




PUBLIC HEALTH STRATEGIES AND PHARMACOLOGICAL MANAGEMENT IN THE TREATMENT OF CHILDHOOD TUBERCULOSIS

ESTRATÉGIAS DE SAÚDE PÚBLICA E MANEJO FARMACOLÓGICO NO TRATAMENTO DA TUBERCULOSE NA INFÂNCIA

ESTRATEGIAS DE SALUD PÚBLICA Y MANEJO FARMACOLÓGICO EN EL TRATAMIENTO DE LA TUBERCULOSIS INFANTIL

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ABSTRACT

Childhood tuberculosis (TB) represents a significant global public health challenge, characterized by high morbidity and diagnostic difficulty due to the paucibacillary nature of the disease in children and the challenges associated with sample collection. The present study consisted of a narrative literature review aimed at synthesizing contemporary scientific evidence regarding public health strategies and pharmacological management in the treatment of childhood TB. The findings indicate advances in diagnosis through the use of molecular methods, such as the detection of circulating DNA of *Mycobacterium tuberculosis* (CRISPR-TB), offering minimally invasive alternatives for paucibacillary cases. In pharmacological management, the SHINE clinical trial validated the shortened four-month treatment regimen for non-severe cases, facilitating treatment adherence. However, therapeutic success depends on the integration of social protection strategies (cash transfer programs and patient navigation), which have proven effective in reducing catastrophic costs and improving adherence. It is concluded that care should be comprehensive and humanized, combining improved clinical interventions with social and multidisciplinary support for families in order to mitigate the socioeconomic impact of the disease and ensure continuity of treatment and child development.

Keywords: Tuberculosis. Child. Public Health. Molecular Diagnosis. Pharmacological Treatment. Adherence.

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RESUMO

A tuberculose (TB) na infância representa um desafio significativo de saúde pública global, caracterizado por alta morbidade e dificuldade de diagnóstico devido à natureza paucibacilar da doença em crianças e aos desafios de coleta de amostras. O presente trabalho consistiu em uma revisão bibliográfica narrativa para sintetizar as evidências científicas contemporâneas acerca das estratégias de saúde pública e do manejo farmacológico no tratamento da TB infantil. Os resultados indicam avanços no diagnóstico com o uso de métodos moleculares, como a detecção de DNA circulante de *Mycobacterium tuberculosis* (CRISPR-TB), oferecendo alternativas minimamente invasivas para casos paucibacilares. No manejo farmacológico, o ensaio clínico SHINE validou o regime de tratamento encurtado de quatro meses para casos não graves, facilitando a adesão. Contudo, o sucesso terapêutico depende da integração de estratégias de proteção social (transferência de renda e navegação de pacientes), que se mostraram eficazes na redução de custos catastróficos e na melhoria da adesão. Conclui-se que o cuidado deve ser integral e humanizado, combinando intervenções clínicas aprimoradas com o suporte social e multiprofissional às famílias, a fim de mitigar o impacto socioeconômico da doença e garantir a continuidade do tratamento e o desenvolvimento infantil.

Palavras-chave: Tuberculose. Criança. Saúde Pública. Diagnóstico Molecular. Tratamento Farmacológico. Adesão.

RESUMEN

La tuberculosis (TB) infantil representa un importante desafío de salud pública global, caracterizado por alta morbilidad y dificultad diagnóstica debido a la naturaleza paucibacilar de la enfermedad en niños y a los desafíos relacionados con la recolección de muestras. El presente trabajo consistió en una revisión bibliográfica narrativa con el objetivo de sintetizar la evidencia científica contemporánea acerca de las estrategias de salud pública y el manejo farmacológico en el tratamiento de la TB infantil. Los resultados indican avances diagnósticos mediante el uso de métodos moleculares, como la detección de ADN circulante de *Mycobacterium tuberculosis* (CRISPR-TB), ofreciendo alternativas mínimamente invasivas para casos paucibacilares. En el manejo farmacológico, el ensayo clínico SHINE validó el régimen de tratamiento abreviado de cuatro meses para casos no graves, facilitando la adherencia al tratamiento. Sin embargo, el éxito terapéutico depende de la integración de estrategias de protección social (transferencias monetarias y navegación de pacientes), las cuales han demostrado ser eficaces para reducir costos catastróficos y mejorar la adherencia. Se concluye que la atención debe ser integral y humanizada, combinando intervenciones clínicas mejoradas con apoyo social y multiprofesional a las familias, con el fin de mitigar el impacto socioeconómico de la enfermedad y garantizar la continuidad del tratamiento y el desarrollo infantil.

