



The Value of System Simulation in Healthcare Operations

Eduardo Pérez Ph.D

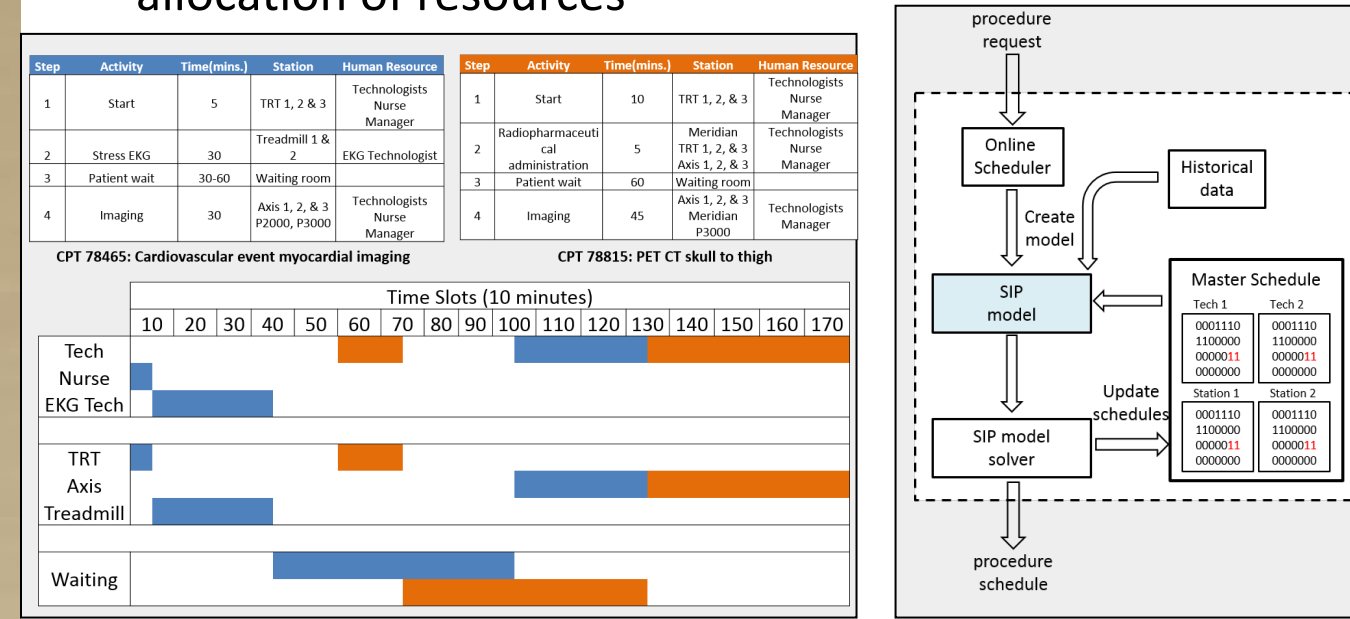
Associate Professor, Industrial Engineering
Ingram School of Engineering, College of Science and Engineering, Texas State University



Patient Service and Resource Management in Specialty Clinics

Goal: To develop **methodologies** and **technology-enabled** solutions to improve patient scheduling and resource management in nuclear medicine radiology clinics

