

COMMENTARY

Effect of Climate Change on Pathogens Migration and Culture

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Abstract

Both pathogens migration and climate change burden the global health thinkers. Therefore, there is a need to conceptualize a relationship between climate change and pathogenic invaders. This opinion attempts to provide an understanding on climate-pathogen migration by identification of common/specific drivers of pathogen migration in the context of climate change. It highlights biochemical interactions and the dynamics of drivers over culture and time.

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The migration perception as being 'migrant choice' has strong roots in belief of public policy makers and in academia^[1]. On the other hand, the climate crisis will aggravate not only environmental but also economic, health and social threats ^{[2][3][4]}. Thus, urgent actions are required to address the climate crisis and to strengthen the implementation of response with an aim to create a durable planet. COP27 becomes the moment when the world leaders responsibly agreed to move from negotiation to actions, thus words have to be implemented to ensure a sustainable transition and

greener future for the coming generations.

Climate change will significantly impact both human migration and population health, including infectious disease, thus, it will change dynamics and pathways of transmission leading to changing profiles of infectious disease ^[5].

Climate change will likely affect the incidence and prevalence of both residual and imported infections in worldwide ^[6]. Although climate affects the range of infectious diseases, still the questions; whether it affects the intensity or timing outbreaks? Whether infectious diseases are affected by climatic scenarios such as warming, heavy rains or weather extremes, as particularly, viral diseases, mostly, sensitive to climate? Whether the human immune system can be altered under increased exposure to ultraviolet radiation and malnutrition due to genetic modifications of agricultural products ^[6]? There is a need for experimental evidences to understand the climatic factors that control the dynamics and distribution of human pathogens, so far, many disease-causing organisms are strongly influenced by environmental factors such as temperature and humidity, which are in turn influenced by climate change ^[7].

For a disease like COVID-19, temperature, wind, and humidity have demonstrated influence on the transmission of Sars-cov-2 in ways not fully understood, but has to do with the virus exposure and host immune susceptibility to COVID-19 ^{[8][9][10]}. It is well noticed, that the ways climate and Sars-cov-2 interact vary considerably between and within regions and populations and are affected by complex interactions with underlying political, demographic, cultural, and socioeconomic conditions ^{[8][9]}.

Pathogens that raise risks to human health are key to assess disease threats to migratory species^[11]. Migrations of animals including humans are glorious while pathogens have been shown to be transmitted by migratory species. Thus, can be considered to predict the behaviour of pathogens migrations to their invasion success to the human hosts and provide a mechanistic understanding of migratory host-pathogen interactions ^[11].

The migration machinery appears to be functionally and morphologically conserved within some pathogenic invaders, however, mechanisms for cellular trafficking by such pathogens to violate biological barriers should to be studied and cleared {m/12,13/}. Understanding this violation is crucial for the development of new approaches to overcome resulted diseases because penetration of host tissue is a prerequisite for the establishment of infections by most pathogens ^[11].

For these reasons, it is widely expected that climate change will affect infectious disease patterns which stresses world leaders to consider climate change and its health consequences with greater necessity, whilst being aware that it is at the root of numerous pathogenic diseases.

It is therefore important to identify and correlate common factors that triggers climate-pathogens modulation and/or migration and to provide solutions to reverse/modulate these changes.

This opinion provides insights on the effect of climate change on the pathogenicity of emerging pathogens by providing a conceptual explanation of this relationship. This includes identification of common and specific drivers or factors that can be better manipulated to overcome the burden of both climate changes and pathogens.

References

1. ^a Black R, Bellagamba A, Botta E, Ceesay E, Cissokho D, et al. Migration drivers and migration choice: interrogating responses to migration and development interventions in West Africa. *Comp Migr Stud*. 2022, 10:10. doi: 10.1186/s40878-022-00283-3.
2. ^a Wozniak M, Helbach A, Römer J, Molkentin K, Müller BS. Health effects of the climate crisis. *MMW Fortschr Med* 2023, 165:53-55. doi: 10.1007/s15006-023-2645-1.
3. ^a Papies EK, Nielsen KS, Soares VA. Health psychology and climate change: time to address humanity's most existential crisis. *Health Psychol Rev* 2024, 1-31. doi:10.1080/17437199.2024.2309242.
4. ^a de Oliveira T, Tegally H. Will climate change amplify epidemics and give rise to pandemics? *Science* 2023, 381(6660):eadk4500. doi: 10.1126/science.adk4500.
5. ^a McMichael C. Climate change-related migration and infectious disease. *Virulence* 2015 6:548-53. doi: 10.1080/21505594.2015.1021539.
6. ^{a, b} Bezirtzoglou C, Dekas K, Charvalos E. Climate changes, environment and infection: facts, scenarios and growing awareness from the public health community within Europe. *Anaerobe* 2011, 17:337-40. doi: 10.1016/j.anaerobe.2011.05.016.
7. ^a Thomas MB. Epidemics on the move: Climate change and infectious disease. *PLoS Biol* 2020, 18:e3001013.
8. ^{a, b} Ford JD, Zavaleta-Cortijo C, Ainembabazi T, Anza-Ramirez C, Arotoma-Rojas I et al. *Lancet Planet Health* 2022, 6:e825-e833.
9. ^{a, b} Awad K. Covid19: End or fade of the pandemic? *Lupine Online Journal of Medical Sciences* 2023, 638-639. DOI: 10.32474/LOJMS.2023.06.000238.
10. ^a Awad K, Maghraby AS, Abd-Elshafy DN, Bahgat MM. Carbohydrate metabolism signatures in immune cells: Response to infection. *Frontiers Immunology* 2022, 13:912899. <https://doi.org/10.3389/fimmu.2022.912899>.
11. ^{a, b, c} Hall RJ, Altizer S, Bartel RA. Greater migratory propensity in hosts lowers pathogen transmission and impacts. *J Anim Ecol* 2014, 83:1068-77. doi: 10.1111/1365-2656.12204.