SEMINAR TITLE

“Healthcare Quality and Reliability Models”

SEMINAR SPEAKER

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ABSTRACT

Although the U.S. healthcare system is among the safest in the world, estimates of the national costs of poor quality and preventable errors are staggering – including 770,000 to 2 million injured patients, 8.7 million additional hospital days, 44,000 to 180,000 care-induced deaths, and $8.8 to $29 billion annually. Adverse events due to poor process reliability are the 8th leading cause of death in the U.S. – higher than traffic accidents, breast cancer, or AIDS. The enormity of these figures has culminated in calls for greater use of systems engineering and two large scale national initiatives having broad impact throughout the U.S. healthcare system – a nation-wide campaign to prevent at least 100,000 hospital-associated deaths and federal mandates to track compliance to a composite reliability statistic of minimum-care processes.

To analyze these data, we derive and characterize a weighted mixed-risk probability model for J non-homogeneous dichotomous events with unequal severity weights and apply this new probability distribution to risk-adjusted mortality, adverse events, and core measure bundles from over 3,000 participating hospitals. These random variables can be significantly non-normal and mathematically always are under-dispersed compared to their binomial approximation (with parameter \( p \) equal to a weighted average of the \( p_i \) rates). Corresponding risk-adjusted statistical control charts and sequential probability ratio tests therefore are developed based on the above and shown to significantly differ from those under i.i.d. or unweighted assumptions. Modified Kullback-Leibler, total absolute deviation, and variance ratio statistics are used to investigate the associated error on tail probabilities and expected run lengths. The seminar will close with an overview of related work in statistical surveillance, deadband adjustment, and reliability engineering in healthcare, and the current status and research directions of healthcare systems engineering more broadly.

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