MEDICO-ECONOMIC IMPACTS OF SIMULATION BASED EDUCATION IN HEALTHCARE

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Chief Medical Officer, AdventHealth Nicholson Center
Professor of Otolaryngology Head and Neck Surgery,
University of South Florida College of Medicine
Medical Director, Head and Neck Surgery, AdventHealth Orlando

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OUTLINE

- Who is the Nicholson Center?
- What innovative work is being done?
- What impact does innovation have on healthcare?


Vision Statement
"To Improve Patient Outcomes
and Advance Healthcare Education through Revolutionary Thinking, Innovation, and Research"

NICHOLSON CENTER: EDUCATION PROGRAM

What does our team provide?

Comprehensive Services

- CME capabilities
- Curriculum development
- Course planning
- Sponsorships
- Marketing

Who provides the instruction?

- AH & External Physicians
- Nicholson Center staff

How do we distribute our content?

- Didactic only
- Procedural room streaming
- Hands-on experiences
- Virtual Learning Platform

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NICHOLSON CENTER: EDUCATION PROGRAM

ACS - AEI Accreditation

1 of 97 worldwide

Global Collaborations

- London – Kings College
- Israel – Assuta Medical
- France – STAN Institute
- Italy – Padova University

Curricula

- NC Created
  - e.g. Basic Robotic Surgery Course
- NC Supported
  - e.g. Orlando Live Endoscopy (CIE)
- AHU Master of Science

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NICHOLSON CENTER: INDUSTRY PROGRAM

What do we provide?

- Meeting space
- Hands-on lab
- Simulation lab
- Prototype/Innovation lab
- Concierge /Guest services
- Digital AV services
- Meeting planning

Who do we serve?

- 119 unique clients

ETHICON a Johnson & Johnson company
Abbott
INTUITIVE SURGICAL
Boston Scientific
Medtronic
stryker
CONMED
CMR SURGICAL
Baxter
BD
3M

What have we achieved?

- Center of Excellence
  - Surgical Training
  - Showcase site
- Global destination training center
  - 65,000+ clinical learners
  - 83 countries

EDUCATION/INDUSTRY PROGRAM VALUE

Improve Quality

- Train clinical workforce
- Improving patient outcomes

Increase Brand Awareness

- Global audience allows for visibility of AdventHealth brand
- Global Collaborations

Value

Physician/Thought Leader Recruitment Retention

- Asset for KOLs
- Educational resources
- Retain talent eager to teach courses

Revenue Streams

- Consumer-facing educational courses
- Industry partners

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EDUCATION VS. INDUSTRY

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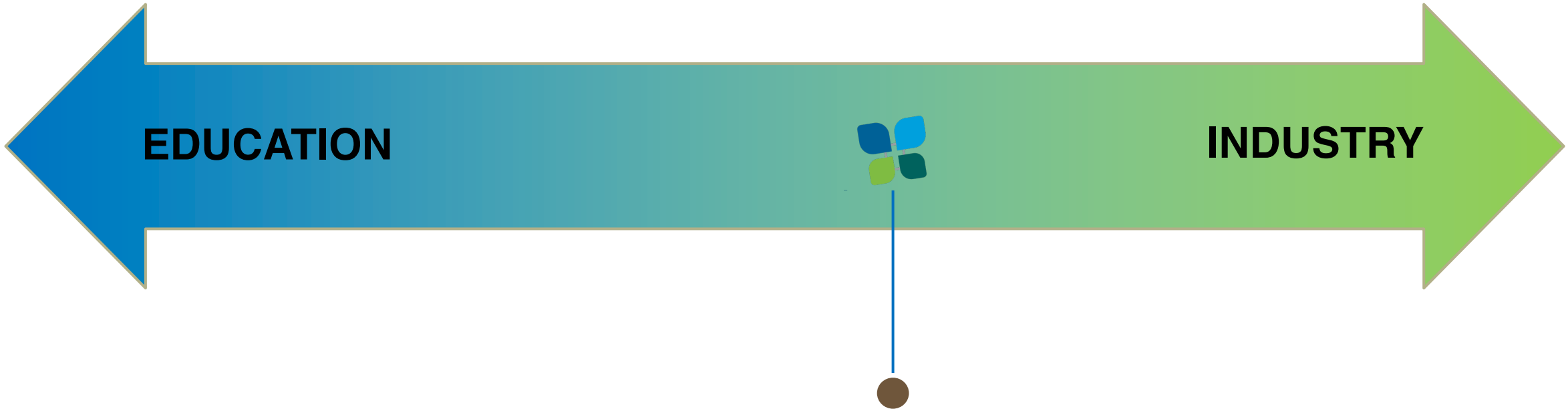
“SWEET SPOT” FOR TRAINING CENTERS

“To improve patient outcomes and advance healthcare education through revolutionary thinking, innovation and research”



