Photo: Giulio De Leo

Schistosomiasis and climate change

Schistosomiasis, also known as bilharzia or snail fever, is a debilitating disease of poverty transmitted through parasite contaminated water and endemic in more than 70 countries in tropical and subtropical regions. With more than 200 million people requiring treatment for schistosomiasis each year and nearly 800 million people at risk of infection (the vast majority in sub-Saharan Africa), schistosomiasis is second only to malaria as the most devastating parasitic disease. As the parasite-bearing snails and free-living stages of the parasites are unable to regulate their body temperature, climate change and human driven changes in water availability are expected to affect schistosomiasis transmission risk among human populations.

The information presented in this factsheet is derived from research conducted by the Belmont Forum-funded project Schistosomiasis and climate change (S&CC). This project studies how rising temperatures, shifts in rainfall patterns, flooding, drought, heat waves, land use changes, and crowding around water affect snail-borne schistosomiasis (snail fever) in Brazil, Cote d'Ivoire, and beyond. In sum, the aim of the project is to understand how climate change and land use change impacts snail populations so that strategies are developed to eliminate this debilitating disease.

The purpose of this factsheet series is to showcase key findings from research on climate change and health from projects funded by the EU and Belmont Forum which are part of the ENBEL network. The series includes only findings from research produced by four EU-funded projects and one JPI Climate-funded project in the ENBEL network as well as from projects funded through the Belmont Forum Climate, Environment and Health Collaborative Research Action (CEH1).

Key facts about schistosomiasis

- Snail fever is an acute and chronic infection that causes abdominal pain, diarrhea, and blood in the stool or urine that can lead to chronic anemia, growth stunting, cognitive impairment in children, infertility, and a higher risk of contracting HIV in women. In severe and chronic cases, death can result from liver failure or bladder cancer.
- Snail fever is acquired through contact with fresh water contaminated by schistosome parasites released by infected freshwater snails.
- Lack of sanitation, lack of access to clean water, and lack of affordable healthcare are factors that increase snail fever transmission in tropical and subtropical regions.

Key findings of the project

- The construction of dams and water management infrastructure in tropical and subtropical regions – to support agriculture expansion and intensification for production of hydropower and to prevent saltwater intrusion – can expand the freshwater habitat where the schistosome-infected snails can thrive. This, in turn, may prevent migration of natural snail predators such as snail-eating fish, prawns, and crayfish. In addition, agrochemical runoff boosts production of periphyton (i.e., organisms such as algae and bacteria that live on the surface of submerged plants and other objects) on which freshwater snails feed.
- Rapid expansion of informal settlements and slums lacking facilities to collect and process sewage may foster the transmission of intestinal schistosomiasis.
- Increasing temperatures caused by climate change may favor schistosomiasis transmission in highlands and at higher latitudes above subtropical regions where it is currently too cold for snail populations to support schistosomiasis transmission. Following the outbreak of schistosomiasis in Corsica, France in 2013, there is growing concern about the potential expansion of schistosomiasis in southern Europe including Spain, Portugal, and Italy.
- Intensification of extreme precipitation in tropical and subtropical regions may create temporary water ponds where freshwater snails may thrive long enough to sustain schistosomiasis transmission. They may also disperse in environmental schistosome-contaminated sewage, thus increasing transmission risk.
- Intensification of droughts drives human populations to gather around stable water bodies (e.g., rivers, canals, lakes, temporary ponds), thus boosting schistosomiasis transmission.
- To counteract the increasing frequency and duration of droughts and to mitigate floods caused by climate change, the typical response is to build dams and water reservoirs, (i.e., infrastructure that are known to expand schistosomiasis suitable habitat in tropical and subtropical regions). Dams built in coastal areas to prevent saltwater intrusion due to sea-level rise caused by climate change may also increase suitable habitat for schistosomiasis transmission as documented by the Diama dam in the lower basin of the Senegal river.

Biomphalaria glabrata in urban Brazilian streets.
At a coastal town in southern Brazil, researchers with the Sao Paulo State Health Department and visiting collaborators retrieved these large Biomphalaria snails in a drainage ditch alongside an urban road.
Photo: Roseli Tuan

Proposed solutions

- Aquaculture for health, (i.e., farming of freshwater species of commercial value that are natural predators of the schistosome bearing snails such as the African lungfish, prawns, and crayfish), can help in controlling snail populations and decrease parasites in the water, thus reducing transmission risk, improving nutrition, and fighting poverty.
- Construction of wastewater treatment facilities is a priority in rapidly expanding slums.

Retrieving Biomphalaria glabrata in Sao Paulo State, Brazil.
In Sao Paulo State, researchers from the Sao Paulo state health department demonstrate field retrieval and identification of Biomphalaria glabrata snails from drainage channels.
Photo: Aly Singleton.

Implications of the research

- Findings from this project have the potential to benefit millions of people infected by, or exposed to, this disease in the environment.
- Development of a user-friendly software tool is underway to help evaluate schistosomiasis transmission risk associated with proposed water management infrastructure.

Who is most at risk?

- More than 800 million people living in tropical and subtropical regions are at risk of schistosomiasis infection.

Conclusions

- The combination of land use change, rapidly growing informal settlements lacking sanitation and access to clean water, and climate change will affect snail and parasite distribution and may potentially expand suitable habitat for schistosome transmission beyond its current distribution.

For more information

- Website: Stanford De Leo Lab: https://deleolab.stanford.edu/disease-ecology-and-health

Publications:

- De Leo GA, Stensgaard AS, Sokolow SH, N'Goran EK, Chamberlin AJ, Yang GJ, Utzinger J. Schistosomiasis and climate change. BMJ, 2020; 371: m4324. https://doi.org/10.1136/bmj.m4324
- Ozretich RW, Wood CL, Allan F, Koumi AR, Norman R, Brierley AS, De Leo, GA, Little, DC. The potential for aquaculture to reduce poverty and control schistosomiasis in Côte d'Ivoire (Ivory Coast) during an era of climate change: A systematic review. Reviews in Fisheries Science and Aquaculture, 2022; 30 (4): 467-497. https://doi.org/10.1080/23308249.2022.2039096

African river prawn Macrobrachium vollenhovenii, a native freshwater predator of snails in Western Africa. Credit: Susanne H. Sokolow Galin

The entire research factsheet series and other outputs from the ENBEL network can be found on www.enbel-knowledge.eu

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