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A Compartmental Model for Zika Virus with Dynamic Human and Vector Populations The Zika virus (ZIKV) outbreak in South American countries and its potential association with microcephaly in newborns and Guillain-Barré Syndrome led the World Health Organization to declare a Public Health Emergency of International Concern. To understand the ZIKV disease dynamics and evaluate the effectiveness of different containment strategies, we propose a compartmental model with a vector-host structure for ZIKV. The model utilizes logistic growth in human population and dynamic growth in vector population. Using this model, we derive the basic reproduction number to gain insight on containment strategies. We contrast the impact and influence of different parameters on the virus trend and outbreak spread. We also evaluate different containment strategies and their combination effects to achieve early containment by minimizing total infections. This result can help decision makers select and invest in the strategies most effective to combat the infection spread. The decision-support tool demonstrates the importance of “*digital disease surveillance*” in response to waves of epidemics including ZIKV, Dengue, Ebola and cholera. This work is joint with the Centers for Disease Control and Prevention. It was named the 2016 Distinguished paper award by the American Medical Informatics Association.

Biosketch

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.

Dr. Lee serves on the National Preparedness and Response Science Board. She is the principle investigator of an online interoperable information exchange and decision support system for mass dispensing, emergency response, and casualty mitigation. The system integrates disease spread modeling with response processes and human behavior; and offers efficiency and quality assurance in operations and logistics performance. It currently has over 9500+ public health site users. Lee has also performed field work within the U.S. on mass dispensing design and evaluation, and has worked with local emergency responders and affected populations after Hurricane Katrina, the Haiti earthquake, the Fukushima Japan radiological disaster, and Hurricane Sandy. Lee has received multiple analytics and practice excellence awards including INFORMS Franz Edelman award, Daniel H Wagner prize for novel cancer therapeutics, bioterrorism emergency response dispensing for mass casualty mitigation, optimizing and transforming clinical workflow and patient care, vaccine immunity prediction, and reducing hospital acquired conditions. Dr. Lee is an INFORMS Fellow. She has received seven patents on innovative medical systems and devices. A brief glimpse of Dr. Lee’s healthcare work can be found in the following link: http://www2.isye.gatech.edu/~evakylee/Eva_Lee_Intl_Innovation_139_Research_Media_HR.pdf - by Sophie Laggan