CISL a division of irt

2010 -- A Year of Destiny for Simulation at Stanford and Nationwide?

- **David M. Gaba, M.D.**
  - Associate Dean for Immersive and Simulation-based Learning, & Professor of Anesthesia; Stanford University
  - Director, Patient Simulation Center of Innovation, VA Palo Alto HCS
  - EIC, *Simulation in Healthcare*

Stanford's Simulation Undertakings are Still World-leading

- I am very proud of all the faculty and clinicians engaged in simulation
- Highly diverse simulation activities for all levels of learners in multiple disciplines & domains
- New CISL accomplishments report reviews latest successes

National & International Simulation Trends

- Simulation accreditation(s) programs are proliferating, e.g.:
  - Am College of Surgeons
  - Am Soc of Anesthesiologists (+ABA /MOCA)
  - SSH (separate education, research, assessment, safety improvement)
  - Etc.

National & International Simulation Trends

- Large networks are adopting simulation
  - Australia national simulation program
  - VA national simulation program
  - Kaiser national simulation program
  - Banner Health (65,000 ft^2 center)
  - Etc.

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National & International Simulation Trends

- Simulation becoming requirement for training and/or certification/MOC
  - Surgery RRC
  - Anesthesia Board MOCA
  - NRP
  - Etc.

CME at Stanford
Time for a Resurgence?

- LKSC is intended to be a venue for traditional and innovative (e.g. simulation) CME
- Direct industrial support for CME is now forbidden
- Stanford has received a grant (more pending) to demonstrate innovative CME curricula without industry funding

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Stanford & VA Sim Facilities

Immersive Learning Center in the Learning and Knowledge Center

To open for teaching, August, 2010

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Immersive Learning Center (ILC)
28,000 sq ft

SP (pt actor) clinic

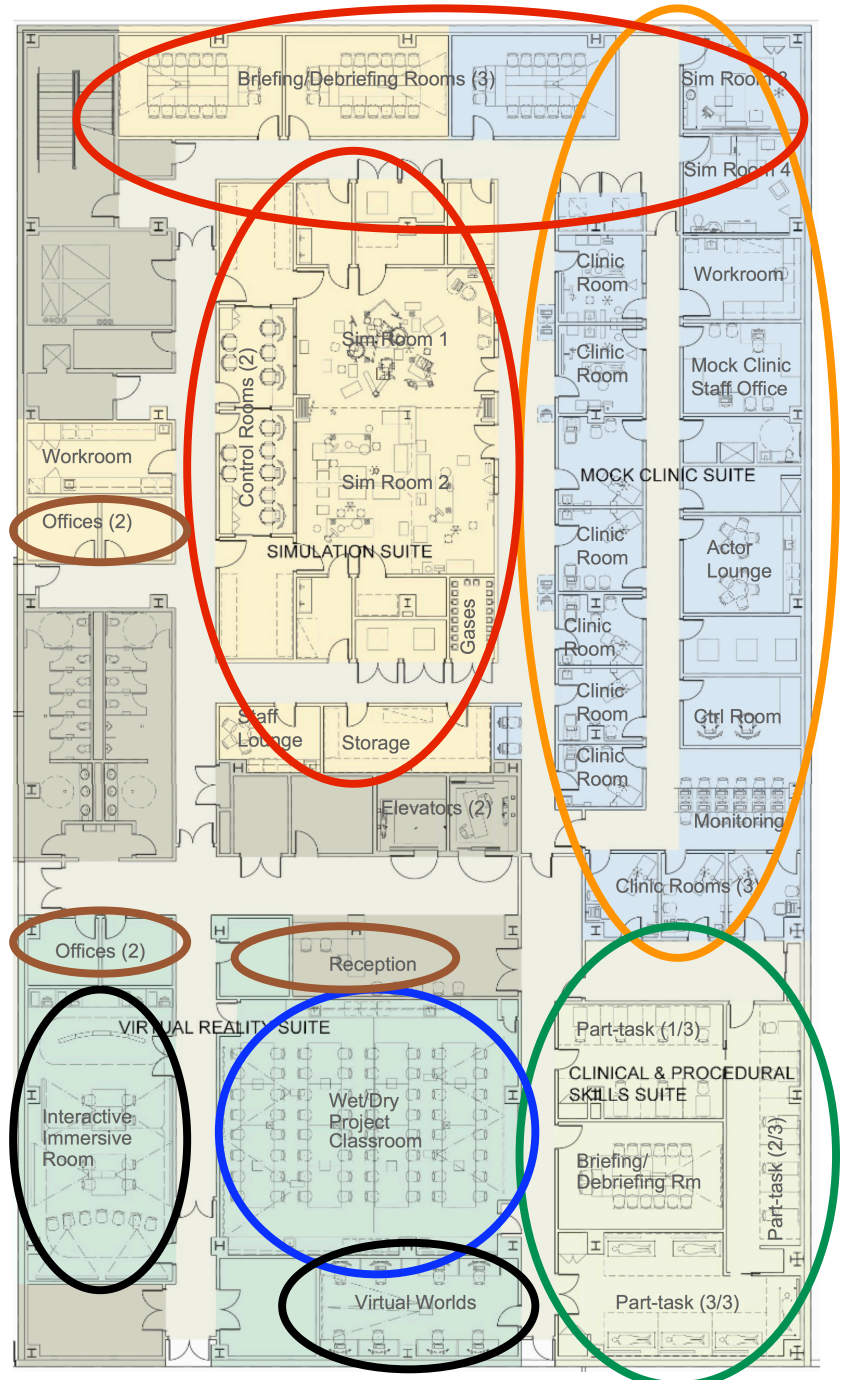
Mannequin-based Simulation

Part-task Training

Virtual Reality

Wet/Dry Classroom

Office Space (+ 3rd floor)



Key Characteristics of ILC in LKSC

- Video from anywhere to anywhere
- Enterprise level recording, annotation, replay system (B-Line)
- High flexibility (most furniture on wheels)
- As much equipment storage as possible

Principles and Plans for ILC in LKSC

- Facilitate use of ISL wherever applicable
- Address ALL learner populations
  - Students, housestaff, experienced
  - Med students are just "1st among equals"
- Use all modalities of ISL
  - Actors, part-task/procedural trainers, mannequins, virtual worlds & VR, visualization, & hybrids of all

Principles and Plans for ILC in LKSC

- Facility & professional staff provided by School of Medicine (no cost to users)
  - CISL Prog Director, Simulationists, technician, SP personnel, AV tech support
- LKSC provides "Housing" and first-line "care & feeding" for simulators
- Depts. Provide instructors as relevant
  - Also any special supplies or equipment

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Principles and Plans for ILC in LKSC

- Can handle multiple simultaneous activities in the ILC (but there are limits)
- Scheduling to be determined
  - Preliminary analysis shows that all known activities could be accommodated, roughly in existing time-slots
  - Med student courses have primacy, but all activities to be negotiated to best compromise

"We're Moving" Program for LKSC Ready for Teaching August 2010

- Temporary occupancy – Jan, 2010
- Hard equipment installation – now through July, 2010
- Soft equipment installation & testing – March, 2010 – August+
- Staff hiring (on-board) now – June
- Staff training – March - August
- Faculty training – May - August

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Simulation & Medical Equipment

- 1° equipment will be provided by LKSC
  - Simulators usable for multiple purposes and learner groups, esp medical students
  - Simulators with high faculty interest for use in LKSC
  - Basic medical equipment for replicated clinical spaces
  - Generic supplies (e.g. gloves)

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Sharing Program for Specialized Simulation Equipment

- LKSC project will provide partial "matching" funding for highly specialized simulation devices; selected examples (out of many):
  - Trans-esophageal echo sim
  - Cataract surgery simulator
  - Cardiopulmonary bypass simulator
  - Urological surgery simulator

Sharing Program for Specialized Simulation Equipment

- Amount of project match depends on:
  - Extent of use for device
  - Interest of faculty
  - Interest of project (me!)
- LKSC will provide "housing" and 1st -line "care and feeding" "for free"
  - Up to limits of space and tech time
  - Definitive support up to primary owner

Sharing Program for Specialized Simulation Equipment

- To suggest simulator(s) for sharing program contact me or Sandi Feaster:
  - gaba@stanford.edu
  - sfeaster@stanford.edu
- Explain what, how many, how used, learner populations, who will teach, etc.
  - May have standardized application form soon

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The End

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Designing a Pedagogical Model for Virtual Reality and Simulation-based Learning Environments of Healthcare

4th Annual CISL symposium
December 14, 2009

Project Manager, Researcher Tuulikki Keskitalo
Professor Heli Ruokamo

Tekes
European Union
European Regional Development Fund

Purpose and Aims of the Research

- Purpose of this research is to shed light on the pedagogical use of virtual reality (*VR*) and simulation-based learning environments in the field of healthcare

- Aim of this research is to develop a pedagogical model to support facilitating, training and learning processes (FTL) (cf. *TSL processes* Kansanen, Tirri, Meri, Krokfors, Husu & Jyrhämä, 2000; Uljens, 1997;) in VR and simulation-based learning environments

Tekes
European Union
European Regional Development Fund

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Figure 1. Arcada Medical Simulation Centre. Reprinted with the permission of the Arcada University of Applied Sciences©2009.

Figure 2. ENVI virtual centre. Reprinted with the permission of Rovaniemi University of Applied Sciences©2009.

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Theoretical Background

- A pedagogical model can be used to shape curriculums or long term courses of studies, to design instructional materials, and to guide instruction in the classroom and other settings (Joyce & Weil, 1980, p. 1)

- Generally, this research builds on the socio-constructivist and socio-cultural perspectives on learning (Lave & Wenger, 1991; Vygotsky, 1978).
  - Learning is related to all actions that take into account a person as a whole (body, mind and spirit) and the role of cultural tools and artefacts (technology and language).
  - Learning is also seen as active, life wide, life long collaborative knowledge co-creation process.

Tekes

European Union
European Regional Development Fund

Theoretical Background

- The pedagogical model is built on the idea of
  - facilitating-training-learning (FTL) process (*cf. TSL process*, Kansanen et al., 2000; Uljens, 1997) and

  - characteristics of meaningful learning (Hakkarainen, 2007; Jonassen, 1995; Jonassen et al., 1999; Nevgi & Tirri 2003; Ruokamo & Pohjolainen 1999; Vahtivuori-Hänninen et al., 2004).

