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THE USE OF VIRTUAL HUMANS TO ASSESS SURGEON COMMUNICATION SKILLS IN A SIMULATED LAPAROTOMY

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INTRODUCTION

- We have previously validated a checklist for performing a laparotomy in a simulated model.

- In this study, we have integrated virtual humans (VHs) into this simulated laparotomy scenario to assess surgeon response to VH communication challenges.

METHODS

- Three interactive VH teammates (anesthesiologist, circulating nurse and surgical technologist) were projected on a 40-inch monitor mounted on a rolling stand.
- Nineteen surgeons (6 faculty and 13 residents) videotaped interacting with VHs while performing a surgical time out and laparotomy on a simulated model.
- Outpatient surgical center (OSC) at the University of Florida – Jacksonville.

METHODS

Communication Elements

1. Leading a surgical timeout.
2. Addressing a timeout interruption.
3. Managing an incorrect sponge count.

✓ *Raters (N=5) reviewed videotapes.*

Psychomotor Elements

1. Performing a laparotomy.

✓ *Raters (N=6) examined simulated laparotomy pads.*

METHODS

LAPAROTOMY CLOSURE RATING FORM

SAFE OR
Simulated Activity For Every Operating Room

1. Bites are between 5 mm to 10 mm wide with 5 mm to 10 mm advancement.

1	2	3	4	5
Bites and advancement too large/small with no consistency		Most bites are between 5-10mm are consistent with regular spacing		All bites are between 5-10mm are consistent with regular spacing

2. Running closure started 1 cm above and below the apices of the fascial incision.

1	2	3	4	5
Neither superior/inferior running suture started 1 cm above/below apex		Either superior or inferior running suture started 1 cm above/below apex but not the other		Both superior and inferior running suture started 1 cm above and below apices

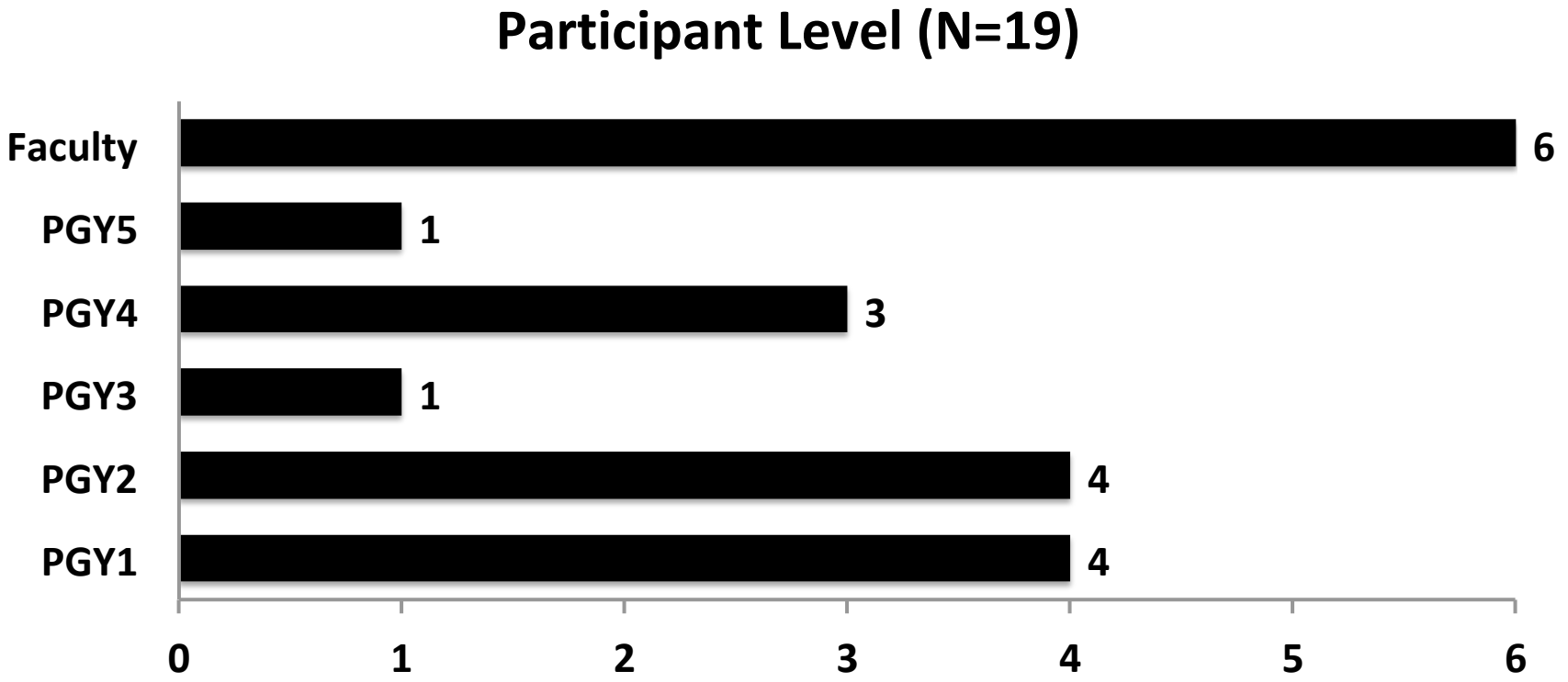
3. Knots are square without "air knots" and have an adequate number of throws (6 to 8).

