Improving Resident Rotation Scheduling to Maximize Training Opportunities

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Motivating Societal Challenge

Cardiovascular Surgery

Shortage of Cardiothoracic Surgeons Is Likely by 2020

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Background—Even as the burden of cardiovascular disease in the United States is increasing as the population grows and ages, the number of active cardiothoracic surgeons has fallen for the first time in 20 years. Meanwhile, the treatment of patients with coronary artery disease continues to evolve amid uncertain changes in technology. This study evaluates current and future requirements for cardiothoracic surgeons in light of decreasing rates of coronary artery bypass grafting procedures.

Methods and Results—Projections of supply and demand for cardiothoracic surgeons are based on analysis of population, physician office, hospital, and physician data sets to estimate current patterns of healthcare use and delivery. Using a simulation model, we project the future supply of cardiothoracic surgeons under alternative assumptions about the number of new fellows trained each year. Future demand is modeled, taking into account patient demographics, under current and alternative use rates that include the elimination of open revascularization. By 2025, the demand for cardiothoracic surgeons could increase by 46% on the basis of population growth and aging if current healthcare use and service delivery patterns continue. Even with complete elimination of coronary artery bypass grafting, there is a projected shortfall of cardiothoracic surgeons because the active supply is projected to decrease 21% over the same time period as a result of retirement and declining entrants.

Conclusion—The United States is facing a shortage of cardiothoracic surgeons within the next 10 years, which could diminish quality of care if non–board-certified physicians expand their role in cardiothoracic surgery or if patients must delay appropriate care because of a shortage of well-trained surgeons. (*Circulation*. 2009;120:488-494.)

Key Words: economics ■ surgery ■ technology ■ workforce

Motivating Societal Challenge

- 3 of 10 deaths due to cardiovascular or COPD in the United States
- Medicare population expected to double by 2030
- Aging cardiothoracic (CT) surgeons
  - Mean age: 55 years old
  - 65% (lung) and 70% (heart) are 51+ years old
- Decreasing number of CT surgeons nationally
  - 2004-08: 26% decline in CT fellows
  - 2010: fewer applicants than positions (93/116)