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TECHNOLOGY IMPACT ON MARKET

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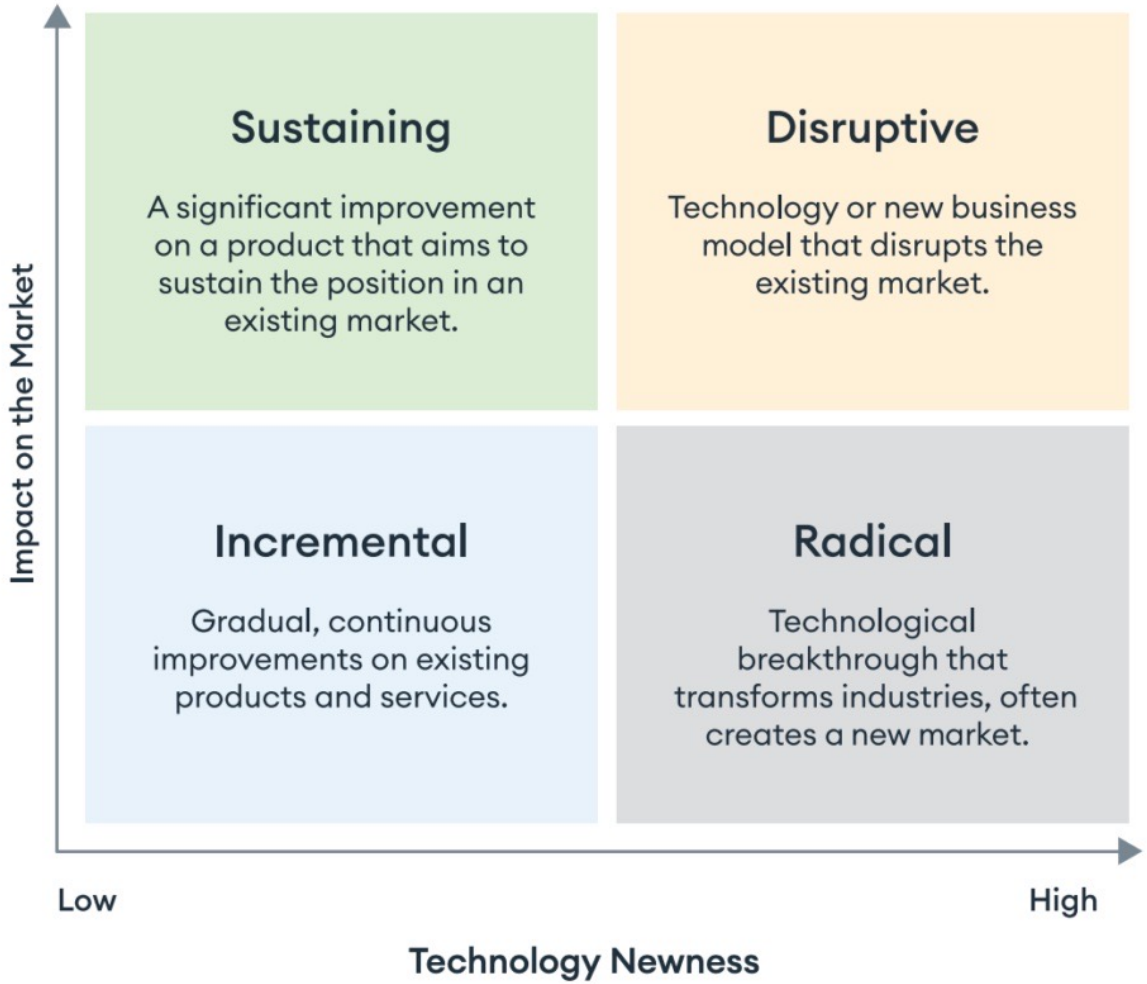

ROBOTIC MOTIVATIONS

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FIDELITY
Improve Fine Movement

EFFICIENCY
Improve Throughput

SAFETY
Improve Surgeon Health

ACCURACY
Reduce Variation

LESS INVASIVE
Reduce Patient Impact

NATIONALITY
Improve Economic Position

DEVICE COST
Capital Investment

FACILITY SPACE
Operating & Storage

INSTRUMENT COST
Dilutes Profit

STAFF TRAINING
Hospital Expertise

INSTRUMENT PROCESSING
Specialized Handling

MARKETING
Focused Message

DO WE NEED THE ROBOT?

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Jacquard Loom invented 1804

Impact seen in labor, consistency, production, future technology

Photos from Science Museum Group

LEVELS OF AUTONOMY

Science Robotics 15 Mar 2017:
Vol. 2, Issue 4, eaam8638
DOI: 10.1126/scirobotics.aam8638

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Level 1

INTUITIVE SURGICAL®

Medtronic

TITAN MEDICAL

SenhanceSurgery
POWERED BY ALF-X

Level 2

Medrobotics
Expanding the reach of surgery®

Level 3

STAR robot

Level 4

ARTAS iX™
ROBOTIC HAIR RESTORATION

Veebot

SURGICAL ROBOTS

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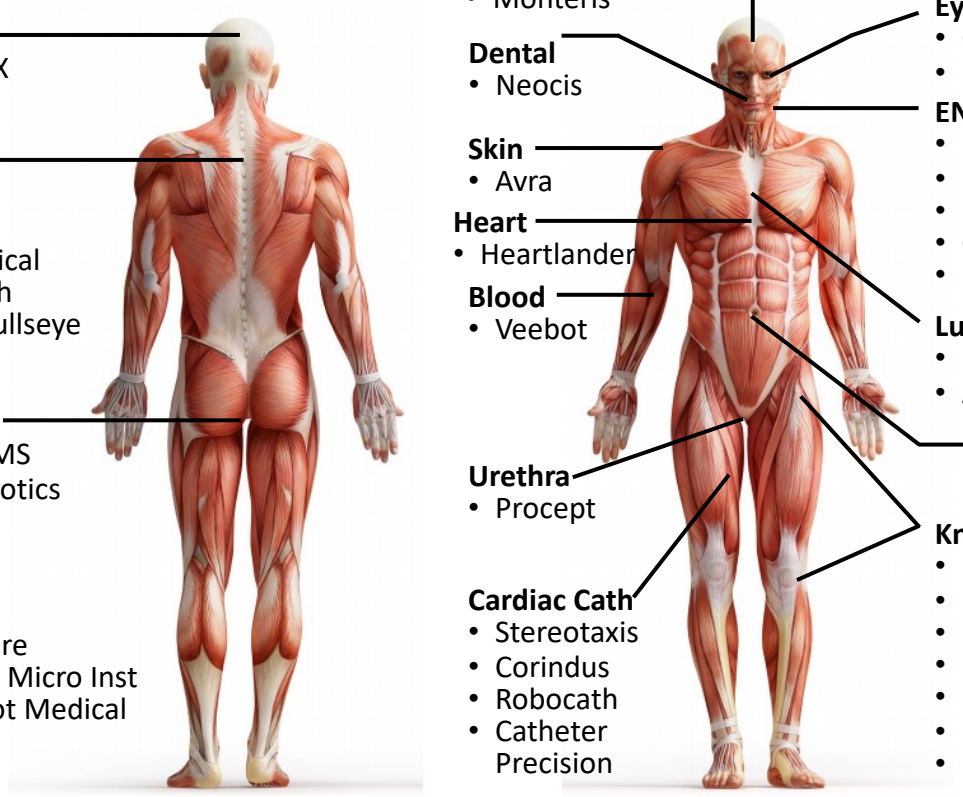
Hair
- ARTAS iX

Spine
- Mazor
- Globus
- KB Medical
- Medtech
- Spine Bullseye

Transanal
- EDAP TMS
- Medrobotics

General
- Kuka
- Microsure
- Medical Micro Inst
- Microbot Medical



Neuro
- Mazor
- Synaptive
- Medtech
- Monteris
- Elekta
- Renishaw
- Centauri
- BrainLab
- Varian
- IMRIS
- Remebot

