

Decision Systems Engineering Spring '14 Seminar Series

“Critical care in hospitals: When to introduce a Step Down Unit”

F E A T U R I N G



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Abstract:

Step Down Units (SDUs) provide an intermediate level of care between the Intensive Care Units (ICUs) and the general medical-surgical wards. Because SDUs are less richly staffed than ICUs, they are less costly to operate; however, they also are unable to provide the level of care required by the sickest patients. There is an ongoing debate in the medical community as to whether and how SDUs should be used. On one hand, an SDU alleviates ICU congestion by providing a safe environment for post-ICU patients before they are stable enough to be transferred to the general wards. On the other hand, an SDU can take capacity away from the already over-congested ICU. In this work, we propose a queueing model to capture the dynamics of patient flows through the ICU and SDU in order to determine how to size the ICU and SDU. We account for the fact that patients may abandon if they have to wait too long for a bed, while others may get bumped out of a bed if a new patient is more critical. Using fluid and diffusion analysis, we examine the tradeoff between reserving capacity in the ICU for the most critical patients versus gaining additional capacity achieved by allocating nurses to the SDUs due to the lower staffing requirement. Despite the complex patient flow dynamics, we leverage a state-space collapse result in our diffusion analysis to establish the optimal allocation of nurses to units. We find that under some circumstances the optimal size of the SDU is zero, while in other cases, having a sizable SDU may be beneficial. The insights from our work will be useful for hospital managers determining how to allocate nurses to the hospital units, which subsequently determines the size of each unit.

*Joint work with Carri Chan and Bo Zhu

Bio:

Mor Armony is an associate professor of operations management at New York University Stern School of Business. Professor Armony teaches courses in operations management and in service operations. Her primary research areas of interest include management of patient flow in healthcare, optimization of customer experience in contact centers, and general stochastic modeling of various operations. Her articles have appeared in numerous publications, including Management Science, Operations Research, and Queueing Systems. Before joining NYU Stern, Professor Armony served as a consultant for Lucent Technologies and for AT&T. She also developed mathematical models for the prediction of financial indexes at Eventus, Israel. Professor Armony received her Bachelor of Science in mathematics and statistics and her Master of Science in statistics from the Hebrew University of Jerusalem. She also received a Master of Science and a Doctor of Philosophy in engineering-economic systems and operations research from Stanford University.