Climate change, a major threat to the progress in ending the tuberculosis pandemic

Cambio climático, una amenaza al progreso en poner fin a la pandemia de tuberculosis

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Tuberculosis (TB) is the leading cause of death due to an infectious agent in 2023, with 1,3 million deaths, including 167,000 deaths among people living with HIV. An estimated 10.6 million people fell ill with TB in 2022[1]. It is important to acknowledge that the global response to TB, particularly since year 2000 has resulted in estimated 75 million lives saved[1]. The low cost of the associated health services has made of the response to TB one of the most cost-effective interventions a health system can offer. Nevertheless, the funding of the response to TB has stagnated in the last 20 years[1].

People living in conditions of vulnerability in any country are at higher risk of developing the disease as the drivers of the epidemic are poverty, malnourishment, poor housing, social exclusion, and other medical conditions determined as well for the same social conditions (e.g., HIV, diabetes, mental disorders, tobacco, harmful use of alcohol and other substances, deprivation of liberty in crowded conditions, among others)[2]. While historical evidence has shown that TB is caused by poverty, more recent evidence has shown that the disease, regardless of the access to effective treatment, is a cause of further impoverishment. From 20% to 80% of people treated for TB are reported to experience catastrophic costs, that is spending more than 20% of income in health care, in virtually in all high TB burden countries[3,4]. This situation is consistently more severe among people affected by drug resistant TB[5].

This vicious cycle of poverty causing TB, and TB causing poverty is compounded by health and humanitarian emergencies. Health emergencies like the recent COVID-19 pandemic erased in one year the progress achieved in at least the previous ten years in several high TB burden[6]. There was in 2022 and 2023 a significant recovery in global indicators of TB diagnosis and treatment services, reversing the negative consequences of the COVID-19, which seriously disrupted health care services, including TB diagnosis and treatment. The chances of bouncing back once the COVID-19 epidemic subsided are likely to be heavily influenced by the strength of the health and social protection systems[1,6].

In this context, climate change is anticipated to further drive well known social, economic and environmental determinants of TB and other medical conditions such as malaria and dengue, for example[7]. A particular determinant of TB, likely to worsen because of climate change, is food security. Food insecurity makes individuals and communities more vulnerable to disease and to poor TB treatment and health outcomes, and easily triggers mass displacement making people more vulnerable to TB disease development and transmission, while disrupting access to health care services[8]. In 2022, one in five estimated incident cases of TB were attributable to undernourishment[1]. The food security is likely to be the most influential pathway for the climate change to impact TB through its effects on agricultural production, food diversity, and the availability of food due to changes in tempe-

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rature, precipitation, loss of biodiversity, and extreme climatic events. Likewise, it creates a negative impact on access to food for the poor. Food prices will be more than double in the next 20 years. Among the total rise in price, 50% is attributable to climate change, which reduces their purchasing power and pushes further towards the swirl of food insecurity and malnutrition[9]. Climate change negatively affects the nutritional value of plant foods. For instance, an increase in carbon dioxide declines protein concentration in many human-plant crops[10].

The body of evidence linking environmental factors with TB is limited. Preliminary findings suggest that a positive association between TB incidence and variables influence by climate change such as temperature, precipitation, and wind speed[11-14].

A scoping review from 2021[13] suggests that climate change increases the exposure of TB infection, particularly among vulnerable and high-risk populations, and escalates susceptibility to TB by reducing the host immune response, intensifying malnutrition, and reducing the availability of vitamin D. Air pollution, particularly indoor air pollution, is an environmental risk factor likely to influence TB. WHO estimates that more than 90% of the world's population live in neighborhoods with polluted air, implying a major effect even if the risk is small[15]. Extreme climate events also induce population displacement which has been associated with increased TB transmission[16].

While most high TB-burden countries are considered highly vulnerable to climate change, the high income economies are also at risk of losing the progress made in ending TB through the influx of migrants, for example. Forced migration and mass displacement can in fact cause the collapse of TB care services due to infrastructures/health systems disruption; increased indoor and outdoor pollution and mental disorders (i.e. stress, anxiety, depression)[17].

More than 108 million people were forcibly displaced worldwide in 2022 as a result of economic and humanitarian crises triggered, among other factors, by climate related disasters and social conflicts[18]. Humanitarian emergencies resulting from armed conflicts, natural disasters or the economic crisis many high TB burden countries suffer often bring internal or external waves of migration. The settings receiving these waves of massive migration often lack the capacity to meet their needs of health and social services, all contributing to higher risk of acquiring or developing TB among the migrants, and of TB transmission between migrants and to local populations[16].

All the mechanisms above are plausible and all of them possibly contribute to the overall impact of climate change on TB. Developing policies to manage TB in the context of climate change, however, has been constrained due to scanty evidence on the complexities around climate-health dynamics. Data about the climatic variability of TB and the spatial distribution of TB, for example, is just not available to inform development of policies and planning of a proper response. Most importantly, there is still poor understanding of the TB implications of no- action to guide decision-making processes. To date, discussions in healthcare have focussed on the adverse health impacts that climate change on health systems and few robust studies have estimated the carbon footprint of the healthcare sector itself[19]. The implementation of the WHO's End TB strategy[20] should consider ways to mitigate the environmental impact on the TB epidemic to ensure and deliver a people centered approach to prevention and care, encourage TB services to reduce, and eventually achieve carbon-neutral TB services.

Starting this area of work is crucial to develop a climate change resilient TB programmes and contribute to the sustainability of the global TB response and – most importantly – protect people affected by TB from the extreme consequences of climate change. Investing in climate change mitigation and adaptation strategies requires a multisectoral engagement and accountability, a major challenge for the TB community.

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