CENTER FOR
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UNIVERSITY OF MICHIGAN

PROVIDING BETTER HEALTHCARE THROUGH SYSTEMS ENGINEERING:

Forecasting and Stochastic Programming Models to Address Uncertainty in the Trauma System Configuration Problem

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Trauma care services are a vital part of all healthcare-based network as timely accessibility is important for citizens. Trauma care access is even more relevant when unexpected events such as the COVID-19 pandemic overload the capacity of the hospitals. Research literature has highlighted that access to trauma care is not even for all populations, especially when comparing rural and urban groups. Historically, the configuration of a trauma system was often not considered as a whole but instead hinged on the designation and verification of individual hospitals as trauma care centers. Recognition of the benefits of an inclusive trauma system has precipitated a more holistic approach. The optimal geographic configuration of trauma care centers is key to maximizing accessibility while promoting the efficient use of resources. This talk focuses on analyzing and forecasting physical trauma sustained from accidents, in environments both personal and work related, pertaining to individual injuries and to formulate a stochastic programming model that utilizes recorded injuries as demands to place trauma centers in the most optimal location. The first part of the talk discusses the limitations faced by the existing trauma healthcare infrastructure by forecasting the expected number of people requiring the services of trauma facilities for both rural and urban locations in Texas. Five types of forecasting methods were analyzed to determine the best option to utilize for forecasting for individual data sets. The aim is to identify which forecasting model performs the best for given data sets that can be used to forecast patient demand for a given location and determine the optimal locations for trauma network expansion. The second part of the talk reports on the development of a two-stage stochastic optimization model for geospatial expansion of a trauma network in the state of Texas. The stochastic optimization model recommends the siting of new trauma care centers according to the geographic distribution of the injured population. The model has the potential to benefit both patients and institutions, by facilitating prompt access and promoting the efficient use of resources.

Eduardo Pérez is an Associate Professor in the Ingram School of Engineering at Texas State University. He was a Postdoctoral Research Associate in the Department of Industrial and Systems Engineering at Texas A&M University from 2010 to 2012. He received his PhD in Industrial and Systems Engineering from Texas A&M University in 2010 and his B.S. in Industrial Engineering from the University of Puerto Rico at Mayagüez, Puerto Rico in 2004. Dr. Pérez's research interests are in the use of methodologies and theories in operations research, systems engineering, discrete-event simulation, algorithms and software design, and decision theory analysis to solve problems in service systems. Some of his research project sponsors include the National Science Foundation (NSF), the Department of Homeland Security (DHS), the Robert Wood Johnson Foundation, Baylor Scott & White Health System, Adventist Health System, and the NEC Corporation. Dr. Eduardo Pérez is a member of the Institute of Industrial Engineers (IIE), the Institute for Operations Research and Management Sciences (INFORMS), and the Society for Computer Simulation International (SCS). He received his Engineering-In-Training (EIT) certification in 2004. He is the director of the Integrated Modeling and Optimization for Service Systems (iMOSS) research laboratory.

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