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Understanding the variability of controls on risk of infection with liver fluke to target disease control strategies under changing climate

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Environmental effects on the transmission of many high burden infectious diseases are increasingly recognized, especially for transmission routes through water and vectors, or intermediate hosts, that live in the environment. Control of such diseases, which is currently largely based on treatment, is increasingly challenging due to climate-induced changes in infection patterns and the rapid emergence of drug resistance. Therefore, prevention through simulation of future disease risk and the devising of more comprehensive strategies, rather than exclusively relying on treatment, are becoming key. This requires mechanistic understanding of the link between disease transmission and underlying drivers, including heterogeneous on-the-ground environmental characteristics, which are those it may be possible to manipulate locally to reduce disease burdens. However, currently assumed drivers on the variability of disease risk are often only climatic, and environmental interventions to supplement drug treatment still under-recognised.

In this work, we use the widespread parasitic disease of fasciolosis, and emerging zoonosis, as a case study. First, we apply the previously developed hydro-epidemiological model for liver fluke to investigate the variability of climatic and environmental drivers on disease risk across the UK. This allows exploring opportunities for environmental control strategies to complement treatment. Second, we evaluate how future risk of infection might respond to climate change across the country, including potential shifts in disease risk and its drivers, using climate projection data. Our results show shifts from modal to bimodal seasonality across the UK going forwards, and that environmental management may provide benefits in risk reduction in certain areas, offering a more sustainable and cost-effective approach in the long run.