Surgery Tutor for Computational Assessment of Technical Proficiency in Soft-Tissue Tumour Resection in a Simulated Setting

Caitlin T. Yeo[1], Justine Ring[1], Matthew Holden[2], Tamas Ungi[2], Gabor Fichtinger[2], Boris Zevin[1]

[1] School of Medicine, Queen's University
[2] School of Computing, Queen's University

Presenter Disclosure

Faculty: Boris Zevin MD, PhD, FRCSC

Relationships with commercial interests:

- **Consulting Fees:** Ethicon Canada
- **Research Funding:** Medtronic Canada

Potential for conflict(s) of interest:

- None

Introduction

- Competency based medical education (CBME)
  - Requirement for objective assessment of technical skills
- Currently available assessment tools
  - Checklists and GRS
  - Rubrics
  - VR simulators
  - Motion tracking
- Lack of platforms for objective assessment of technical proficiency in open surgery

Objective

1. To design Surgery Tutor platform for objective assessment of technical proficiency in open surgery.

2. To provide evidence in support of construct validity of the scores obtained by Surgery Tutor for open soft-tissue resection in a simulated setting.

Methods

Utilized Messick's construct validity framework:

- Content: do instrument items completely represent the construct?
- Response process: the relationship between the intended construct and the thought processes of subjects or observers
- Internal structure: acceptable reliability and factor structure
- Relations to other variables: correlation with scores from another instrument assessing the same construct
- Consequences: do scores really make a difference?

The American Journal of Medicine (2006) 119, 166.e7-166.e16

Methods

- 30 participants recruited for the study
  - Assigned to “novice”, “intermediate” and “experienced” groups
  - Based on number of prior soft-tissue resections as primary surgeon

- Resected 2 palpable and 2 non-palpable tumors from a phantom model

- Outcomes:
  - hand and instrument motions
  - number of tumor breaches
  - time to perform each resection
  - mass of excised specimens
  - margin status

