

Challenges in Training Cardio Thoracic Transplant Surgeons

Amy Cohn, Ryan Chen, Mark Daskin
Rishindra Reddy, Andrea Obi, Jennifer Chung
University of Michigan

INFORMS October 2012, Phoenix AZ



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?



Acknowledgements

- Ryan Chen
- Mark Daskin
- Rishi Reddy, Andrea Obi, Jennifer Chung
- Wandi Lin, Siyuan Sun
- SURE summer team



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?



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?
 - 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

