Incorporating Individualized Learning Styles in Surgical Training to Enhance Competency

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CHEPS

INNOVATING HEALTHCARE DELIVERY

FOSTERING LEARNING

BUILDING COMMUNITY

POSITIVE IMPACT THROUGH...
Research
Education
Implementation
Outreach
Dissemination
THE PATH TO BECOME A SURGEON

Bachelor’s Degree → Medical School → Residency → Fellowship to Specialize (optional)
THE SURGICAL RESIDENCY PROGRAM

Learning opportunities depend on monthly variations in training experiences
ACGME MINIMUM CASE REQUIREMENTS

• In order to achieve certification, trainees must achieve minimum case requirements determined by the Accreditation Council for Graduate Medical Education (ACGME)

• Trainees are assumed to be competent in a procedure if they have met the minimum case requirements
INACCURATE GENERALIZATIONS

• Having minimum case requirements that apply to every trainee:
  • Assumes every trainee achieves competency after the same number of cases for a given procedure
  • Assumes each time period (a month on a given service) provides the same number of cases for a given procedure
  • Assumes competency is binary (i.e. a trainee is considered to be competent or not competent based on if they have achieved the minimum case requirement)

• Studies show that not all trainees are competent at the end of their residency program
INTRODUCING AND APPLICATIONS OF OUR MODEL

• Discrete event simulation can allow us to both assess the impact of variability and to analyze different policies.

• For example, analyze how varying the length of time on service can impact the likelihood of achieving minimum case requirement.

• Our model can also show inadequacies present in the current surgical training model by simulating a residency program and incorporating variabilities.
RANDOM PROCEDURE OPPORTUNITY

• Currently, the minimum case requirements assume that each trainee will have equal opportunities to cases for a given procedure

• Our model allows us simulate procedure opportunity as a distribution chosen by the user
CONTINUOUS LEARNING CURVES

• Currently, it is assumed that a trainee is competent in a procedure if they achieve the minimum case requirement

• In our model, we treat competency as a continuous function where it follows a logistic function

• The learning curve parameter is defined as the number of cases a trainee needs to achieve 90% competency
RANDOM LEARNING CURVES

• Currently, the minimum case requirement assumes that all trainees will learn at the same rate

• Our model allows for variability in learning speeds by allowing the user to have the learning curve parameter be drawn from a random distribution
Randomly generate a trainee’s learning curve

Randomly generate the number of procedures

Insert in learning curve

Generate competency level

Many replications

Distributions of outcomes
WHAT HAPPENS WHEN YOU PUT IT ALL TOGETHER?

• Consider the following scenario:
  • ACGME minimum case requirement for a given procedure is 40
  • The residency program is 5 years long, with 7 trainees per year
  • Therefore, if every trainee learned at the same rate and was exposed to the same number of procedures, we would hypothetically need 280 cases per year for everyone to hit the threshold of 40

• What happens if we vary the learning rates?
• What happens if we vary the arrival rates?
WHAT HAPPENS WHEN YOU PUT IT ALL TOGETHER?

Cumulative Percentage of Trainees in Each Competency Bucket for Varying Distributions of Learning Curve Parameters

Standard Deviations in Learning Curve Parameters: 0, 5, 10
WHAT HAPPENS WHEN YOU PUT IT ALL TOGETHER?

Cumulative Percentage of Trainees in Each Competency Bucket for Varying Arrival Rates with Random Learning Curves

Average Annual Arrival Rates: 280, 300, 320, 340, 360, 380
FUTURE DIRECTIONS

• Expand our model to incorporate multiple services, multiple procedures, skill transfer, skill decay
• Collect data to make our simulations more accurate (such as procedure variability, learning curve variability)
• Create a time-based model that allows for further investigation of the effects of different policies
ACKNOWLEDGEMENTS

Thank you to Amanda Naccarato, Che-Yi Liao, Samir Agarwala, and all previous CHEPS students who have contributed to this work. Thank you to Angela Thelan, M.D.