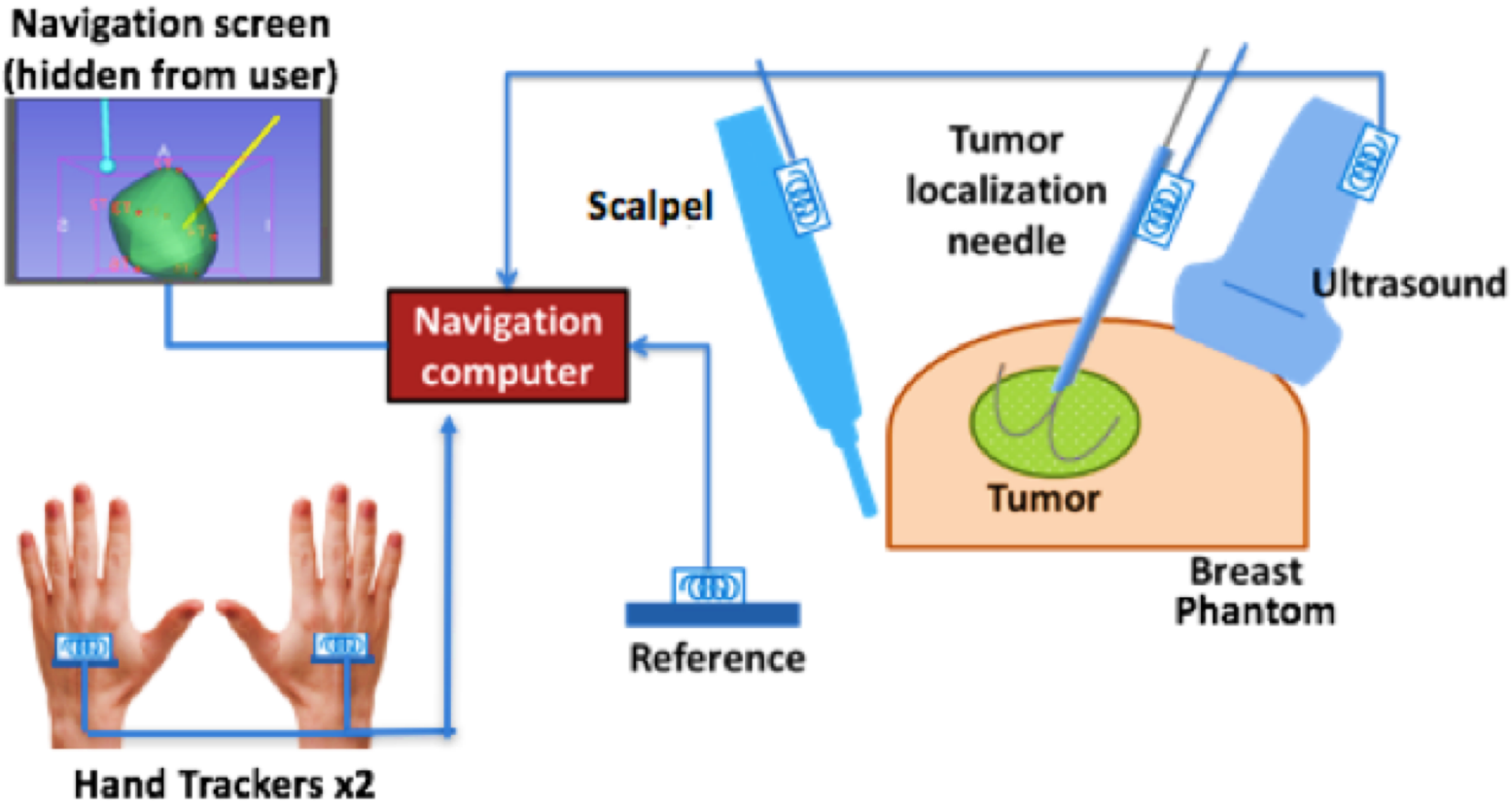
Methods

- Internal Structure
  - Test-retest reliability (ICC)

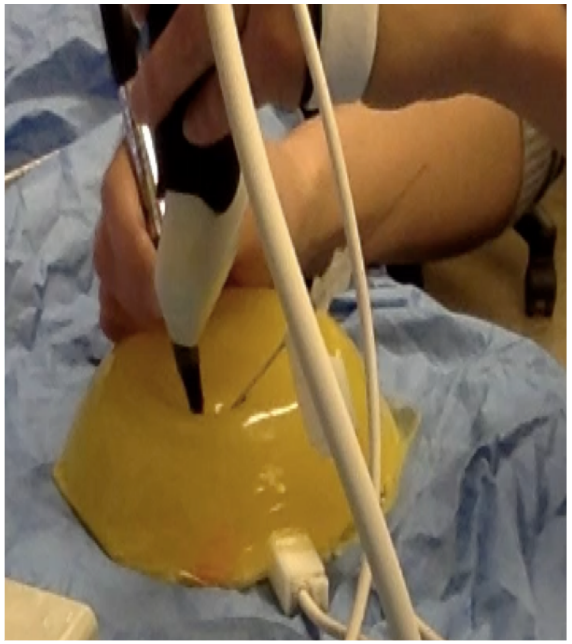
- Evidence in support of construct validity
  - Compared scores of “novice”, “intermediate” and “experienced” groups for outcomes of interest (Kruskal-Wallis)

- Relationship to other variables
  - Compared scores on Surgery Tutor against OSATS scores (Pearson coeff)
  - Blind rating of videos of technical performance using OSATS tool