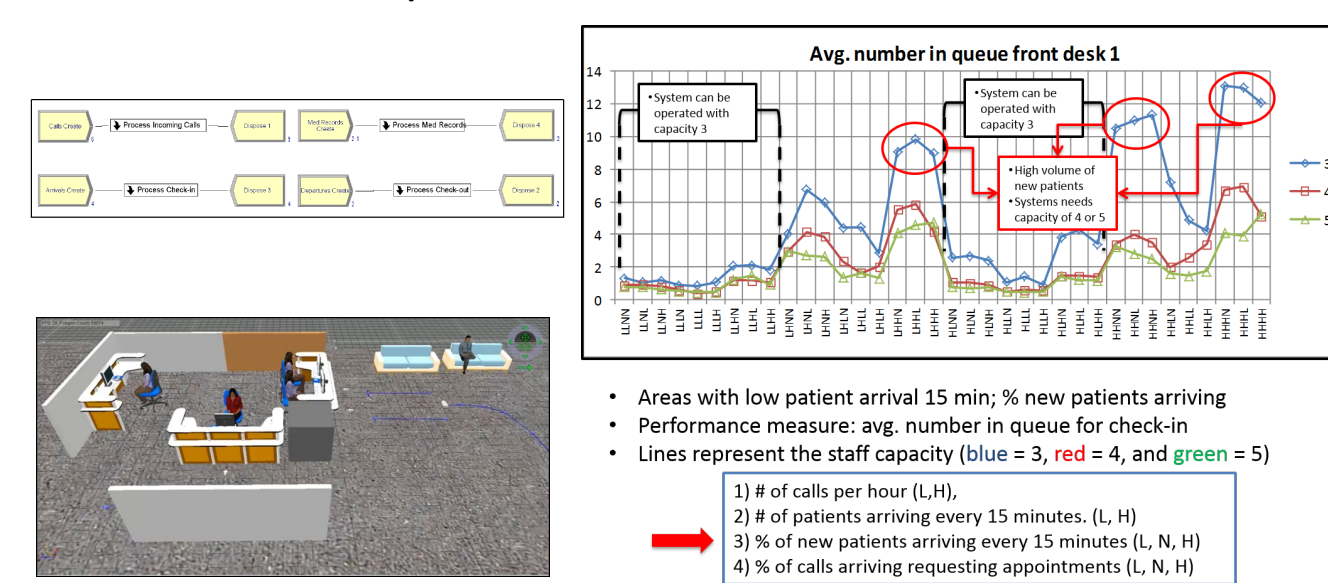
- Perform system assessment to diagnose system failure points.
- Improve practice patterns and utilization of key resources by developing optimal appointment scheduling techniques
- Promote adherence to protocols and coordination of patient hand-offs to improve outcomes and patient satisfaction
- Choose from a set of collaborative, proven physician-engagement strategies to reduce the total cost of care while aligning clinical delivery to outcomes and quality
- Minimize unnecessary clinical and system variation to align cost per case and determine the appropriate allocation of resources



Improving Patient Service in Multispecialty Outpatient Healthcare Clinics

Goal : To develop models to improve the patient **admission processes** occurring at a **multi-specialty** outpatient clinic front desk.

- A simulation model was developed to represent the clinic's front desk operations, which is novel.
- Our simulation model captures the complexities and interactions occurring at the front desk, which are difficult to capture using analytical techniques.
- The objective of the study is to improve the current operations at the front desk of the clinic to reduce **patient waiting times for service, patient waiting time for check-in and check-out, and reduce the number of phone calls unanswered** by the front desk staff members at the clinic.



Minimizing Healthcare-Associated Infections: A Simulation Study

Goal: The purpose of this simulation study is to understand the effects of various methods of managing **health care associated infections** (HAIs), specifically catheter associated urinary tract infections (CAUTIs), on the number of CAUTIs reported in an inpatient healthcare organization. The research objective is to derive **new models** to help hospitals minimize their total number of healthcare associated infections (HAIs) while maintaining excellent levels of patient service. This research will help to answer the following questions:

- Why have current prevention strategies been unsuccessful in eliminating CAUTIs?
- What are the main system factors conducive to the occurrence of CAUTIs?
- Which patient populations have the largest chance of suffering a CAUTI?
- What are the best methods for managing CAUTIs throughout the healthcare organization?

