

Temporal Ordering Dominates Spreading Processes on Contact Networks

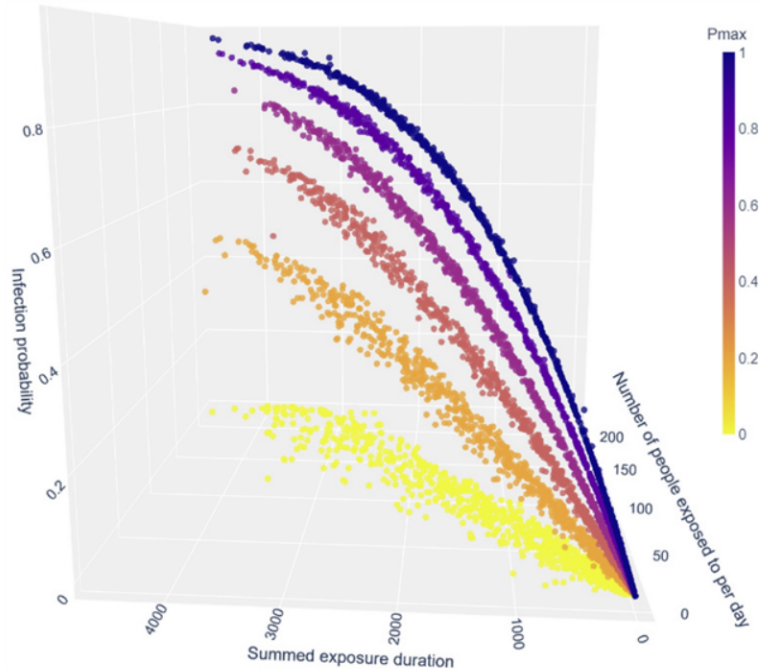
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The dynamics of processes spreading on networks depend critically on temporal structure: the ordering, timing, and duration of contacts along which transmission occurs. Yet most models either aggregate contacts into static graphs, losing causal ordering, or treat time-respecting paths without incorporating the heterogeneous, weighted nature of real interactions. I will present an interaction-driven framework that operates directly on empirical temporal contact networks, and use epidemic spreading as a lens to expose how the temporal fabric of a network — independent of its aggregate topology — governs collective outcomes.

The results reveal a sharp separation: temporal network properties dominate spreading dynamics far more than the characteristics of the process itself. This has a structural consequence for intervention: operations that preserve network activity while dilating its temporal density suppress spreading more robustly than spatial partitioning, which loses its advantage once the process is seeded across multiple entry points. Asymptomatic transmission is a biological fact, but its epidemic impact is a network property — consequential only in sparse contact regimes where symptomatic spread alone cannot sustain the process.

These findings reframe epidemic control as a problem of network observability and intervention design: the right target is the temporal fabric of interactions, not just their spatial organization.



The **temporal dynamics** of a community have a more **significant** effect on the spread of the disease than the characteristics of the spreading processes

When considering airborne diseases, it is important to consider the **duration of temporal meetings** to model the spread of pathogens in a population

The enigmatic nature of **asymptomatic transmission** stems from the latent effect of the network density and has a substantial impact only in **sparse communities**