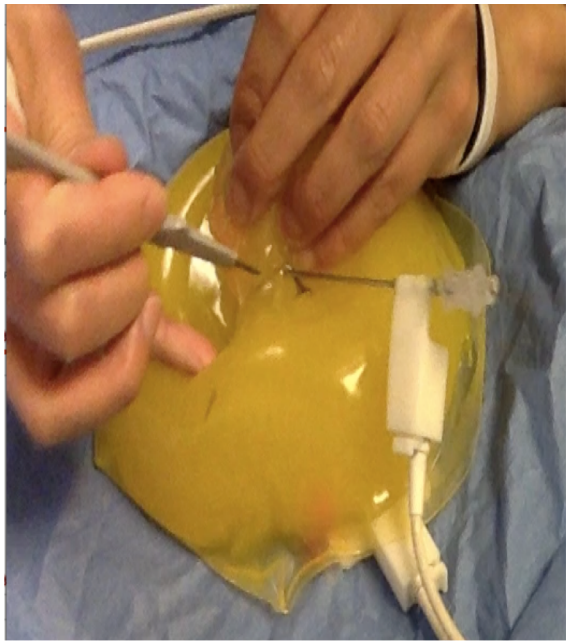
Surgery Tutor: Schematic



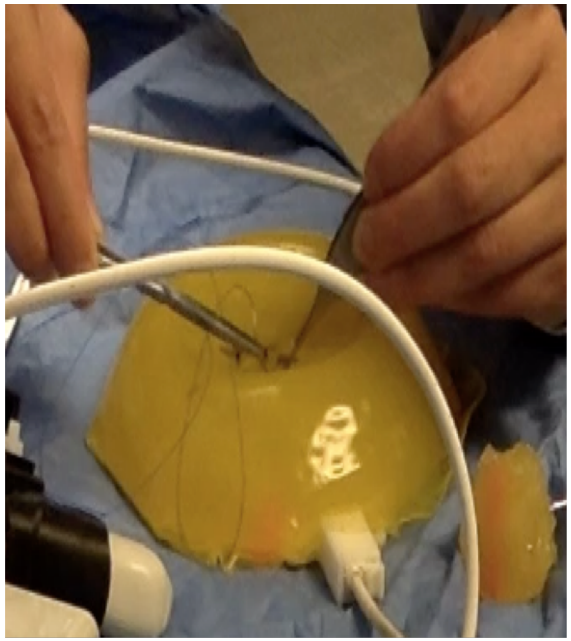
Workflow



Phase 1: Planning



Phase 2: Excision



Phase 3: Closure

Results: Demographics

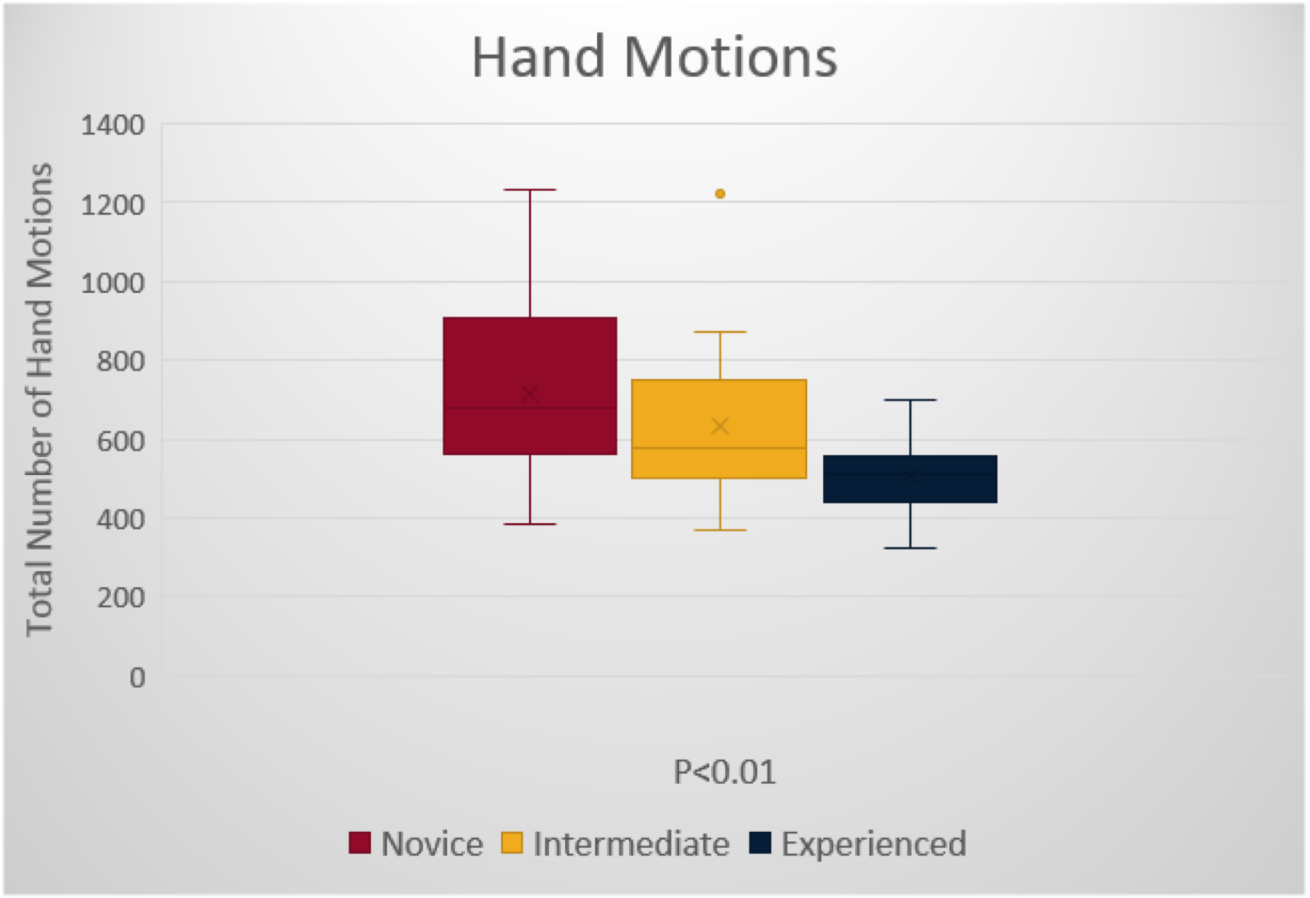
	Novice (n=10)	Intermediate (n=10)	Experienced (n=10)	P
Gender				
• **M**	5	7	5	
• **F**	5	3	5	
Level of training				
• **Senior medical student**	6	0	0	
• **Junior resident (PGY 1-2)**	4	4	0	
• **Senior resident (PGY 3-5)**	0	5	5	
• **General surgeon**	0	1	5	
Number of soft tissue resections	0 (0-6)	21 (11-40)	88.5 (43-1000)	<0.01
Comfort with soft tissue resections (0-10)	1.5 (0-8)	5 (3-7)	8.5 (7-10)	<0.01
Comfort with breast lumpectomy (0-10)	1.5 (0-5)	5 (2-8)	8 (6-10)	<0.01

Internal Structure (ICC)

