Clearing Bottlenecks on the Road to Cardiac Intensive Care

The Problem
Cardiovascular disease is the leading cause of death in the US. Many cardiac patients require surgery. Finite capacity, variability and unpredictability limit our ability to meet all requests for transfer from outside hospitals into the Cardiovascular Center (CVC) of Michigan Medicine (MM).

The bottleneck in providing care is often not the OR, the surgeon, or the staff, but the cardiac ICU. By enabling policy makers to better understand how uncertainty impacts ICU utilization, we can improve access and patient care.

The Approach
We have developed a simulation tool that enables the evaluation of the system in both current state and under proposed future policies. This tool also provides a mechanism for educating policy makers about the impacts of uncertainty and variability on complex systems.

Test Policies to Increase Patients’ Access to High Quality Care

The Seth Bonder Foundation

Simulation: Understanding the Problem

Patient Arrives ➔ Open ICU Bed? ➔ Patient Denied

ICU

Ready for Transfer? ➔ Open Step-Down Bed?

NO

Step Down (SDn)

Patient Discharged

Data

Michart

Data Direct

SQL Database

Inputs

Fixed Inputs
• Bed Count
• Time Horizon
• Replications

Random Inputs
• Patient Type
• Arrival Rate
• Length of Stay

Patients
• # Arrival
• # Accepted
• # Denied

Metrics
• Length of Stay
• Bottleneck
• Bed Utilization

Current State

Future State

SIMULATION

Educate Clinical Partners About Uncertainty

Takeaways

Allows for analyses like:
• What is the impact of adding 4 new SDn beds?
• What happens if doctor moves time of scheduled surgery?
• How would 50% increase in elective surgery impact declines on transfer requests?

• The declined outside transfer and internal transfer bottleneck is not a function of dedicated SDn beds.
• Increase in internal transfer bottleneck suggests evaluation of the internal patient flow prior to arrival at the ICU.

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