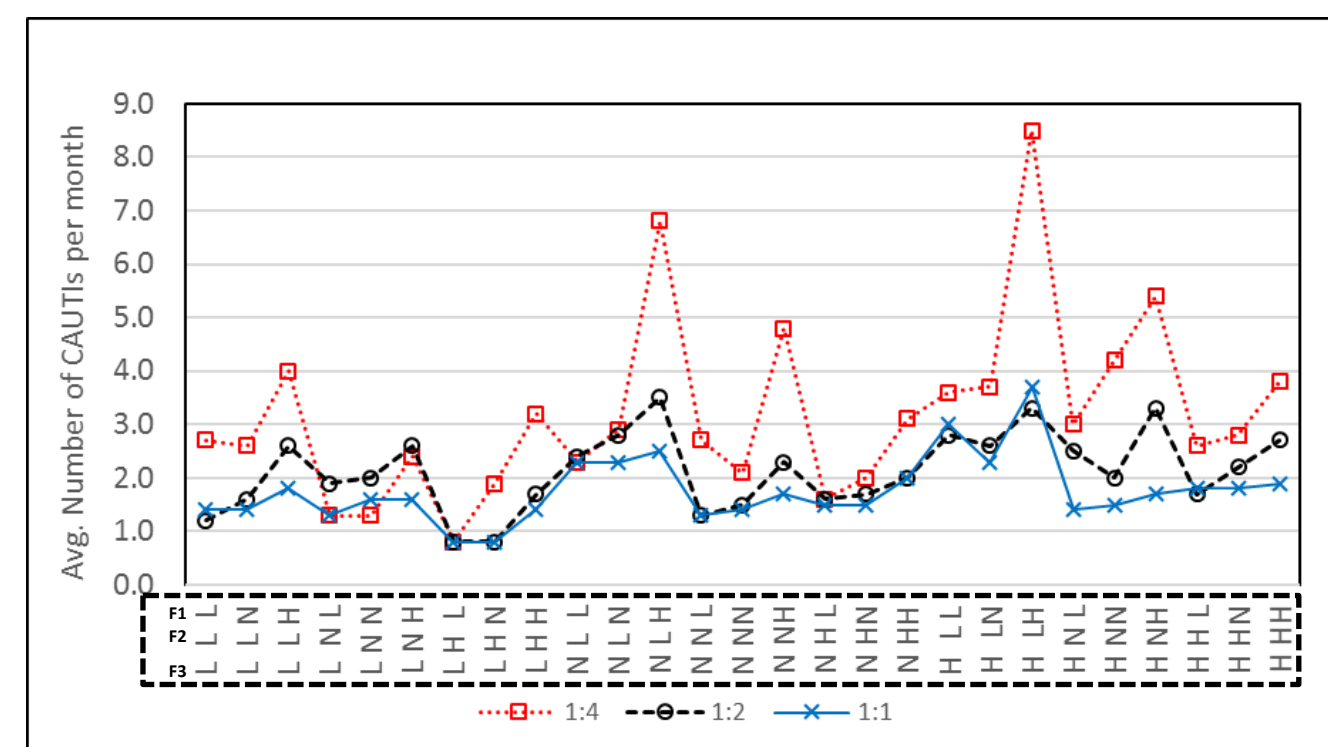
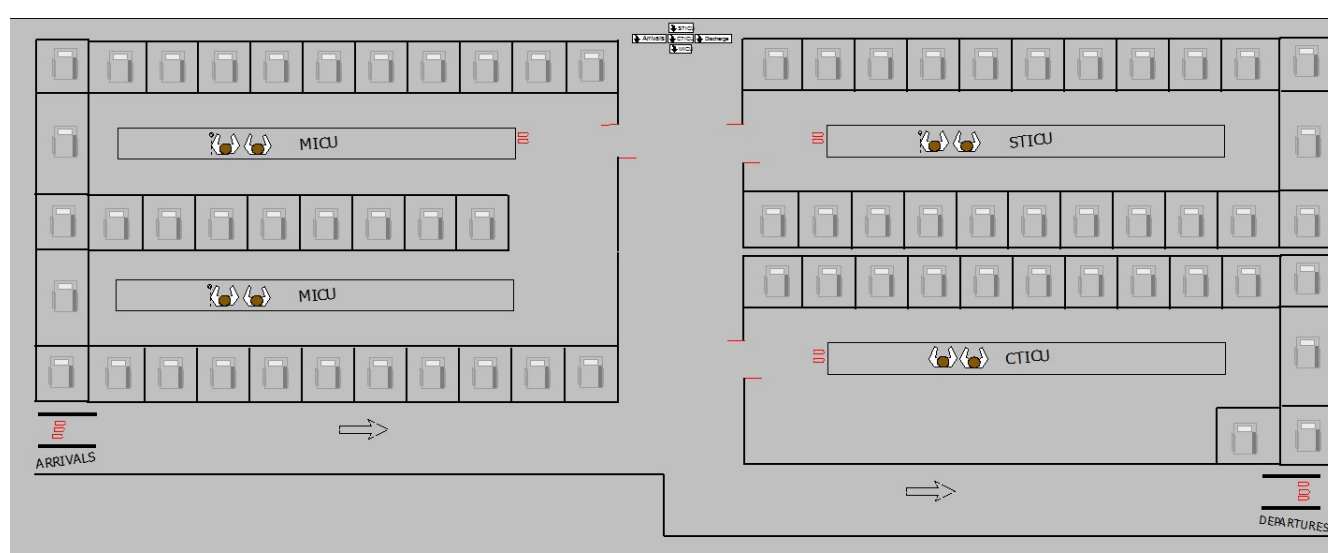