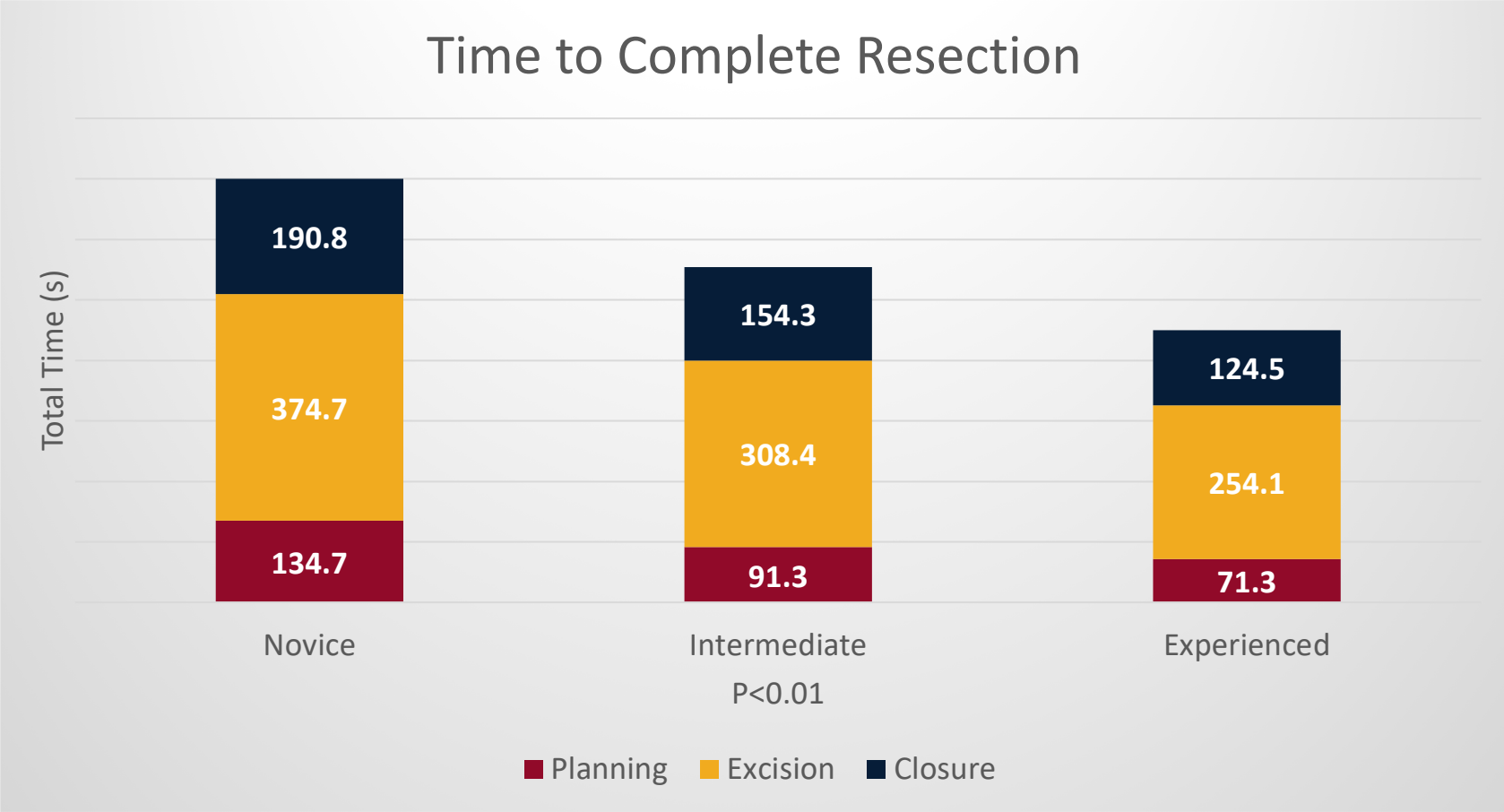
	ICC	P
Novice	0.596 (0.008-0.856)	<0.01
Intermediate	0.569 (0.083-0.856)	<0.01
Experienced	0.737 (0.400-0.899)	<0.01

Table 2: Interclass correlation coefficient (ICC)

