

# Scheduling Fellows for Cardiothoracic Transplant Surgery

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### Problem Statement



Cardiothoracic organ transplantation may be necessary for patients faced with end-stage heart or lung disease. These complicated operations are performed by cardiothoracic (CT) surgeons.

1. Majority of CT surgeon population nearing retirement
2. Increasingly complex program requirements for new CT surgeons
3. Medicare population expected to double by 2030

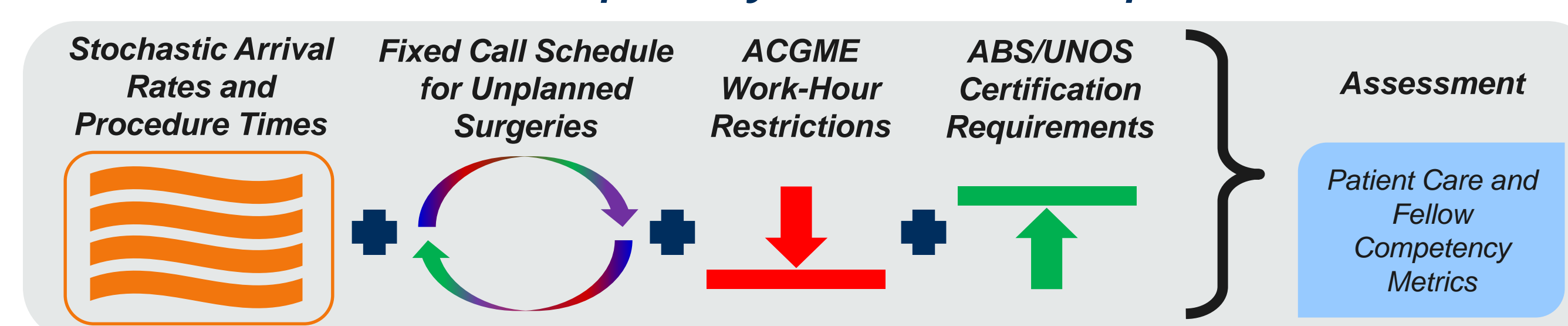


Efficacious training of new CT surgeons is imperative to combat these challenges and minimize the expected shortage. We investigate the University of Michigan Health System (UMHS) Fellowship in Thoracic Surgery's capacity to provide its fellows with sufficient training for heart and lung transplants in the allotted fellowship time.

#### Training pathway for a CT surgeon



#### Complexity of Fellowship



#### Q4 Call Schedule

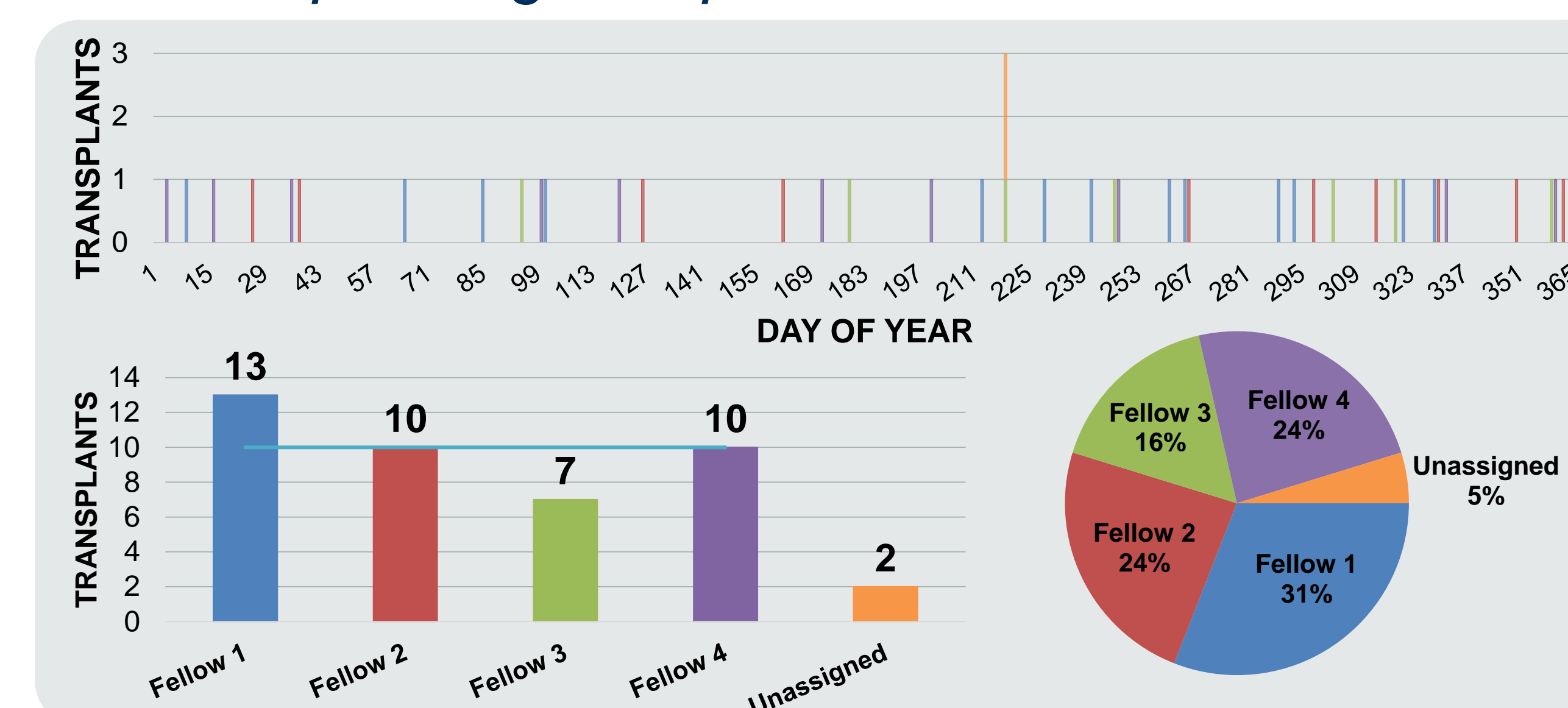
Sun	Mon	Tue	July Wed	Thu	Fri	Sat
	1 Chen	2 Jones	3 Smith	4 Reddy	5 Chen	6 Jones
7 Smith	8 Reddy	9 Chen	10 Jones	11 Smith	12 Reddy	13 Chen
14 Jones	15 Smith	16 Reddy	17 Chen	18 Jones	19 Smith	20 Reddy
21 Chen	22 Jones	23 Smith	24 Reddy	25 Chen	26 Jones	27 Smith
28 Reddy	29 Chen	30 Jones	31 Smith			