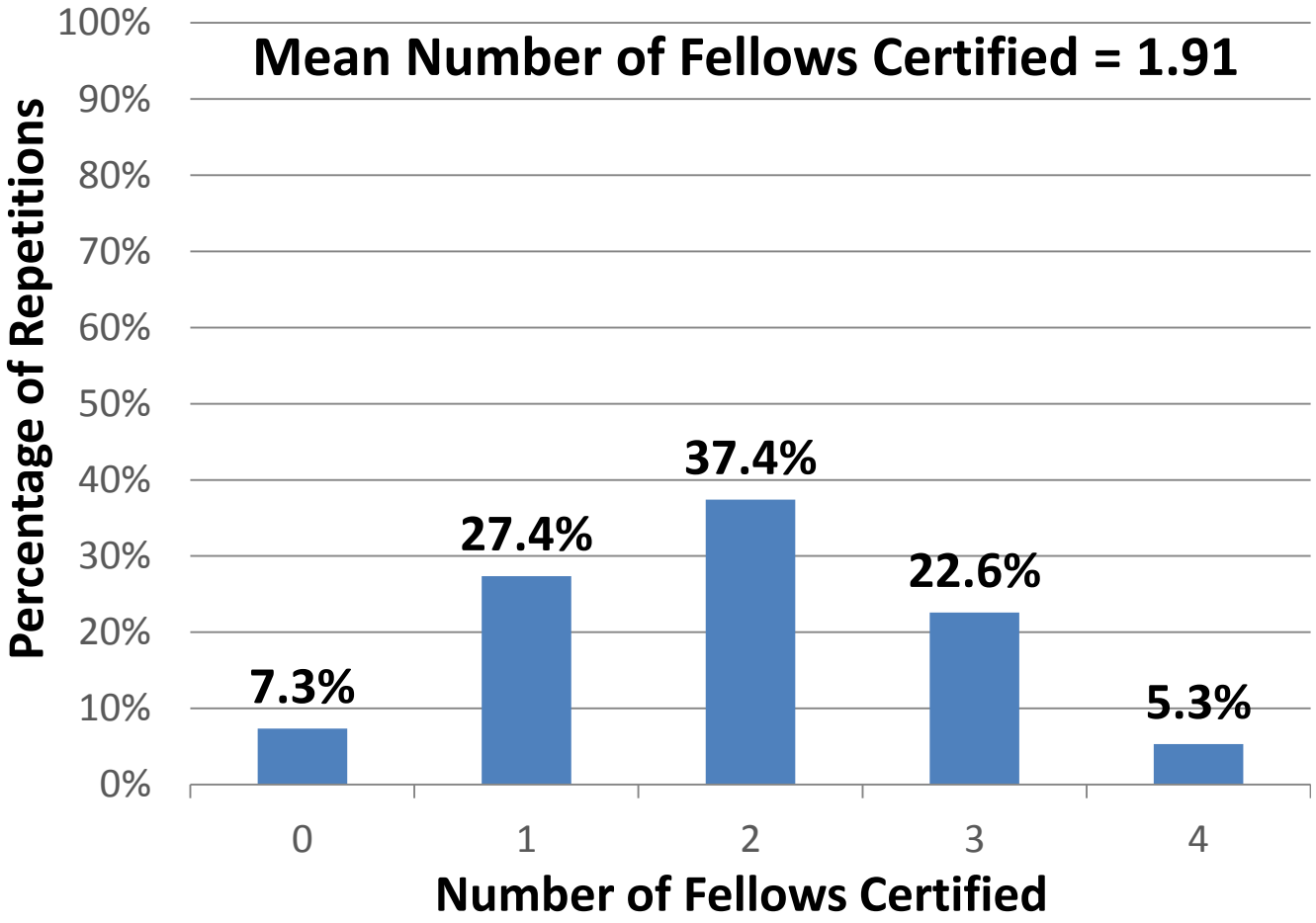
4 x 10 does NOT always equal 40!

- Our original project started with this seeming contradiction
  - An average of 40 transplants per year at UMHS
  - 4 residents alternating call in rotation
  - 10 transplants required for certification
  - Most residents were struggling to get adequate training