Palabras clave: Tuberculosis. Niño. Salud Pública. Diagnóstico Molecular. Tratamiento Farmacológico. Adherencia.



1 INTRODUCTION

Tuberculosis (TB) remains among the main infectious diseases with global impact, representing a major challenge for public health systems (Zaidi et al., 2024).

In the pediatric population, childhood TB remains one of the leading causes of global morbidity and mortality, resulting in approximately 1 million new cases annually (Marais et al., 2014). Despite being a preventable and treatable condition, underdiagnosis is frequent in endemic areas due to the intrinsic difficulties of sample collection and the paucibacillary nature of the disease in pediatric patients (Marais et al., 2014; Snow et al., 2020). Unlike adults, who commonly present with multibacillary cavitary TB, children often manifest intrathoracic lymph node disease and severe extrapulmonary forms, such as tuberculous meningitis, especially in infants and immunocompromised patients (Marais et al., 2014).

In this context, the diagnosis of childhood tuberculosis remains challenging, especially due to the low bacillary load and the difficulty in obtaining adequate respiratory samples. Recent studies have demonstrated advances in molecular methods based on the detection of circulating DNA of *Mycobacterium tuberculosis*, expanding the possibilities of early diagnosis and therapeutic monitoring of the disease (Turkova et al., 2022).

Meningeal tuberculosis (TBM) represents the most severe manifestation of childhood TB, being more frequent in children under three years of age and associated with high morbidity and mortality. Although BCG vaccination offers partial protection against disseminated and meningeal forms, severe cases still occur, especially in infants and immunocompromised (Marais et al., 2014).

In addition to the clinical challenges, the socioeconomic burden imposed on families is severe. Even before the diagnosis, a significant portion of households face catastrophic costs that compromise household finances, aggravating cycles of intergenerational poverty (Shah et al., 2023). Recently, the COVID-19 pandemic has exacerbated this vulnerability, causing disruptions in national control programs, delays in appointments, and epidemiological fluctuations that have resulted in surges in hospitalizations after the quarantine period (Zaidi et al., 2024). Therefore, the integration of child-sensitive social protection strategies and the improvement of pharmacological management are fundamental pillars to mitigate the impact of TB in this population (Shah et al., 2023; Turkova et al., 2022).



2 METHODOLOGY

The present study is a narrative literature review, developed with the aim of synthesizing and examining contemporary scientific evidence on public health strategies and pharmacological management in the treatment of tuberculosis in childhood. The search was conducted by consulting the PubMed database, using the descriptors "Tuberculosis" and "Child", which were structured using the Boolean operators AND and OR, in strict accordance with the MeSH (Medical Subject Headings) terminology. Articles published in the last fifteen years, made available in full and written in Portuguese or English, which had direct thematic relevance were included. Searches without specific correlation with the scope of the article, duplicate publications, narrative reviews with low methodological rigor, and articles not indexed in the database were excluded. The selection process was operationalized in two phases: the initial screening of titles and abstracts, followed by the critical analysis of the full texts to ratify the relevance. The information extracted was systematized and presented in a descriptive way.