### Solution Approach

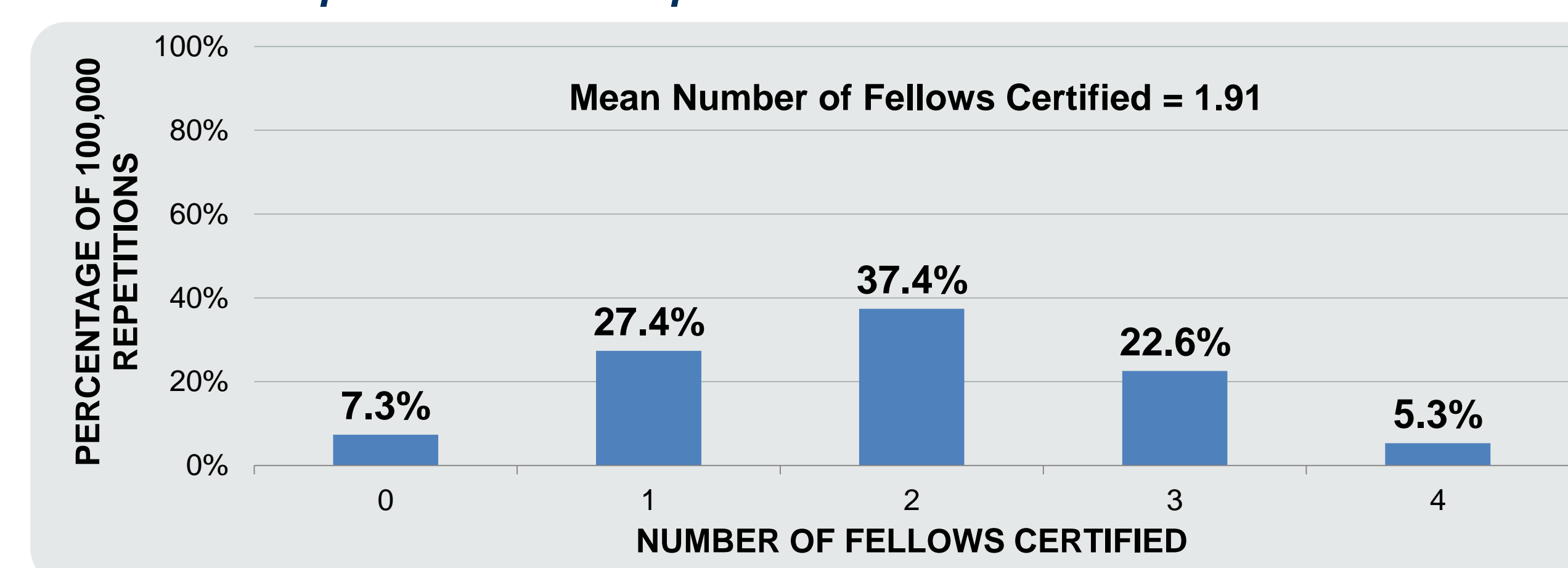
1. Analyze transplant historical data (Jan. '09 – May '11)
2. Simulate transplant arrivals
3. Match transplants to the on call fellow
4. Generate graphical reports

