Simulating a Medical Observation Unit for a Pediatric Emergency Department

Xuanya Zhang¹, Mark Grum M.S.E.¹, Gabriel Zayas-Caban, Ph.D.¹
Center for Healthcare Engineering and Patient Safety¹, University of Michigan

Problem Statement

Our research focuses on determining the necessity for and optimal size of an observation unit (OU) to help facilitate patient care and improve efficiency at a pediatric emergency department.

Solution Approach

We model the operation of the ED as a multi-stage stochastic network with data from 18000 patient visits:
• Assigned probable Emergency Severity Index (ESI) level and respective treatment time
• After treatment, patients can be (with fitted probability)
  – admitted to an IU,
  – admitted to an OU/stay on Observation protocol
  – sent home

Simulation model:
• Discrete-event simulation model
• Fitted the model (without OU) to the data collected
  – Validated with Patient arrival comparison (avg 468 pt/week vs. avg 437.6 pt/week)
• Performance Metrics: Time to treatment, Blocked Time by full OU, Utilization of ED & OU beds

Impact/Results

• With the result of different scenarios, we were able to determine the more desirable combination of ED bed and OU bed under 5x current arrival rate.
  – Clear reduction of the ED beds utilization/crowding
  – Sharp reduction of Time to Treatment for patients
  – Optimal 2 OU Beds sharply reduce Patient Blocked time

Future Research

• Optimal OU configurations: Physical layout & floor plan, the number of beds and staff required to achieve desirable operational performance
• Incorporate more data into the model: Staffing information and detailed service times by provider types (nurses, PAs, residents, and attending MDs)

Acknowledgements

• We would like to acknowledge the following organizations: The Center for Healthcare Engineering and Patient Safety, C.S. Mott Children’s Hospital, The Seth Bonder Foundation, The U of M Center for Research on Learning and Teaching (CRLT), and The TDC Foundation
• We would like to thank the following individuals: Valerie Washington, Hassan Abbas, Luis Guzman, Amy Cohn

Background

What is an Observation Unit?
• Dedicated area for patients in the ED that need an extended stay (>24 hours)
• Doctors use additional time to further evaluate, monitor and treat patients, resulting in more informed decision-making

Why is it important?
↑ quality of care           ↓ ED revisits
↓ readmission rates        ↓ lengths of stay
↓ health care costs

Potential benefits
• Higher likelihood of correct disposition decision (i.e. admit vs. discharge)
• Additional time to monitor the patient’s condition
• Reduce readmissions into the ED and inpatient unit (IU)
• reduce the delay to treatment for ED patients

Real data vs Simulation data (Pt Arrival)

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