Review Article

Impact of COVID-19 on the control and reorganization of tuberculosis care

Impacto da COVID-19 no controle e reorganização da atenção à tuberculose

Impacto de la COVID-19 en el control y reorganización de la atención a la tuberculosis

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Abstract

Objective: To identify scientific evidence on the impact of the COVID-19 pandemic on tuberculosis care and control.

Methods: Scoping review conducted in June 2020 in the following databases: Cochrane Library, Embase, LILACS, MEDLINE, PubMed, Web of Science, Cinahl and Scopus; and Opengrey - grey literature. The descriptors used in the search were: coronavirus, COVID-19, SARS-CoV-2 and tuberculosis. The selection process was performed by two independent reviewers using the Rayyan platform with the inclusion of 30 studies.

Results: The COVID-19 pandemic had an impact on tuberculosis control and the main challenges arising from it are related to the influence of social distancing on diagnosis, follow-up and adherence to treatment, including the reorganization of tuberculosis services, mainly as a result of the necessary mobilization of health teams working in the area for the care of COVID-19. Limited access to inputs and health services was also registered, which occurred similarly in relation to other health problems, thereby showing programmatic vulnerability. The effects of the pandemic in the social dimension that contributed to increase the social vulnerability also stand out.

Conclusion: Many challenges have been posed by the COVID-19 pandemic, particularly with regard to maintaining tuberculosis control actions. We expect this review will contribute to support new studies and implement public policies aimed at confronting both diseases.

Resumo

Objetivo: Identificar as evidências científicas sobre o impacto da pandemia de COVID-19 na atenção e no controle da tuberculose.

Métodos: Revisão de escopo realizada em junho de 2020 nas seguintes bases de dados: Cochrane Library, Embase, LILACS, MEDLINE, PubMed, Web of Science, Cinahl e Scopus; e literatura cinzenta-Opengrey. Os descritores utilizados na busca foram: *coronavirus,* COVID-19, *SARS-CoV-2 e tuberculosis.* O processo de seleção foi feito por dois revisores independentes por meio da plataforma Rayyan, com a inclusão de 30 estudos.

Resultados: A pandemia da COVID-19 teve impacto no controle da tuberculose e os principais desafios decorrentes relacionam-se à influência do distanciamento social no diagnóstico, seguimento e adesão ao tratamento, incluindo a reorganização dos serviços de tuberculose, principalmente como resultado do necessário deslocamento de equipes de saúde que atuavam na área para a atenção à COVID-19, registrando-se também limitação de acesso a insumos e a serviços de saúde, o que de igual modo ocorreu em relação a

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outros agravos de saúde, evidenciando-se vulnerabilidade programática. Destacam-se, ainda, os efeitos da pandemia na dimensão social, o que contribuiu para o aumento da vulnerabilidade social.

Conclusão: Muitos são os desafios impostos pela pandemia na COVID-19, particularmente no que diz respeito à manutenção das ações de controle da tuberculose. Espera-se que esta revisão contribua para embasar novos estudos e para a implementação de políticas públicas orientadas ao enfrentamento de ambas as enfermidades.

Resumen

Objetivo: Identificar las evidencias científicas sobre el impacto de la pandemia de COVID-19 en la atención y el control de la TB.

Métodos: Revisión de alcance realizada en junio de 2020 en las siguientes bases de datos: Cochrane Library, Embase, LILACS, MEDLINE, PubMed, Web of Science, Cinahl y Scopus, y literatura gris-Opengrey. Los descriptores utilizados en la búsqueda fueron: *coronavirus,* COVID-19, *SARS-CoV-2 y tuberculosis.* El proceso de selección fue realizado por dos revisores independientes a través de la plataforma Ryyan, con la inclusión de 30 estudios.

Resultados: La pandemia de COVID-19 tuvo impacto en el control de la tuberculosis y los principales desafíos derivados están relacionados con la influencia del distanciamiento social en el diagnóstico, seguimiento y adherencia al tratamiento, lo que incluye la reorganización de los servicios de TB, principalmente como resultado del necesario traslado de los equipos de salud que actuaban en el área hacia la atención a la COVID-19. También se registraron limitaciones de acceso a insumos y servicios de salud, lo que ocurrió de igual modo con relación a otros problemas de salud y dejó en evidencia la vulnerabilidad programática. Además, se observan efectos de la pandemia en la dimensión social, lo que contribuye al aumento de la vulnerabilidad social.