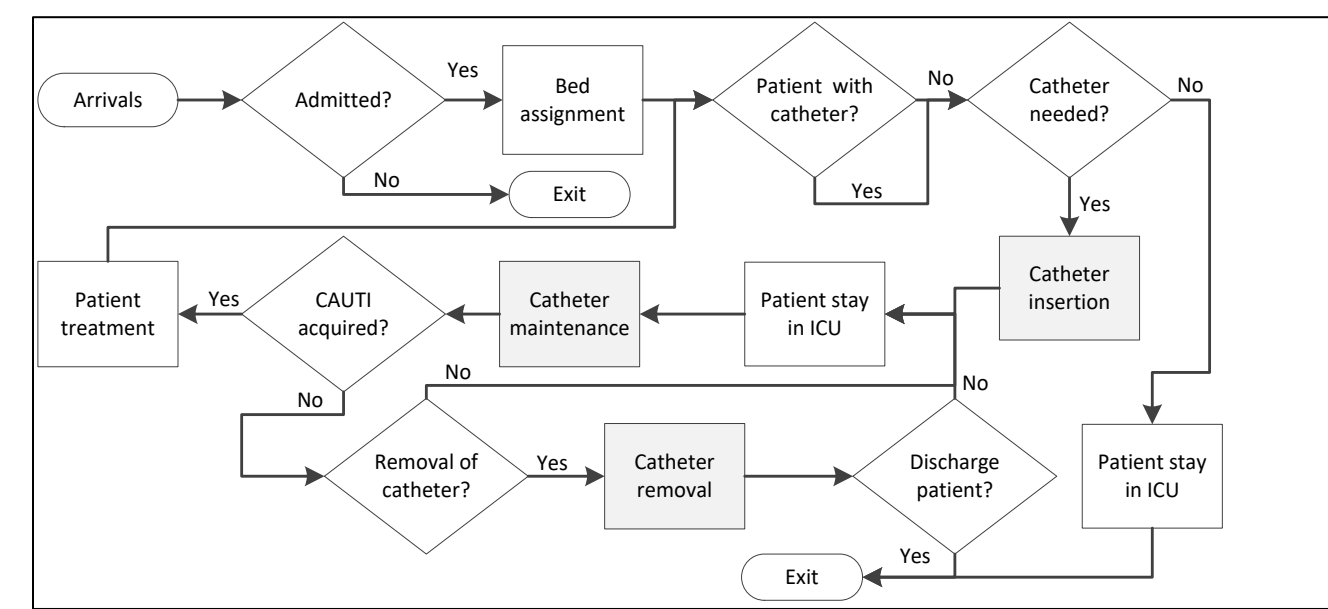