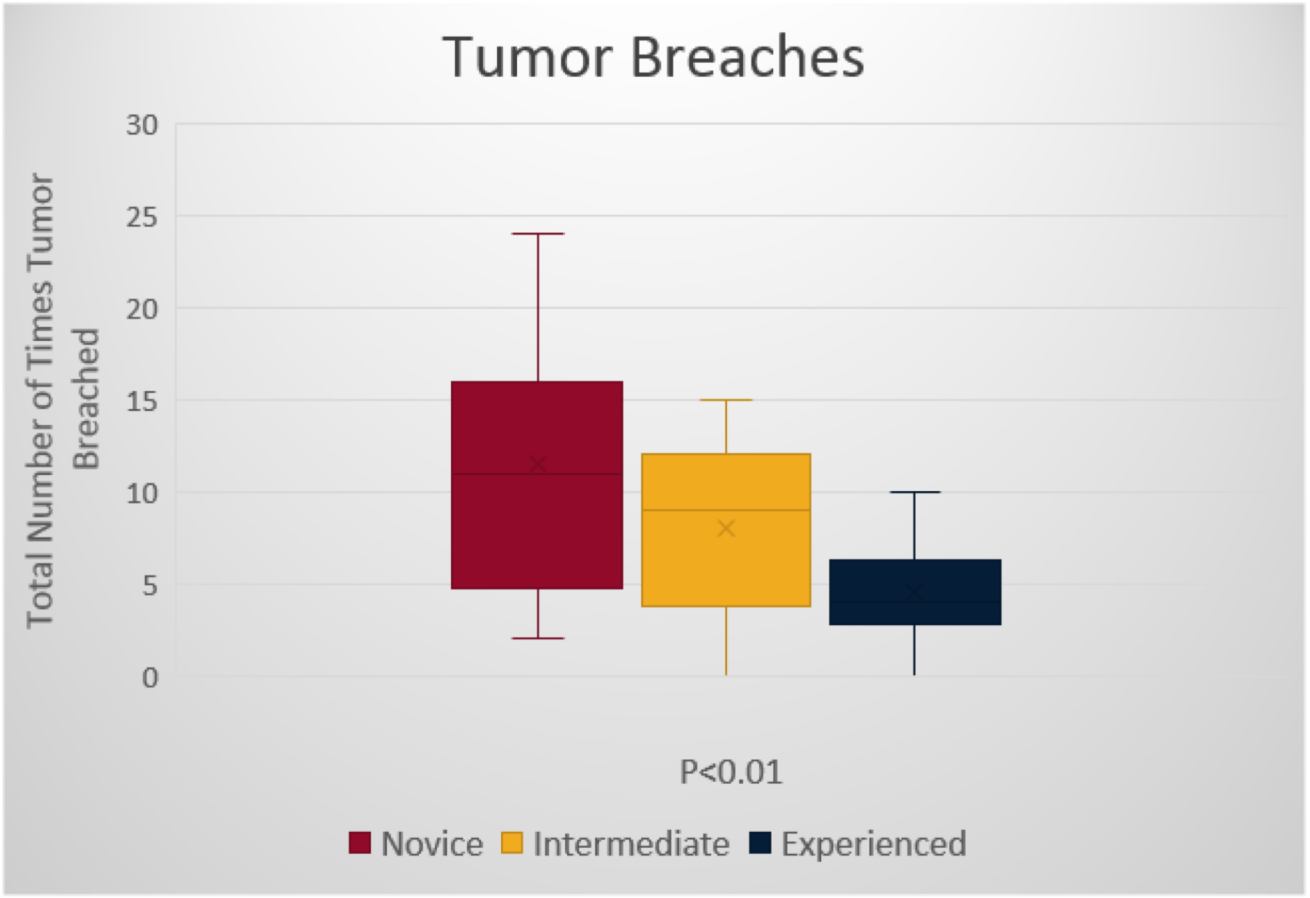
Construct Validity: Hand Motion Analysis



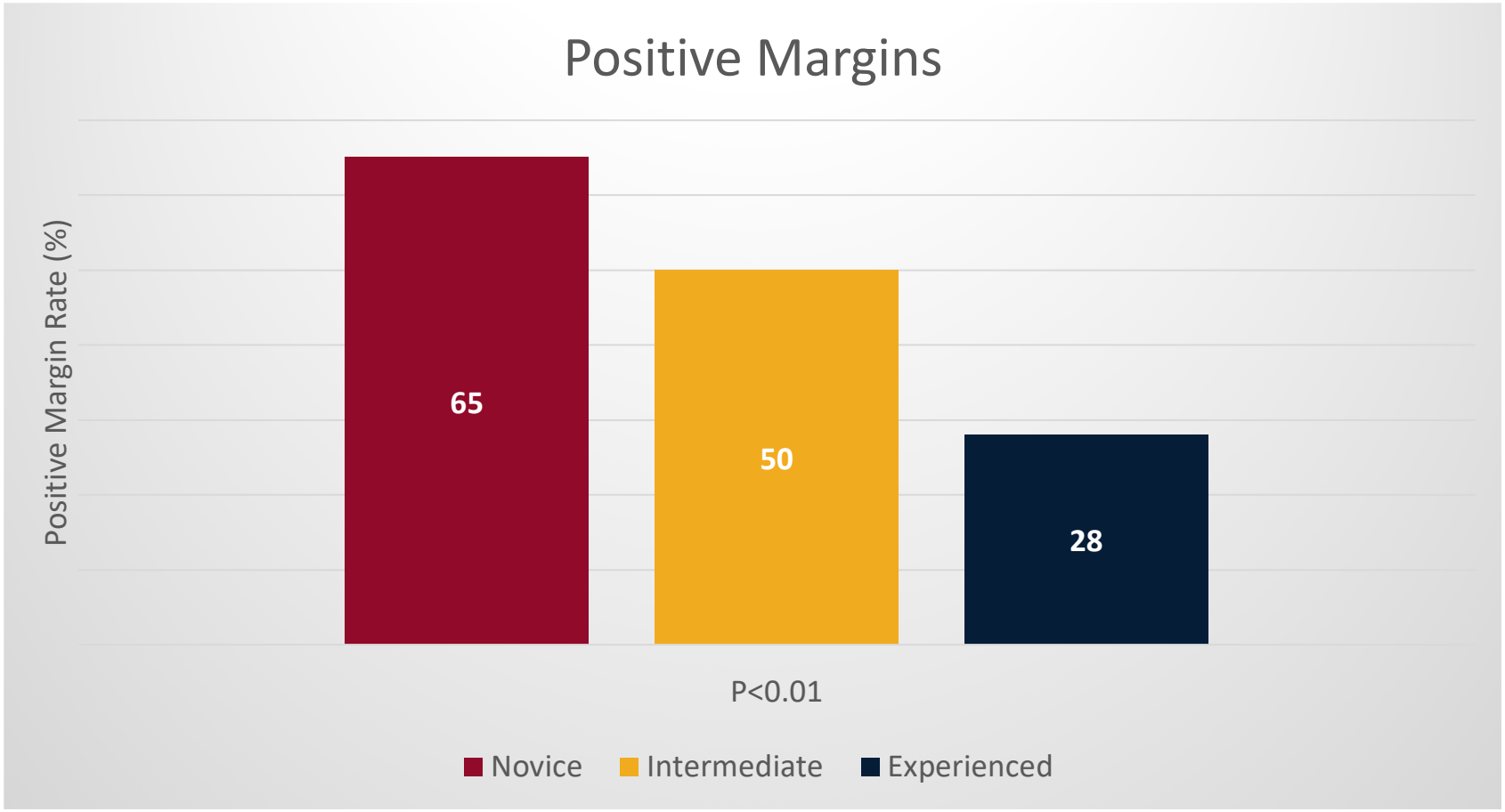
Construct Validity: Time to Complete Resection



