Objective

- **Overall**: Redesign interprofessional clinical learning environment to improve (1) care quality, (2) learning outcomes, and (3) provider well-being & satisfaction
- **Project Specific**: Analyze current state of graduate medical education (GME) in an internal medicine residency program from a systems engineering perspective

Partners

- MMC Internal Medicine residency program
- Healthcare Systems Engineering Institute (Boston, MA)
  - Expertise in design and analysis of complex systems of systems

Background & Motivation

- Healthcare has changed dramatically, but GME remains much the same
- Physicians and medical students suffer high rates of depression and burnout
  - Medical students: 27% depression prevalence, 11% suicidal ideation [1]
  - Over 54% physicians experience ≥1 burnout symptom in 2014 [2]
- Accreditation Council for Graduate Medical Education (ACGME) study
  - Significant variation in resident training across United States
- ACGME funded 8 academic medical centers to develop innovative, collaborative solutions and approaches that can be spread nationally
- MMC funded to develop and implement the iPACE patient unit
  - Interprofessional Partnership to Advance Care and Education

Interviews & Observations

- Conducted 27 semi-structured 1-on-1 and group interviews
- Shadowed care team members (residents, nurse, care manager)

Cross Functional Process Flow Maps & Time Studies

- Understand stakeholder workflows and identify potential bottlenecks and delays
- Analyze how residents spend time and variation between residents and days
- Study actual work patterns (“work-as-done”) vs. process plans (“work-as-imagined”)

Methods & Results

Macro-Ergonomic Work Context

- Education barriers: Lack of time for reflective learning, fatigue due to duty hours and heavy workloads, and variable training
- Patient safety barriers: Lack of interdisciplinary communication/teamwork

Failure Analysis

- Identified 18 failure modes, with 21 effects and 43 causes
- Team identified more care-related failures (13) than learning-related failures (5) and rated them with much higher severity
- Poor communication between medical professions and with patients is most common severe failure

<table>
<thead>
<tr>
<th>Failure Mode</th>
<th>Effect</th>
<th>Likelihood</th>
<th>Severity</th>
<th>Consequence of Failure</th>
</tr>
</thead>
</table>
| Communication failure | None | 10 | None | 13 10 | Communication
| Preparatory failure | Rare | 10 | None | 9 10 | Communication
| Pre-Procedure failure | Rare | 10 | None | 13 10 | Communication

Functional Interdependencies

- Providing patient care is the most interconnected function
- Communication is critical in achieving learning outcomes and accomplishing daily activities

Overall Findings

- Identified barriers and challenges in interprofessional education:
  - Work burden and strains on time
  - Interruptions and fragmentation in work flows
  - Lack of communication between disciplines
  - Scheduling and logistical barriers

Current Work

- Evaluate resident workflows in newly-established iPACE unit
- Analyze frequency and sources of interruptions in iPACE vs. other patient care units
- Investigate how informal learning occurs on units by observing and recording teachable moments
- Study nurse workflows, failures, and interruptions

Future Work

- Spread learnings and best practices to other departments and hospitals
- Evaluate impact of improved interprofessional learning on patient outcomes and costs
- Another thing???