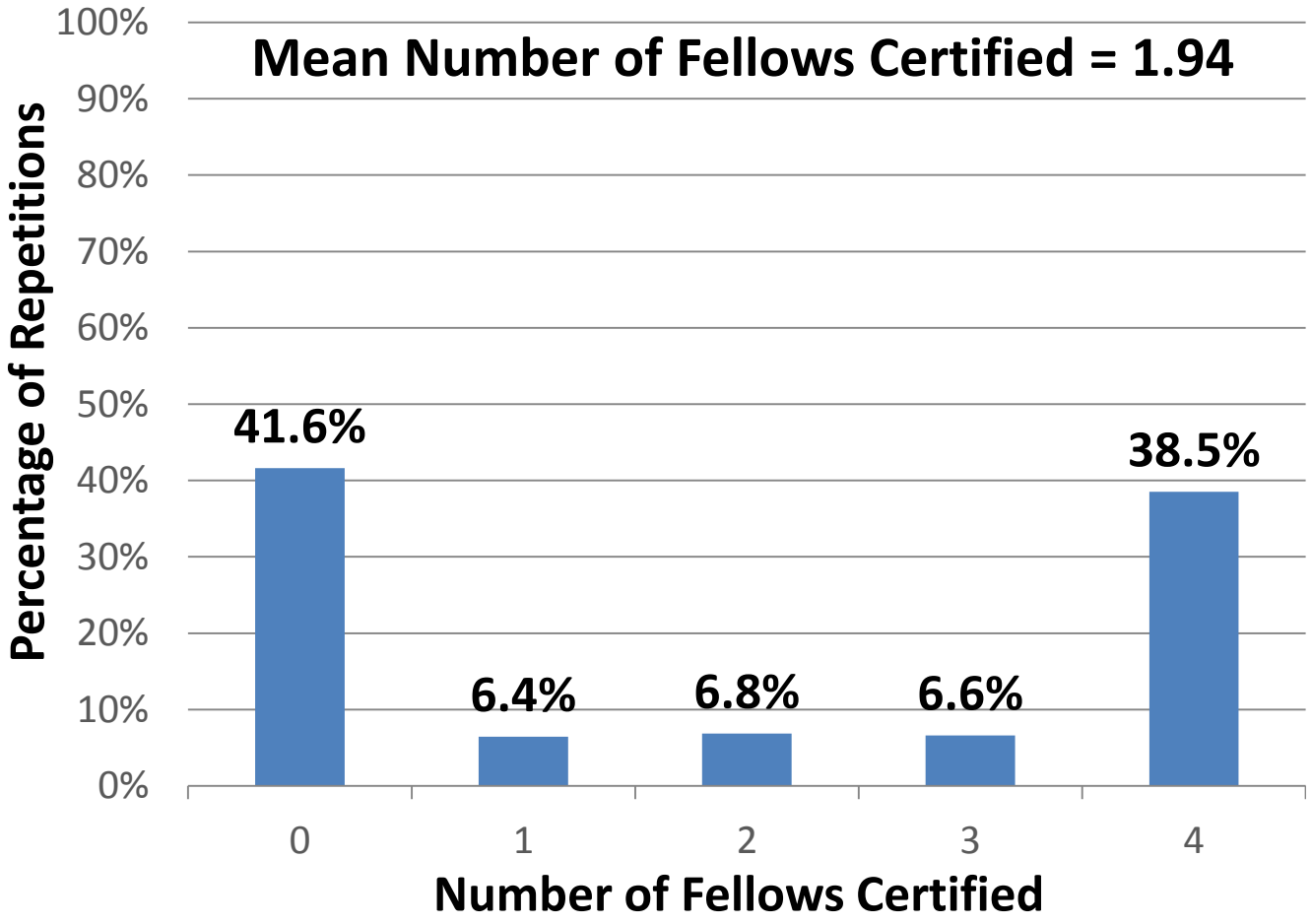
What we did about it

- Built a computerized tool to educate clinicians about randomness and impact on scheduling
- Developing new scheduling paradigms to improve training – more efficient and more effective