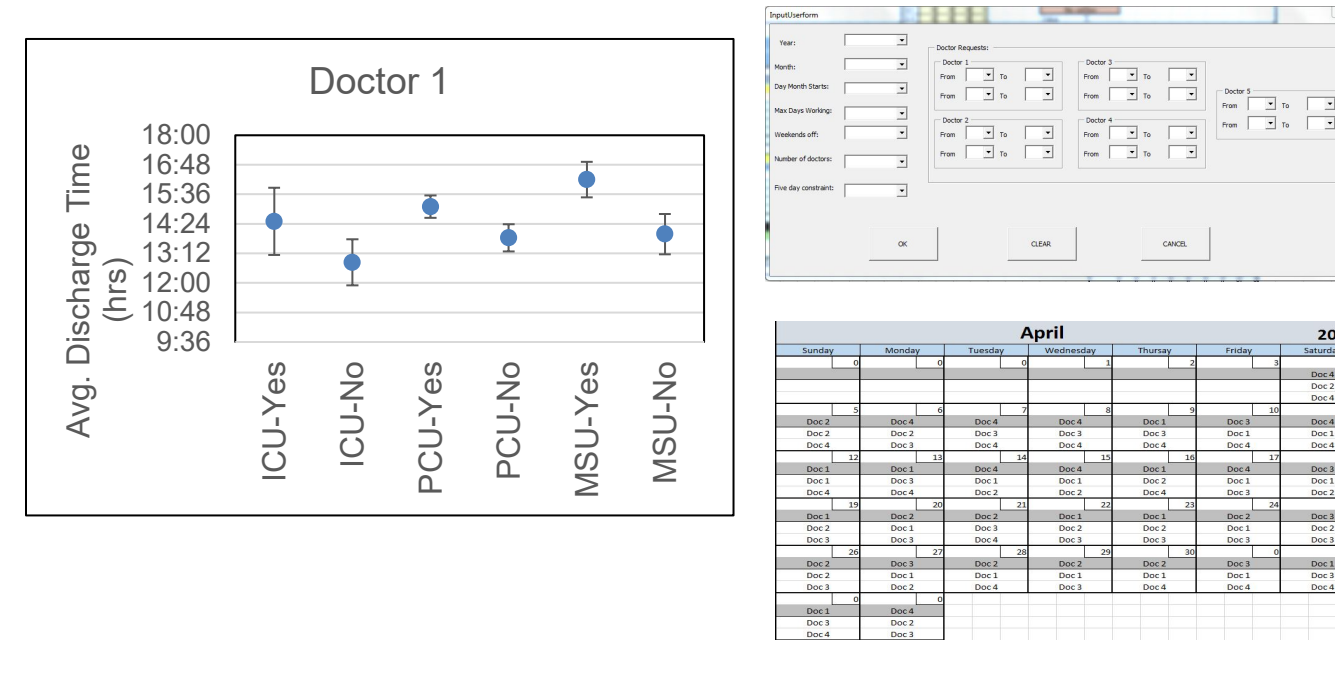
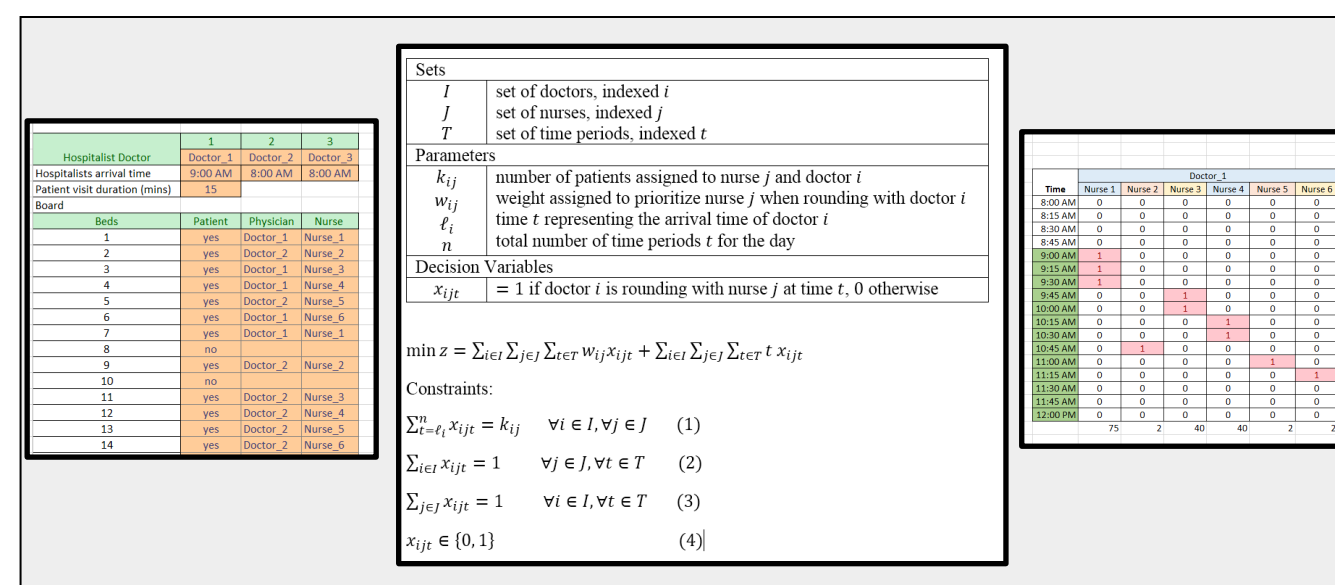
