COMMENTARY

Mobility restrictions are more than transient reduction of travel activities

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The world is getting closer, enabling far-ranging human movements as well as disease diffusions (1). This greater interconnectedness has drawn our attention to a core feature of the real world—the "small-world" characteristic (2). Thinking from a network perspective, the world consists of closely connected communities which are bridged by random, long-distance connections. However, this network structure has made the world more vulnerable to infectious disease.

During the early stage of the COVID-19 pandemic, mobility restrictions such as lockdown measures have proven their worth in mitigating disease spread (3–5). The current challenge is averting disease burden while promoting socioeconomic recovery. In order to craft solutions, we really need to detail and translate the effect of mobility restrictions.

Schlosser et al. (6) bring us answers to two key questions surrounding the effect of COVID-19 lockdown: How does the structural mobility network change? What are the impacts on epidemic spreading? The authors use mobile phone data to uncover structural changes in mobility in Germany during the pandemic. They show a profound restructuring of the mobility network—a more local, clustered network by reducing long-distance travels. They relate this structure to epidemic transmission, pointing to the prominent effectiveness of this structural change to suppress epidemic curves and slow down the spatial spread. This study underscores the complex consequences of mobility restrictions, for policymakers, and provides general implications for similar scenarios in the future.

How Has Mobility Changed?

We normally feel that mobility change is highly related to mobility-restricting measures (Fig. 1*A*). Most restrictions in Germany took effect in mid-March, and, consequently, the number of trips was drastically reduced (~40%). Across Germany, however, the level of mobility reduction varies. Severely affected states and densely populated cities are associated with a greater mobility reduction. Mobility-restricting policies and individual incentives for behavior change could be the reason, although disengaging their relative roles calls for further research.

It should come as no surprise that the mobility network during lockdown is considerably less dense than the prelockdown network (Fig. 1*B*). Should this loss of density be attributed solely to fewer trips in total? To move beyond the overall reduction of trips, we reflect on the fundamental structural change of the mobility network. Schlosser et al. (6) point out that it is the substantial reduction of long-distance trips that has restructured mobility and mitigated the "small-world" property, leading to a more local, clustered lockdown network.

Consistent with many countries (7, 8), the decline of mobility in Germany was followed by a gradual increase concurrent with the lifting of restrictions, reaching to the prelockdown level around early June. In light of this, we could intuitively expect a restoration to the regular mobility pattern. Yet, the structural change of mobility networks tends to last long, persisting even during postlockdown.

How Do These Changes Impact Epidemic Spreading?

The spread of infectious diseases coevolves with human movement behavior (9, 10). Detailing the lockdown-induced changes in mobility allows Schlosser et al. (6) to better understand the effect of lockdown on epidemic spreading. They consider two lockdown scenarios—"distancing" and "isolation"—that differ in contact rate between infected and susceptibles. In either scenario, lockdown measures reduce the overall incidence and "flatten" the epidemic curve, lowering and delaying the infection peak (Fig. 1*C*). Besides the modulation of epidemic curves, a restructured mobility network is fundamental from a practical point of view: The farther away from outbreak origin, the later the epidemic will arrive.

A deeper understanding of mobility-restricting policies will lead to better epidemic mitigation strategies. By merging the two fields, Schlosser et al. (6) push our minds forward.

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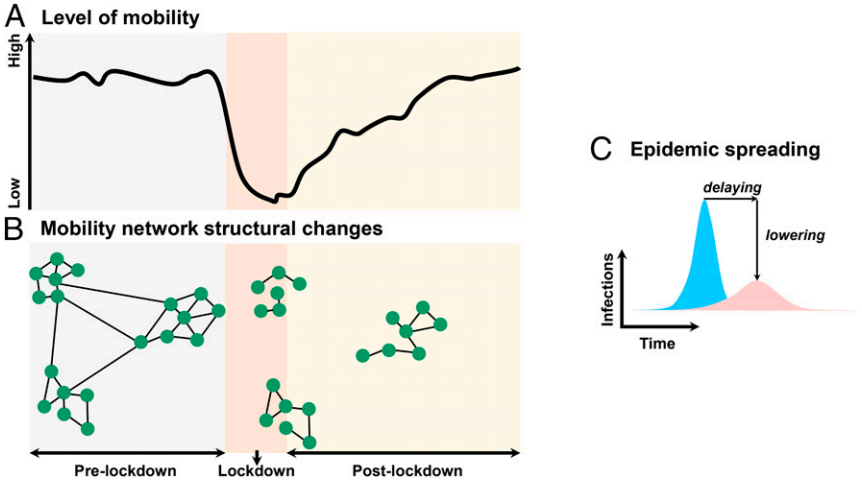

Fig. 1. Mobility changes and epidemic spreading. (*A*) Travel restrictions drive the change of mobility over time. Strict travel restriction during lockdown leads to a drastic reduction of mobility; lifting of the restrictions after lockdown is associated with a gradual increase of mobility, reaching to the prelockdown level. (*B*) Lockdown induces long-lasting and profound structural changes of mobility networks. During lockdown, the mobility network becomes more local and clustered, with significant reduction of long-distance travels. (*C*) This restructuring of the mobility network could have a fundamental role in shifting the epidemic spreading pattern, delaying and lowering infection peak.

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