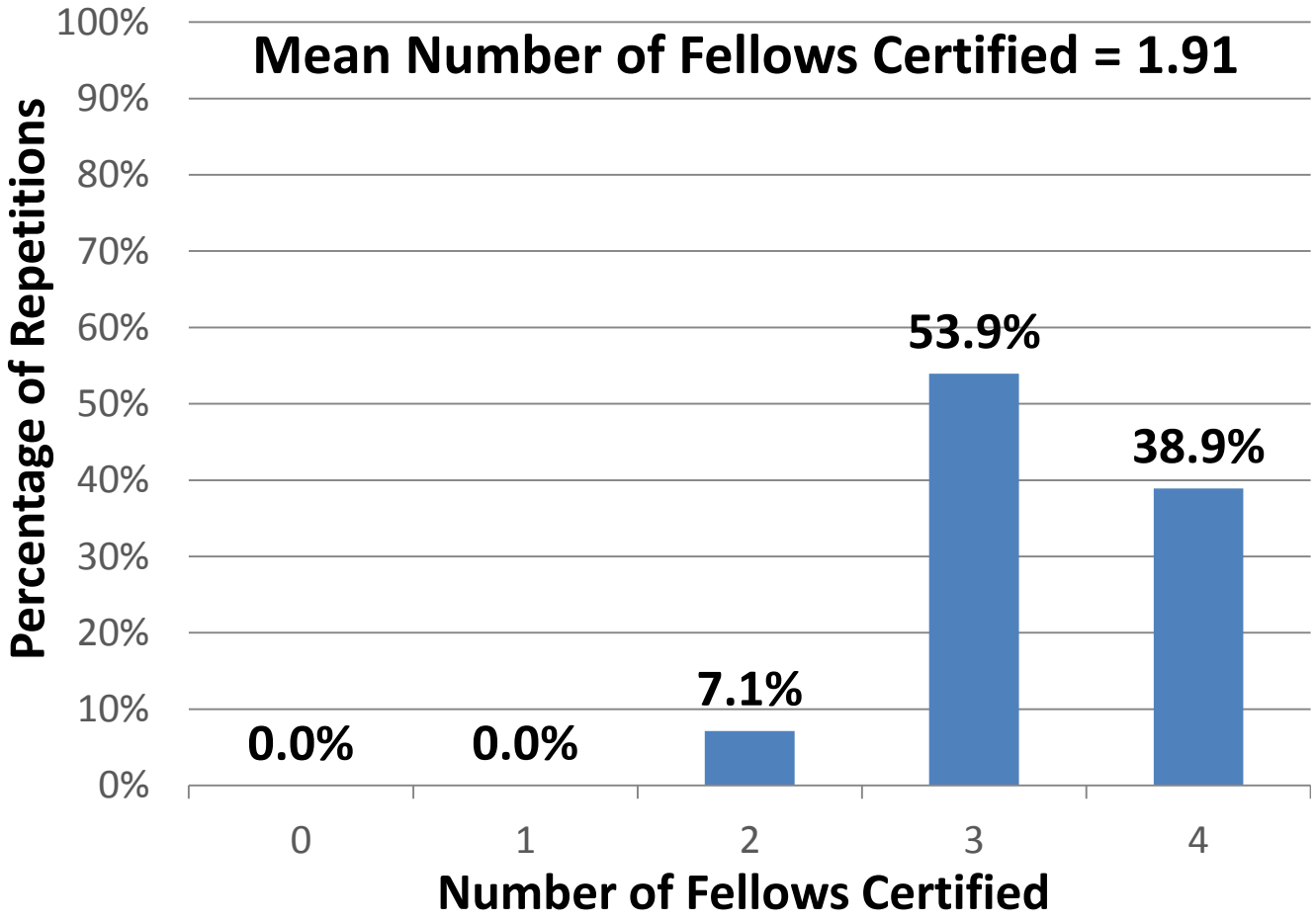
Current State



On Call Until Procedure



On Call Until Certified



Core Question

How can we re-design residency programs to provide more efficient training, higher quality of patient care, and greater appeal to future potential surgeons?

Determining Current Solutions

- Predominant models of problem solving
  - How is scheduling done currently?
  - What data is needed to create schedule?
  - Who is involved?
- Factors that guide the process
  - Goals
  - Constraints
  - Rules
  - Wishes

Survey of U of M Programs

Program Directors & Coordinators:

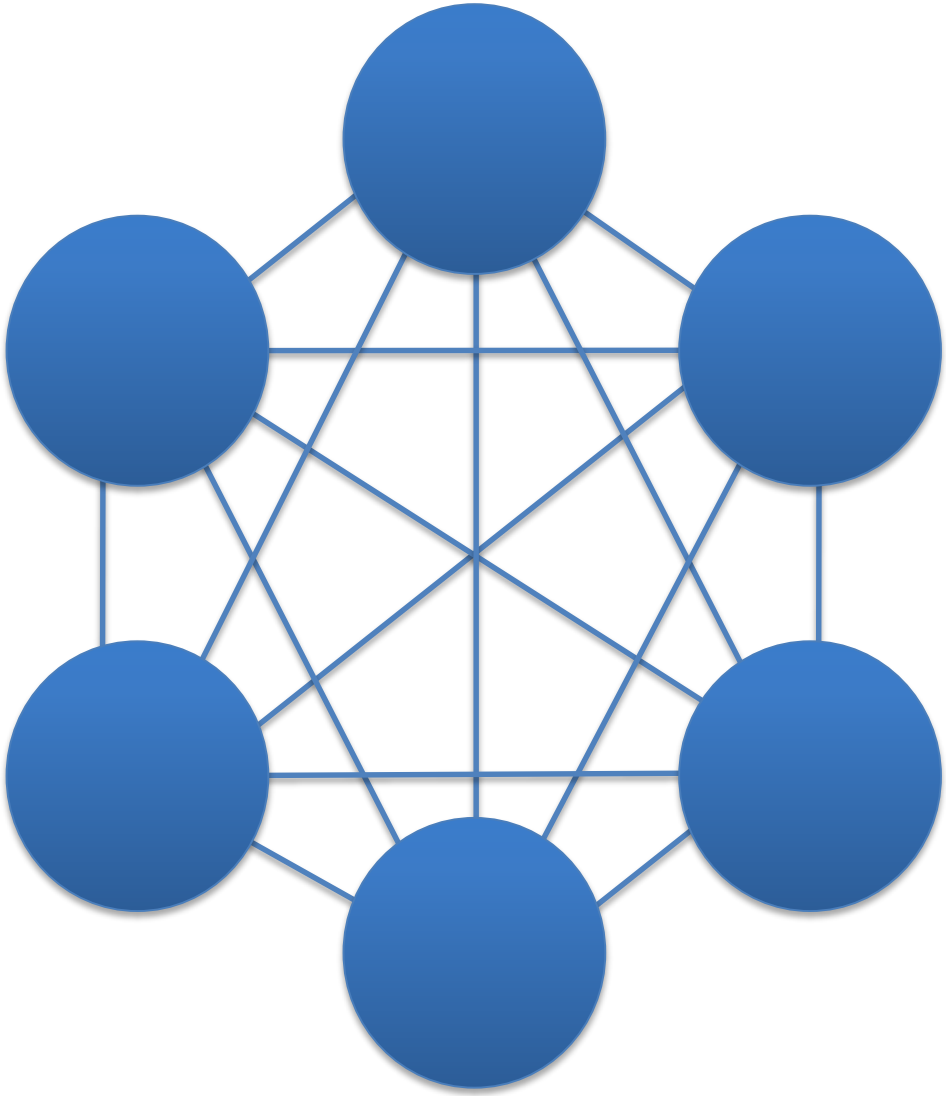
- General surgery
- Cardiothoracic surgery
- Vascular surgery
- Neurosurgery
- Otolaryngology
- Ob/Gyn
- Pediatric surgery

Chief Residents & Residents:

- Orthopedic surgery
- Plastics
- Urology
- Vascular surgery

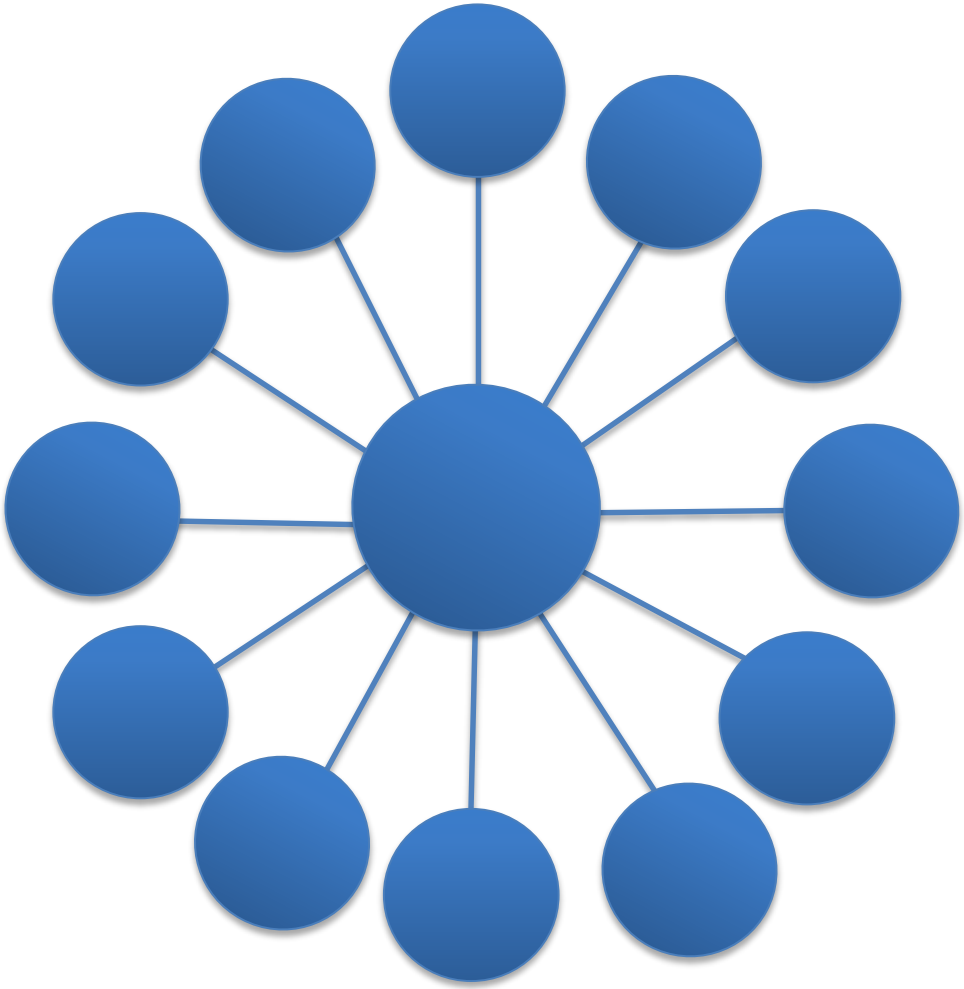
Model 1: Interactive

- Synchronous
- Multi-party
  - Resident representatives
  - Program directors
  - Other program reps
- Multi-constraint



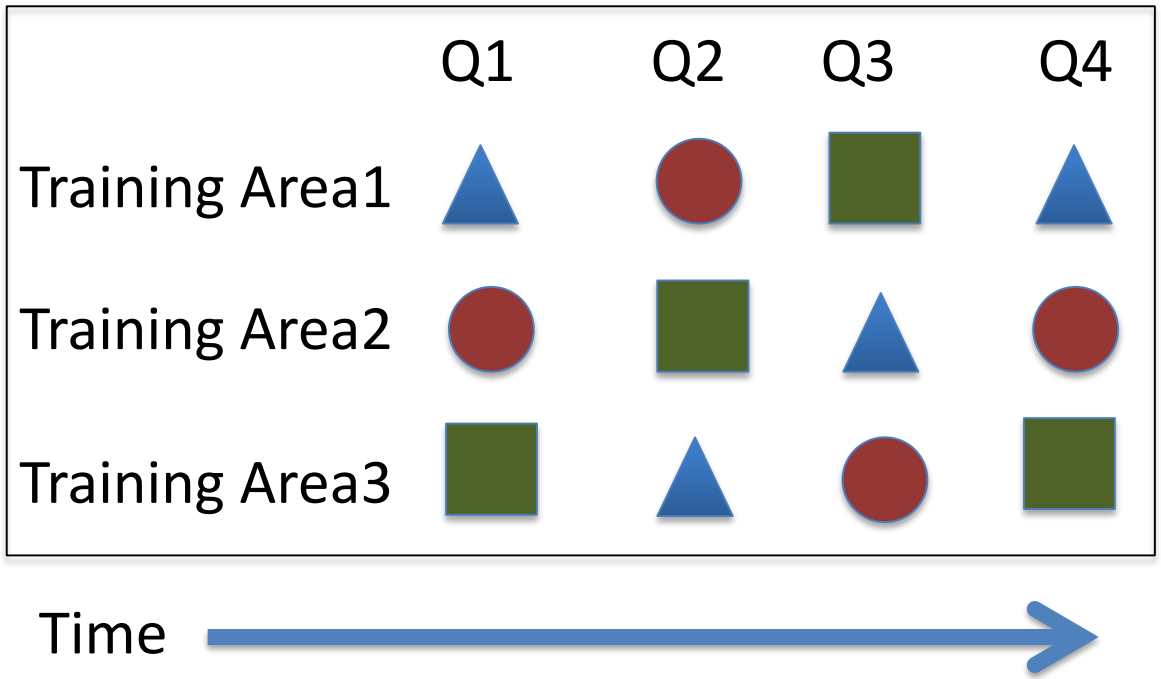
Model 2: Central Coordination

- Asynchronous, iterative
- Centralized
- Multi-party
  - Program coordinator
  - Other program representatives
- Multi-constraint