1	2	3	4	5
Knots are not square multiple air knots inadequate number of throws		Knots are for the most part square some air knots present most knots have adequate # of throws		Knots are square no air knots all knots adequate number of throws

4. No obvious defects in the incision when placed under tension.

1	2	3	4	5
Large defects in the closure when placed under tension		Some/small defects in the closure when placed under tension		There are no defects in the closure when placed under tension

RESULTS



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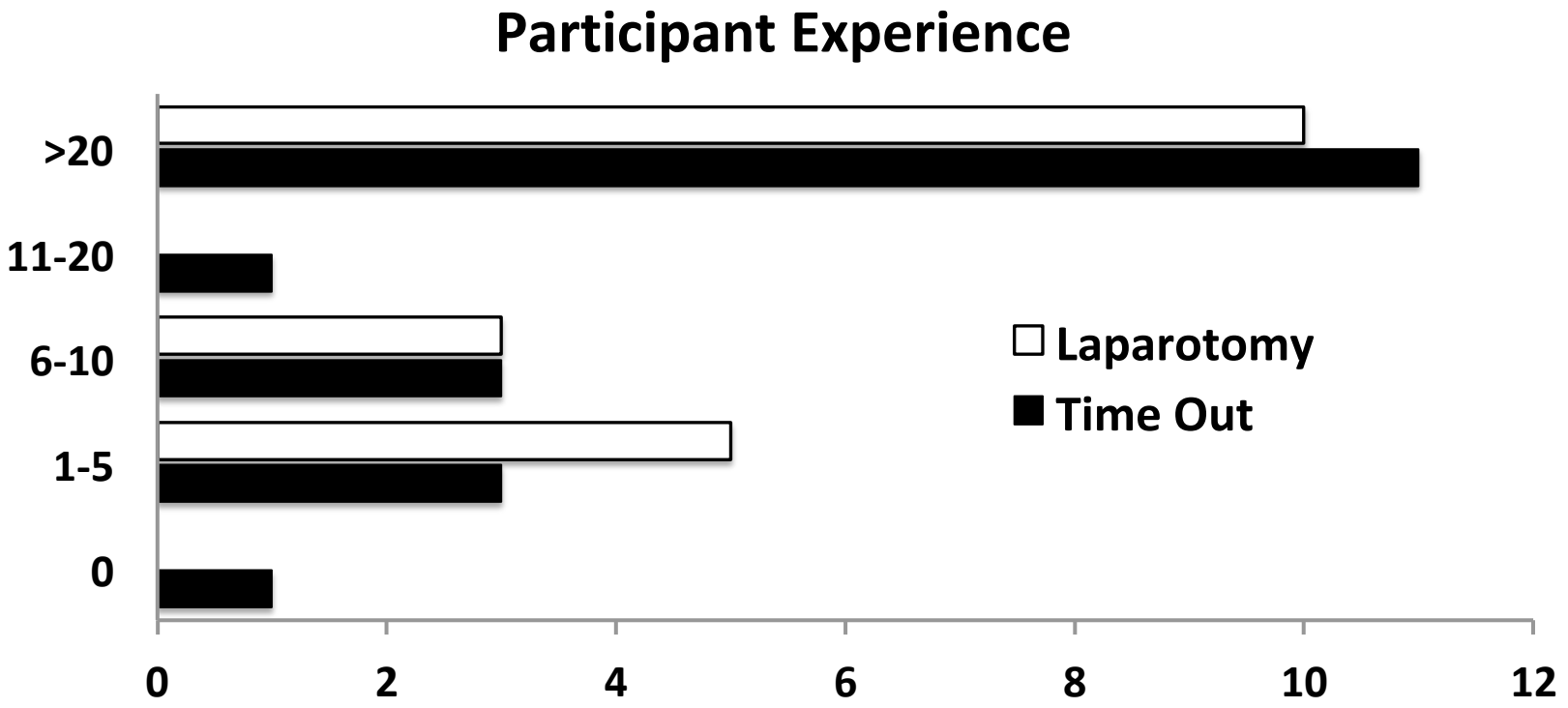

RESULTS

Post Interaction Survey

Immersion Level	STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE	WEIGHTED AVERAGE
I felt as though I was in a real operating room.	0.00% 0	15.79% 3	15.79% 3	63.16% 12	5.26% 1	3.58
The set up of the virtual OR enhanced the immersiveness of the overall simulation.	0.00% 0	0.00% 0	15.79% 3	57.89% 11	26.32% 5	4.11
The presence of the virtual characters enhanced the scenario and made it seem more realistic.	0.00% 0	10.53% 2	5.26% 1	63.16% 12	21.05% 4	3.95
I felt like the virtual characters were aware of my presence.	0.00% 0	5.26% 1	15.79% 3	73.68% 14	5.26% 1	3.79
I perceived the virtual characters as being only computerized images not as real people.	0.00% 0	10.53% 2	36.84% 7	47.37% 9	5.26% 1	3.47
The virtual characters seemed conscious and sentient.	0.00% 0	10.53% 2	57.89% 11	31.58% 6	0.00% 0	3.21
The mock abdomen adequately simulated the real abdominal wall (skin, subcutaneous tissue, fascia).	5.26% 1	26.32% 5	36.84% 7	31.58% 6	0.00% 0	2.95
The feeling of closing the fascia of the mock abdomen was similar to in vivo closure of the abdomen.	15.79% 3	21.05% 4	31.58% 6	31.58% 6	0.00% 0	2.79

