Active Control Time (ACT): an Objective Metric for Trainee Participation in Robotic-Assisted Surgery

AUTHORS: Julie M. Clanahan, MD[1]; Andrew Yee, PhD[2]; Michael M. Awad, MD PhD[1]

BACKGROUND

- Operative performance feedback for trainees is critical for development but is often subjective and infrequent[1]
- Computer-assisted technology including da Vinci Surgical Systems now provides objective, quantifiable performance metrics that can be tracked[2]
- Validity evidence is needed before metrics can be used to define trainee progression and autonomy[3]

AIM: To assess validity of a novel objective metric entitled active control time (ACT) for evaluating trainee participation in robotic-assisted cases

METHODS

- Trainee user performance data from Intuitive (Sunnyvale, CA) was retrospectively analyzed; case complexity was reviewed in the electronic medical record (EMR)
- Time period: September 2020 through July 2021
- Inclusion: all robotic cases performed with a single Minimally Invasive Surgery faculty at institution
- Definitions:
  1) **Percent active control time (%ACT)**: amount of trainee console time spent in active system manipulations over total active time from both consoles
  2) **Complex case**: case with increased complexity note documented in operative report within EMR
- Kruskal-Wallis and Mann Whitney U statical tests applied

RESULTS

- Total: 123 robotic cases with 18 general surgery residents and 1 fellow included; 56 of those cases categorized as "complex case"
- Case composition: 79 hiatal hernia repair, 11 Heller myotomy, 12 cholecystectomy, 6 inguinal hernia repair, 15 other robotic cases

Trainee Level	Aggregate Median %ACT	p-value	Standard Case Median %ACT	Complex Case Median %ACT	p-value
PGY1s	6.1% (IQR 2-14)				
PGY3s	32% (IQR 27-66)				
PGY4s	42% (IQR 26-52)				
PGY5s	50% (IQR 28-70)	p=0.0005	60% (IQR 48-75)	36% (IQR 23-53)	p=0.0002
Fellow	61% (IQR 41-85)	p<0.0001	74% (IQR 61-100)	47% (IQR 29-62)	p=0.0045
	p<0.0001		* IQR = interquartile range		

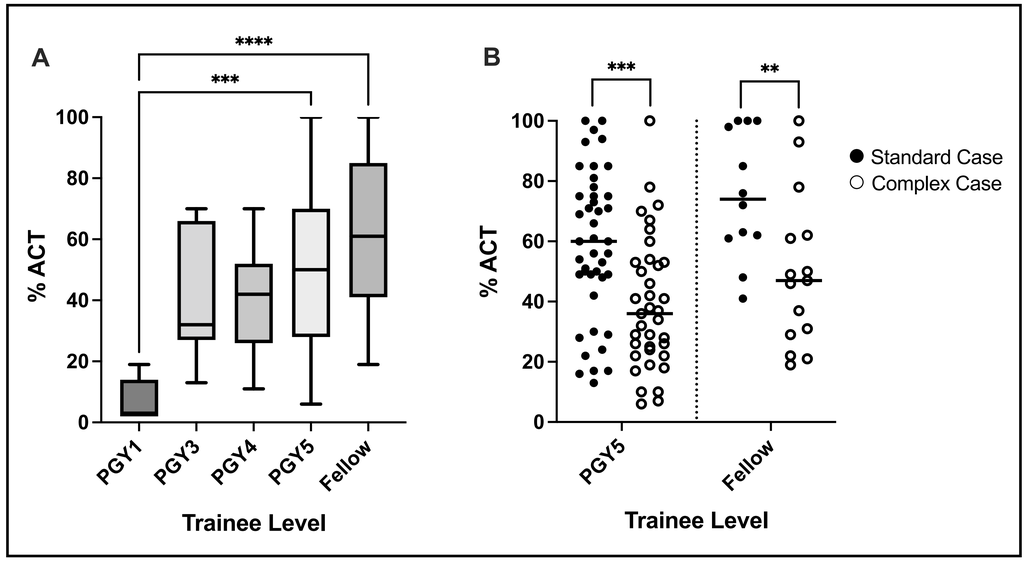


Figure 1A: Median %ACT in boxplot showing case distribution by trainee level
Figure 1B: Median %ACT in standard versus complex cases for PGY5s and fellow

CONCLUSIONS

- Key findings: Demonstrated an increase in %ACT with increasing trainee level and a decrease in %ACT with increased case complexity
- Findings in line with predicted participation trends
- Provides **validity evidence** for use of ACT as surrogate for trainee participation in robotic cases
- One of first studies to investigate standard metric for active operating time in robotic surgery training

FUTURE DIRECTIONS

- Current ongoing study comparing perceptions of case participation against objective ACT measurements
- Future studies will focus on delineating procedure and task-specific ACT to increase trainee autonomy and entrustment behaviors
- Interest in incorporating video-based coaching methods to improve ACT across various trainee levels

AFFILIATIONS

1. Department of Surgery, Section of Minimally Invasive Surgery, Washington University School of Medicine, St. Louis, MO. 2. Department of Surgery, Division of Plastic and Reconstructive Surgery, Washington University School of Medicine, St. Louis, MO

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