</p>

## DISCUSSION

### Epidemiological impacts of the pandemic on TB case detection and reporting

With the advent of the Covid-19 pandemic as a persistent public health issue for over two years, there has been growing awareness that it would be crucial to revitalize efforts to control TB and other neglected diseases, considering that the worsening of these overlooked conditions would have negative repercussions on public health in the future<sup>19</sup>.

Regarding epidemiological aspects, studies highlight that reported cases among men and migrants decreased, while healthcare disruptions at the onset of the pandemic were more prominent among men

compared to women, even though men are among the most affected populations<sup>13,16,19</sup>. These factors suggest that cases are not decreasing but rather being underdiagnosed and underreported. In other words, the reduction in TB-related numbers does not signify an actual improvement in this situation, but rather that there is less and less control over the true magnitude of the disease. The overwhelming focus on the Covid-19 pandemic became so dominant that TB was further neglected, disregarding the fact that it is as lethal as Covid-19 if not properly treated<sup>12,20</sup>.



## Challenges in the diagnosis and treatment of TB cases

Regarding TB screening, it was observed that there was no prioritization of case management during the Covid-19 pandemic, adding further challenges to addressing the disease. During this period, laboratory and healthcare professionals who worked with TB were reassigned to focus on Covid-19, and, worsening this scenario, many were sidelined for being in high-risk groups<sup>20</sup>. As a result, some TB outpatient clinics and laboratories were temporarily closed during the intensive phase, and among those that remained open, shortages of reagents and supplies for testing were reported<sup>14,16</sup>.

In this context, a study conducted in Indonesia found that users preferred to seek care at private community health facilities, both formal and informal. This preference was driven by concerns about exposure to the Covid-19 virus in public facilities, which are often more crowded and pose a higher risk of contamination. However, this shift may raise additional concerns, such as inaccurate diagnoses and treatment delays due to the limited diagnostic capacity and possible lack of regulation and quality control in these fa-

cilities<sup>22</sup>.

This scenario had a significant impact on TB diagnosis, considering that in the years prior to the pandemic, the number of reported TB cases was increasing. However, the focus on controlling Covid-19 diverted attention from other existing diseases, leading to a reduction in requests for TB diagnostic tests, resulting in underdiagnosis of the disease<sup>15,18-20</sup>.

In addition to laboratory issues, research indicated difficulties in accessing healthcare facilities due to intermunicipal travel restrictions and limitations on the movement of people in all environments, as well as transportation costs, considering that the period itself imposed even greater economic challenges on the population, with an increase in unemployment rates, for example<sup>16</sup>. These factors also impacted case follow-up, leading to a reduction in monthly control sputum tests during treatment<sup>18-20</sup>, along with barriers such as the discontinuation of DOT, medication shortages, difficulties in tracking missing patients, and delays in treatment initiation, partly due to the fear of contracting Covid-19<sup>16,18</sup>.

## Proposed strategies to mitigate the impacts of the Covid-19 pandemic on TB care

Although this study highlights the challenges faced in PHC during the pandemic, these observations not only allow but make it essential to focus on planning and implementing actions aimed at mitigating the impacts of the Covid-19 pandemic on the TB epidemiological scenario, such as early case investigation among vulnerable populations, also targeting dual investigation when patients present with symptoms common to both diseases<sup>17,19,21</sup>. Among these actions is screening that includes tests for both diseases, given the similarity of signs and symptoms, prioritizing the most severe cases for care and immediate initiation of TB treatment once identified<sup>17,19,21</sup>.

However, it was found that when tests for Covid-19 were requested, TB investigation was not conducted in most cases, despite

the possibility of coinfection, even in cases with HIV positivity, which is a crucial aspect for early TB detection and deserves greater attention<sup>17,19,21</sup>. Thus, although the method used proved effective for patients already undergoing TB follow-up, the test requests did not include the search for new cases. Additionally, it is possible that patients presenting with TB symptoms were mistakenly diagnosed and treated as Covid-19 cases, which may contribute to delays in diagnosis amid a public health emergency scenario<sup>17,19,21</sup>.

Although this study focuses on TB prevention and care actions within PHC, the consequences of problems in other levels of care within an interconnected service network are a reflection of what occurs in this context. Even if the user initially sought he-

althcare services at other levels of care, it is crucial to have counter-referral so that they can also be followed up by PHC, aiming for co-management of cases and surveillance in

the territories. This is important because one of PHC's attributes is to establish a bond with the community to ensure comprehensive and continuous care<sup>18,20</sup>.

## CONCLUSION

The onset of the Covid-19 pandemic had a substantial impact on the reduction of TB case notifications, which cannot be attributed to an actual improvement in indicators, but rather to the fact that the focus on pandemic control directly interfered with the achievement of the goals and accomplishments obtained over the past decades in combating TB, amid the overburdening of healthcare services during this atypical period.

The consequence of this scenario was an increase in the fragility of TB prevention and care actions within PHC, due to the scarcity of human and material resources that were redirected to meet the demands of Covid-19. Additionally, strategies for screening respiratory symptomatic individuals, TB diagnosis, and treatment were either reduced or not implemented, which may ultimately affect treatment outcomes.

In this context, it is crucial to emphasize the importance of conducting studies on the changes in the epidemiological profile of TB during the Covid-19 pandemic, as well as analyzing the

strategies adopted by health services to ensure continuity of care for people affected by TB during this period. This should include screening, concurrent investigation for both diseases given their similarity in signs and symptoms and the identification of contacts.

Moreover, it is essential to reinforce the importance of this analysis given the growing global concern about the resilience of health systems in pandemic contexts, considering the possibility of other crises emerging. These lessons can inform decision-making regarding the organization of the healthcare network for managing diseases and conditions, including TB, in routine healthcare services, contributing to the continuity of actions even in adverse scenarios.

However, it is important to note that the Covid-19 pandemic is a recent event, which may present a challenge in assessing its long-term impacts on TB prevention and care actions within PHC. The available studies may have limited their analyses to immediate effects, which also represents a limitation of the present investigation.

## CRedit author statement

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All authors have read and agreed with the published version of the manuscript.

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