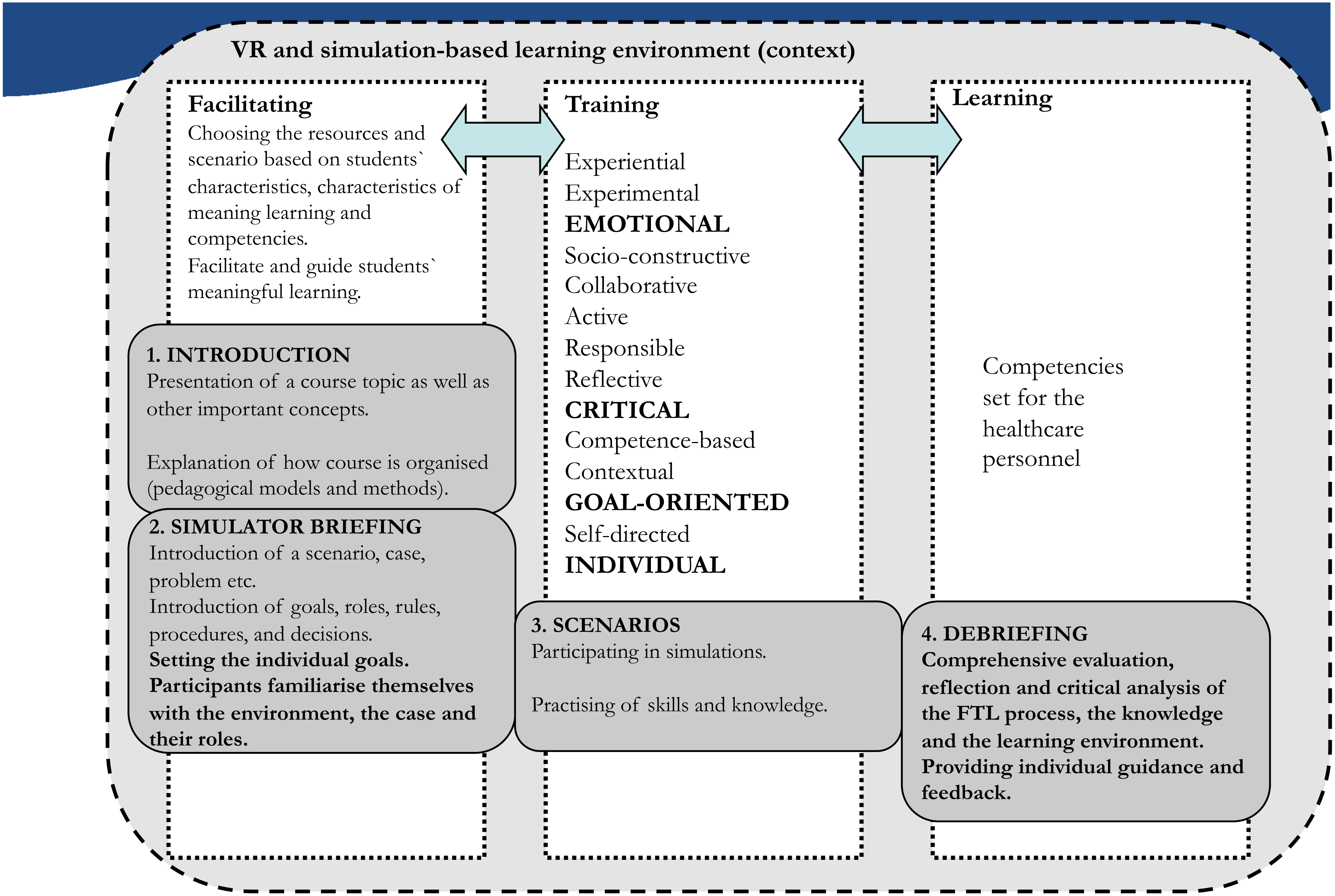

Figure 3. Redesigned pedagogical model for VR and simulation-based learning environment.

Methods

- Designing a pedagogical model is conducted using design-based research method (DBR) (Brown, 1992; Design-based Research Collective, 2003)

2. Cycle of the pedagogical model design:

1. Designing of the pedagogical model based on theories and results of previous researches.

2. The enactment of the redesigned pedagogical model and data collection at the Stanford University, School of Medicine 2009–2010.

3. Analysis of Data.

4. Redesigning of the pedagogical model based on data collection and analysis.

- Data Collection
  - Pre- and post questionnaires for students, interviews of students and teachers, video recordings of sessions

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Thank you!

Centre for Media Pedagogy (CMP)
http://www.ulapland.fi/CMP
Faculty of Education (FoE)
http://www.ulapland.fi/ktk
University of Lapland (UoL)
http://www.ulapland.fi

Email: Firstname.Lastname@ulapland.fi

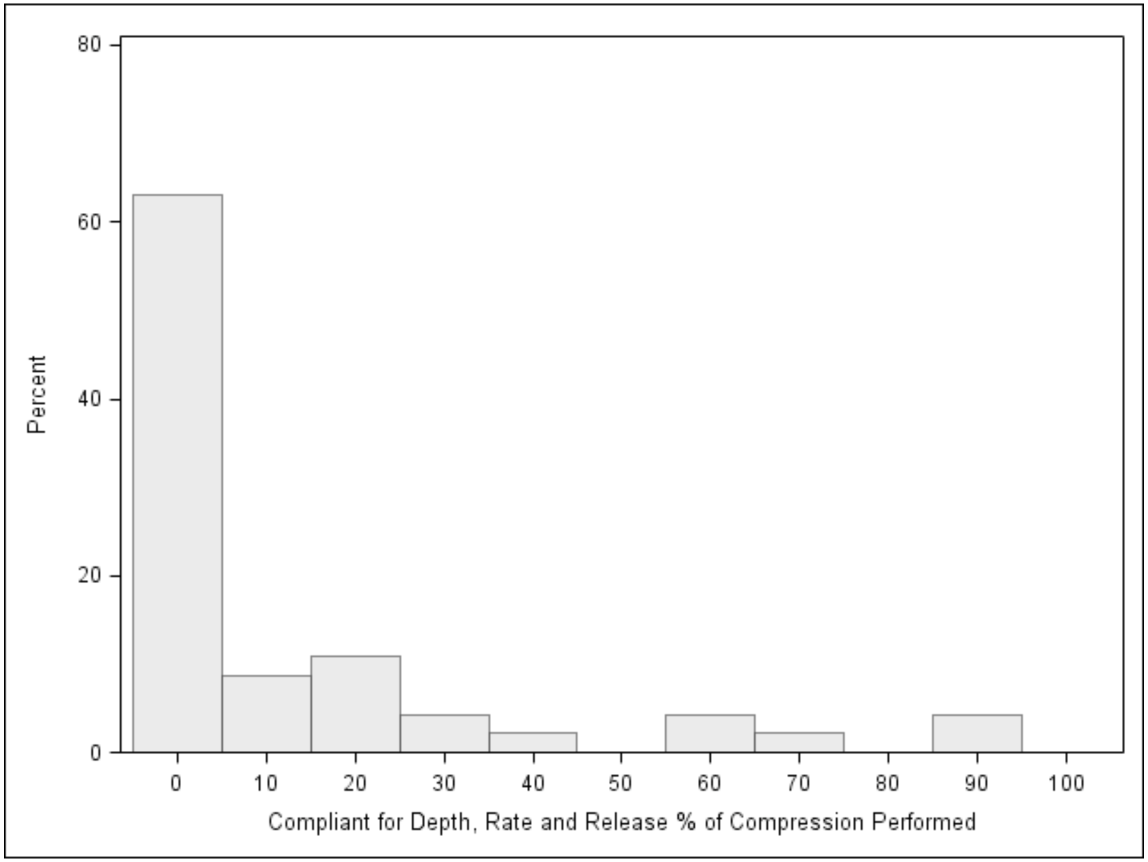
CPR Manikin: Can It Improve Performance?

JESSICA E. PIEROG
GREGORY H. GILBERT

Overview

- Demonstration
- Results
- Conclusions
- Future Studies

Baseline



Percent
80
60
40
20
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0
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20
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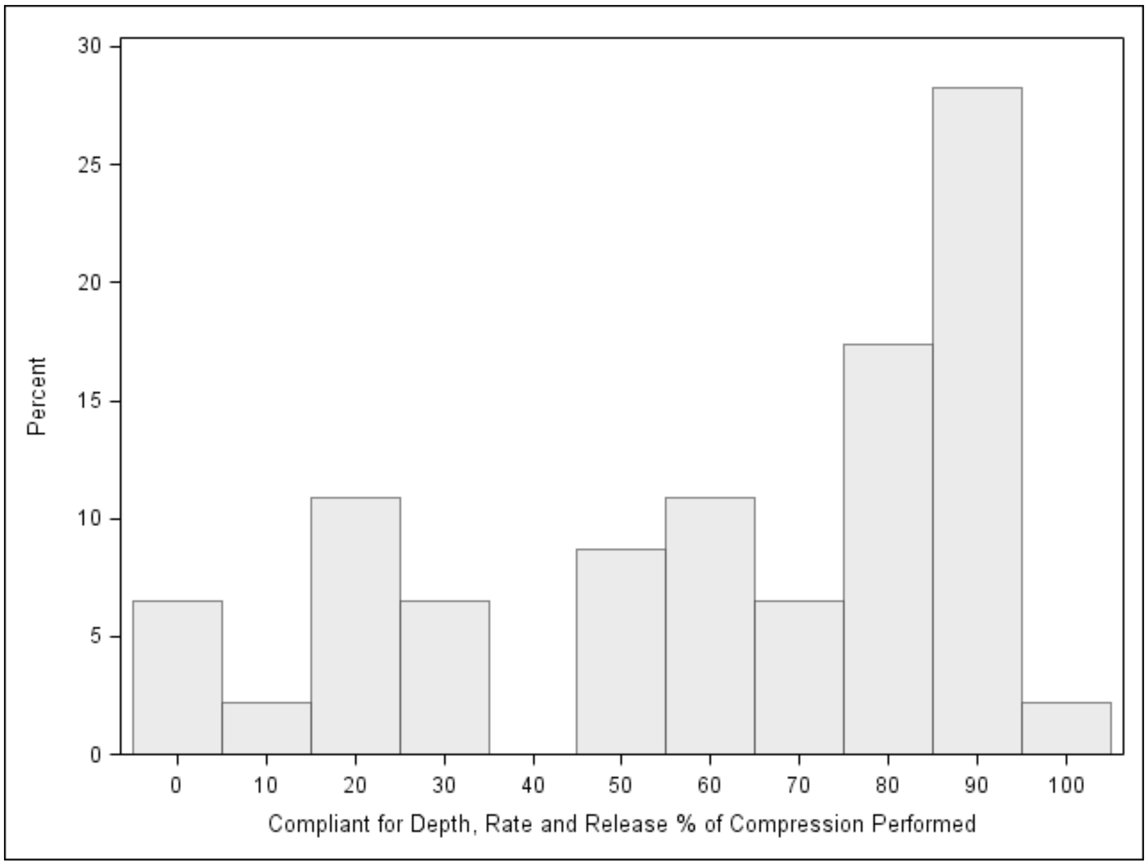
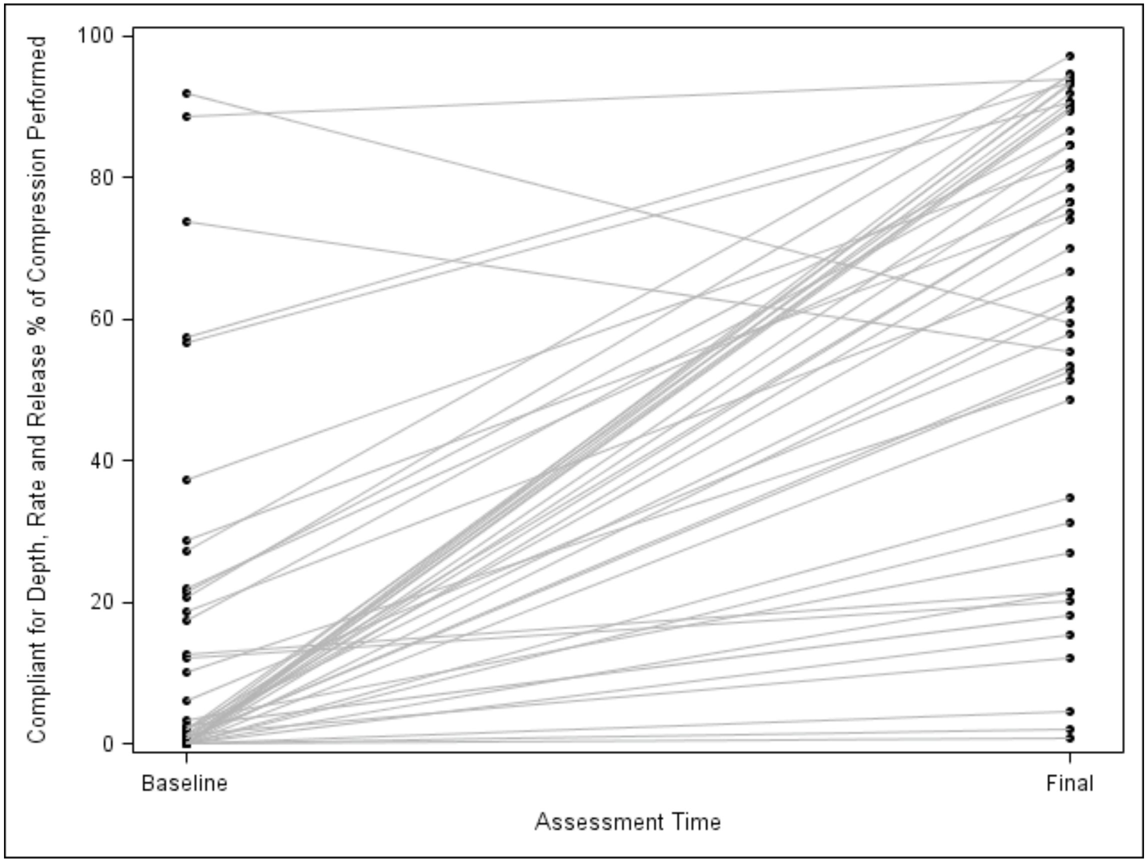
60
70
80
90
100
Compliant for Depth, Rate and Release % of Compression Performed