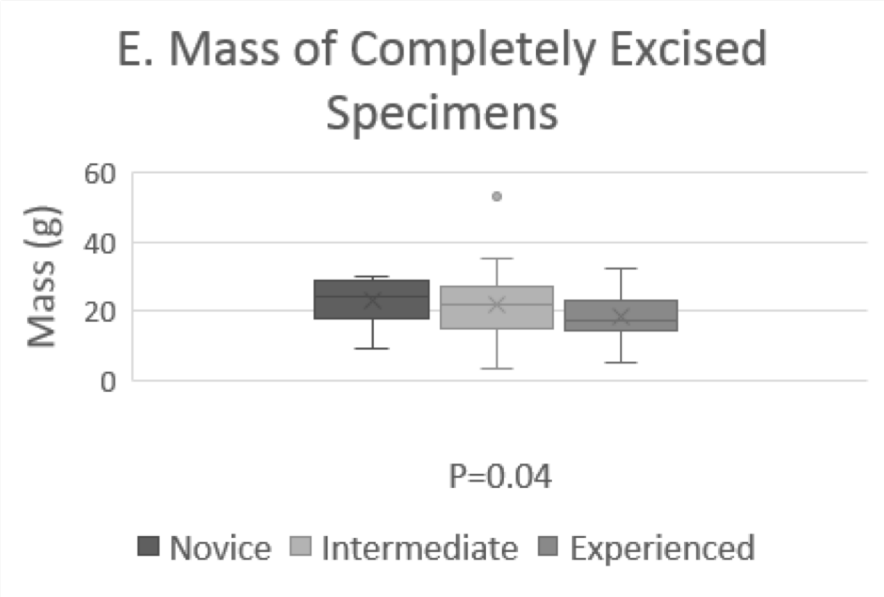
Construct Validity: Tumor Breaches



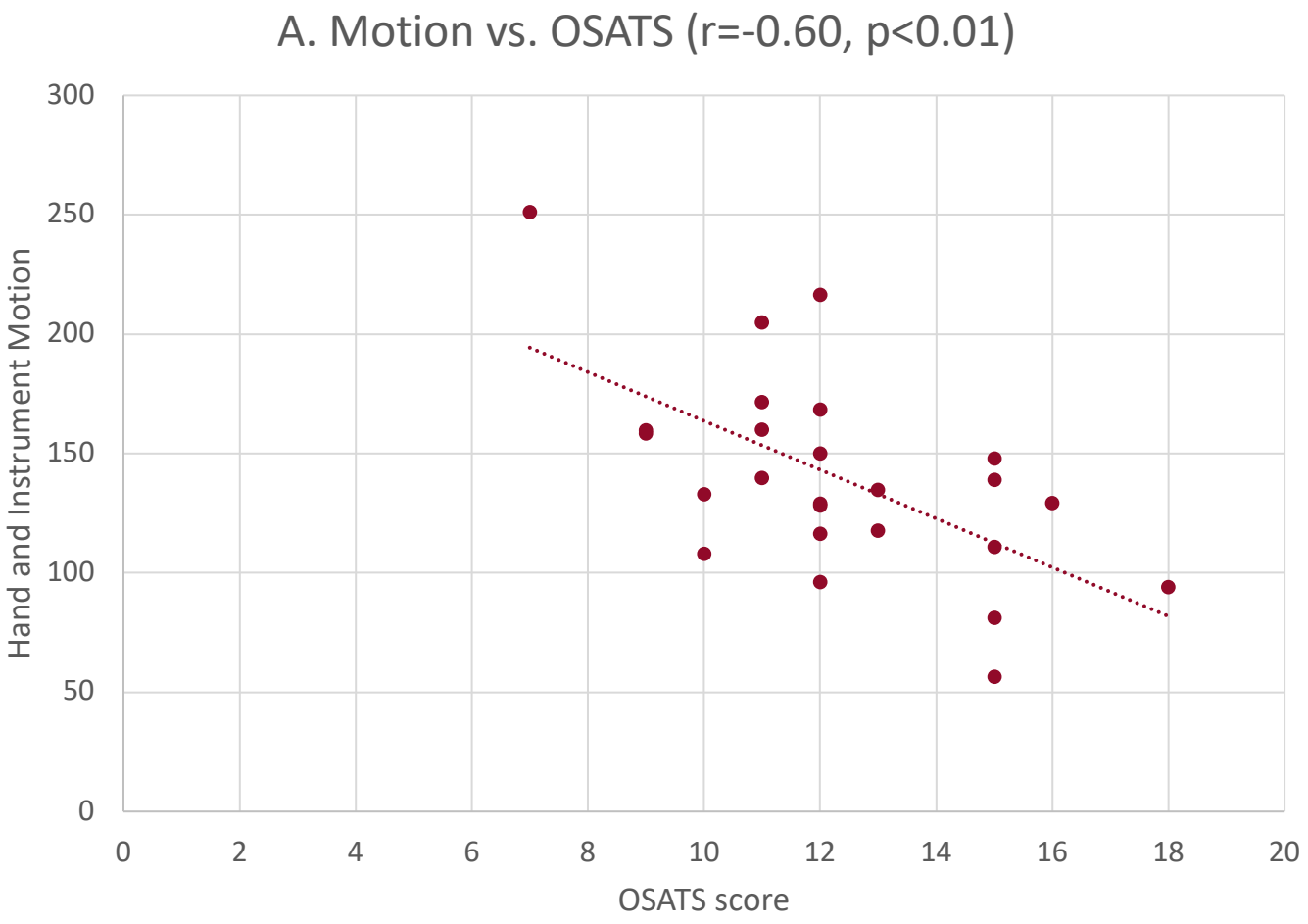