Conclusión: Muchos son los desafíos impuestos por la pandemia de COVID-19, particularmente en lo que se refiere a mantener las acciones de control de la tuberculosis. Se espera que esta revisión contribuya para fundamentar nuevos estudios y para la implementación de políticas públicas orientadas al afrontamiento de ambas enfermedades.

Introduction

COVID-19, an infection caused by the SARs-CoV-2 virus, was declared a pandemic in March 2020 by the World Health Organization (WHO).[1] This event of catastrophic proportions has affected millions of families with important social repercussions, especially in relation to the worsening of social inequality, accentuating global public health problems, including the control of tuberculosis (TB), which is the leading cause of death from a single infectious disease worldwide.[2]

People with TB or who have had it are considered vulnerable to COVID-19, because they can develop more severe forms of the disease as a result of the previous pulmonary involvement. The early diagnosis of TB and COVID-19 can prevent an unfavorable clinical evolution.[3] Given the rapid progression of the pandemic and the need to adopt measures to contain it, with consequences for health practices, epidemiological and health surveillance actions and for the management of health services, robust official information to support knowledge of the epidemiological situation of TB and COVID-19 coinfection is still lacking.

As TB is a socially determined disease with low social visibility, its control faces incisive challenges in the face of the COVID-19 pandemic, which could compromise the achievement of the goals of the global End TB Strategy: reducing mortality from this disease by 95% and TB incidence by 90% in the period from 2015 to 2035.[4] In the specific case of Brazil, it will also lead to difficulties in complying with recommendations of the National Plan for the End of Tuberculosis, which establishes specific objectives and activities based on targets of reducing the incidence rate to less than ten cases/100,000 population and the TB mortality rate to less than one death/100,000 population by 2035.[5]

The pandemic exacerbates health inequalities. In developing countries such as Brazil, social inequality represents fertile ground for the dissemination of COVID-19 and makes it difficult to comply with health recommendations given the restricted access to basic hygiene supplies and personal protective equipment, and the assistance offered by services of the health care network.[6]

As TB is associated with precarious living, health and working conditions,[7] the emergence of COVID-19 is expected to intensify the challenges to be faced.[8] TB control programs can be affected by the need to reorganize health services and professionals in terms of assistance to COVID-19, in addition to the possible unavailability of supplies and medicines for their management and control. Furthermore, social distancing can interfere in the performance of directly observed treatment (DOT) and in the periodic follow-up of people with TB.[2]

The WHO expressed concern about the possibility of compromising the progress achieved in relation to the prevention and treatment of TB and emphasized the importance of national disease programs ensuring the continuity of actions aimed at controlling the disease during the pandemic, through innovative people-focused approaches.[1] In turn, the Brazilian Ministry of Health recommended to the State and Municipal TB Control Programs: the use of available technologies for monitoring TB treatment and monthly dispensing of medications, prioritizing care for people with symptoms; the request of TB tests to COVID-19 suspects, among other actions.[9]

Recognizing that the reality imposed by the COVID-19 pandemic greatly affects the control of TB in Brazil and worldwide and that knowledge on this topic is still lacking, the aim of the present study was to identify the scientific evidence on the impact of the COVID-19 pandemic in the care and control of TB.

Methods

A Scoping Review is the most appropriate method to detect and map specific characteristics or concepts in primary studies with the purpose of identifying the available evidence on a topic and knowledge gaps.[10] The survey in the databases was performed in June 2020. This review was registered in the Open Science Framework database. The WHO emphasizes the importance of reviews in challenging times, such as in other pandemics[11] to seek alternatives for decision-making in health and respond appropriately to a clinical or health policy-related question.

The research question was developed through the PCC strategy, and the elements of the mnemonic P (population), C (concept) and C (context) were TB and COVID-19, COVID-19 pandemic and impact on TB control and care, respectively. The present study was guided by the following question: What is the scientific evidence regarding the impact of the COVID-19 pandemic on the control and reorganization of TB care?

The positive and negative epidemiological and clinical effects of the COVID-19 pandemic on TB care were considered as impact in the study.

The electronic search was conducted using the descriptors: *("coronavirus"[MeSH Terms] OR "coronavirus"[All Fields])) OR COVID-19[All Fields] OR SARS-CoV-2[All Fields] and tuberculosis.* The following general databases were considered: Cochrane Library (via Wiley); Embase (via Elsevier); LILACS; Medical Literature Analysis and Retrieval System Online (MEDLINE), PubMed, Web of Science, Cinahl and Scopus. Electronic search was also performed in the grey literature database: Opengrey (https://opengrey.eu), as well as manual search.

