Examining Transmission of Fear and Disease[1]

Most research in epidemiology does not take into consideration the possibility that people act differently when there is an epidemic than they do when there is not. The "individuals" in these models do not, for example, interact directly with one another to gain information on disease prevalence or in deciding how to behave. Those models that do include this type of prevalence-dependent behavior almost exclusively assume behavioral changes that are depressive in their effect on the epidemic, protective self-isolation (sequestration) being the most common. However, research on mass behavior during crises (and even epidemics specifically) records another behavioral response that is common—flight. Unlike protective sequestration, flight has the potential to increase transmission in the short term, and across spatial regions.

Research

Expository models of two contagion processes (one of disease proper, and one of fear about the disease) reveal that, in spatially extended settings where fear may inspire long-range migration, the possibility of fear propagating faster than disease will prove highly consequential. Not only does flight increase incidence dramatically, but it also increases the rapidity and geographic scope of the epidemic. In the models, epidemics rarely spread fully with no flight—but almost always spread fully with even a small amount of flight. In rare cases where the epidemic spreads fully without flight, it takes much longer to do so than in cases with flight. It may also generate high congestion undermining evacuation efforts and exacerbating exposures. The model makes clear that even a small level of fear-inspired flight can dramatically affect contagion dynamics.

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In addition, the models offer insight on an outstanding question in epidemiology; the multiple temporal waves of incidence observed in the 1918 Pandemic Flu. One mechanism for the multiple waves of 1918 may have been the premature government decisions to lift social distancing measures (i.e., bans on public gatherings, the closure of schools). Several cities prematurely declared victory over the epidemic and abruptly ended control measures, potentially causing additional

[1] This Fact Sheet is adapted from Joshua M. Epstein et al, "Coupled Contagion Dynamics of Fear Computational Explorations." Center on Social and Economic Dynamics Working Paper No. 50, O
http://www.brookings.edu/dynamics.aspx

waves of infections. However, these patterns might also be created purely by the interplay between the spread of the influenza virus and the spread of fear or behavioral adaptation to the virus. In a numerical simulation of the model, the incidence of the pathogen initially increases, then as the epidemic of fear increases, the number of susceptible individuals exposed to infectious individuals declines because many individuals remove themselves from circulation due to fear. This causes a temporary decline in the number of individuals infected with the pathogen, but as individuals return (from removal) to the susceptible compartment having recovered from fear, transmission of the pathogen increases the number of individuals in pool, creating a second peak in disease cases. Still, it may be that different mechanisms or mixes of them were at play in particular cases.

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Conclusion

In general, this preliminary research enforces the overarching point that *infectious disease models must incorporate behavior* and that further research on this topic is surely warranted.