After Teaching



Comparison



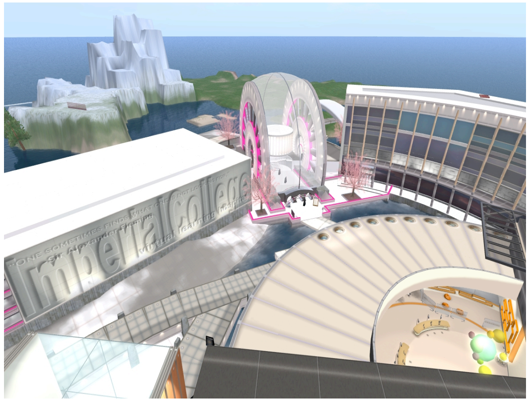
Compliant for Depth, Rate and Release % of Compression Performed
100
80
60
40
20
0
Baseline
Final
Assessment Time

Conclusions

- Experienced CPR Providers Have Significant Room For Improvement
- Improvement Can Be Achieved Quickly
- Objective Training Tool May Improve CPR Education, Training & Performance

Future Studies

- Comparing Teaching Modalities
- CPR Instructors: Subjective Evaluation Accuracy?
- Retention



Medical Education in Virtual Worlds: Use of Automated Pedagogical Agents

By
William Yu, MSME, MSBME
Visiting Medical Student
at Stanford Bioinformatics

Primary Use of Virtual Worlds

- Training and Education
- Collaboration and Meetings
- Simulations and Product Prototyping

Sample of Virtual World Platforms

SECOND LIFE

Teleplace

PROTONMEDIA

activeworlds

Advantages & Disadvantages of Virtual Worlds for Medical Education

Advantages

- Cost savings
- Spatial communication
- Multimedia communication
  - Voice (Internet telephony, podcasts)
  - Instant messaging
  - Chat
  - Video (videostreaming)
  - Images
  - Animations
- Wider outreach

Disadvantages

- High hardware capability requirements
- Slow rendering and animation of objects (lag)
- Difficult to navigate
- Not exactly “real” – no haptics, limited non-verbal communication abilities ($$)
- Animations requires student partially ceding control of avatar
- Content creation tool sets and importing 3-D models require $$ and training

Selected Medical Education Sites in Second Life

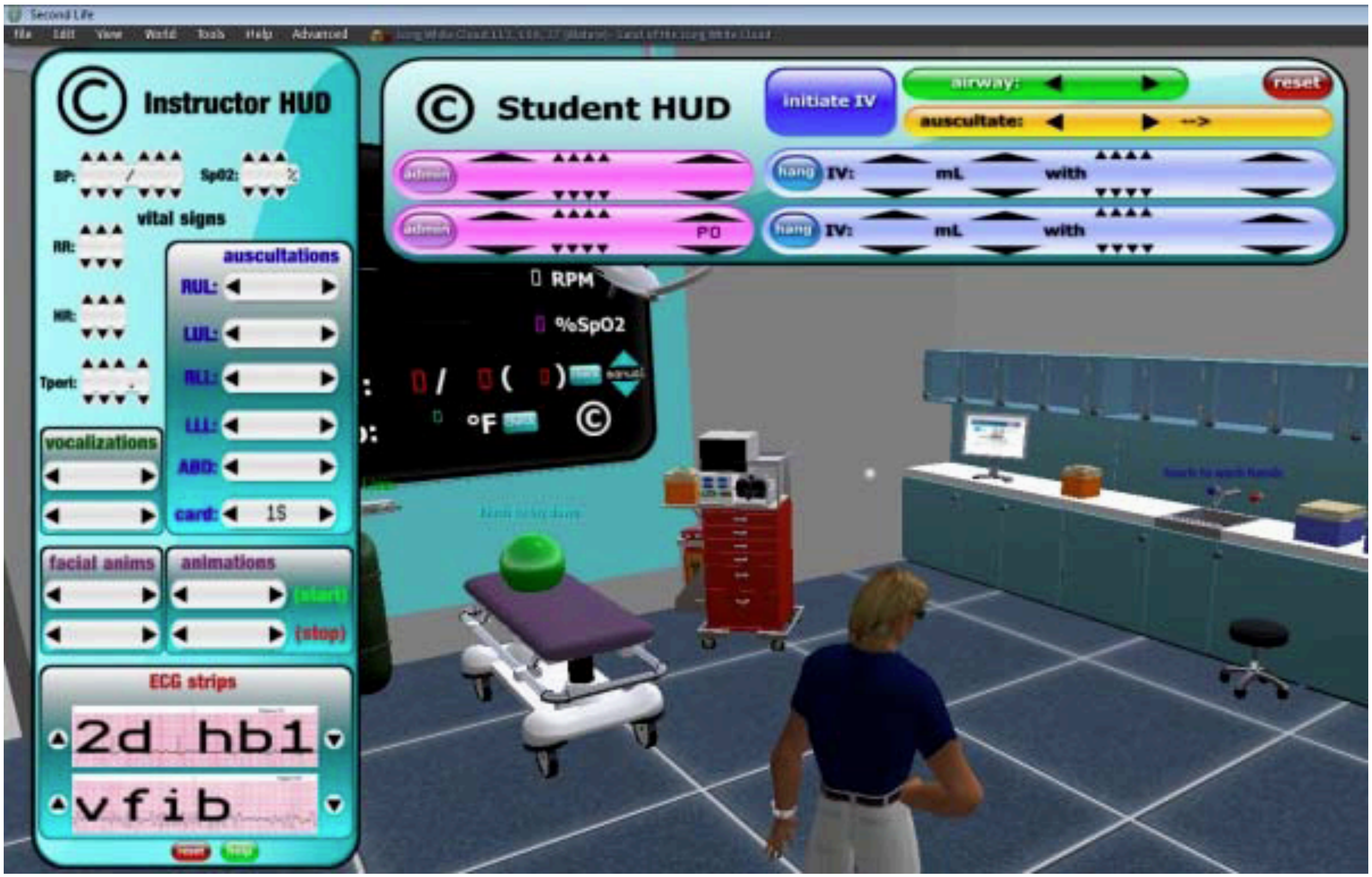
Medical Professional-oriented Sites

- Ann Myers Medical Center
- Heart Murmur Simulations
- Imperial College of London
- Ontario Health Center
- Genome Island
- Virtual Hallucinations
- Reproductive Systems Simulator (Sperm and Ovaries Virtual Tour)
- Long White Cloud (Univ. of Auckland)

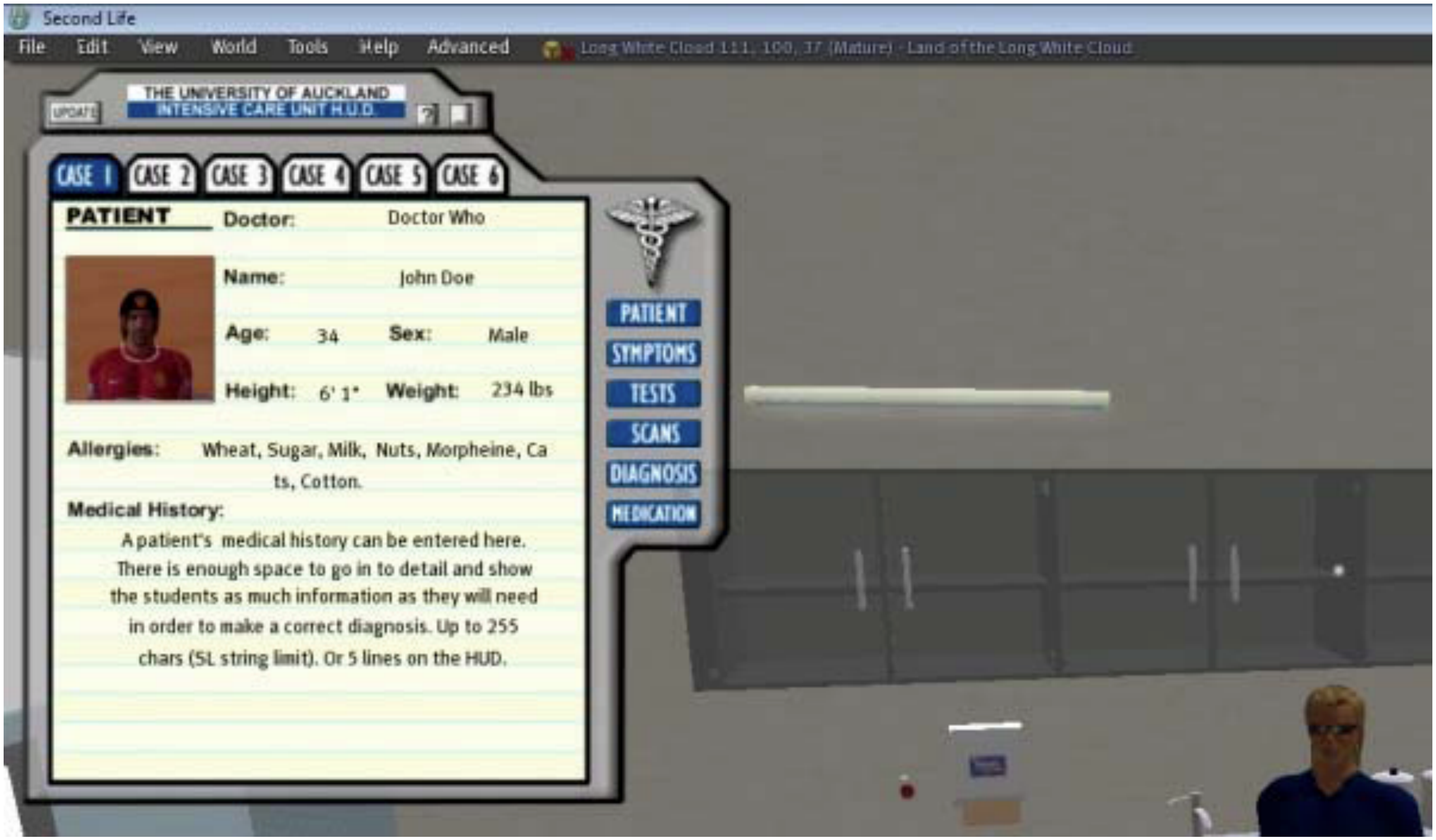
Patient-oriented Sites

- HealthInfo Island
- Virtual Support Center
- SL Stroke
- Virtual Ability
- Virtual Hallucinations