Chart 1 presents the search strategies in the different databases.

Chart 1. Distribution of search strategies according to database

Database/Search strategy
- PUBMED: ("coronavirus"[MeSH Terms] OR "coronavirus"[All Fields]) OR "covid 19"[All Fields] AND tuberculosis[Abstract] = 281 results
- LILACS: "coronavirus" OR "covid 19" AND "tuberculosis" = 05 results
- MEDLINE: (covid-19 or coronavirus) AND tuberculosis = 126 results
- EMBASE: ('coronavirus infection' OR 'covid 19') AND tuberculosis = 163 results
- CINAHL: (covid-19 or coronavirus) AND tuberculosis = 14 results
- WEB OF SCIENCE: ("coronavirus" OR "covid 19") AND "tuberculosis" = 97 results
- COCHRANE LIBRARY: "coronavirus" in Title Abstract Keyword OR "Covid 19" in Title Abstract Keyword AND "tuberculosis" in Title Abstract Keyword = 07 results (Cochrane Reviews)
- OPEN GREY: Opengrey: coronavirus AND tuberculosis = 00 results
- SCOPUS: (TITLE-ABS-KEY ("coronavirus" OR "covid 19") AND TITLE-ABS-KEY (tuberculosis)) = 278 results

The study selection process was performed by two independent reviewers and disagreements were resolved by consensus. The selection of studies was performed in two steps. In the first step, the titles and abstracts of the references identified in the search strategy were evaluated and potentially eligible studies were pre-selected. In the second step, the full evaluation of the pre-selected studies was performed to confirm their eligibility. The selection process was performed through the Rayyan platform (https://rayyan.qcri.org).[12]

Results

Initially, 684 studies were identified. After removal of duplicate articles and exclusion according to the established inclusion criteria, 30 studies were considered (Figure 1).

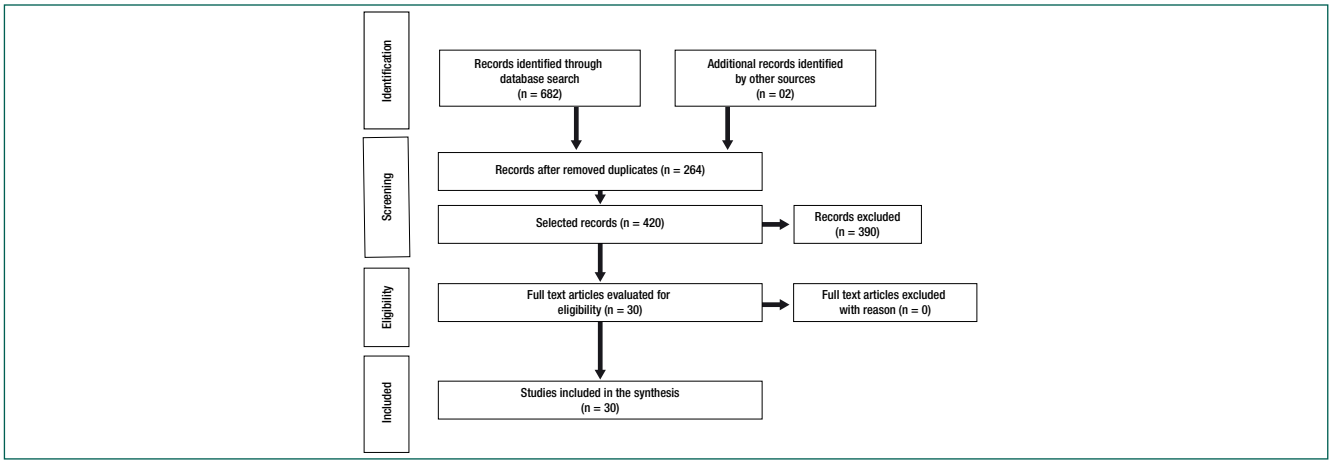

Figure 1. Preferred Reporting Items for PRISMA Extension for Scoping Reviews (PRISMA-SCR) flowchart on study selection

Regarding the type of publication, of the 30 studies analyzed, eight were correspondence, four were reviews, three were letters, two were case studies, editorial and perspective, respectively, and one addressed recommendation, news, resource, brief communication and report, comment, opinion, technical note and modelling analysis, respectively. The study location was not explained in 19 publications, three occurred in South Africa and two publications involved eight countries each. The other publications were developed in Vietnam, China, Portugal, Canada, El Salvador and Nigeria.

The studies were categorized in chart 2 considering: Reference, Type of publication, Study location and Results.