Dental
- Neocis

Skin
- Avra

Heart
- Heartlander

Blood
- Veebot

Urethra
- Procept

Cardiac Cath
- Stereotaxis
- Corindus
- Robocath
- Catheter Precision

Eyes
- Cambridge Consult
- Preceyes

ENT
- Medrobotics
- Intuitive
- Medineering
- Galen Robotics
- iotaMotion

Lungs
- Intuitive
- Auris

Knee/Hip
- Stryker/Mako
- THINK Surgical
- Smith & Nephew
- Tinavi
- OmniLife
- Orthotaxy
- AOT

Abdomen
- Intuitive
- Transenterix
- Accuray
- Titan Medical
- CMR Surgical
- Meere Co.
- Micro Hand S
- Verb
- Medtronic
- Medicroid
- Virtual Incision
- Vicarious Surgical
- Memic Med
- USMI
- Avatera
- MST
- AKTORmed
- Human Xtensions
- ACTIV Surgical
- EndoControl
- XACT
- Perfint
- Freehand
- Endomaster
- Dexterite Surgical

LinkedIn Robot-of-the-Day #ROTD

THE LEARNING CURVE

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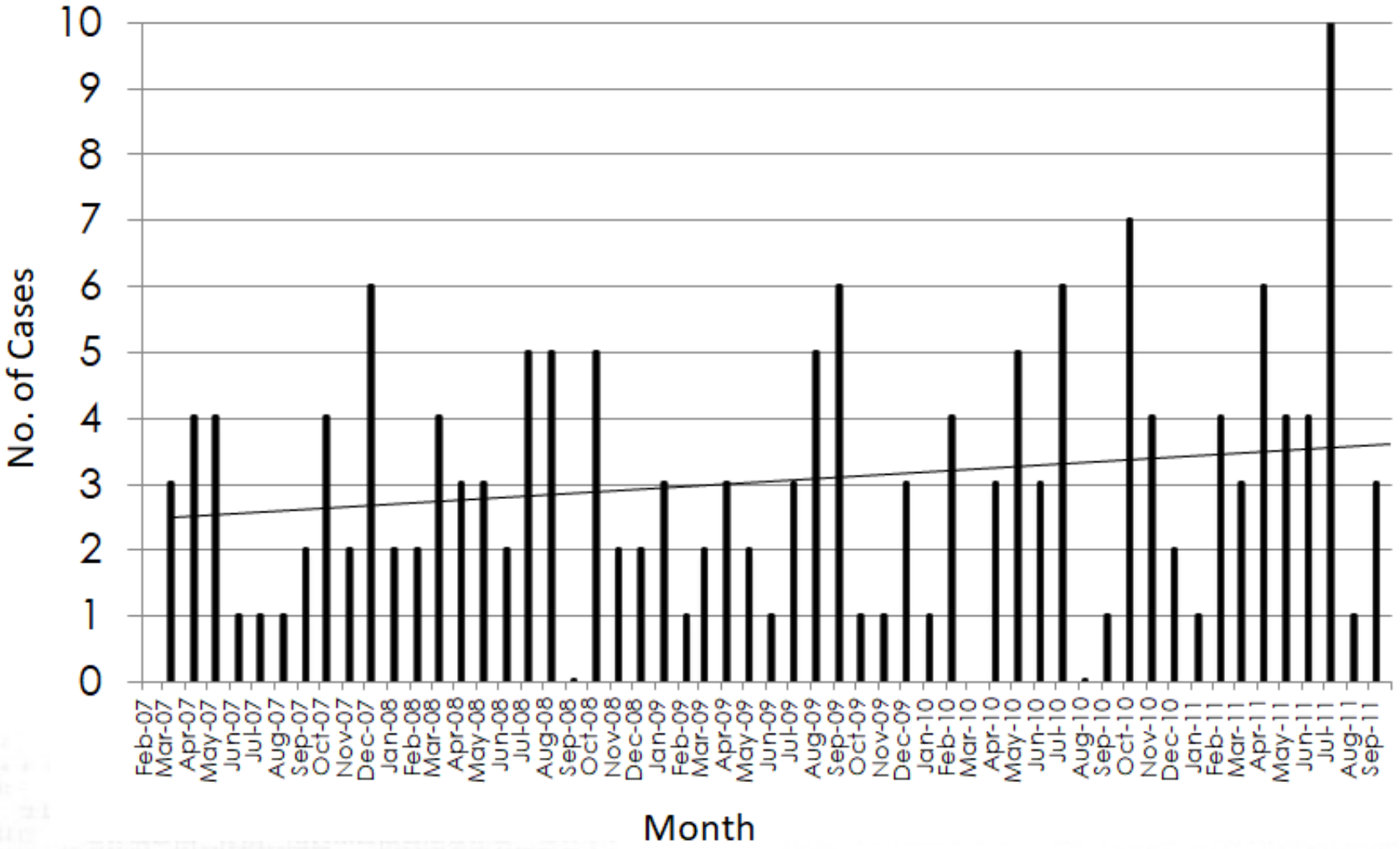
The learning curve represents the initial difficulty in learning something new and, to an extent, how much there is to learn after familiarity.

