

Mycobacterium Tuberculosis Drug Resistance

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DESCRIPTION

Tuberculosis (TB) has plagued humanity for centuries, and despite significant progress in diagnosis and treatment, it remains a global health crisis. The emergence of drug-resistant strains of *Mycobacterium tuberculosis* (*M. tuberculosis*), the bacterium responsible for TB, poses a substantial challenge to TB control efforts worldwide. This article explores the current trends in *M. tuberculosis* drug resistance, examining the types of drug resistance, their global distribution, factors contributing to resistance, and strategies to combat this growing threat.

Understanding drug-resistant TB

Drug-resistant TB occurs when *M. tuberculosis* becomes insensitive to the effects of one or more anti-TB drugs. There are two primary categories of drug resistance:

Drug-susceptible TB: In this form, *M. tuberculosis* is susceptible to the first-line TB drugs, including Isoniazid (INH) and Rifampicin (RIF), which are the basics of TB treatment. Drug-susceptible TB can be effectively treated with standard anti-TB drug regimens.

Drug-resistant TB: Drug-resistant TB includes two subcategories:

Multi Drug-Resistant TB (MDR-TB): MDR-TB is resistant to at least INH and RIF, the two most potent anti-TB drugs. Treating MDR-TB is challenging, requiring the use of second-line drugs that are less effective, more toxic, and often more costly.

Extensively Drug-Resistant TB (XDR-TB): XDR-TB is resistant to INH and RIF, as well as to fluoroquinolones and at least one of the three injectable second-line drugs (amikacin, kanamycin, or capreomycin). XDR-TB is even more difficult to treat, with fewer treatment options and poorer outcomes.

Current global trends in drug resistance

Drug-resistant TB is a growing concern worldwide, and its distribution varies by region. Here are some key global trends:

High-burden countries: High-burden TB countries, such as India, China, Russia, and South Africa, report a significant burden

of drug-resistant TB cases. These countries often face challenges in diagnosing and treating drug-resistant forms of TB.

MDR-TB epidemic: MDR-TB is considered an epidemic in some parts of the world, particularly Eastern Europe and Central Asia. Factors such as inadequate treatment regimens, poor treatment adherence, and limited access to healthcare contribute to the high prevalence of MDR-TB in these regions.

XDR-TB challenges: XDR-TB remains a severe threat. Limited treatment options and high mortality rates make it a daunting challenge for both healthcare providers and patients.

Emergence of pre-XDR TB: Pre-XDR TB, characterized by resistance to INH, RIF, and one group of second-line drugs, is increasing. This complicates treatment further and underscores the urgent need for effective interventions.

Factors contributing to drug resistance

Several factors contribute to the emergence and spread of drug-resistant TB:

Incomplete treatment: Inadequate or incomplete treatment of TB allows *M. tuberculosis* to mutate and develop resistance to anti-TB drugs. This can occur due to treatment interruptions, non-adherence to prescribed regimens, or poor-quality medications.

Misuse of antibiotics: Inappropriate use of antibiotics in TB-endemic regions can lead to the development of drug resistance. This includes the use of TB drugs without proper diagnosis or prescription.

Healthcare infrastructure: Weak healthcare systems, particularly in resource-limited settings, may lack the capacity to diagnose and treat drug-resistant TB effectively. This can result in delayed or inadequate treatment.

Close contact and crowding: TB transmission is more likely in crowded and poorly ventilated spaces, increasing the risk of exposure to drug-resistant strains.

HIV coinfection: HIV weakens the immune system, making individuals more susceptible to TB infection and increasing the likelihood of drug-resistant TB development.

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Lack of access to second-line drugs: Limited access to second-line anti-TB drugs, often due to cost or availability, hinders effective treatment of drug-resistant TB.

Strategies to combat drug-resistant TB

Efforts to combat drug-resistant TB require a multifaceted approach:

Early detection: Timely and accurate diagnosis of drug-resistant TB is essential. Molecular diagnostic tools like GeneXpert MTB/RIF have improved the speed and accuracy of diagnosis, allowing for prompt initiation of appropriate treatment.

Improved treatment regimens: Developing shorter, more effective and less toxic treatment regimens for drug-resistant TB are a priority. This includes the use of new and repurposed drugs like bedaquiline and delamanid.

Treatment adherence: Ensuring that patients adhere to their treatment regimens is crucial. Patient-centered care, including education and support, can improve adherence rates.

Infection control: Implementing infection control measures in healthcare settings and congregate settings, such as prisons and

homeless shelters, can help reduce TB transmission and the development of drug resistance.

Preventive therapy: Providing preventive therapy, such as Isoniazid Preventive Therapy (IPT), to individuals at risk of TB can reduce the development of drug-resistant forms.

Vaccination: Continued research into TB vaccines, such as the BCG booster vaccine and new candidate vaccines, may play a role in preventing TB, including drug-resistant forms.

CONCLUSION

M. tuberculosis drug resistance is a formidable challenge that demands global attention and concerted efforts. While drug-resistant TB poses significant threats to public health, ongoing research, improved diagnostics, and innovative treatment regimens to happen. Addressing the factors contributing to drug resistance and ensuring access to effective TB care for all are essential steps in the fight against this ancient and persistent infectious disease. The global community must remain committed to combating drug-resistant TB to reach the aim of TB elimination.