Chart 2. Summary of the characteristics of included studies

Reference	Type of publication	Study location	Results
World Health Organization. Information Note 12 May 2020. Tuberculosis and COVID-19. World Health Organization; 2020.[1]	Technical note	Not applicable	Recommends: provision of adequate stocks of TB medication in order to ensure continuity of treatment in a self-administered manner and avoid unnecessary exposure, as well as the use of digital technologies.
Togun T, Kampmann B, Stoker NG, Lipman M. Anticipating the impact of the COVID-19 pandemic on TB patients and TB control programmes. Ann Clin Microbiol Antimicrob 2020; 19(1):21.[2]	Review	Not applicable	The discussion on how the pandemic will affect TB took different scenarios as example. In the United Kingdom, the resizing of professionals to act against COVID-19 requires prioritizing actions focused on the disease and not on prevention. TB control in Africa will be impacted at individual, macroeconomic and health system levels.
Tadolini M, Codecasa LR, García-García Jé-Mía, et al. Active tuberculosis, sequelae and COVID-19 co-infection: first cohort of 49 cases. Eur Respir J. 2020; 56(1):2001398.[13]	Letter	8 countries	Of the 49 patients with COVID-19 and TB, 53% had TB before COVID-19; 28.5% had COVID-19 first and 18.3% received both diagnoses on the same day or week. Almost all (except one) had comorbidity. The mortality rate was 12.4%.
Nguyen TA, Cuong QN, Kim ALT, Huong TN, Nguyen HN, Fox GJ, Marks GB. Adapting a TB contact investigation strategy for COVID-19. Int J Tuberc Lung Dis. 2020: 24(5): 548-50.[14]	Correspondence	Vietnam	A TB contact investigation adapted to COVID-19 was performed. A flowchart for screening for SARS-CoV-2 and tracking in sites with a low level of community transmissibility was proposed.
Alagna R, Besozzi G, Codecasa LR, et al. Celebrating World Tuberculosis Day at the time of COVID-19. Eur Respir J 2020; 55: 2000650.[15]	Letter	Not applicable	There are similarities in tackling the two diseases: they overload the health system; both demand rapid diagnosis and awareness of the population; they cause social stigma; and the lack of a surveillance system for shared monitoring.
Cınar OE, Sayınalpb B, Karakulaka EA, Karatasa AA, Veleta M, Inkayac AC, et al. Convalescent (immune) plasma treatment in a myelodysplastic COVID-19 patient with disseminated tuberculosis Transfusion and Apheresis Science 2020.[16]	Case study	Not applicable	It presents the case of a TB patient immunocompromised due to myelodysplastic syndrome and with COVID-19 who received treatment with two immunological therapies of convalescent immune plasma.
Boffa J, Mhlaba T, Sulis G, Moyo S, Sifumba Z, Pai M, et al. COVID-19 and tuberculosis in South Africa: A dangerous combination. S Afr Med J 2020;110(5):341-2.[17]	Correspondence	South Africa	Presents the concern about the situation of the health system and poor communities in South Africa. Health professionals should be aware of the possibility of double infection (COVID-19 and TB) in PLWHA.
Yadav SR, Kumar R, Kumar A, ISH P, Gupta N, Chakrabarti S. COVID-19: Avoiding a second tragedy in a tuberculosis burdened country. Monaldi Archives for Chest Disease 2020; 90(2):1338.[18]	Letter	Not applicable	Measures already used in TB control such as screening, cough etiquette practices, contact investigation and isolation measures can be applied in the prevention of COVID-19.
He G, Wu J, Shi J, Dai J, Ga,er M, Jiang X, et al. COVID-19 in Tuberculosis Patients: A Report of Three Cases. J Med Virol 2020;10.[19]	Case study	China	Report of three patients with pulmonary TB and COVID-19, who were prospectively followed from admission to discharge. Two older adults evolved to severe forms of COVID-19 and had a long recovery process.
Saunders MJ, Evans CA. COVID-19, tuberculosis, and poverty: preventing a perfect storm. Eur Respir J 2020;56: 2001348.[20]	Editorial	Not applicable	With more people living in poverty, there will be an increase in TB cases, a reduction in human and material resources for its control, and an impact on the monitoring of treatment and investigation of suspects, the provision of medicines, an increase in the stigma and compromise of social protection measures.

Continue...

Continuation.