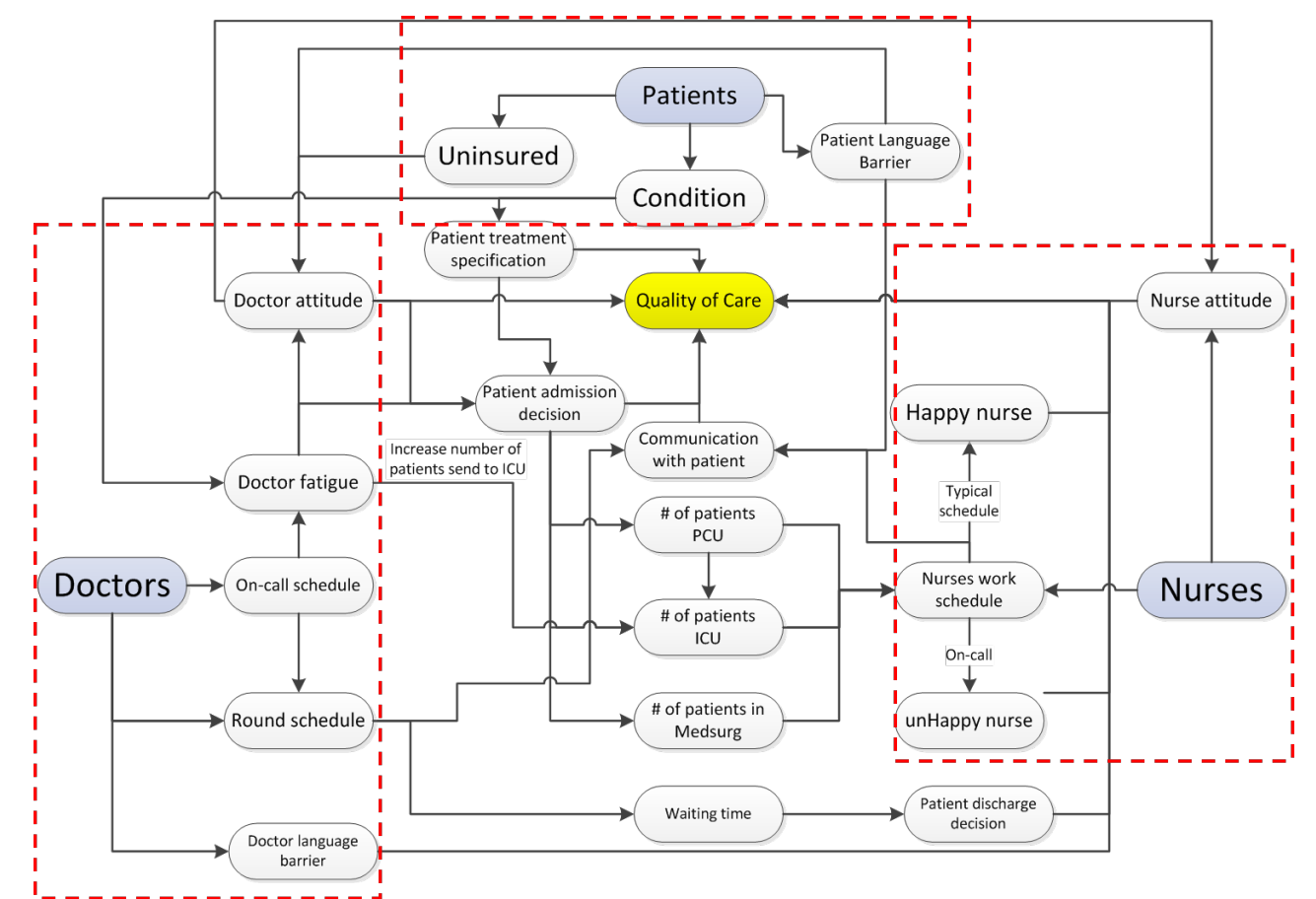