3 RESULTS AND DISCUSSION

Current evidence indicates that the approach to childhood TB should transcend drug treatment alone. Social protection strategies, including cash transfers and patient navigation, have been shown to be effective in reducing the family economic burden by dramatically decreasing the occurrence of catastrophic costs after treatment initiation (Shah et al., 2023). Implementing these measures helps caregivers maintain adherence by minimizing school disruptions and delays in child development (Shah et al., 2023). In the diagnostic field, the emergence of molecular technologies such as the CRISPR-TB assay for the detection of *Mycobacterium tuberculosis-free* DNA in blood offers a promising and minimally invasive alternative for paucibacillary and extrapulmonary cases, overcoming the limitations of sputum-based tests (Huang et al., 2022).

In pharmacological management, the SHINE clinical trial marked a paradigm shift by confirming that the shortened treatment regimen to four months (16 weeks) is non-inferior to the standard six-month regimen in children with non-severe, drug-sensitive TB (Turkova et al., 2022). This regimen reduces potential toxicity and facilitates treatment adherence (Turkova et al., 2022). For adolescents, adherence challenges are accentuated by issues of autonomy and stigma, requiring "friendly" health services that ensure confidentiality and psychosocial support (Snow et al., 2020).



The use of pediatric formulations in combined fixed doses represents an advance, as it facilitates the administration of medications and makes the treatment more appropriate to the reality of the child and the family. Recent studies also indicate that, in selected cases of non-severe and drug-sensitive tuberculosis, shorter therapeutic regimens can present good results, provided that they are applied with well-defined clinical criteria. However, the effectiveness of care also depends on support for families, close monitoring by health services, and social protection measures, since economic and educational difficulties can directly interfere with therapeutic continuity (Turkova et al., 2022; Shah et al., 2023).

Perinatal tuberculosis and forms associated with immunosuppression represent important challenges in the clinical management of children, due to the rapid progression of the disease and the need for early diagnosis and treatment. Infants and children under five years of age generally have good tolerability to first-line drugs, although cases with high bacillary load, extensive disease, or suspected drug resistance require expanded therapeutic regimens and close monitoring of adherence. In addition, non-adherence to treatment was pointed out as one of the main causes of inadequate therapeutic response, reinforcing the importance of directly observed therapy and continuous follow-up. In addition, children co-infected with HIV may develop immune reconstitution inflammatory syndrome (IRIS) after initiation of antiretroviral therapy, a condition associated with temporary worsening of symptoms and the need for specialized clinical management (Marais; Schaaf, 2014).

BCG vaccination remains vital in preventing disseminated forms and meningitis in young children, although its efficacy against pulmonary TB in adolescents is limited (Snow et al., 2020). New research on BCG revaccination in QFT-negative adolescents indicates possible additional protection against sustained infection, signaling pathways for future immunization campaigns (Snow et al., 2020). Finally, the analysis of the impact of COVID-19 revealed that while social distancing temporarily reduced transmission, the slowdown in screening programs resulted in a subsequent increase in severe cases and post-pandemic hospitalizations, reinforcing the need for resilient surveillance systems (Zaidi et al., 2024).



4 CONCLUSION

Childhood tuberculosis remains a significant public health problem due to difficulties in early diagnosis and the vulnerability of children to the disease. The advancement of molecular methods, such as the detection of circulating DNA of *Mycobacterium tuberculosis*, has enabled faster and more accurate diagnoses, which favors the early initiation of treatment and the reduction of complications. However, the fight against childhood tuberculosis transcends the prescription of medications.

To ensure therapeutic success and reduce treatment abandonment, care must be comprehensive and humanized, encompassing not only the clinical aspects, but also the social and emotional needs of the child and his family. It is essential to ensure multiprofessional monitoring, social support for families and the strengthening of surveillance and immunization actions. Health services need to maintain close monitoring, with clear guidance to those responsible, listening to the difficulties faced, and articulation with social support actions. This follow-up is crucial, since factors such as displacement, lack of information, fear of prejudice and financial limitations can directly interfere with therapeutic adherence. Thus, it is ensured that the child is fully assisted, respecting his clinical condition, routine, development and quality of life.

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