Reference	Type of publication	Study location	Results
Cox V, Wilkinson L, Grimsrud A, Hughes J, Reuter A, Conrade F. Critical changes to services for TB patients during the COVID-19 pandemic. Int J Tuberc Lung Dis 2020;24(5):542-4.[21]	Correspondence	Not applicable	It describes changes resulting from the pandemic to protect people with TB from exposure to SARs-COv-2, such as: reducing unnecessary visits to health services, priority care and telephone monitoring to ensure adherence to TB treatment.
Peixoto VR, Mexia R, Santos NS, Carvalho C, Abrantes A. From Tuberculosis to COVID-19: Legal and Constitutional Framework Regarding Compulsory Isolation/Treatment due to Contagious Diseases in Portugal. Acta Med Port 2020;33(4):225-8.[22]	Perspective	Portugal	The proportionality between risks and public health measures, the balance between the citizens' rights, freedoms and guarantees, and the defense of Public Health must be analyzed for decision-making.
Pang Y, Lin Y, Du J, Gao J, Li L. Impact of COVID-19 on tuberculosis control in China. Int J Tuberc Lung Dis 2020;24(5):545-7.[23]	Correspondence	Not applicable	Changes in the organization of health services due to COVID-19 can compromise early diagnosis, considering the fear of seeking care, as well as the interruption of TB treatment.
Kiddell-Monroe R, Ranta M, Enook S, Saranchuk P. Inuit communities can beat COVID-19 and tuberculosis. The Lancet 2020; 5.[24]	Correspondence	Canada	The virus can reach the population of Nunavut (Inuit community) and lead to tragic consequences. As access is only by air, medical facilities are basic and there are not enough COVID-19 tests.
El Salvador. Ministerio de Salud. Lineamientos Técnicos para el Abordaje y Seguimiento de casos de Tuberculosis, ante la Emergencia Nacional por Covid-19. El Salvador; 2020.[25]	Recommendation	El Salvador	The technical document presents treatment modalities (supervised in the health service, at home, by video call); actions for the prevention of COVID-19 in people with TB; actions of health professionals to detect new cases of TB and biosafety in the laboratory network.
Dara M, Sotgiu G, Reichler MR, Chiang CY, Chee CBE, Migliori GB. New diseases and old threats: lessons from tuberculosis for the COVID-19 response. Int J Tuberc Lung Dis 2020; 24(5):544-5.[26]	Correspondence	Not applicable	Actions for TB control can be complementary to COVID-19 control, such as: joint training with epidemiological surveillance sectors, use of diagnostic tools and practices developed in TB control, such as screening, respiratory etiquette, contact investigation, control of infection and social distancing.
Riccò M, Gualerzi G, Ranzieri S, Bragazzi NL. Stop playing with data: there is no sound evidence that Bacille Calmette-Guérin may avoid SARS-CoV-2 infection (for now). Acta Biomed 2020;91(2):207-13.[27]	Review	Not applicable	Ongoing research on how BCG vaccination policy might have affected the pandemic in terms of incidence and/or mortality were identified.
Nordling L. Tested by HIV and TB, South Africa confronts new pandemic. Science 2020; 368(6487):117.[28]	News	South Africa	Mobile COVID-19 testing clinics were sent to densely populated areas. Institutes conducting research on TB and HIV redirected their teams; one of the studies investigates the use of chloroquine and others, the possibility of diagnosing asymptomatic cases of COVID-19 and the association of TB/HIV.
Manyazewal T, Woldeamanuel Y, Fekadu B, Marconi VC. The fight to end tuberculosis must not be forgotten in the COVID-19 outbreak. Nature MEd 2020;26(6):811-2.[29]	Correspondence	Not applicable	An increase in TB cases and development of drug resistance are expected during the pandemic. Governments must seek strategies to ensure adherence to TB treatment.
Adepoju P. Tuberculosis and HIV responses threatened by COVID-19. The Lancet 2020; 7(5): e319-20.[30]	Resource	Nigeria	COVID-19 has been affecting TB and HIV control measures. The supply and transport of TB drugs is at risk of being interrupted. The scarcity of protective equipment, the lack of training of health professionals in relation to differential diagnosis between TB and COVID-19, and the difficulty of getting to health services can contribute to worsen the health situation.
