

**CORRESPONDENCE**

**Climate change and TB: the soil and seed conceptual framework**

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We read with interest the recent correspondence from Harries et al. in which they rightly point out that health care services have a meaningful impact on climate and can inadvertently contribute to increased incidence and mortality from climate-sensitive diseases.<sup>1</sup> The authors correctly highlight TB as a disease that could be exacerbated by climate change. We also agree that preventing TB may reduce the carbon footprint attributable to TB by reducing the need to diagnose and treat. However, we believe that the connection between the environment and TB is bi-directional, and there are numerous pathways through which climate change is already impacting the global TB pandemic.<sup>2</sup>

Climate change can impact the TB pandemic through mechanisms that either aid TB transmission (the seed) or make hosts more vulnerable to TB disease (the soil). Examples of the former include increased risk of displaced populations living in cramped conditions due to severe weather events and increased risk of TB transmission. The latter, vulnerability to TB disease, can be increased by more frequent severe weather events (such as floods), which disrupt access to preventive and therapeutic care. This includes care for prominent TB risk factors such as HIV and diabetes, as well as TB preventive therapy, as described by Harries et al.<sup>1</sup> The pace of climate change is rapid and non-linear, meaning that although some of these mechanisms may currently appear negligible, they can suddenly, increasingly hamper global TB elimination efforts.<sup>3</sup>

One critical pathway through which climate change will affect the TB pandemic is its impact on food security and nutrition. In many high TB burden countries such as India, undernutrition remains the leading risk factor for TB.<sup>4</sup> Based on decades of data, we know that undernutrition is associated with increased risk of TB disease incidence, increased severity of TB disease and increased mortality.<sup>4</sup> Smallholder food production in India is threatened by irregular rainfall, extreme climate events, hotter temperatures, a reduction in arable land by salt water infiltration due to rising sea levels and cyclones, and reduced crop output.<sup>5</sup> Furthermore, impaired water quality due to extreme weather events such as flooding may lead to infectious diarrhoea and parasitic infections that exacerbate undernutrition in people vulnerable to TB.<sup>2</sup> Climate shocks that reduce food access are also responsible for spikes in malnutrition. Forecasting and mitigating the effects of climate on food availability, food access and water quality may aid TB elimination efforts in India, as well as other countries with high TB incidence.

Policymakers, clinicians, researchers and public health practitioners will have to cultivate creative approaches to contain the seed and disrupt the soil. Thinking ahead and acting on these pathways now, will buttress TB elimination efforts as the impacts of climate change, marked by more extreme weather events, make themselves increasingly evident.

## *References*

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