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Dynamics of a delay differential SEIR model with test, trace, isolate

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We study an extension of a compartmental SEIR model by including a TTI-strategy (test, trace, isolate), inspired by COVID-19. Here infected individuals are identified with some testing rate, and then they and their contacts are quarantined for a fixed period of time, resulting a system of delay differential equations. We prove the threshold result between extinction and persistence of the disease, and then study the stability of the endemic equilibrium when the reproduction number exceeds unity. For a particular COVID-like set of parameters we observe rich dynamics such as stability switches of the endemic equilibrium, Hopf bifurcations, bistability regions and endemic bubbles. A particularly interesting situation is when a branch of periodic orbits connects a super- and a subcritical Hopf-bifurcation from the endemic steady state.

Joint work with Gabriella Vas and Gergely Röst.