Scheduling Surgical Fellows to Achieve Adequate Training on Procedures with Random Occurrences: An Evaluation

William Pozehl BSE1, Amy Cohn PhD1, Rishi Reddy MD2, Jake Seagull PhD3, Mark Daskin PhD1, Ryan Chen1
1. Department of Industrial and Operations Engineering, 2. Department of Surgery, 3. Department of Medical Education

Introduction
Heart and lung disease are the 1st and 3rd leading causes of death in America. These diseases especially afflict the elderly, a population expected to double by 2030. Heart or lung transplantation may be necessary for end-stage patients. However, a majority of the trained cardiothoracic (CT) surgeons that perform these transplants are nearing retirement. Furthermore, we trained 26% fewer new CT surgeons nationally from 2004 to 2008. A 2010 report comparing supply of and demand for CT surgeons projected a shortage of these physicians by 2020. Efficacious training of new CT transplant surgeons is imperative to combat these challenges. We seek to evaluate the performance of such a training program in this regard.

Graduate Medical Education
Becoming a CT surgeon requires many years of training. Medical school graduates that want to become CT surgeons must first complete a General Surgery residency followed by a Thoracic Surgery fellowship. Having completing these programs, certified CT surgeons may practice independently. This career trajectory is shown below.

Methods
We assessed the performance of the Fellowship in Thoracic Surgery at the University of Michigan Health System (UMHS) with respect to adequately training its fellows for heart and lung transplantation by:

- Analyzing transplant historical data (Jan. ‘09 – May ‘11)
- Simulating transplant arrivals
- Matching transplants to the on call fellow
- Generating graphical reports

We developed a simulator tool to perform steps 2 – 4 rapidly under various input parameters.

Results
Sample single- and multiple-repetition simulation outputs are shown in Figures 3 and 4, respectively.

Conclusions
The simulator tool may be used to evaluate program performance. In the specific case of training fellows for cardiothoracic transplants, the UMHS should expect to certify all its fellows only about 5% of the time under current conditions. On average, the program is expected to certify fewer than half of the fellows in a given year. These results imply potential system changes, including:

1. Program size reduction
2. Case volume expansion
3. Cal schedule alternatives
4. Certification policy changes

The simulator may be used to evaluate the effects of the first two potential changes by changing input parameters appropriately. The simulator also has the capability to test some theoretical alternative call schedules, including staying on call until receiving a single transplant opportunity or until receiving the number necessary for certification. Though the simulator is designed for assessing certification with respect to transplants, it may also be applied to other operations with random arrivals but fixed physician schedules.

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References