University of Southern California

DANIEL J. EPSTEIN DEPARTMENT OF INDUSTRIAL AND SYSTEMS ENGINEERING

EPSTEIN INSTITUTE SEMINAR • ISE 651 SEMINAR

Robust Models of Epidemics, and Emergency Allocation

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ABSTRACT

In the event of an influenza pandemic, or even a severe epidemic, staff levels across many kinds of organization, will drastically be reduced, possibly impairing operations. For example, most public utilities require minimum staff levels in order to operate, at all. Police, fire and other emergency services would be severely impaired. Healthcare services, in particular, would be highly degraded. The impact of such staff shortfalls would be most severe in dense urban areas. To combat the shortfall, "surge" staff plans would be deployed, whereby emergency staff is temporarily reassigned from less densely settled areas, so as to manage the shortfall. Surge staff, however, would only be available in limited quantities and during limited time periods. Moreover, surge staff deployment levels would have to be carefully preplanned, for the simple reason that the logistics of large staff movements would likely make it very difficult to make large changes "on the fly".

The quantitative modeling of epidemics is traditionally carried out using "SEIR" or "SIR" models, which track the evolution of different population categories (in particular, infected individuals) as a function of time. SEIR models are rich in parameters, in particular the infectivity rate, p, which (broadly speaking) describes the probability that a contact between a sick and an healthy individual will result in contagion. In the epidemics literature, such parameters are treated as fixed (and known) quantities. However, many of these parameters are either difficult to actually observe, difficult to measure (post-epidemic) and in fact may represent quantities that are modeling tools rather than meaningful, "true" parameters. At the same time, SEIR models are highly nonlinear -- so changes in the parameters can drastically affect the evolution of an epidemic.

In this talk we will describe ongoing work using a variety of models so as to address, from a robust perspective, the evolution of an epidemic, and the resulting "optimal" deployment of surge staff. This is joint work with Cecilia Zenteno (MIT).

TUESDAY, FEBRUARY 12, 2013

VON KLEINSMID CENTER (VKC) ROOM 100

3:30 – 5:00 PM

SPEAKER BIO

Professor Daniel Bienstock first joined Columbia University's Industrial Engineering and Operations Research Department in 1989. Professor Bienstock teaches courses on integer programming and optimization.

Before joining Columbia University, Professor Bienstock was involved in combinatorics and optimization research at Bellcore. He has also participated in collaborative research with Bell Laboratories (Lucent), AT&T Laboratories, Tellium, and Lincoln Laboratory on various network design problems.

Professor Bienstock's teaching and research interests include combinatorial optimization and integer programming, parallel computing and applications to networking. Professor Bienstock has published in journals such as *Math Programming, SIAM, and Math of OR*.