Yasri S, Wiwanitkit V. Tuberculosis and novel Wuhan coronavirus infection: Pathological interrelationship. Indian J Tuberc 2020.[31]	Correspondence	Not applicable	Data from January 21, 2020, showed 221 cases of new infection by the new coronavirus, one case of co-infection with TB (0.45%) and six deaths.
Motta RC, DÁmbrosio L, García-García JM, Golettu D, Gualano G, Lipani F. Tuberculosis, COVID-19 and migrants: Preliminary analysis of deaths occurring in 69 patients from two cohorts. Pulmonol 2020;26(4):233-40.[32]	Brief communication	Eight countries	Eight deaths out of 69 patients were observed. Most (n=7) were male and mean age 70 years. The diagnosis of TB was prior to that of COVID-19, and only one of them had a simultaneous diagnosis of COVID-19 and TB; the others were diagnosed with COVID-19 between seven and 75 days (median 22.5 days) after the diagnosis of TB.
Sharkie IK. BCG is a Good Immunotherapeutic Agent for Viral and Autoimmune Diseases: Is it a New Weapon against Coronavirus (COVID-19)? Electron J Gen Med. 2020;17(6):em229.[33]	Review	Not applicable	The action triggered by the BCG vaccine on the immune system may constitute resistance to a variety of unrelated diseases and pathogens, leading to the reduction of some types of viral infections, one of them being COVID-19.
Rajarshi K, Chatterjee A, Ray S. BCG vaccination strategy implemented to reduce the impact of COVID-19: Hype or Hope?. Med in Drug Discovery 2020;7.[34]	Review	Not applicable	Clinical trials involving the BCG vaccine in health professionals who work on the front lines of COVID-19 are in progress, inquiring if the vaccine reduces the severity and occurrence of the disease.
Redelman-Sidi G. Could BCG be used to protect against COVID-19? Nature Rev Urol 2020;17(6):316-7.[35]	Comment	Not applicable	Research is underway to test the hypothesis that the BCG vaccine protects against COVID-19. If the results prove a protective effect, the following questions are asked: How long does immunity last after vaccination? What is the ideal time to vaccinate?
Covián C, Retamal-Díaz A, Sueno SM, Kalergis AM. Could BCG Vaccination Induce Protective Trained Immunity for SARS-CoV-2? Front. Immunol 2020;11.[36]	Perspective	Not applicable	Countries where BCG vaccination is administered at birth showed a lower rate of infection and deaths related to COVID-19, suggesting that this vaccine can induce trained immunity and offer some protection to COVID-19.
Hergarty PKm Sfakianos JP, Giannarini G, Dinardo AR, Kamat AM. COVID-19 and Bacillus Calmette-Guerí: What is the Link? Eur Uro Oncol 2020;3(3): 259-61.[37]	Editorial	Not applicable	The European countries most affected by COVID-19 were those that did not have a national BCG vaccination program; the incidence in countries with vaccination was 0.8 per million and 34.8 per million in those without this program.
Maciel EN, Gonçalves-Júnior E, Dalcolmo MMP. Tuberculosis and coronavirus: what do we know? Epidemiol Serv Saude 2020; 29(2):e2020128.[38]	Opinion	Not applicable	The high incidence of TB in some Brazilian states, added to the high population density observed on the outskirts of large cities will bring obstacles to confronting COVID-19.
Amimo F, Lambert B, Magit A. What does the COVID-19 pandemic mean for HIV, tuberculosis, and malaria control? Trop Med Health 2020; 48:32.[39]	Short report	South Africa	The study assessed the impact of COVID-19 on the control of HIV, TB and malaria in Africa. Measures to control COVID-19 neglect the epidemiological, social and economic reality. The isolation measures and limitations of some sectors such as travel and business determine that the working age population faces difficulties in accessing essential services.
Stop TB Partnership. The potential impact of the covid-19 response on tuberculosis in high-burden countries: a modelling analysis [Internet]. Stop TB Partnership, Geneva: Stop TB Partnership, Geneva; 2020 Stop TB Partnership.[40]	Modelling analysis	Not applicable	Modeling analysis to estimate the impact of COVID-19 in three high TB burden countries (India, Republic of Kenya and Ukraine) suggests a 25% reduction in TB detection and a 13% increase in TB mortality. Between 2020 and 2025, an additional 6.3 million cases of TB are expected.