Model 3: Simple Template

- Limited options
- Limited participants
- Variations:
  - Central assignment
  - "Random"
  - Draft process



Considerations

System perceived as equitable

Types of goals, constraints, rules, & wishes

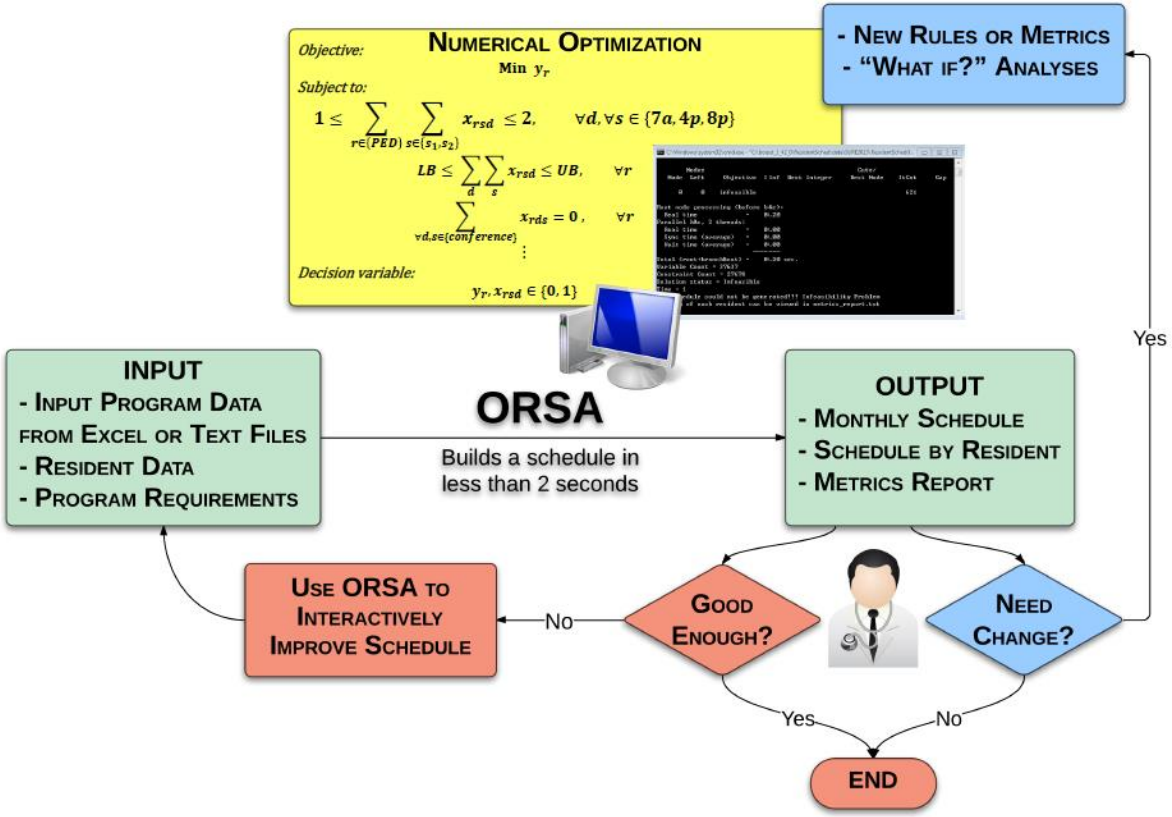
- Explicit
  - Balance of expertise (by PGY, or individual quality)
- Hidden
  - Seasonal variations (by expected specialty, or by interest) (e.g. pediatrics in summer has higher volume)
- Wish list
  - Load balancing (schedule easy blocks between hard blocks; vacation plans with flexible services)