Figure Average number of CAUTIs per month for ICU 3 (F1: % avoidable catheter insertions (L/N/H), F2 catheter daily removal chance (L/N/H), and F3: late maintenance risk (L/N/H).

The Impact of System Factors on Patient Perceptions of Quality of Care

Goal: The purpose of this research is study the impact of the providers' **system factors** on the patient perceptions of **quality of care** which is currently assessed by the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores.

- As national policy efforts, such as VBP are implemented, understanding the **potential tradeoffs** between **patient satisfaction** and measures of efficiency of **hospital system factors** is important to achieve health equity.
- This research will identify systems factors that can prove to be significant in improving communication between providers and patients.
- Currently six out of the eight dimensions evaluated in the HCAHPS survey involve communication.
- The final goal is to create a health system that is easy to **access** and **navigate**; that is meeting patients' needs; and where patients and their families feel they are being heard, respected, and able to contribute to decisions related to their own care.



Recent Papers (students):

- Pérez, E., B. Uyan, D.P. Dzubay, and S.H. Fenton, "Catheter-Associated Urinary Tract Infections: Challenges and Opportunities for the Application of Systems Engineering" **Health Systems**, Vol.6, No.1, pp.68-76, 2017.
- Pérez, E., B. Uyan, R.E. Rohde, H. Wehbe-Janeke, A.K. Hochhalter, and S.H. Fenton, "Assessing Catheter Associated Urinary Tract Infections Prevention Intervention in Intensive Care Units: A Discrete Event Simulation Study" **IE Transactions on Healthcare Systems Engineering**, Vol.7, No.1, pp.43-52, 2017.
- Alvarado, M.M., T.G. Cotton, L. Ntamo, E. Pérez, "Modeling and Simulation of Oncology Clinic Operations in Discrete Event System Specifications" **SIMULATION**, Vol.94, No.2, pp.105-121, 2018
- Pérez, E., V. Anandhan, and C. Novoa "A Simulation Based Planning Methodology for Decreasing Patient Waiting Times in Pure Walk-in Clinics" **International Journal of Information Systems in the Service Sector (IJSSS)**, accepted.
- Pérez, E. "An Appointment Planning Algorithm for Multispecialty Outpatient Clinics", submitted.
- Dzubay, D. and E. Pérez "Scheduling Hospitalists Considering Patient Perceptions of Quality of Care" submitted.
- Dzubay, D.P. and E. Pérez, 2016, "The Impact of System Factors on Patient Perceptions of Quality of Care", **Proceedings of the 2016 Winter Simulation Conference**, Washington, DC, December 11-14.
- Reese, H., V. Anandhan, E. Pérez, and C. Novoa "Improving Patient Waiting Time at a Pure Walk-In Clinic", **Proceedings of the 2017 Winter Simulation Conference**, Las Vegas, NV, December 3-6.
- Pérez, E. "Integrating Mathematical Optimization in DEVS for Nuclear Medicine Patient and Resource Scheduling". **Proceedings of the 2017 Winter Simulation Conference**, Las Vegas, NV, December 3-6.

Acknowledgments



Robert Wood Johnson Foundation



Eduardo Pérez, Ph.D.
Associate Professor of Ingram School of Engineering, Texas State University
601 University Drive, San Marcos, TX 78666.
Office: IH 4001F
Phone: 512-245-4467
Fax: 512-245-7771
E-mail: eduardopr@txstate.edu