Long White Cloud Simulation



Long White Cloud Simulation



Automated Pedagogical Agents
Introduction

Overview

- Autonomous agents that occupy computer learning environments and facilitate learning by interacting with students or other agents
- Pedagogical agent behaviors include:
  - Ability to reason
  - Acts as a peer, co-learner, or competitor
  - Assist instructors and students in virtual worlds

Animated Pedagogical Agents

- New breed of pedagogical agents that integrate with chat bot technology
- Evolved from advancements in multimedia interfaces & technologies
- Exhibit lifelike behaviors by exploiting both the auditory and visual channels of learner
  - intonation of voice
  - gestures
  - facial expression

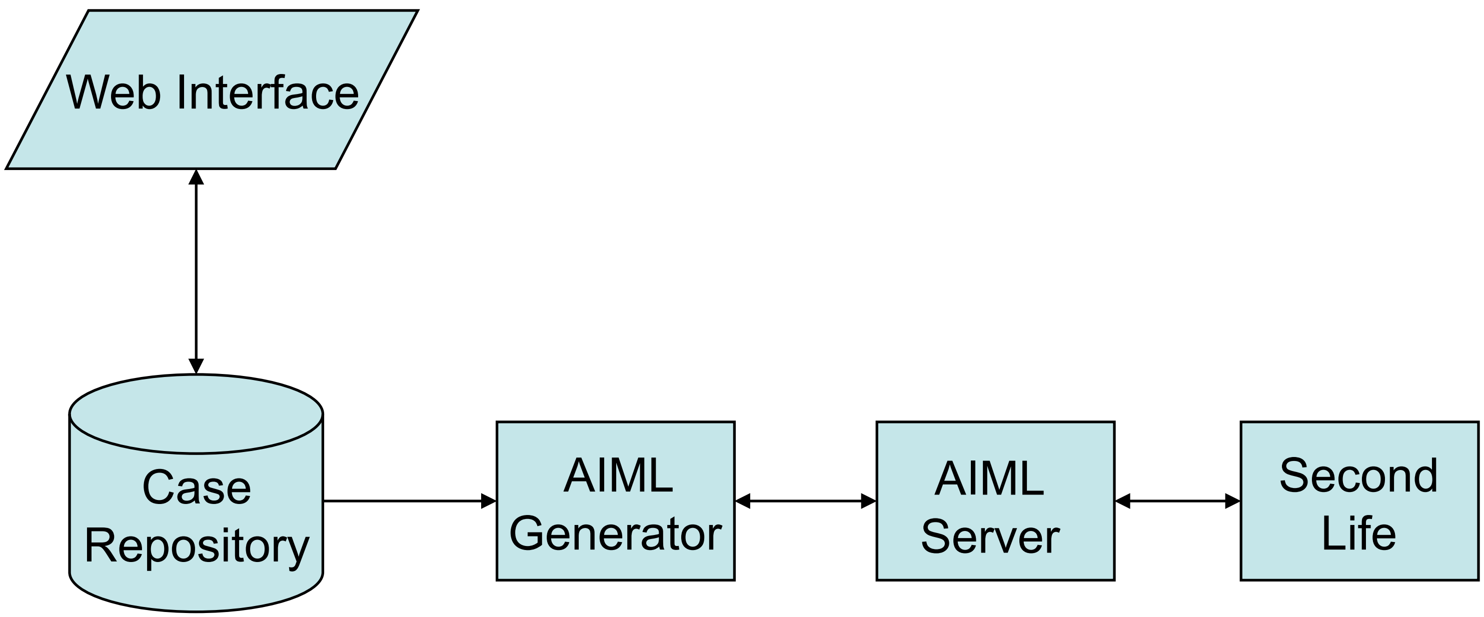
Value Proposition of Automated Pedagogical Agents (Web-based or Virtual World)

- Risk-free
- 24-hour availability
- Administrative cost savings
- Ease to add new cases and update existing cases
- Global pooling of subject matter experts for case development
- Greater exposure to a wider variety of diseases and clinical experiences
- Can provide a means for evaluation, assessment, and certification via simulations
- Most Importantly – positive learning outcomes for students to meet educational requirements (to a limited degree)

Virtual Patient Simulations for Medical Education

- Most virtual world communication is primarily text-based
- Virtual patient controlled by artificial intelligence via AIML and processed via AIML interpreters (Java, C, C++, etc.) for conversational element
- Natural language processing is patterned after traditional patient-doctor interactions (pattern tag - template tag structure)
- Other interactions done via LSL scripts
- Use 3D animation and rendering software (Poser, Avimator, etc.) which is exported to SL
- Integrating animation, audio and chat bot technology → animated pedagogical agent

System Architecture



Possible Uses of Automated Pedagogical Agents in Medical Education

Medical Students

- Physical Diagnosis and Examination
- Third year Individual Core Clerkship OSCE
- USMLE Step 2 Clinical Skills

Housestaff

- ACLS or PALS
- USMLE Step 3

Continuing Medical Education

- Collaborate with certification bodies

Future Development

- Increase collaboration to pool subject matter experts
- Develop analytics to measure clinical skill performance of users vs. traditional teaching models
- Incorporation of clinical decision support engine with animation and SL script
- Incorporation of affective communication

Conclusions

- Virtual world technologies should be embraced for medical education purposes with potential for improved learning outcomes
- System architecture design goals should include
  - Flexibility
  - User friendly
  - Scalability
  - Portability

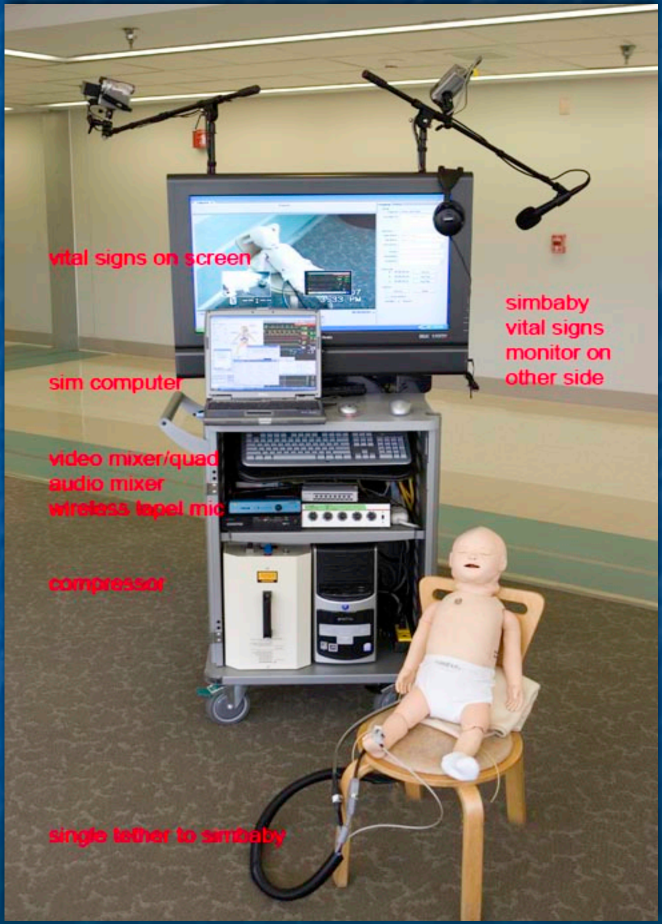
PASS: **P**ediatric **A**nesthesia **S**imulation in-**S**itue

Anita Honkanen, MD
Chief of Pediatric Anesthesia

PASS: Rapid Setup

- Compact cart
- Compressor
- Computer
- Audio-visual equipment
- Video monitor
- Patient monitor on reverse side
- portable

Created by Michael Chen, MD



Basic Activities

- Physician Training:
  - Residents
  - Fellows
  - hospitalists
- Team Training:
  - APU, OR's
- Systems Checks and Improvement:
  - APU, OR's

Hospitalist: Airway and Sedation

- Historically: rotate in OR for one week,
  - Airway management
  - Experience/increased knowledge of sedation meds
- New Model: day 1 in workshop/sims, days 2 and 3 in OR to apply knowledge
  - Airway workshop: mannequin, tools, techniques
  - Simulation: sedation scenarios - airway/dysrhythmia
  - Review lecture

Perioperative Quality Improvement through Simulation

Goals:

- Improve OR Team understanding of emergency communication
- Improve OR Team understanding of crisis protocols
- Improve Time to Response in critical crises
- Develop Team Coordination and Roles
- Ensure Appropriate Equipment Available

* Ultimately: Impact Patient Outcomes/Safety

Proposed Target Crises

- “Lost Airway” scenario
- Cardiac Arrest
- Massive Unexpected Blood Loss
- Fire in the OR
- Malignant Hyperthermia
- Evacuation

“Lost Airway”

- Can not mask ventilate
- Can not intubate
- Outcome without surgical intervention: desaturation, hypoxic arrest, death
- Requires emergent tracheostomy

Current OR Stats

- Emergent tracheostomy
- Cancellation for inability to intubate, great difficulty masking

- Multiple episodes of requests for help and confusion about communication

When and How?

- Cross departmental coordinated
  - Annual (fire, massive transfusion, evacuation, MH)
- Scheduled OR Crisis
  - Monthly (airway, MH)
- Swat OR Crisis
  - Weekly (cardiac arrest)
  - Any OR that finishes prior to 4PM eligible
  - Run scenario with team in room

Scheduled OR Crisis

- Schedule a "Sim Baby" crisis for one hour in middle of OR day
- One crisis/month
- Every service, one crisis/year
- Complete scenario, debrief, evaluation of performance: in situ in OR
- Compile review of team performance and improvement over year

Tests for OR Teams

- Anesthesiologist:
  - Difficult airway protocol, code protocol, team communication and coordination
- Surgeon
  - Emergent tracheostomy, code protocol, team communication and coordination
- Nursing
  - Initiating emergency protocol, team communication, code protocol
- Ancillary Staff
  - Emergency protocol, coordination of equipment, communication

Simulation Coordinators

- Anesthesia:
  - Michael Chen, RJ Ramamurthi, Rebecca Claure, Jumbo Williams, Manchula Navratnam, Anita Honkanen
- Nursing:
  - Christine Smith
- Surgery:
  - Sanj Dutta

Simulation in Cardiac Surgery: Local to National

James I. Fann, M.D.
Associate Professor in Cardiothoracic Surgery
Stanford University