Potential Engineering Interventions

- Optimization algorithm for determining and assigning block schedules
- Analytics and metrics for tracking resident progression toward goals
- Visualization techniques for individualized tracking

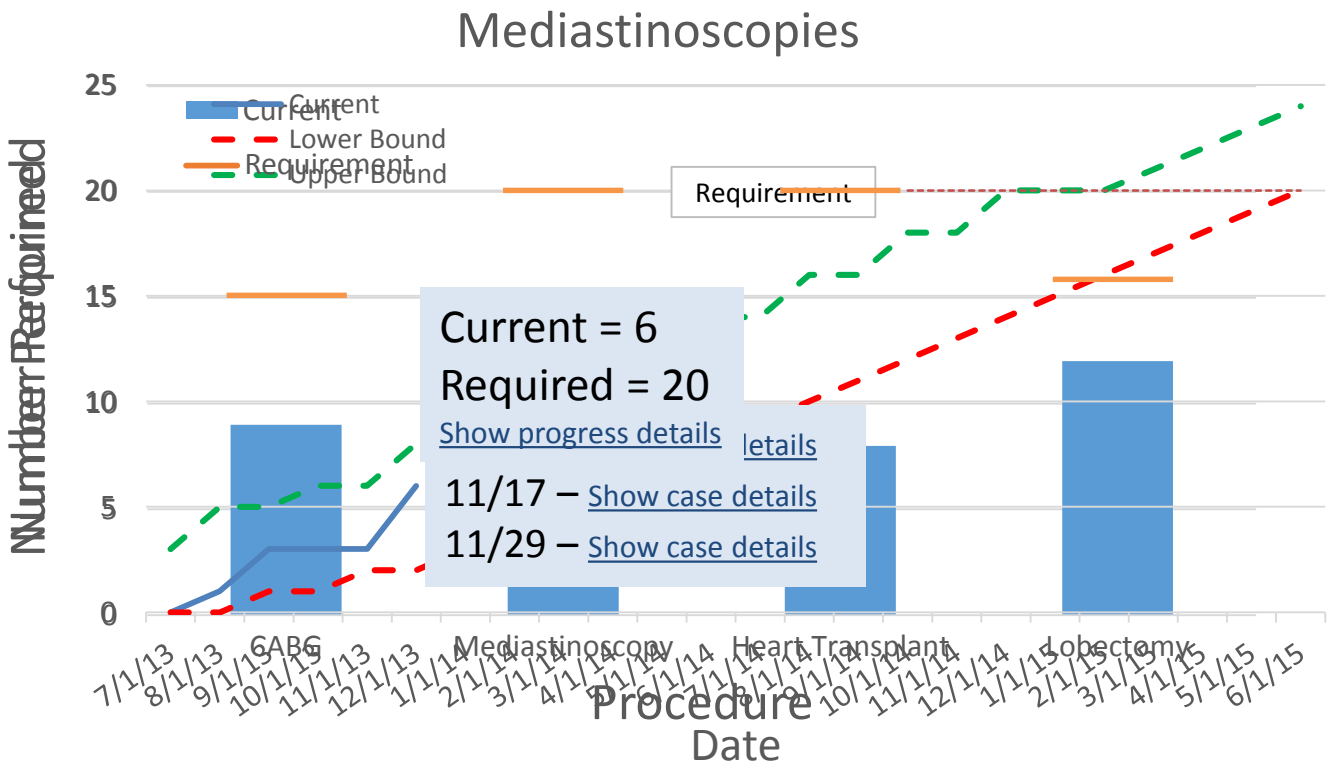
Potential Engineering Solutions

Construct block schedules using optimization and interactive revision



Potential Engineering Solutions

Use visual analytics for individualized tracking



Additional Goals

- Coodinate input from multiple, linked departments
- Prioritize needs of residents across years and departments
- Facilitate shared knowledge of progress amongst residents, faculty, and departments

Questions [?] / Comments [!]

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