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Tipping points in epidemiological systems

Dynamical transitions in complex systems continue to garner attention from mathematicians, on account of both their fascinating behaviour as well as their applications to public health. Many of these systems can be characterized as coupled behaviour-disease systems, where there is a two way feedback between some nonlinear transmission dynamics and a nonlinear human system. A familiar example is the COVID-19 pandemic, where a pandemic wave could drive widespread adoption of infection control measures but, as case incidence dropped, the subsequent relaxation of these measures fostered conditions for the next pandemic wave. In this talk, I will provide an overview of some of my research on mathematical modelling of tipping points in epidemiological systems, including coupled social-epidemiological systems. Methods include dynamical systems models, bifurcation theory, evolutionary game theory, and data-driven dynamical systems approaches assisted by deep learning.