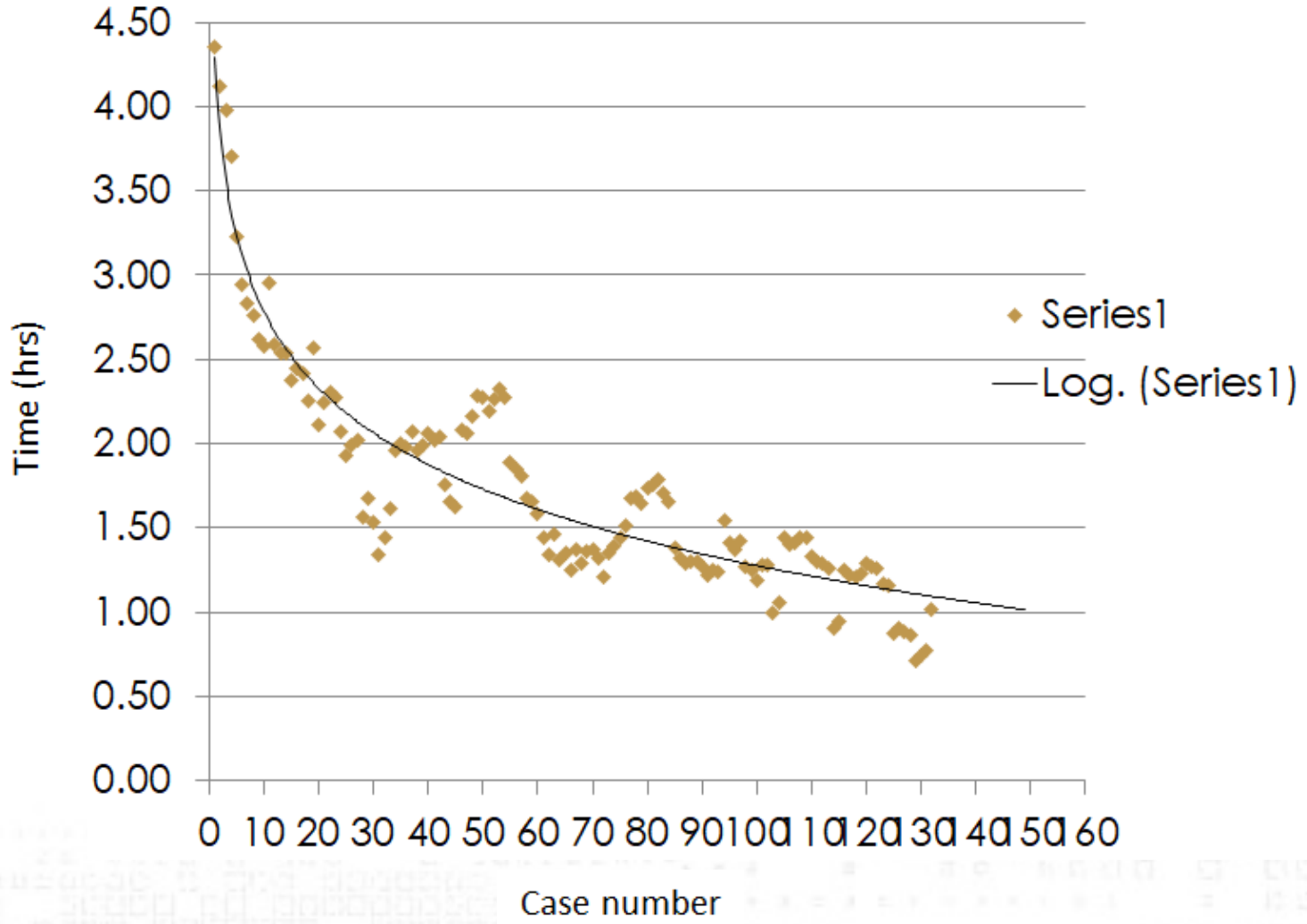
Influenced by:

- **Surgeon**
- **Surgical team**
- **Patient population**
- **Frequency of cases**
- **Number of cases performed**

CASE FREQUENCY



AVERAGE OPERATIVE TIMES



FUNDAMENTALS OF ROBOTIC SURGERY

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FRS
Fundamentals of Robotic Surgery

SIGN IN

Curriculum Consensus Training Model Experts Contact News

Welcome to FRS

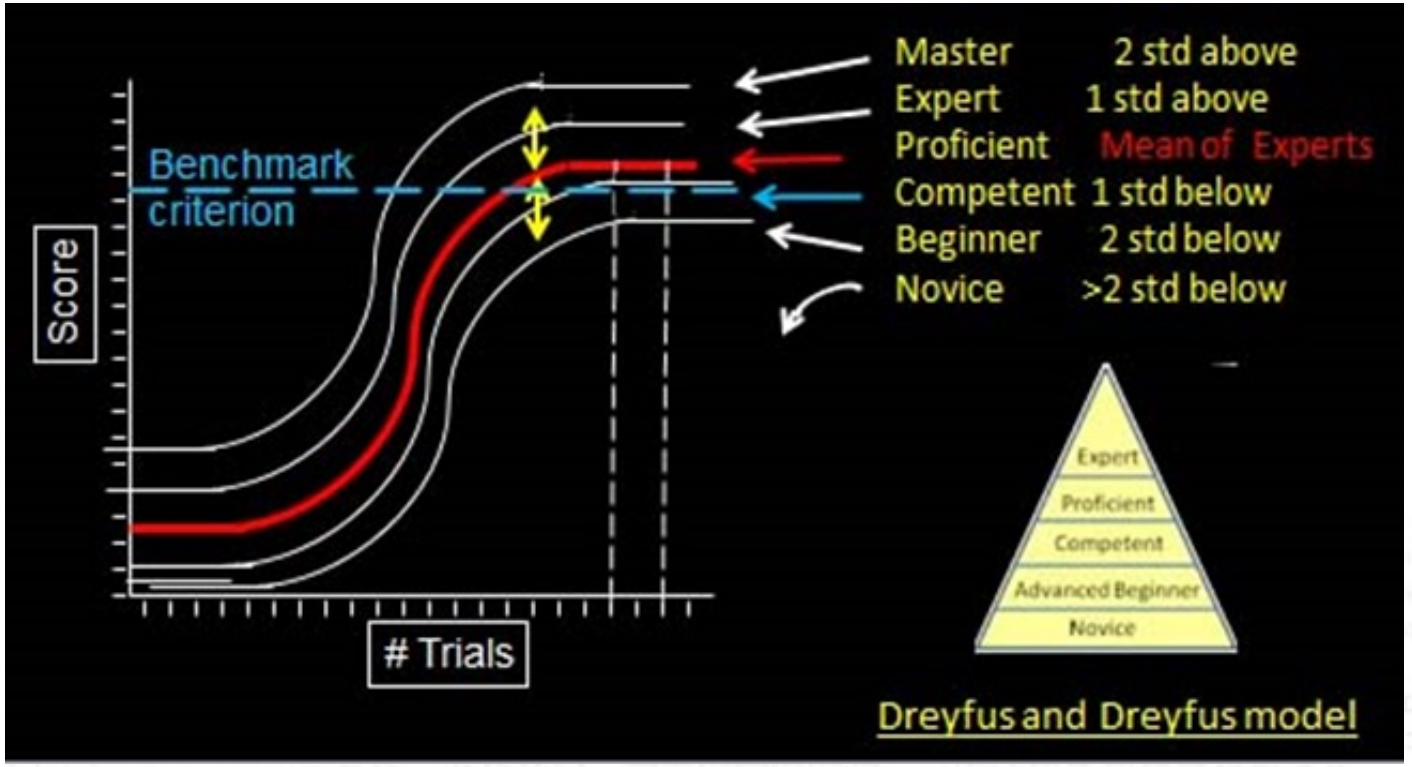
The Fundamentals of Robotic Surgery (FRS) is the definitive robotic surgical skills education, training, and assessment program. FRS is a multi-specialty, proficiency-based curriculum of basic technical skills to train and assess surgeons to safely and efficiently perform robotic-assisted surgery. The clinical robotic surgery subject matter experts developing the content for this program represent all of the major surgical specialties in the United States that currently perform robotic-assisted surgical procedures, the Department of Defense and the Veterans Administration (VA).