SIMULATION IN CARDIAC SURGERY

Three Pronged Approach

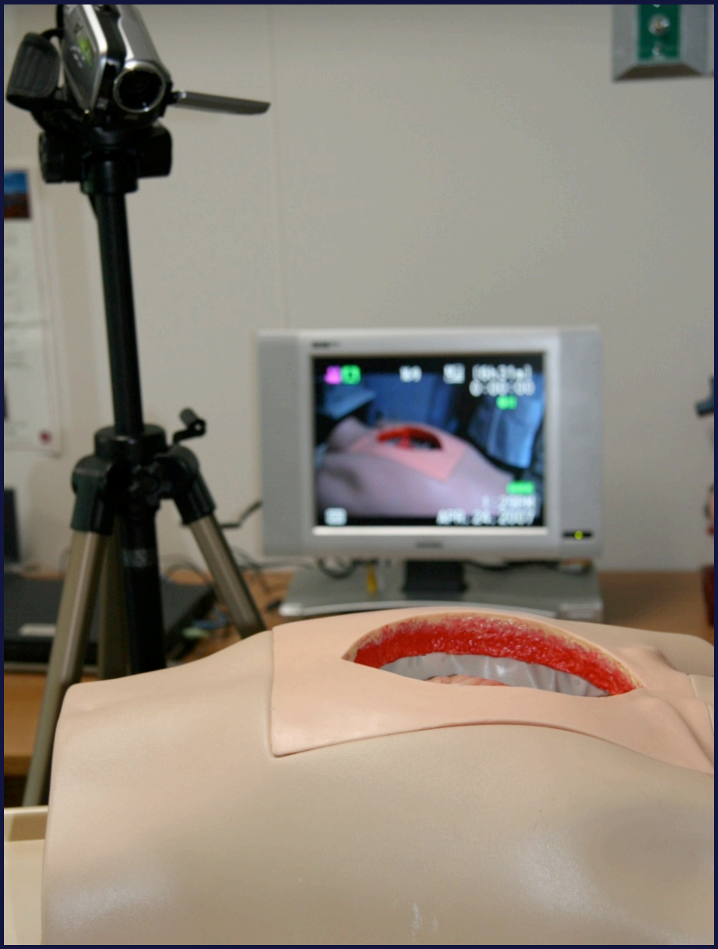
1. Skills/task stations

2. Wet-lab

3. Environmental

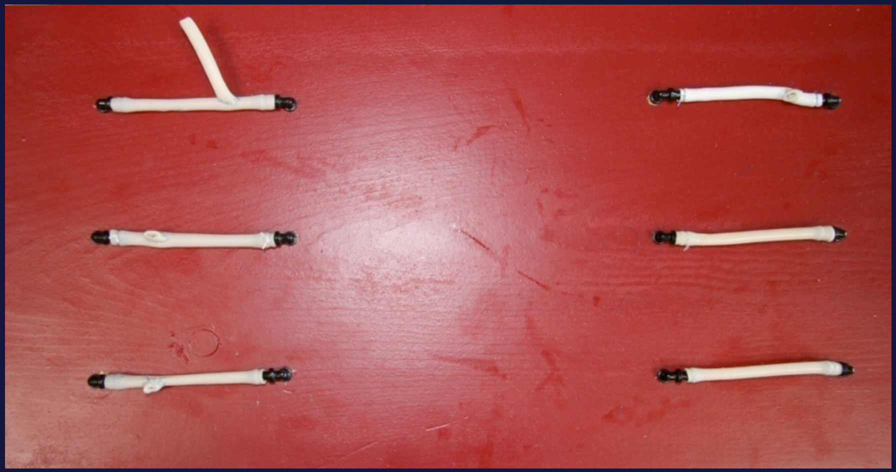
Simulation in Cardiac Surgery

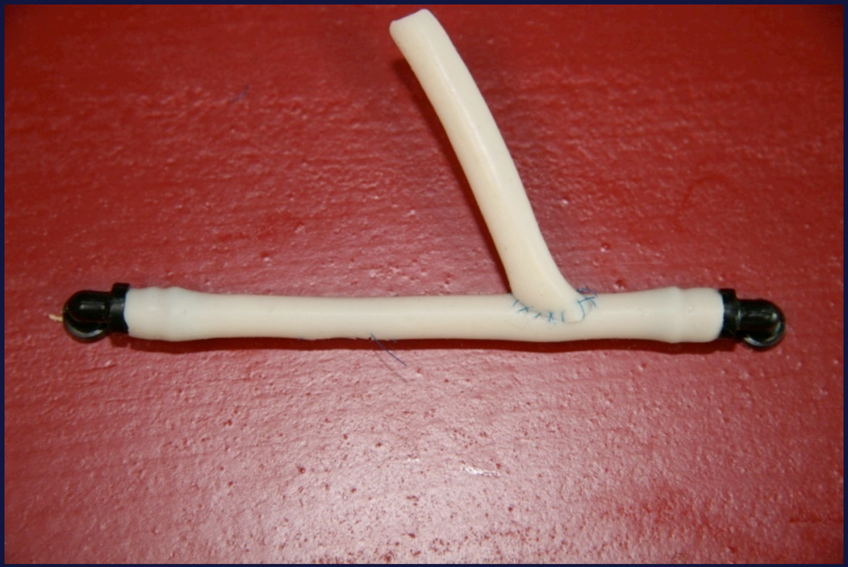
Cardiac Surgical Laboratory

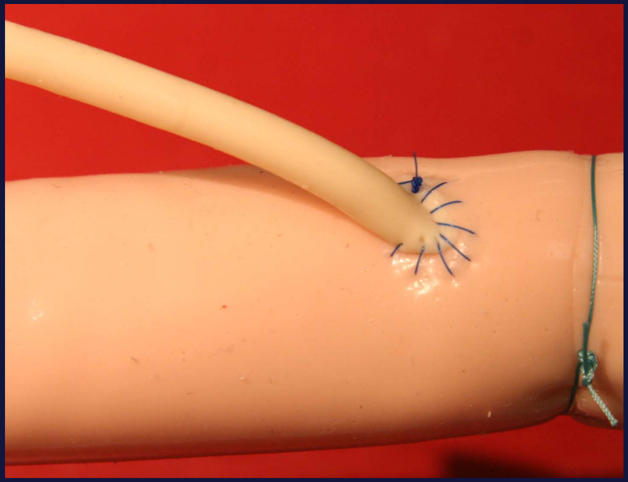


SIMULATION IN CARDIAC SURGERY

Task Station: Anastomosis







Simulation in Cardiac Surgery

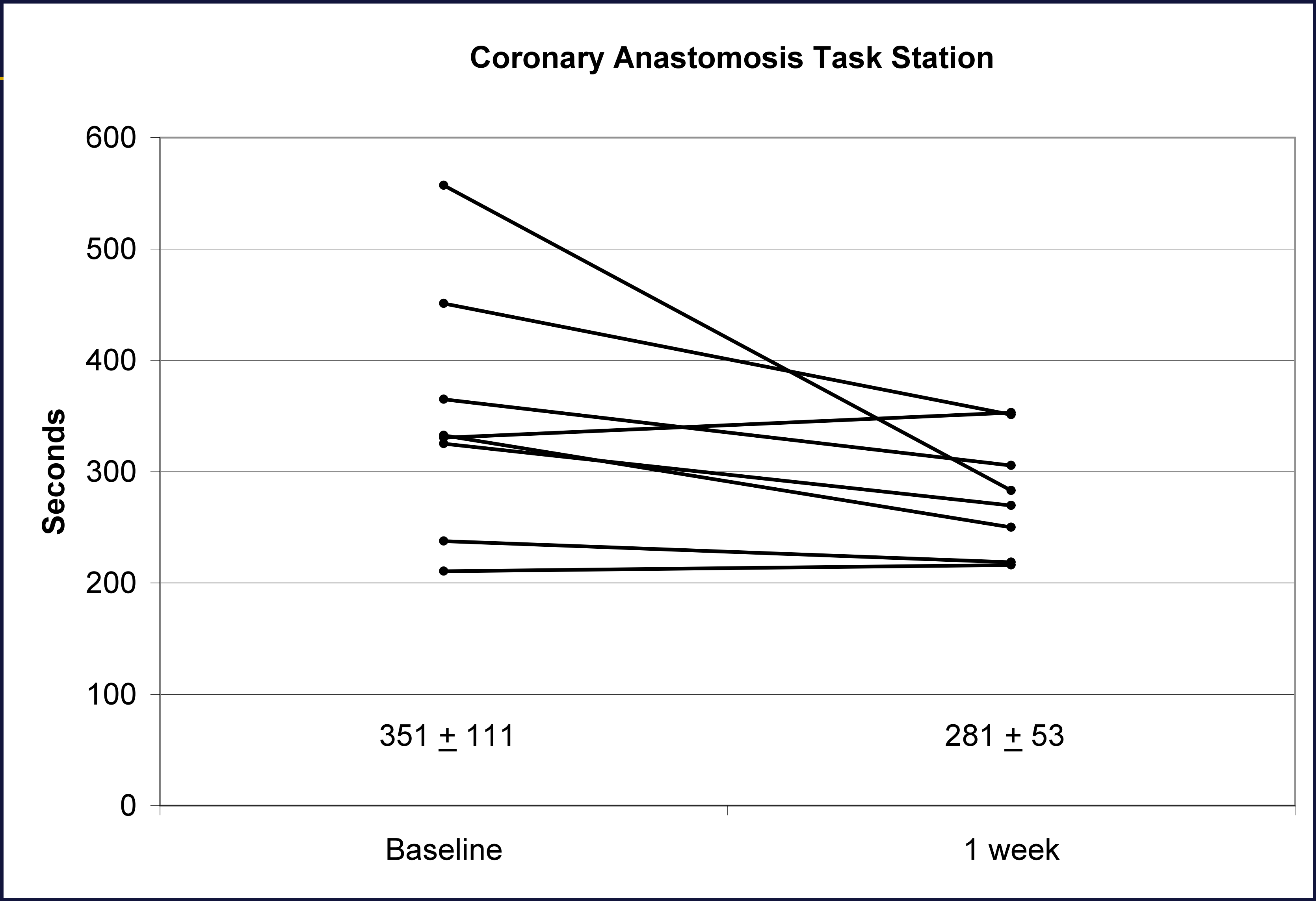
Improvement in Coronary Anastomosis with Cardiac Surgery Simulation

Distributed practice: portable anastomosis station and beating heart model.

8 cardiothoracic surgery residents
Cardiac surgery training: minimal experience to >2 years.
Protocol:
Simulated operating room:
Skill station: 2 end-to-side anastomoses of 3 mm synthetic vein graft to target vessel.
Beating heart model: 2 end-to-side anastomoses to LAD artery 70 beats/min).
Home: Skill station practice, recording practice times.
Simulated operating room (at 1 week):
Skill station: 2 anastomoses
Beating heart model: 2 anastomoses
Sessions were timed, recorded, and reviewed by two blinded experienced surgeons using rating scales.

Fann JI, et al. JTCVS 2008; 136: 1486-1491.

SIMULATION IN CARDIAC SURGERY



Fann JI, et al. JTCVS 2008; 136: 1486-1491.

SIMULATION IN CARDIAC SURGERY

Fann JI, et al. JTCVS 2008; 136: 1486-1491.

SIMULATION IN CARDIAC SURGERY

Anastomosis task station: Mean performance rating scores and degree of improvement comparing pre-practice and post-practice

	Pre-	Post-	Improvement
1. Graft orientation	2.1±1.5	1.4±0.8	31%
2. Bite appropriate	2.0±1.0	1.5±0.8	24%
3. Spacing appropriate	1.9±0.9	1.4±0.7	26%
4. Castroviejo needle holder use	2.0±1.4	1.7±1.0	18%
5. Use of forceps	2.2±1.1	2.0±1.3	9%
6. Needle angles	1.8±1.0	1.4±0.7	21%
7. Needle transfer	2.2±1.1	1.6±0.9	26%
8. Suture management / tension	2.2±1.2	1.4±0.7	34%
9. Knot tying	1.6±0.9	1.4±0.7	12%

Data are expressed as mean ±SD

Fann JI, et al. JTCVS 2008; 136: 1486-1491.

SIMULATION IN CARDIAC SURGERY

Improvement in Coronary Anastomosis with Cardiac Surgery Simulation

Conclusions of Study

1. In general, distributed practice using the skill station at home improves the ability to perform coronary anastomoses in static and beating heart environments as assessed by time to completion and performance ratings.

2. However, not all residents improved, consistent with “ceiling effect” with the simulator and “plateau effect” with trainee.

3. Simulation can be useful in preparing residents for coronary anastomoses and may provide an opportunity to identify the need and methods for remediation.

Fann JI, et al. JTCVS 2008; 136: 1486-1491.

BOOT CAMP 2008

Thoracic Surgery Directors Association

American Board of Thoracic Surgery

University of North Carolina Friday Center

Five topics:

- Coronary anastomosis
- Cardiopulmonary bypass
- Pulmonary resection
- Bronchoscopy and mediastinoscopy
- Aortic valve surgery

Fann et al. JTCVS 2009, in press.