Construct Validity: Positive Margins



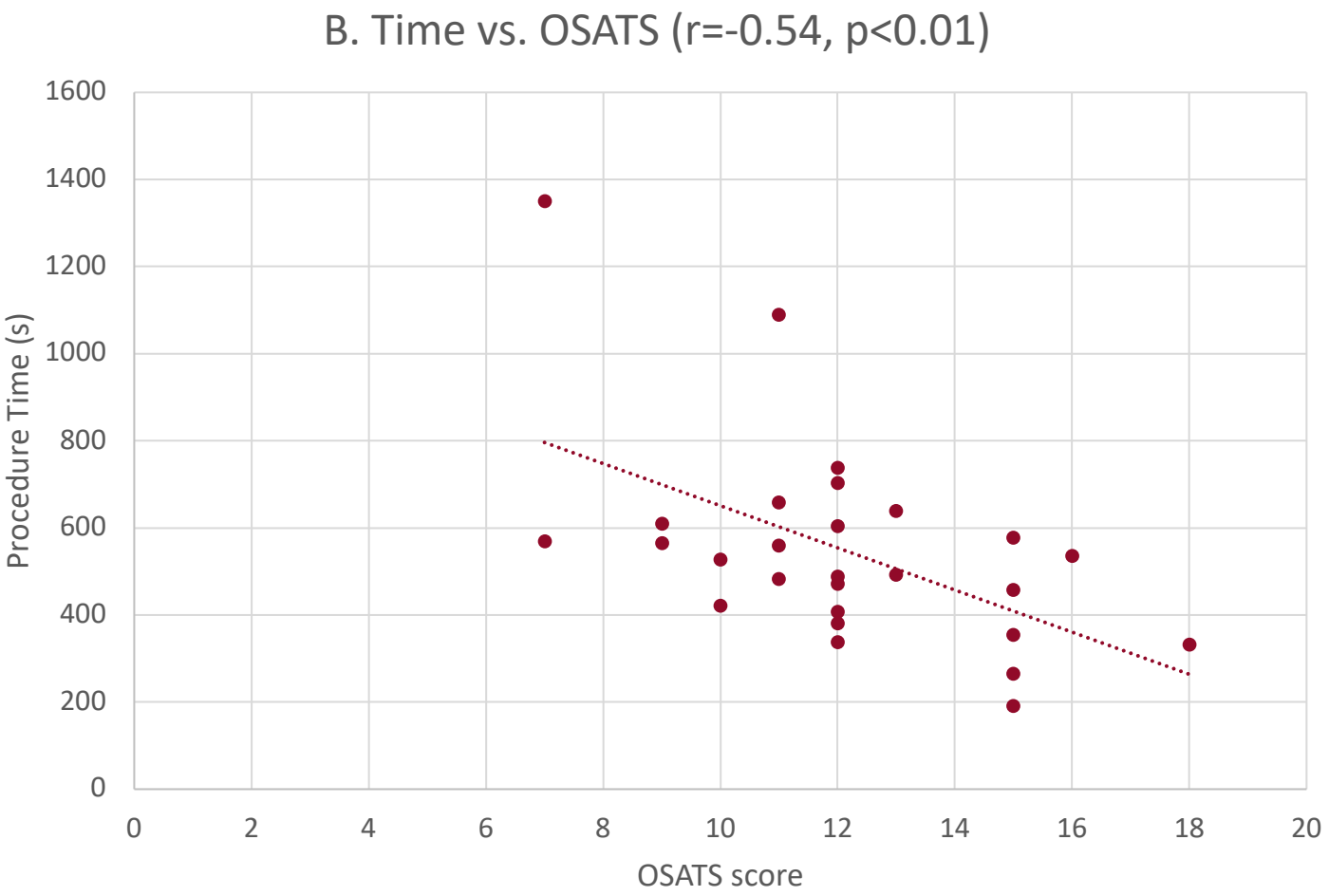
Construct Validity: Mass of Excised Specimens