REGISTER FOR THE FRS CURRICULUM

Latest News

SETTING BENCHMARKS

- Process for Setting the Benchmark Criteria for Any Curriculum
- Train expert/experienced surgeons to their learning curve
- Two consecutive trials with no improvement
- Calculate the mean of their performance
- Calculate the standard deviation for other levels
- Proficiency is the Mean of Expert Performance



FRS VALIDATION

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Proving the Effectiveness of the Fundamentals of Robotic Surgery (FRS) Skills Curriculum

A Single-blinded, Multispecialty, Multi-institutional Randomized Control Trial

Satava, Richard M., MD, FACS[*]; Stefanidis, Dimitrios, MD, PhD[†]; Levy, Jeffrey S., MD[‡]; Smith, Roger, PhD[§]; Martin, John R., MD[†]; Monfared, Sara, MD[†]; Timsina, Lava R., PhD[†]; Darzi, Ara Wardkes, MD[¶]; Moglia, Andrea, PhD[||]; Brand, Timothy C., MD[#]; Dorin, Ryan P., MD[**]; Dumon, Kristoffel R., MD[††]; Francone, Todd D., MD[‡‡]; Georgiou, Evangelos, MD PhD[§§]; Goh, Alvin C., MD[¶¶]; Marcet, Jorge E., MD[||||]; Martino, Martin A., MD[##]; Sudan, Ranjan, MD[***]; Vale, Justin, MBBS[|||]; Gallagher, Anthony G., PhD[†††,‡‡‡]

Annals of Surgery: January 31, 2019 - Volume Publish Ahead of Print - Issue - p
doi: 10.1097/SLA.0000000000003220
Original Article: PDF Only

FRS HANDS-ON TRAINING SIMULATOR: THE "DOME"

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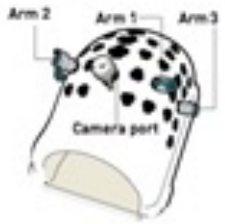
Dome Instruction Guide

Task 1
Docking and instrument insertion

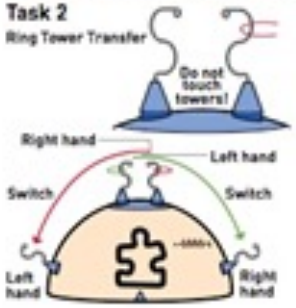


First insert camera port and camera.

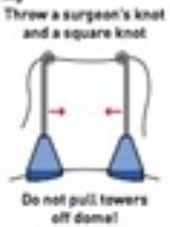
Then use visualization to insert trocars and instruments.

Insert instruments:
Arm 1: Needle Driver, Arm 2: Needle Driver, Arm 3: Curved Scissors

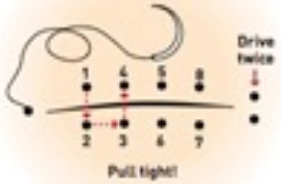
Task 2
Ring Tower Transfer



Task 3
Knot-Tying

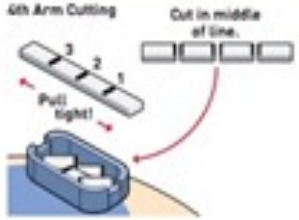


Task 4
Suturing



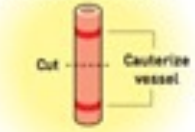
Insert instruments:
Arm 1: Curved Scissors, Arm 2: Maryland Graspers, Arm 3: Needle Driver

Task 5
4th Arm Cutting



Task 6
Puzzle Piece Dissection

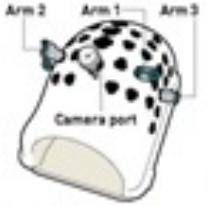
Task 7
Vessel Dissection



FOR ASSISTANCE PLEASE CONTACT THE SUPPORT STAFF AT 407-303-4276 OR AT FRS@FLHOSP.ORG.

Task 1a
Docking and instrument insertion

First insert camera port and camera.



Then use visualization to insert trocars and instruments.

Task 1b
Camera Targeting
Start with target #1

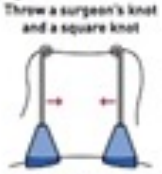
Zoom IN until two red lines are are seen

Zoom OUT until two green lines are seen

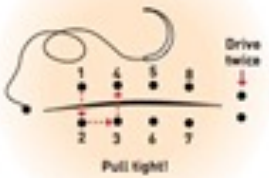
Insert instruments:
Arm 1: Needle Driver, Arm 2: Needle Driver, Arm 3: Curved Scissors

Task 2
Ring Tower Transfer

Task 3
Knot-Tying

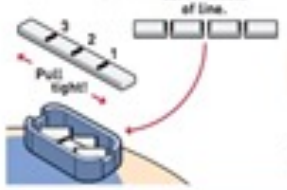


Task 4
Suturing



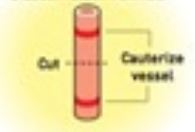
Insert instruments:
Arm 1: Curved Scissors, Arm 2: Maryland Graspers, Arm 3: Needle Driver