Simulation in Coronary Artery Anastomosis

METHODS

33 first-year cardiothoracic surgery residents
Divided into 4 groups, 4 consecutive hours
6-7 faculty per 8-9 residents
20 minute lecture:
- Coronary angiography
- How to perform an anastomosis

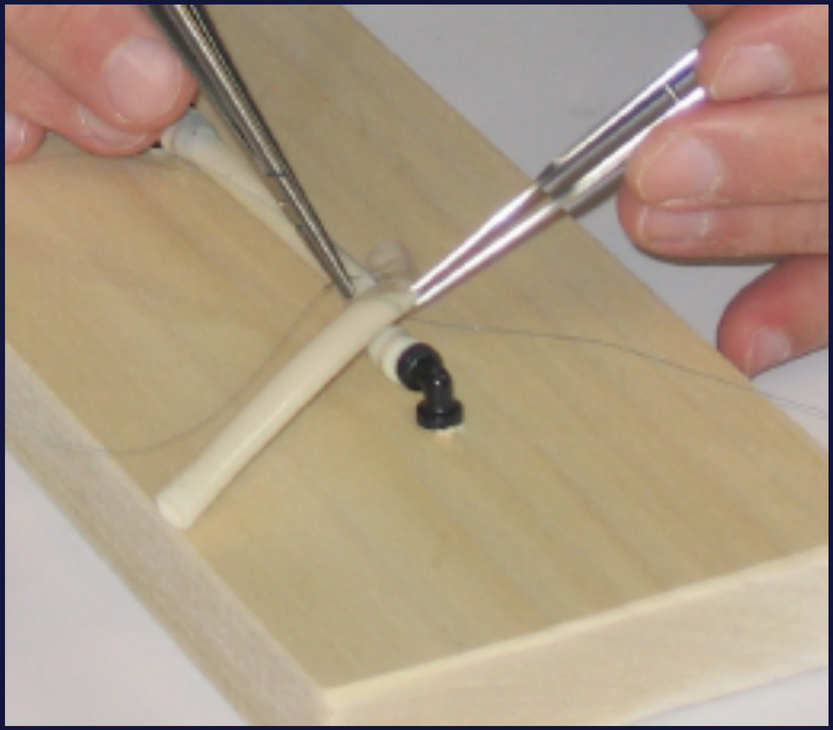
Simulation Lab:
- Anastomosis task station
- Porcine heart model

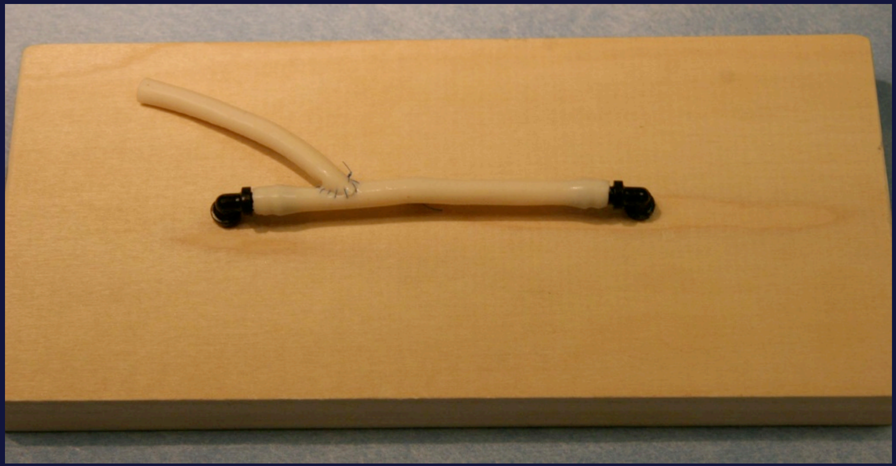
On-site immediate assessment (global scale)
Video-recorded: assessed by 3 surgeons (blinded)
Resident exit questionnaire
Follow up questionnaire at 6 months

Fann et al. JTCVS 2009, in press.

Simulation in Coronary Artery Anastomosis

ANASTOMOSIS TASK STATION

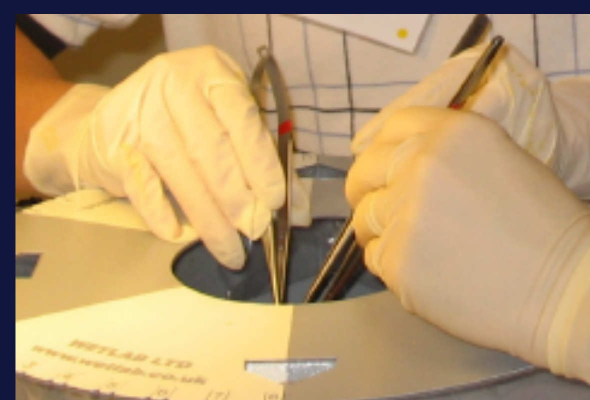




4 mm silastic vessel
End-to side anastomosis
5-0, 6-0 polypropylene sutures

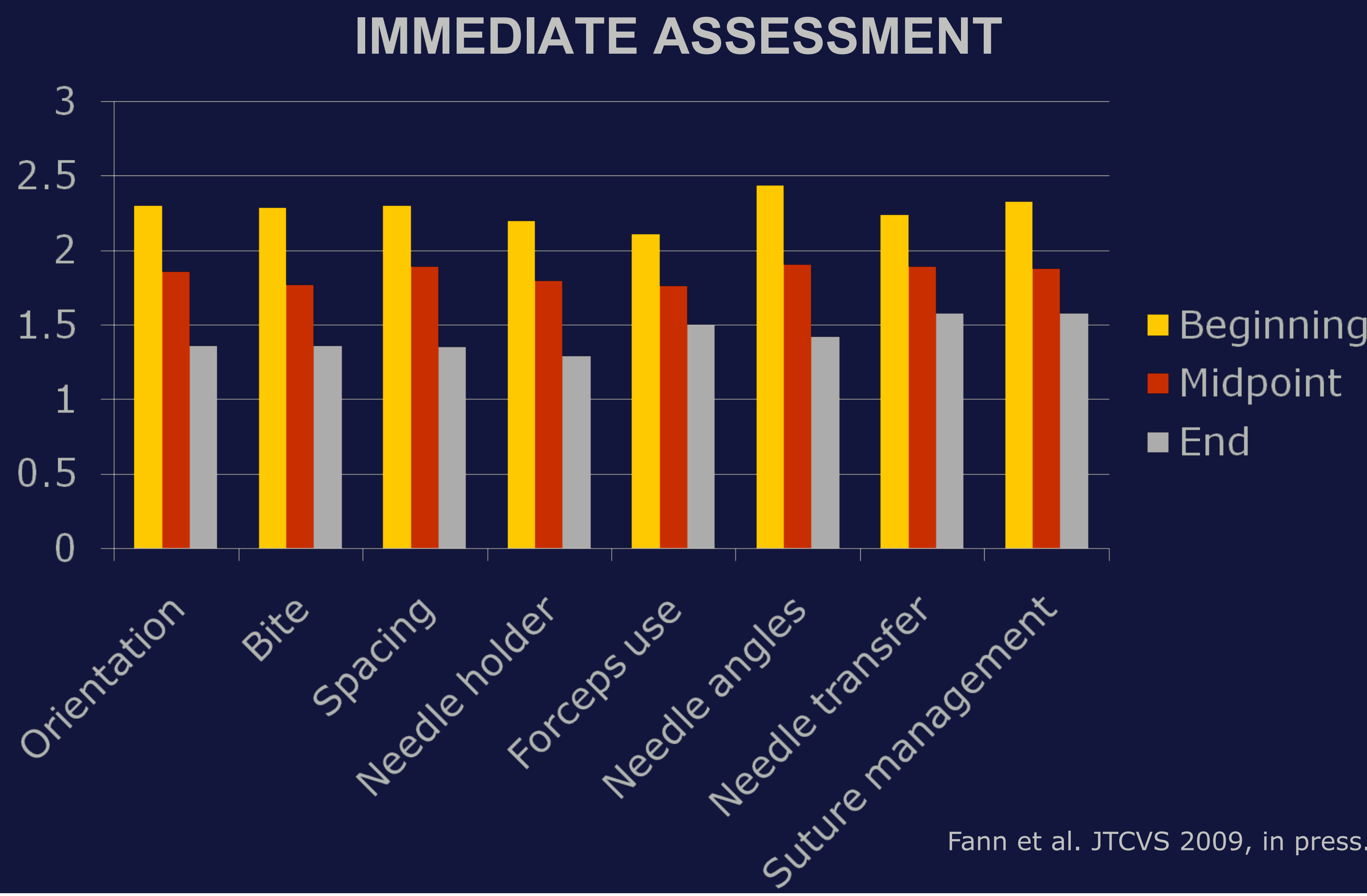
Simulation in Coronary Artery Anastomosis

PORCINE HEART MODEL



TASKS:
Expose LAD
Arteriotomy
Distal anastomosis
Proximal anastomosis

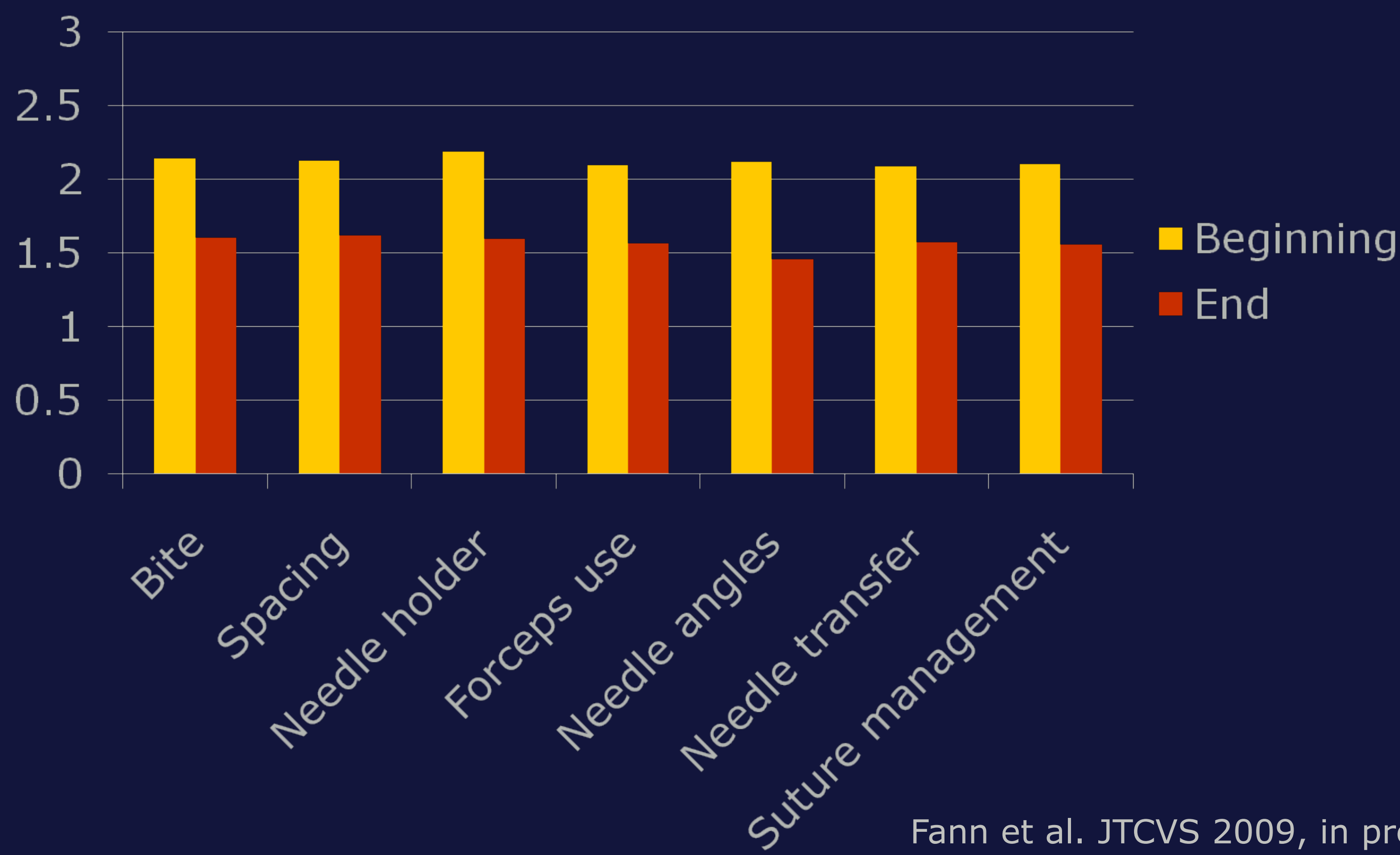
SIMULATION IN CORONARY ARTERY ANASTOMOSIS



Fann et al. JTCVS 2009, in press.