RESULTS

Post Interaction Survey

Skill Confidence/Improve	STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE	WEIGHTED AVERAGE
I am confident in my ability to perform laparotomy.	0.00% 0	5.26% 1	21.05% 4	42.11% 8	31.58% 6	4.00
I am confident in my ability to perform abdominal wall closure.	0.00% 0	11.11% 2	5.56% 1	50.00% 9	33.33% 6	4.06
I am confident in my ability to perform a complete and appropriate time out.	0.00% 0	0.00% 0	5.26% 1	42.11% 8	52.63% 10	4.47
I am confident in my ability to manage a possible retained surgical item in the abdomen.	0.00% 0	5.26% 1	0.00% 0	52.63% 10	42.11% 8	4.32
Today's simulation has improved my ability to perform laparotomy.	0.00% 0	15.79% 3	31.58% 6	31.58% 6	21.05% 4	3.58
Today's simulation has improved my ability to perform abdominal wall closure.	0.00% 0	15.79% 3	31.58% 6	26.32% 5	26.32% 5	3.63
Today's simulation has improved my ability to perform a complete and appropriate time out.	0.00% 0	5.26% 1	31.58% 6	36.84% 7	26.32% 5	3.84
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Pre Survey 3.70

Pre Survey 3.25

Sample VH Interaction

RESULTS

Communication Elements

Surgical Time Out	Residents N (%)	Faculty N (%)	p Value (α=0.05)
Initiated	11 (84.6)	5 (83.3)	NS
Interruption Addressed	7 (53.8)	6 (100)	NS
Time Out Resumed	2 (15.4)	4 (66.7)	NS
Time Out Restarted	5 (38.4)	2 (33.3)	NS

RESULTS

Communication Elements

Response to Incorrect Count	Residents N (%)	Faculty N* (%)	P Value (α=0.05)
Stopped Operating	7(53.87)	5 (100)	NS
Asked for Recount	7 (53.8)	3 (60.0)	NS
Asked for X-ray	6 (46.1)	2 (40.0)	NS
Searched Abdomen	10 (76.9)	5 (100)	NS

*One faculty did not receive incorrect count challenge.

RESULTS

Psychomotor Elements

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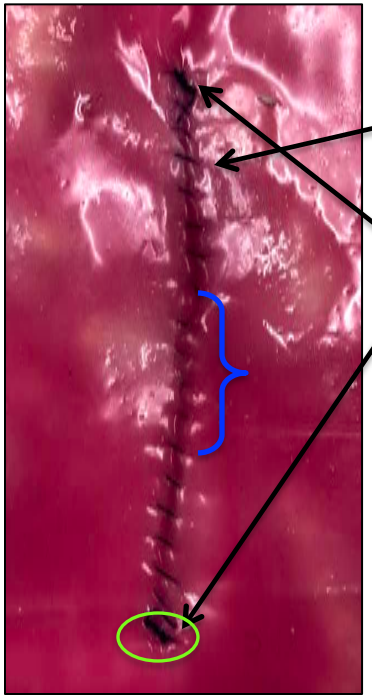

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RESULTS

Psychomotor Elements

Closure Item*	Residents Mean (95% C.I.)	Faculty Mean (95% C.I.)
Bites (Distance/Spacing)	2.61 (1.97, 4.28)	1.97 (1.05, 2.89)
Running Closure (Start/Finish)	1.88 (1.25, 2.51)	1.50 (0.95, 2.01)
Knots (Square/# Throws)	3.51 (2.88, 4.14)	2.89 (1.70, 4.08)
Defects (With Tension)	3.88 (3.22, 4.54)	2.67 (1.42, 3.92)
Overall	11.88 (9.77, 13.99)	9.02 (5.51, 12.53)

*Likert scale 1-5 (1=worst, 5=best).

RESULTS

Participant Comments

"Phenomenal opportunity to practice surgical and verbal skills as a solo surgeon."

"This was very helpful. I think that having a perfect performance to watch would be great in knowing how to improve."

"It strengthened my ability to communicate with my team in the OR."

"The tissue planes were strange at first, having never operated on simulated humans. Still, once I got the hang of it, I was fine."

CONCLUSIONS

- We have successfully integrated VHs with a simulated laparotomy model to teach/assess communication/teamwork and psychomotor skills.

- Participant performance demonstrates a need for deliberate practice with feedback in correctly performing a surgical time out and a laparotomy with an incorrect sponge count for surgical residents and faculty.