Task 5
4th Arm Cutting

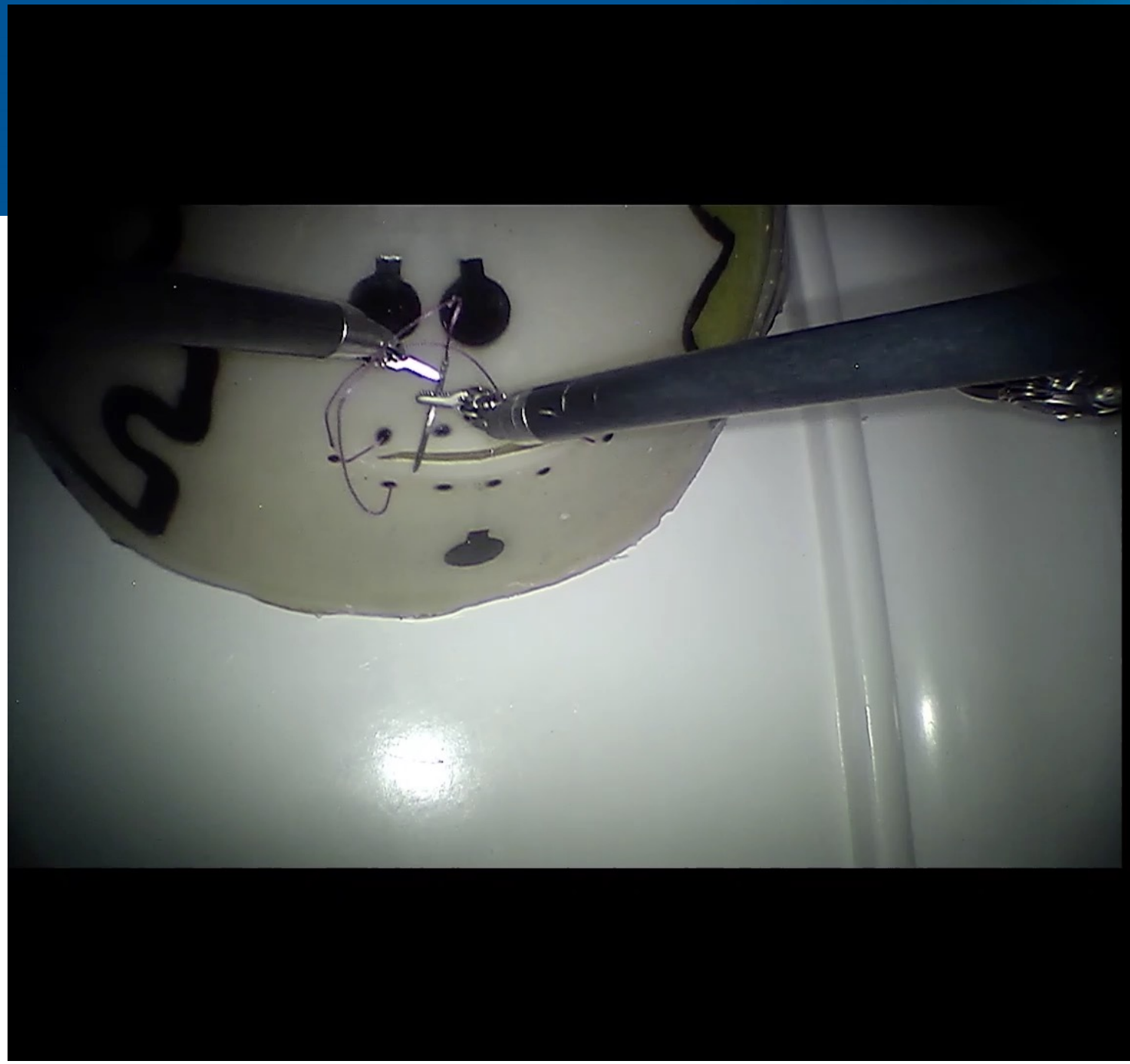


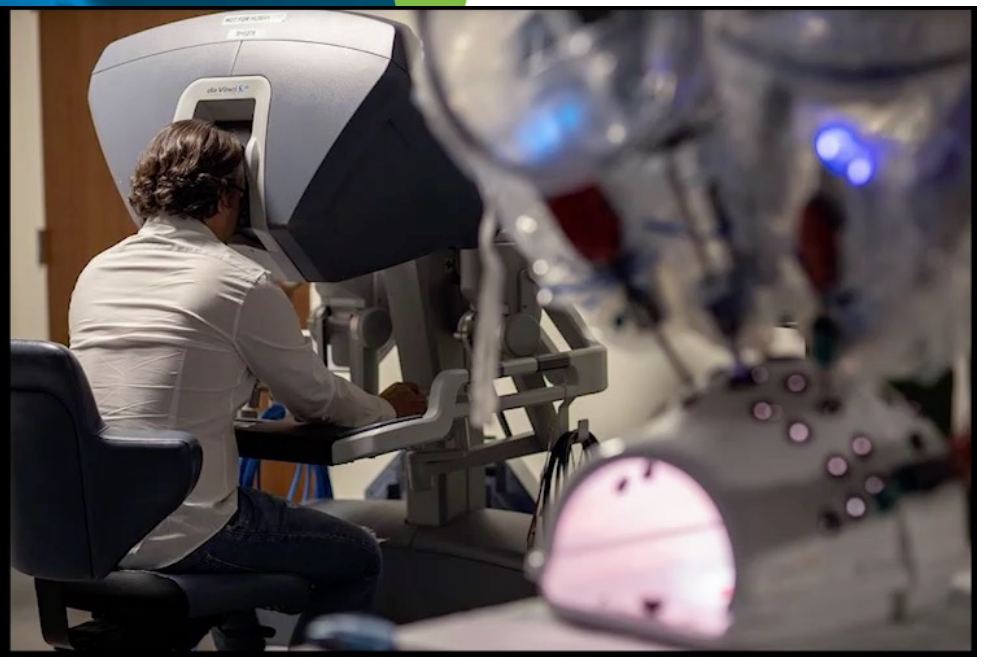
Task 6
Puzzle Piece Dissection

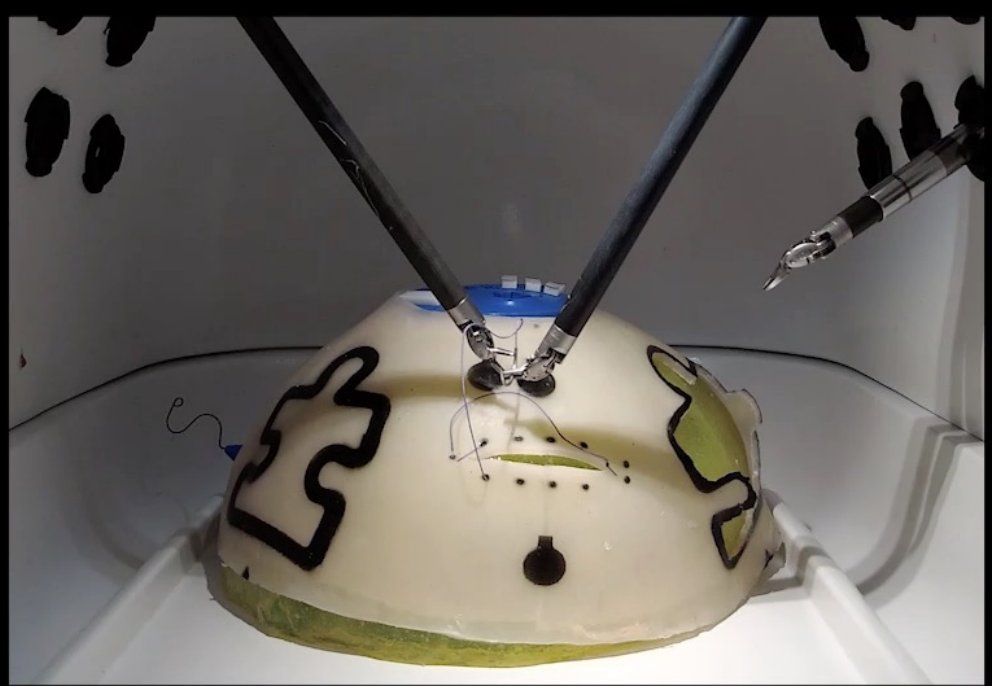
Task 7
Vessel Dissection



Dome Instruction Guide







ROBOTIC ASSESSMENT TOOL: GEARS

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Global Evaluative Assessment of Robotic Skills: Validation of a Clinical Assessment Tool to Measure Robotic Surgical Skills