The reading and analysis of the articles resulted in the following analysis categories and their constituent elements (Table 3).

Table 3. Analysis categories and their constituent elements

Increase of BCG vaccine in COVID[27,33-37]	Impact of the COVID-19 pandemic on TB control[2,13,14,17,19-22,24,29-32,38-39,41]	Effects of COVID-19 on the organization of health services[1,15,16,18,23,25-26,28]
- Effects of BCG Vaccine on COVID-19	- Influence of COVID-19 on TB treatment follow-up and adherence - COVID-19 aggravates the context of social vulnerability with implications to TB control	- Need to reorganize human and material resources aimed at TB and other diseases to fight COVID-19 - General changes in health care

Discussion

The studies included in this review showed the broadness of the TB problem and impact on the pandemic. Most topics in the articles point to the impact of COVID-19 on TB control, especially with regard to the problems and difficulties caused by the pandemic, such as the necessary measures of social distancing and its repercussions, namely access to early detection, follow-up and adherence to TB treatment. In this line, the deterioration of living and working conditions stands out, with a significant increase in social vulnerability. As for the effects of COVID-19 on health systems, mainly there is the need of reorganization of services in order to meet the pandemic demands, with implications for the care of TB patients. Another important category of analysis refers to the implications of BCG vaccination, especially in relation to questions about its protective effect on the evolution of COVID-19.

In this review, we sought to synthesize the state of the art on TB and COVID-19 based on the categories presented. The category *Impact of the COVID-19 pandemic on TB control* brings together most references identified in the literature, highlighting the concern of researchers, particularly because the pandemic can compromise the achievements in the control of TB over decades, thereby constituting an obstacle to reach the goals established by the End of TB Strategy.

COVID-19 surpassed TB in the ranking of the most killing infectious diseases in the world. Undoubtedly, the pandemic deepens social inequalities, extending beyond the health crisis. This crisis threatens to disproportionately affect populations in less developed countries of Africa, Southeast Asia and Central and South America. As a result, given the established social determination of TB, there might be an increase in cases in densely populated countries in this group.[20-38]

As for the category *Effects of COVID-19 on the organization of health services*, it is possible to observe similarities between TB and COVID-19. The similarities are related to: the importance of early diagnosis and awareness about the control of infectious diseases, the social stigma that both diseases carry, the lack of knowledge about the susceptibility of some groups to infection and the importance of a platform for sharing data. On the other hand, there is a discrepancy in investments for the control of COVID-19, as well as the agility in the reorganization of health systems by some countries, substantially in the context of hospital care, mainly by providing intensive care beds and equipment.[15] We highlight the necessary speed in the adaptation of health systems to the pandemic emergency. Mainly in Brazil, the COVID-19 pandemic determined the injection of financial resources, especially in high complexity hospital settings and in private health units, leaving aside the necessary attention to case surveillance in the territory within the public sphere of Primary Health Care.

The pandemic brought additional challenges to various sectors beyond epidemiological surveillance at the national and international level. It also exerted influence on international relations and the recognition of the need for public policies aimed at reducing inequalities in access to health systems and social injustice. Allied to the fundamental reversal of this situation, the importance of some strategies to contain the pandemic stands out, for example: large-scale availability of tests, logistics in health and related areas for the territorial isolation and monitoring of positive cases and contacts, investments for the protection of health professionals, provision of appropriate and effective medical equipment and supplies, as well as the necessary policies by the State to maintain the social protection of the population and strategies for programmed and safe resump-

tion, with the maintenance of priority actions and services, especially essential health programs such as the TB Control Program.[40,41]

The pandemic also has impacted on the organization of health services, with emphasis on the reduction of human and material resources destined to TB control,[20] the need to reorganize services previously destined to TB for the care of COVID-19 cases,[23] shortage of protective materials, lack of training of health professionals in relation to the differential diagnosis of TB and COVID-19, as well as in relation to safety precautions, proper use of personal protective equipment and criteria of isolation.[21,30]

In the scope of outpatient services, the management of human resources to act on the front line against COVID-19 has an impact on the operationalization of DOT and on the active search for respiratory symptoms, and the latter was also compromised by the necessary social distancing linked to barriers of access to health services. All these aspects may reflect negatively on the early diagnosis of TB cases, disease indicators, the increase of drug-resistant strains,[29,42] processes of treatment adherence and monitoring of cases and their contacts.[2] Another relevant aspect impacting on the early diagnosis of TB is the stigma, materialized as the presence of cough, a situation in which the user may hesitate to seek the health service.[2]

Social distancing is recommended as a fundamental measure to contain the advance of COVID-19.[14,22,30] However, restricting attendance at the health service can compromise adherence to TB treatment and lead to unfavorable outcomes. Added to the economic limitations caused by the pandemic, these factors negatively influence the access to essential services, also due to medical costs and lack of transport to reach health facilities.[39]

With a view to overcoming these impacts, the publications suggest the reduction of unnecessary visits to health services, the monitoring via telephone contact or through digital platforms, in addition to prioritizing care when it is face-to-face.[21,23] The provision of adequate stocks of drugs to complete self-administered TB treatment[1], rapid restoration of TB services and intensification of active search of cases, including contact investigation through digital technologies are also suggested.[42]