We developed a simulator in Visual Basic using mathematical modeling to rapidly perform steps 2 – 4 for user-defined inputs describing the CT training program. The simulator has single-repetition, multi-repetition, and sensitivity analysis capabilities. Results derived from inputs representative of the Fellowship in Thoracic Surgery are presented below.

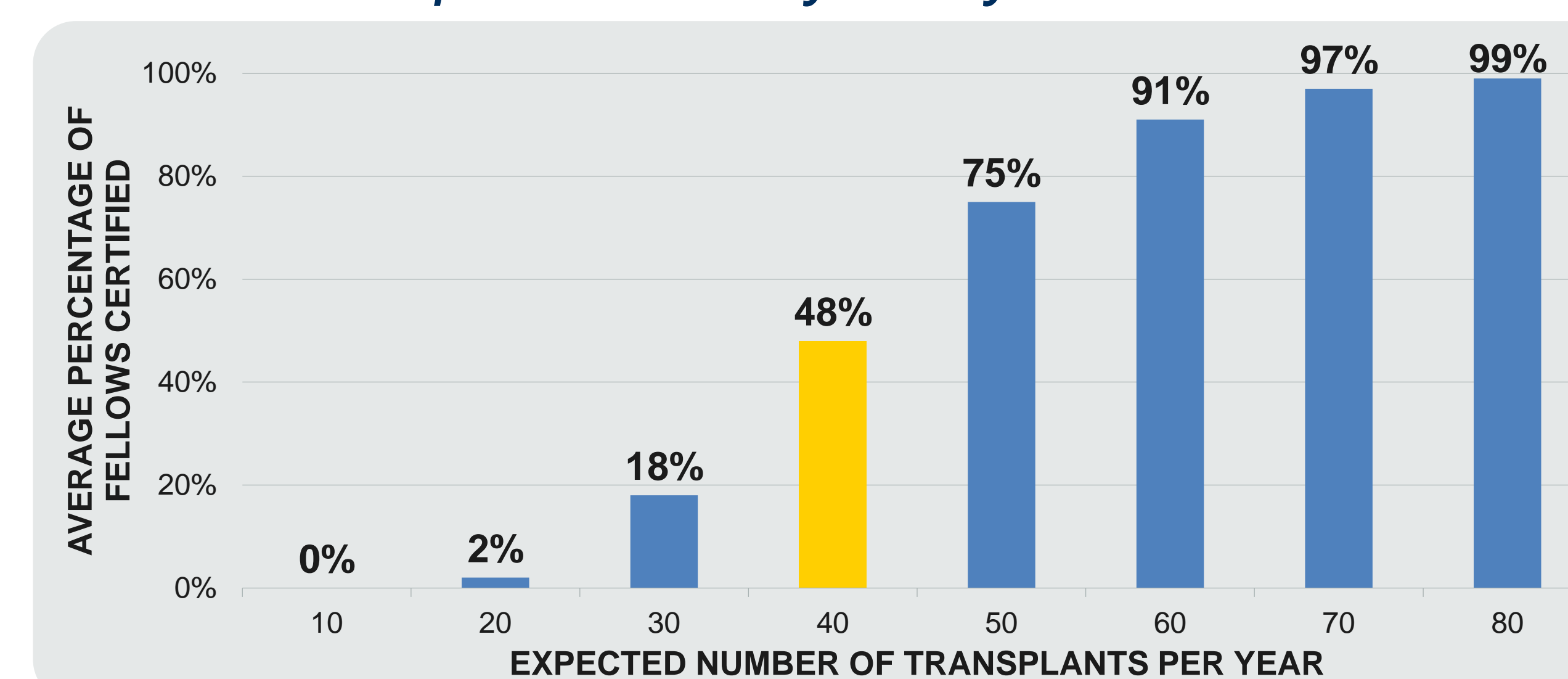
#### Sample Single-Repetition Simulation Results



