Speaker: Eva Lee, Georgia Institute of Technology

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Title: Vaccine Prioritization for Effective Pandemic Response

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Abstract: Public health experts agree that the best strategy to contain a pandemic, where vaccination is the prophylactic treatment but vaccine supply is constrained, is to give higher priority to higher-risk populations. We derive a mathematical decision framework to track the effectiveness of prioritized vaccination through the course of a pandemic. Our approach couples a disease-propagation model with a vaccine queueing model and an optimization engine to determine optimal prioritized coverage in a mixed-vaccination strategy. This demonstrably minimizes infection and mortality. Given estimated outbreak characteristics, vaccine inventory levels, and individual risk factors, the study reveals an optimal coverage for the high-risk group that results in the lowest overall attack and mortality rates. This knowledge is critical to public health policy makers for determining the best strategies for population protection. This becomes particularly important in determining when to switch from a prioritized strategy emphasizing high-risk groups to a nonprioritized strategy in which the vaccine becomes available publicly. Our analysis highlights the importance of uninterrupted vaccine supply. Although the 2009 H1N1 supply, received in interrupted batches, eventually covered over 30 percent of the population, the resulting attack and mortality rates are significantly inferior to those in a scenario where only 20 percent of the population is covered with an uninterrupted supply. We also learned that early vaccination is important. Contrasting the 2009 H1N1 supply to a 10 percent uninterrupted supply, a three-week delay in vaccination reduces the 9.9 percent infection reduction of the former to a mere 0.9 percent. The optimal trigger for switching from prioritized
to nonprioritized vaccination is sensitive to infectivity and vulnerability of the high-risk groups. Our study further underscores the importance of throughput efficiency in dispensing, and its effects on the overall attack and mortality rates. The more transmissible the virus is, the lower the threshold for switching to nonprioritized vaccination. Our model, which can be generalized, allows the incorporation of seasonality and virus mutation of the biological agents. The system empowers policy makers to make the right decisions at the appropriate time to save more lives, better utilize limited resources, and reduce the health-service burden during a pandemic event.

**Bio:** Dr. Lee is a Professor in the H. Milton Stewart School of Industrial and Systems Engineering at Georgia Institute of Technology, and Director of the Center for Operations Research in Medicine and HealthCare, a center established through funds from the National Science Foundation and the Whitaker Foundation. The center focuses on biomedicine, public health, and defense, advancing domains from basic science to translational medical research; intelligent, quality, and cost-effective delivery; and medical preparedness and protection of critical infrastructures. She is a Distinguished Scholar in Health Systems, Health System Institute at Georgia Tech and Emory University. She is also the Co-Director of the Center for Health Organization Transformation, an NSF Industry/University Cooperative Research Center. Lee partners with hospital leaders to develop novel transformational strategies in delivery, quality, safety, operations efficiency, information management, change management and organizational learning. Lee’s research focuses on mathematical programming, information technology, and computational algorithms for risk assessment, decision making, predictive analytics and knowledge discovery, and systems optimization. She has made major contributions in advances to medical care and procedures, emergency response and medical preparedness, healthcare operations, and business operations transformation. A brief glimpse of Dr. Lee’s healthcare work can be found in the following link: