# A novel framework to account for ecological drivers in the control and elimination of environmentally transmitted disease: a modelling study

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## Abstract

Background Popular fears about human infectious disease often focus on pathogens spread by person-to-person contact. By contrast, we show that 70–80% of human pathogens are environmentally transmitted (ie, people are infected through contact with free-living stages or environmental reservoirs including soil, water, vectors, food, or non-human hosts in the environment). In fact, environmentally transmitted diseases represent about 40% of today's global burden of human infectious disease (or 150 million disability adjusted life-years). Here, we call for renewed attention to the connection between human health and environmental factors, with a focus on identifying ecological solutions to interrupt transmission.

Methods We developed a simple modelling framework that is able to capture the two main transmission pathways namely, direct (host-to-host transmission, such in the case of influenza and measles) and transmission through an environmental reservoir (such, in the case of cholera, vector borne diseases, helminthiasis and sapronosis). We used the epidemiological model to analyse the role of ecological drivers for environmentally transmitted parasites and pathogens and to investigate the effectiveness of drug treatment for both directly and environmentally transmitted diseases.

Findings Through the analysis of system dynamics, we show that periodic drug treatments that lead to the elimination of directly transmitted diseases might fail to do so in the case of human pathogens with an environmental reservoir. For environmentally transmitted diseases, more effective control can be achieved when classic treatment strategies are complemented with interventions that act on the environmental reservoir of the pathogen or reduce exposure.

Interpretation Control of environmentally transmitted diseases can be more effective when human treatment is complemented with interventions targeting the environmental reservoir of the pathogen. Wherever environmental approaches to reduce human disease and preserve ecosystems are available, health practitioners, environmental scientists, and communities can work synergistically to solve health problems.

Funding National Science Foundation, Bill and Melinda Gates Foundation, NIMBioS, SNAP-NCEAS, Stanford FSI-SEED-GDP.

### Contributors

AG, SHS, MHB, and GDL, conceived the study. GDL analysed the model. All authors discussed the outcome of the study and reviewed the final Abstract.

#### **Declaration of interests**

We declare no competing interests.

#### Acknowledgments

SHS and GDL have been supported by NSF CNH grant # 1414102, the Bill and Melinda Gates Foundation, NIH Grant 1R01TW010286-01, Stanford GDP SEED grant 1183573-100-GDPAO, and the SNAP-NCEAS-supported working group "Ecological levers for health: Advancing a priority agenda for Disease Ecology and Planetary Health in the 21st century" and the NIMBioS-supported working group on the Optimal Control of Environmentally Transmitted Diseases. AG, CNN, and MHB were funded by a James McDonnell Foundation grant (#20020322) and NIH grant (#K01TW008773) from the Fogarty International Center. This work was partly supported by the National Center for Ecological Analysis and Synthesis (NCEAS) and the National Socio-Environmental Synthesis Center (SESYNC) with funds from the NSF. JFG and BR were supported by a grant from the Agence Nationale de la Recherche (CEBA ANR-LABX-10-2501) and JFG received support from the UN programme FutureEarth. EAM was supported by grants from the NSF (DEB-1518681 and DEB-1640780), a Stanford Center for Innovation in Global Health seed grant, and a Stanford Woods Institute Environmental Ventures Program grant.

Published Online April 28, 2017

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