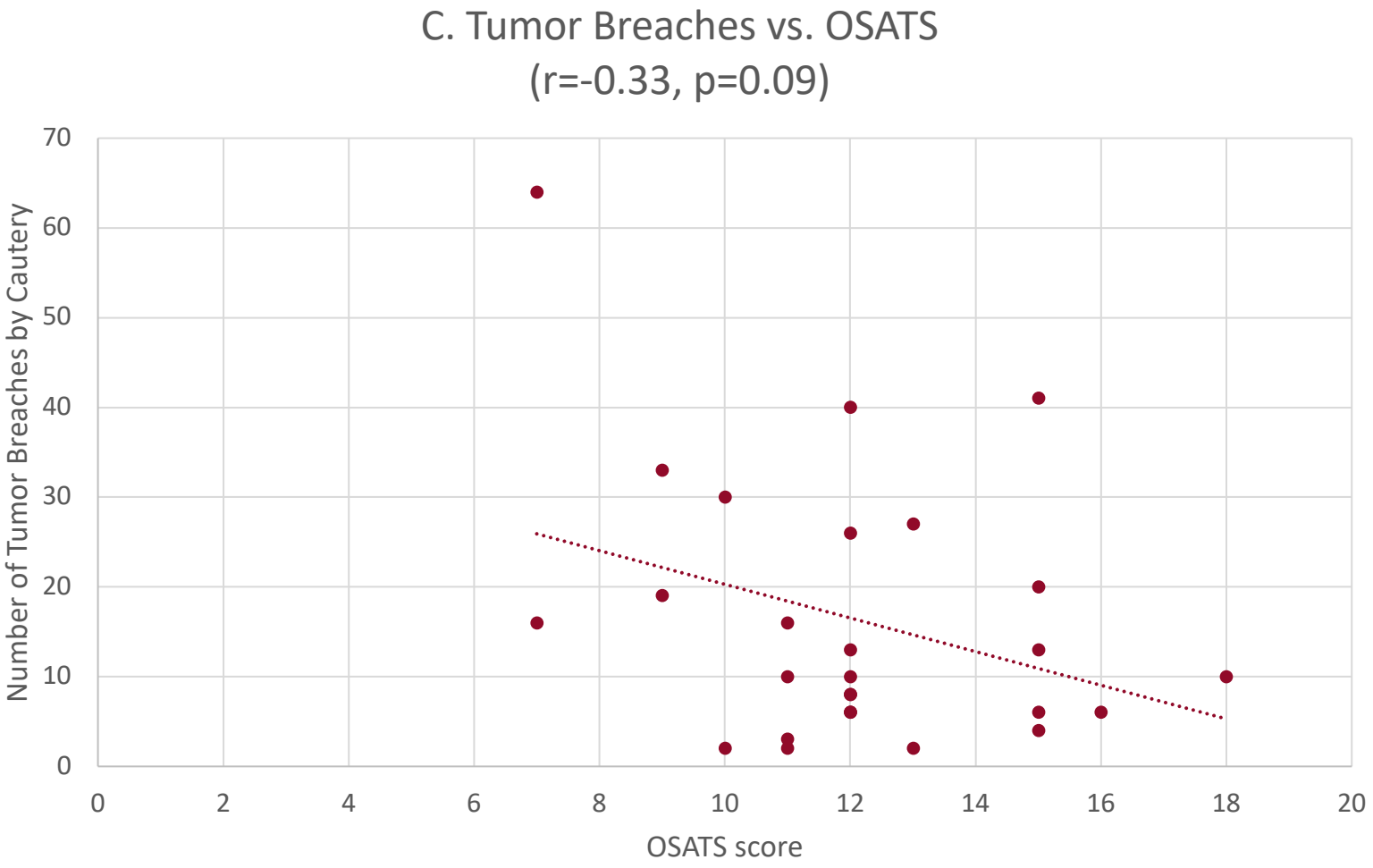
Relationship to other variables



Relationship to other variables



Relationship to other variables



Summary of Results

- Moderate to good Internal Structure (Test-Retest Reliability)
- Evidence in support of Construct Validity of scores on Surgery Tutor
- Evidence of relation to OSATS scores for time and motion; NOT tumor breaches
- This platform can be used for proficiency-based training in open surgery procedures in a simulation setting

Summary of Results / Conclusions

- Moderate to good Internal Structure (Test-Retest Reliability)
- Evidence in support of Construct Validity of scores on Surgery Tutor
- Evidence of relation to OSATS scores for time and motion; NOT tumor breaches
- Surgery Tutor platform can be used for proficiency-based training in open surgery procedures in a simulation setting