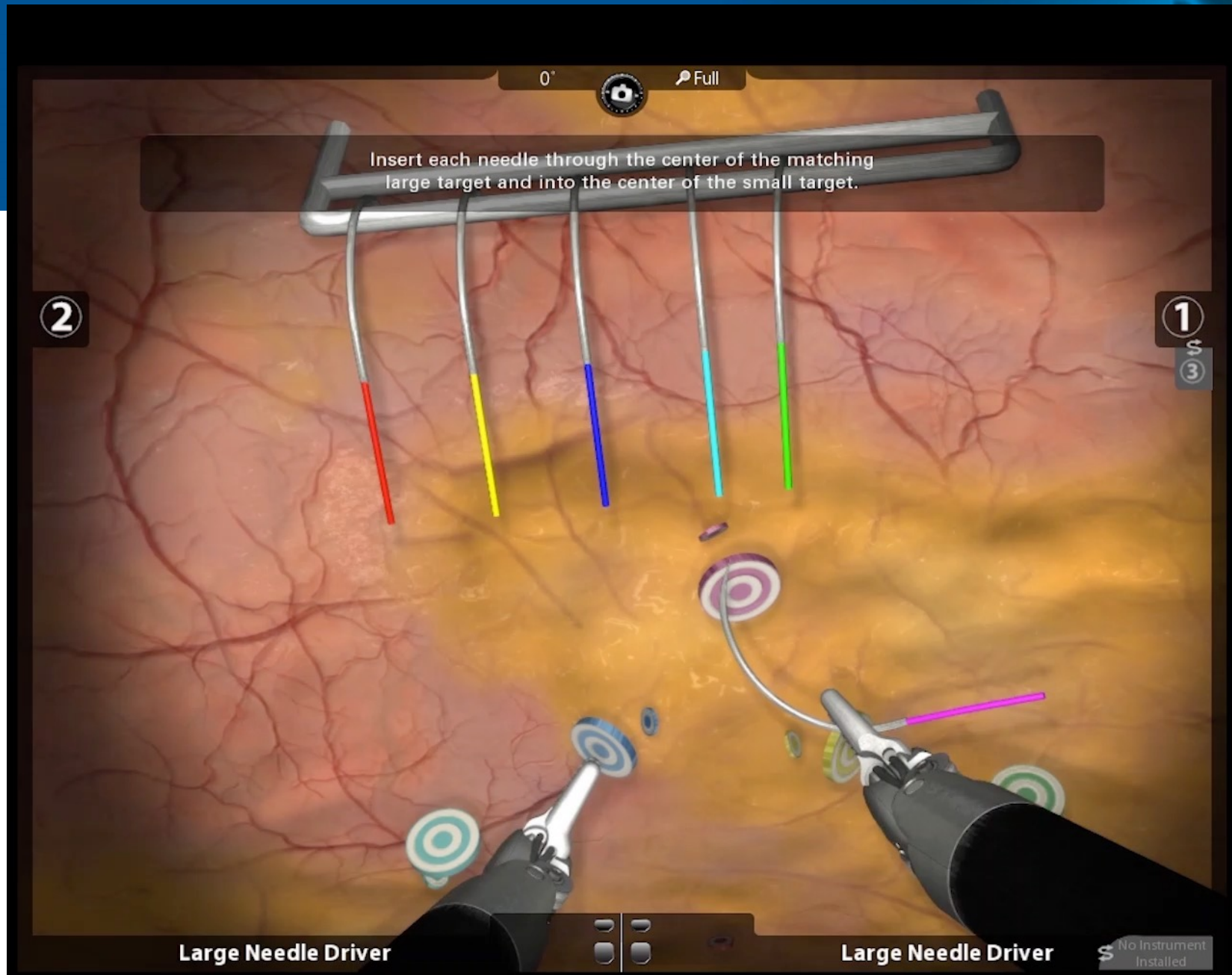
Alvin C. Goh,* David W. Goldfarb, James C. Sander, Brian J. Miles† and Brian J. Dunkin

From the Scott Department of Urology, Baylor College of Medicine (ACG, DWG, JCS) and Methodist Institute for Technology, Innovation and Education (BJD), Houston (BJM), Texas

0022-5347/12/1871-0247/0
THE JOURNAL OF UROLOGY®

Vol. 187, 247-252, January 2012
Printed in U.S.A.
DOI:10.1016/j.juro.2011.09.032

Depth perception				
1	2	3	4	5
Constantly overshoots target, wide swings, slow to correct		Some overshooting or missing of target, but quick to correct		Accurately directs instruments in the correct plane to target
Bimanual dexterity				
1	2	3	4	5
Uses only one hand, ignores nondominant hand, poor coordination		Uses both hands, but does not optimize interaction between hands		Expertly uses both hands in a complementary way to provide best exposure
Efficiency				
1	2	3	4	5
Inefficient efforts; many uncertain movements; constantly changing focus or persisting without progress		Slow, but planned movements are reasonably organized		Confident, efficient and safe conduct, maintains focus on task, fluid progression
Force sensitivity				
1	2	3	4	5
Rough moves, tears tissue, injures nearby structures, poor control, frequent suture breakage		Handles tissues reasonably well, minor trauma to adjacent tissue, rare suture breakage		Applies appropriate tension, negligible injury to adjacent structures, no suture breakage
Autonomy				
1	2	3	4	5
Unable to complete entire task, even with verbal guidance		Able to complete task safely with moderate guidance		Able to complete task independently without prompting
Robotic control				
1	2	3	4	5
Consistently does not optimize view, hand position, or repeated collisions even with guidance		View is sometimes not optimal. Occasionally needs to relocate arms. Occasional collisions and obstruction of assistant.		Controls camera and hand position optimally and independently. Minimal collisions or obstruction of assistant


0°
Full
Insert each needle through the center of the matching large target and into the center of the small target.
2
1
3
Large Needle Driver
Large Needle Driver
No Instrument Installed