#### Sample Multi-Repetition Simulation Results



#### Sample Sensitivity Analysis Results



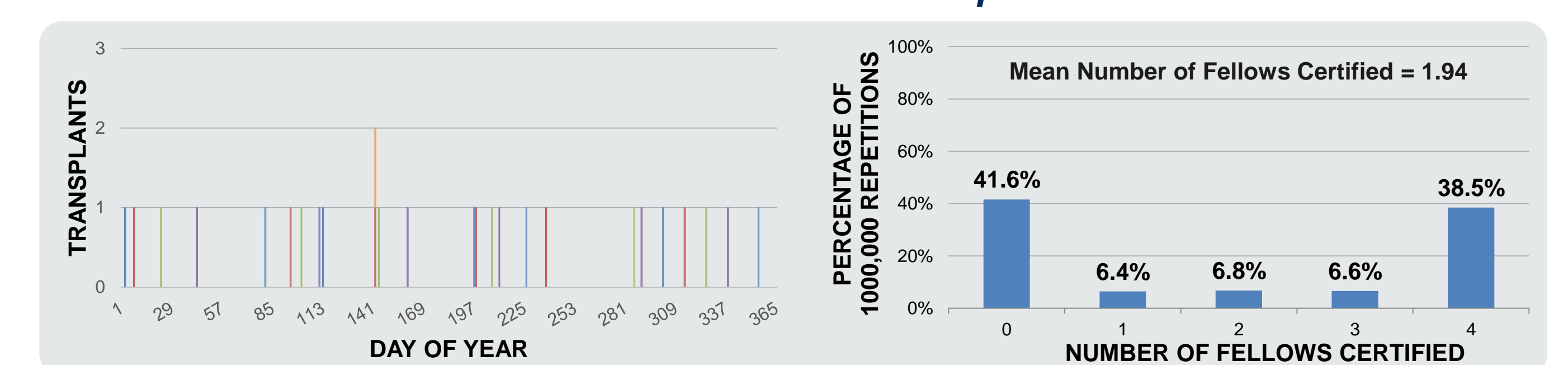
### Conclusions

The simulator tool may be used to evaluate program performance and inform decision-making. In the case of training fellows for cardiothoracic transplants, the UMHS should expect to certify all of its fellows only about 5% of the time in the allotted fellowship duration. On average, the program is expected to certify fewer than half of its fellows in a given year. These results imply potential system changes:

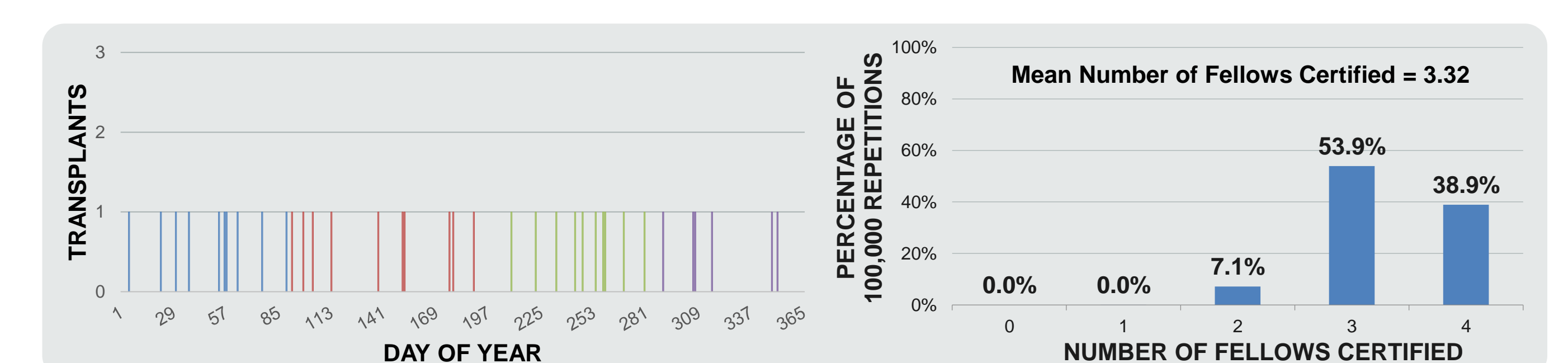
1. Program size reduction
2. Case volume expansion
3. Certification policy changes
4. Call schedule alternatives

The simulator may be used to evaluate the effects of the first three potential changes directly by changing input parameters appropriately. We have also encoded some theoretical call schedules for testing. We illustrate a sample timeline and the multi-repetition simulation results for two alternative call schedule paradigms.

#### On Call Until Transplant



#### On Call Until Certified



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. Those interested in learning more may download the simulator from:

<http://transplantsimulator.herokuapp.com/>

For more information, contact Amy Cohn at:

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