In a study that sought to analyze two different realities, the United Kingdom and Africa, the negative impact of the COVID-19 pandemic in relation to TB actions was demonstrated, given the need to prioritize actions aimed at COVID-19 and not at TB prevention. In addition, it highlighted that the decrease in the circulation of people with TB in health services can compromise the established bond and consequently, the adherence to treatment. Problematizing aspects of the interaction between both diseases enables fundamental learning between communities, health professionals and policy makers, highlighting the need to recognized the relationship between many infectious diseases and social inequities[2]. On the other hand, in addition to recognizing this association, the need for structural changes in societies must be recognized as well, in order to lead social groups to equal access to goods that provide dignity for the conduction of life.

With regard to the category *Increase of BCG vaccine in COVID*, the importance of health professionals' attention with the occurrence of both diseases concomitantly is highlighted. As the pandemic progresses, more people with TB will have been exposed to SARS-CoV-2 and a positive result for this disease does not exclude the possibility of TB, especially in high-burden environments.[3]

In this review, some references dealing with the use of the Bacillus Calmette-Guérin (BCG) vaccine in the fight against COVID-19 were identified. However, there was a consensus on the lack of evidence of the protective effect of the BCG vaccine against infections caused by SARS-CoV-2, and the results of ongoing research are still awaited.[27-33-37] In any case, preliminary clinical studies indicate that the BCG vaccine can induce an adaptive immune response in the body and trigger protection against some viral infections, including the COVID-19. However, a systematic review on the subject questions the quality of the studies developed, mainly in relation to the lack of clarity about the confounding factors (demographic information of the countries evaluated, proportion of people living in urban environments, among others), as well as the fact that

only the differences between incidence and mortality of COVID-19 in relation to vaccination rates were evaluated.[27]

When reflecting on the epidemiological scenario of COVID-19 and the experiences in controlling the pandemic, its potential consequences are considered. Although the rapid technological evolution has enabled the development of vaccines that make it possible to at least reduce the evolution of cases to severe and lethal conditions, the lack of a specific vaccine to prevent the disease still requires social distancing actions in order to reduce the speed of the epidemic curve, as well as public policies aimed at workers' protection and investments in the health sector.[40]

In the sphere of TB, the WHO reinforces that the identification and treatment of people with the disease are fundamental pillars for its prevention and control and must be maintained during the COVID-19 pandemic. Thus, the efforts and actions to control and eliminate TB, such as infection prevention and control, contact tracking, domestic and community care, and surveillance and monitoring systems, which have been adopted over the years, can help in responding to COVID-19.[3]

Tuberculosis control programs, as well as the founding principle of the National Health Service (Brazilian SUS), which is universality, suffered from a decrease in resources as a result of the approval of the Constitutional Amendment 95/2016 that froze the Union's spending on primary expenses for 20 years and broke the essential core of the right that is the guarantee of budgetary resources for its sustainability. In this sense, it also affects the prioritization of actions to mitigate COVID-19, the necessary vaccination coverage and the early detection of cases and measures that may contain its spread. Furthermore, it shows that the negligence of the federal sphere in relation to the necessary social protective measures has consequences in the daily life of social groups weakened by social insertion.

The history of achievements in the implementation of TB control policies is threatened by the COVID-19 pandemic. In addition, there is the relationship between TB and social inequality, which is also one of the effects of the expansion of the new coronavirus and highlights the need for investments and structural changes by national, local and international governments. The importance of ethical and political sustainability of TB control programs for maintaining effective disease management and surveillance actions is also highlighted.

Conclusion

The studies analyzed allow the conclusion that in the period investigated, the scientific literature presented mainly three categories of themes related to the impact of the COVID-19 pandemic on TB care: influence of the disease on the follow-up and adherence to TB treatment, with aspects that worsened such needs, including discontinuity, mainly due to the necessary social distancing at the beginning of the pandemic. COVID-19 intensified social vulnerability, with repercussions on the incidence of TB, especially considering that the latter is recognized as socially determined. The second thematic category refers to the necessary organization of health services in order to meet the demands of COVID-19 that impacted negatively on the control of TB in terms of organization of work processes and care logistics. The third category refers to the effects of the BCG vaccine on SARS-CoV-2 infection, with still inconclusive results. We emphasize the concern with the impact of the COVID-19 pandemic on the programmatic sustainability of chronic communicable diseases such as TB, which still represents a global public health problem and requires prolonged and continued care by health services.

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