COMPUTER SIMULATION PERFORMANCE METRICS

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Quality & Proficiency Metrics:

Time to Complete Exercise
Economy of Motion
Master Workspace Range

Risk & Safety Metrics:

Instrument Collisions
Excessive Instrument Force
Instruments Out of View
Misapplied Energy Time
Blood Loss Volume
Broken Vessels

COMPUTER SIMULATION PERFORMANCE METRICS

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Florida Hospital Nicholson Center — The skill to heal. The spirit to care.®

mimic

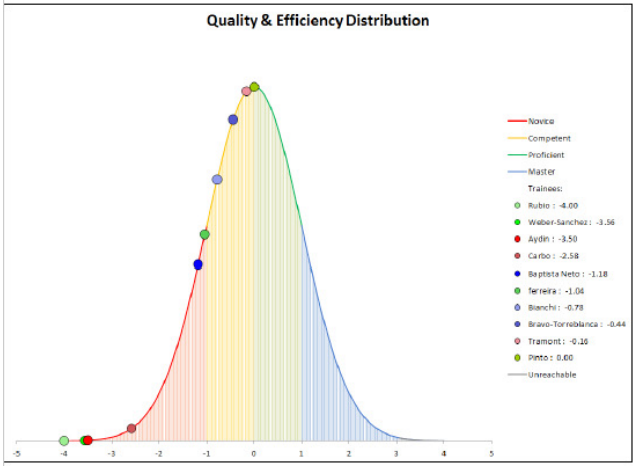
MSim Course Report: BROC-Si

First Session Date	Last Session Date
11/13/2017	11/17/2017

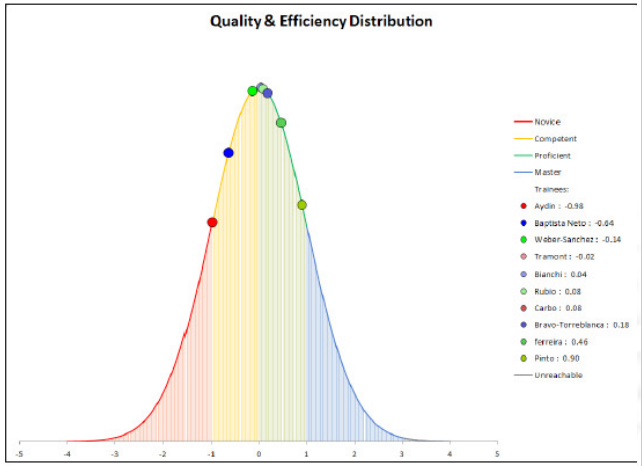
User Performance Improvement

(Quality and Efficiency Metrics)

Initial Performance



End Performance



Florida Hospital Nicholson Center — The skill to heal. The spirit to care.®

mimic

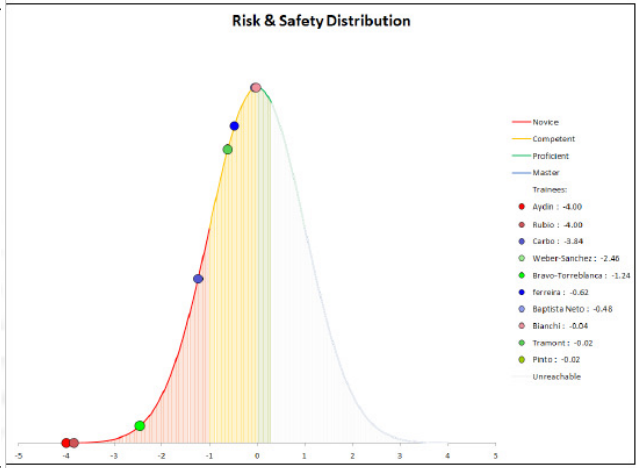
MSim Course Report: BROC-Si

First Session Date	Last Session Date
11/13/2017	11/17/2017

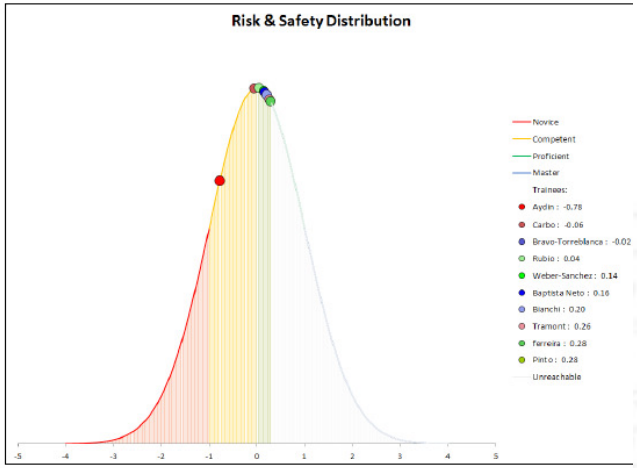
User Performance Improvement

(Risk and Safety Metrics)

Initial Performance



End Performance



PERFORMANCE: PATIENT OUTCOMES

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TECHNICAL SKILL ASSESSMENT OF SURGEONS PERFORMING ROBOT-ASSISTED RADICAL PROSTATECTOMY: RELATIONSHIP BETWEEN CROWDSOURCED REVIEW AND PATIENT OUTCOMES

Khurshid R. Ghani, Ann Arbor, MI; Bryan Comstock, Seattle, WA;*

Table. Risk-Adjusted Rates of Short-term Outcomes After Robot-Assisted Radical Prostatectomy, According to Peer Ratings of Surgical Skill in MUSIC.

Patient outcomes	Quartile 1 skill (lowest 25%)	Quartile 4 skill (highest 25%)	P-value
Excess Blood Loss (>400 cc) rate	3.4%	3.4%	0.901
Prolonged urethral catheter (>16 days) rate	4.4%	6.4%	0.050
Urethral catheter replacement rate	6.7%	3.2%	0.001
Readmission rate	7.7%	4.3%	0.002

Source of Funding: Blue Cross Blue Shield of Michigan

FUTURE IMPACT OF ROBOTIC SURGERY

(The robot today) “is an extension of the physician’s eyes and hands. A robot is supposed to tell you valuable information that’s going to help guide you, it will do some things automatically for you. It will use Big Data, it will use anatomical recognition software…”

“ The top 5% of surgeons can do things that the other 95% just can’t do... Our goal is to democratize surgery... meaning every surgeon can get the results of those high operators in the top 5% of their field.”

Gary Pruden, Worldwide Medical Device Chairman, Johnson and Johnson

Scott.Magnuson.MD@adventhealth.com

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