SIMULATION IN CORONARY ARTERY ANASTOMOSIS

ASSESSMENT--VIDEO RECORDINGS



Fann et al. JTCVS 2009, in press.

Simulation in Coronary Artery Anastomosis

Follow up questionnaire at 6 months (27 respondents)

Statement	Yes	No
1. Did anastomosis session provide basis for technical training/improvement?	27 (100%)	
2. Did synthetic graft anastomosis stress important technical components?	27 (100%)	
3. Did porcine heart anastomosis stress important components?	27 (100%)	
4. Has your anastomosis skills in operating room improved in last 6 months?	24 (89%)	3 (11%)
5. Have you been able to continue to practice anastomosis out of OR?	14 (52%)	13 (48%)
6. Have you developed cardiac simulation devices for practice?	10 (37%)	17 (63%)
7. Has your residency program started a cardiac simulation program?	5 (19%)	22 (81%)

Fann et al. JTCVS 2009, in press.

CONCLUSIONS

1. Focused Boot Camp improved residents' ability to perform anastomosis based on immediate assessment and video recordings.
2. Perceived as effective in skill acquisition.
3. Boot Camp with simulation is one method of augmenting early resident training.
4. Emphasis on deliberate and distributed practice is necessary.

Fann et al. JTCVS 2009, in press.

IMPLICATIONS

1. Assessment tools should be user-friendly and adapted to assessors' experience.
2. Simulators of varying fidelity is important as resident progresses in training.
3. Performance in OR depends not only on technical skill, but also cognitive integration, judgment, and complex interactions among team members.
4. At Boot Camp 2009, performance assessment of cardiopulmonary bypass and crisis management.

STANFORD SCHOOL OF MEDICINE

STANFORD HOSPITAL & CLINICS
Stanford University Medical Center

A Simulation-Driven Patient Safety Program to Improve Clinical Outcomes on Medical and Surgical Inpatient Units

Investigators:

Clarence H. Braddock III, MD, MPH
Nancy L. Szaflarski, PhD, RN, FCCM
Lynn M. Forsey, PhD, RN
John M. Morton, MD, MPH, FACS
David M. Gaba, MD
Geoffrey Lighthall, MD
Steven K. Howard, MD
Tina Hernandez-Boussard, PhD, MPH

Funding Source: Gordon and Betty Moore Foundation

Background

- Patient safety is a major public concern but little progress has been made since the IOM reports
- Failure to recognize early signs and symptoms of physiological deterioration and provide appropriate and timely intervention has major effects on hospital morbidity and mortality

Med J Aust 1999;171:22 Intensive Care Med 2002;28:1629

Understanding the Problem

- Inability to detect and treat hospital complications early has been ascribed to:
  - Deficiencies in teamwork and communication due to lack of formal training
  - Inadequate knowledge and pattern recognition
  - Suboptimal critical thinking and decision-making
  - Suboptimal safety culture in hospital work environments (microsystems)

Med Care 2006;44:117   Nurs Res 2005;54:74

Study Goals

- To implement a simulation-driven, patient safety program to improve early detection and treatment of hospital complications by nurses and residents on inpatient units
- To evaluate the feasibility of the program
- To analyze the program's effects on selected outcomes

Patient Safety Program (Study Interventions)

1. High-fidelity, in-situ simulation exercises
    - Focus: Early detection & treatment of hospital-acquired complications
    - Four exercises per month per hospital unit
    - Interdisciplinary exercises:
        - Leadership & teamwork
        - Communication skills
        - Shared mental model
        - Situational awareness
    - Nursing exercises:
        - Cognitive knowledge
        - Communication skills
        - Critical thinking skills
        - Comfort and confidence in calling for help early

Patient Safety Program (Study Interventions)

2. Institute debriefings of actual RRT and Code Blue calls
3. Hold monthly meetings of unit-based Patient Safety Teams
4. Conduct reflection sessions with nurses and residents to reinforce lessons (using videotapes of past simulation exercises)
5. Conduct quarterly patient safety conferences
6. Institute a recognition program to reward individual clinicians for:
    - superior teamwork efforts
    - early detection/treatment

Study Hypothesis

The effects of a simulation-driven, patient safety program on inpatient units will:

PRIMARY OUTCOMES:

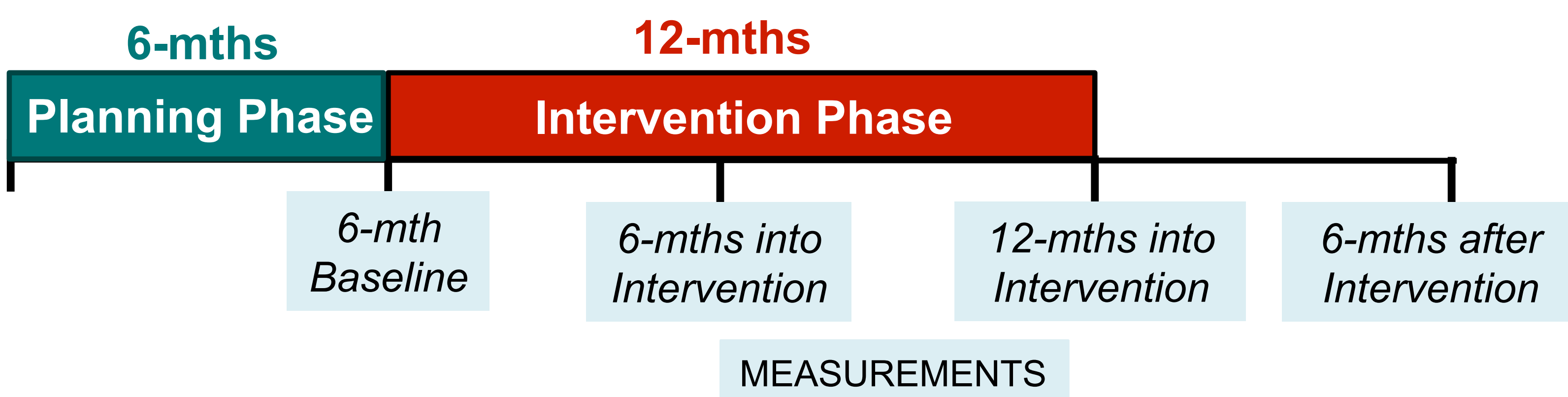
- Decrease rate of unplanned transfers to higher level of care (e.g., ICU, OR)
- Decrease rate of selected hospital-acquired complications
- Decrease risk-adjusted hospital mortality

SECONDARY OUTCOMES:

- Improve teamwork performance
- Improve knowledge, critical thinking and decision-making of hospital-acquired complications
- Improve the safety culture of microsystems
- Improve nurses' comfort and confidence in calling for help early

Study Characteristics

- A prospective interventional trial employing a case-crossover design (pre-post comparison)
- Inpatient Setting:
  - 3-Medicine Intermediate Intensive Care Units and 1-Surgical floor
  - Buy-in and engagement of Unit-Based Medical Director and Patient Care Services Manager
- Timeline and Measurement Cycle:



Outcome Measures

PRIMARY OUTCOMES

- Administrative data validated through thorough medical record review
- University HealthSystem Consortium's Risk Model

SECONDARY OUTCOMES

- Interdisciplinary Team Performance
  - Blinded, trained clinicians will rate performance using behaviorally-anchored rating scales from videotaped exercises
- Safety Culture
  - AHRQ Hospital Survey on Patient Safety Culture
- Critical Thinking
  - Health Sciences Reasoning Test
- Nurses' Comfort and Confidence:
  - Survey to be developed and validated

Conclusion

This study will evaluate whether frequent, in situ simulation that focuses on early detection and treatment of hospital-acquired complications can produce lasting, meaningful improvements in:

- interdisciplinary team and individual performance
- clinical outcomes

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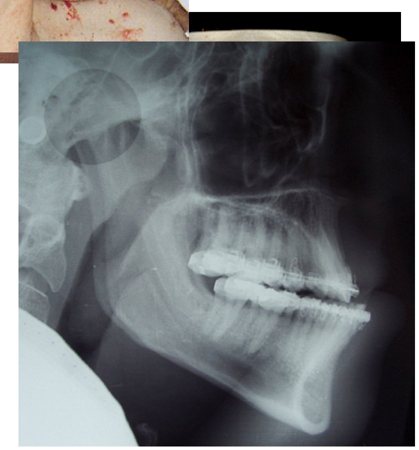
VISUOHAPTIC VIRTUAL ENVIRONMENTS FOR INTERACTIVE EXPLORATION OF CT

SABINE GIROD, MD, DDS, PHD
Oral & Maxillofacial Surgery
KEN SALISBURY, PHD
Computer Science

VISUOHAPTIC CRANIOFACIAL SURGERY

- **Education and information of patient**
  - Visualization of procedures planned
- **Education of students and residents**
  - Craniofacial anatomy
  - Simulation of procedures
  - Sensorimotor skills and/or high-level decision-making
- **Surgical Simulation**
  - Precise individual planning
  - Reduction of surgical time



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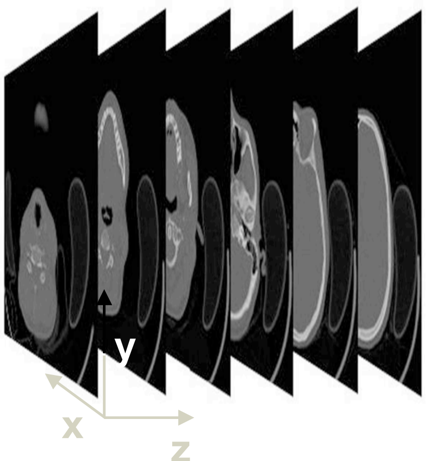
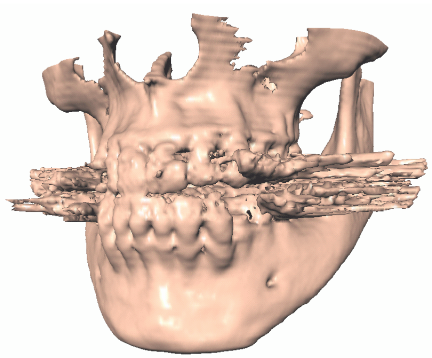
CLINICAL DATA ACQUISITION

