

# Challenges in Training Cardio Thoracic Transplant Surgeons

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# Key Question

- How can we prepare a well-trained, sufficiently large pool of cardio thoracic transplant surgeons while maintaining compliance with ACGME work rules and satisfying UNOS certification requirements?



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# Background

- Cardio thoracic surgeons perform several thousand heart and lung transplants annually in the U.S.
  - 2300+ hearts in 2011, 1800 lungs
- These numbers are increasing annually
- More than 50% of practicing cardio thoracic surgeons are age 55 or older
- 70 CT training programs (not all do transplants)
- 70-80 graduates per year
- Shortage predicted by 2020



# Training Process

- 4 years of medical school
- 5 years of residency in general surgery
- 2 – 3 years of CT fellowship
- Optional fellowship afterwards
- CT training averages to 9.3 years of training post-med school
- Average age of completion is 39



# Life of a CT Resident/Fellow

- Weekdays, 6am to 6pm surgery, clinic, etc.
- Primary calls
- Backup calls
- Weekend calls
- Where do transplants fit in?



# Sources of Conflict

- ACGME restricts work hours
- UNOS dictates training requirements
- Transplants are lengthy processes
- Opportunities arrive stochastically and with little advance warning



# Scope of Our Project

- Model the dynamics of this process
  - Integration of scheduled activities (shifts) and unscheduled activities (transplants)
- Analyze the capacity of the system to certify transplant surgeons
- Identify alternative scheduling paradigms to increase this capacity
- Provide tools for policy makers to better understand the impact of policy changes



# First Phase of Analysis

- Emphasis on ACGME compliance:
  - IF transplants arrive according to a random (exponential) distribution
  - IF fellows are assigned according to the call schedule
    - Will they be ACGME-compliant?
    - Will they be UNOS-certified?



# Results of First Phase of Analysis

- Short answer:
  - NOT compliant with ACGME rules in many cases
  - NOT able to achieve UNOS certification in many cases
- Which begs the question...
  - Even without ACGME restrictions, can UNOS certification be achieved?



# Motivation for Computer Simulation

- Cardio thoracic surgeons don't always think about probability the way engineers do
- Policy makers limiting work hours don't always think about probability the way engineers do
- Policy makers setting training certification levels don't always think about probability the way engineers do



# Motivation for Computer Simulation

- Motivating question:
  - If you have, on average, 40 transplants per year...
  - If you have four residents...
  - If each resident is on call every fourth night...
  - What is the probability that each resident gets 10 transplants over the course of the year?



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  - What is the probability that each resident gets 10 transplants over the course of the year?
  - Hint: It's not 1!



# Description of Computer Simulation

- A way to demonstrate these probabilistic issues to people not used to thinking about probability
- A way to analyze policy questions
- A way to evaluate alternative scheduling paradigms



# Demo of Computer Simulation

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