- Real patient data
- Segmentation and 3D-reconstruction



- Artefact removal
- Precision inadequate
- NEWTOM



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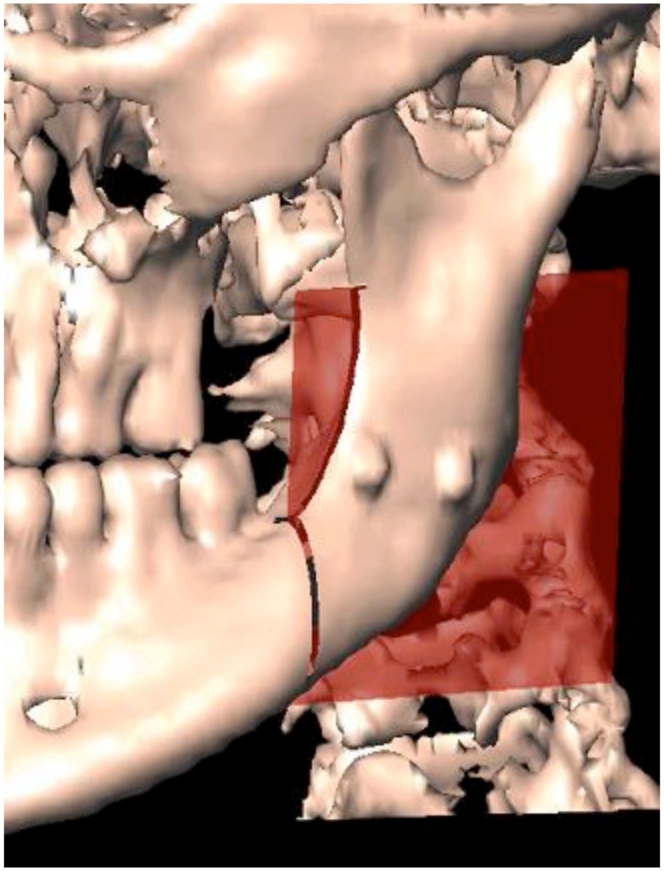
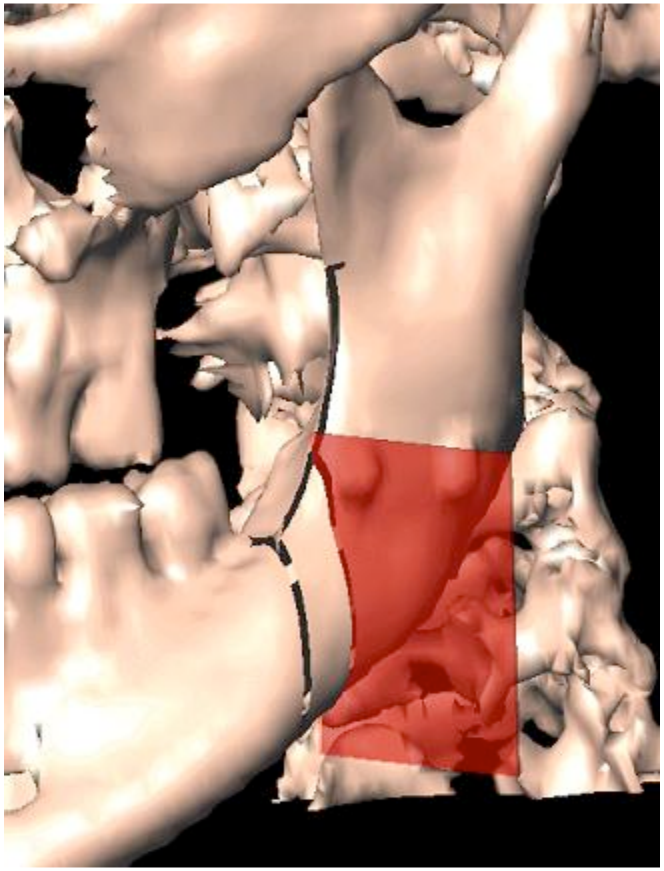
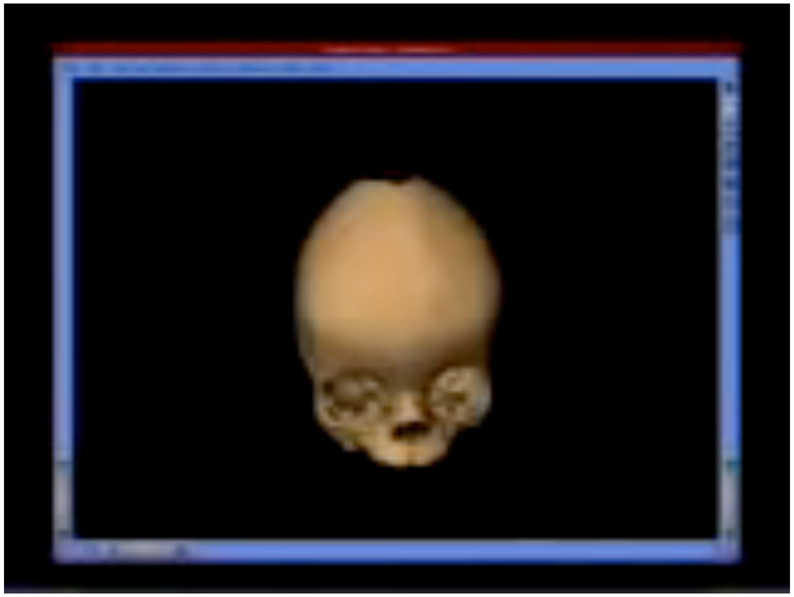
VIRTUAL BONE CUTTING





CRANIOSYNOSTOSIS

SURGICAL PLANNING VIRTUAL & REALITY



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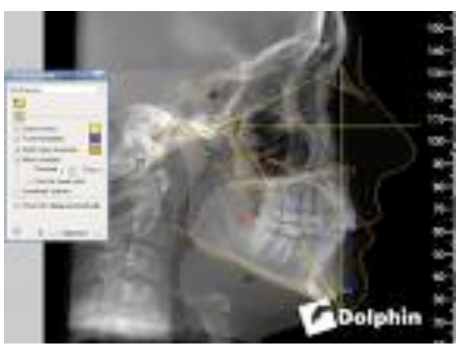
Orthognathic Surgery

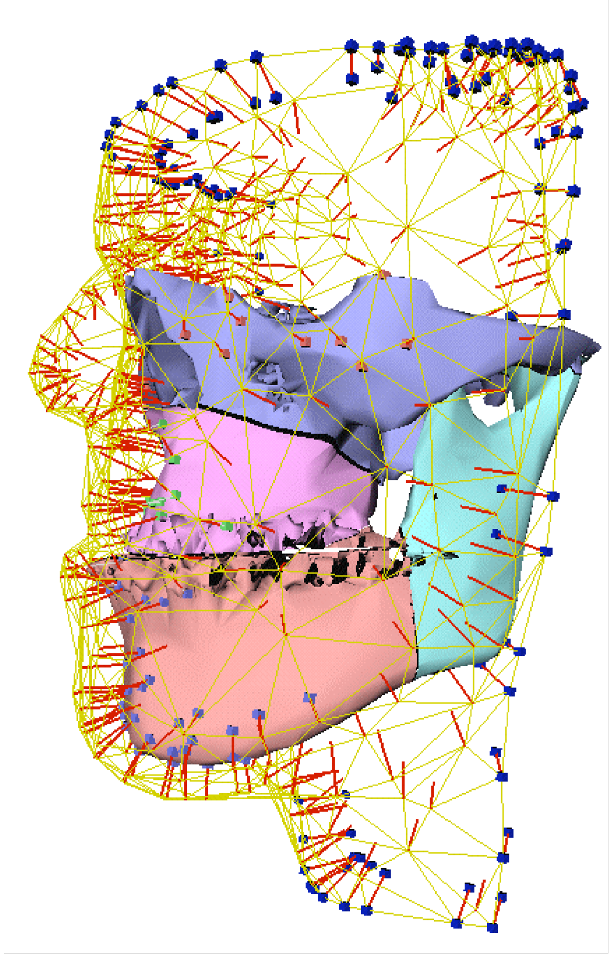
- Photographs and x-rays
- Ceph tracing
- Model surgery
- Visualization and planning commercially available



After Surgery

SOFT TISSUE MODEL

- Mass-spring model
- Gliding bone connection
- Global stability
- Collision detection



SOFT TISSUE PREDICTION

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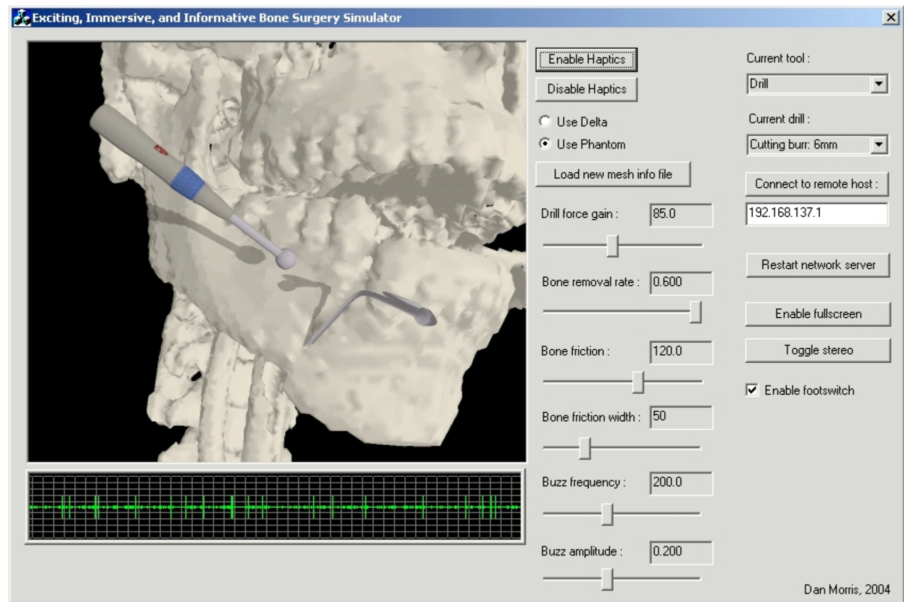
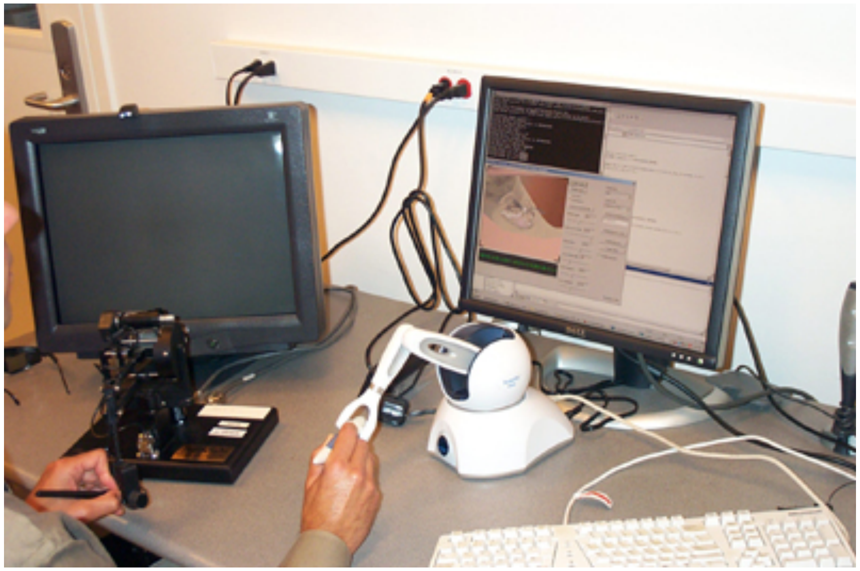
VISUOHAPTIC SIMULATION ENVIRONMENT

- Haptic and visual drill/bone model
- Surgeon/Trainee can “feel” bone
- Simulated drill sound and vibration based on experimental data
- Simulated neurophysiology monitoring
- Networked training and demonstration environment



Haptic Simulator

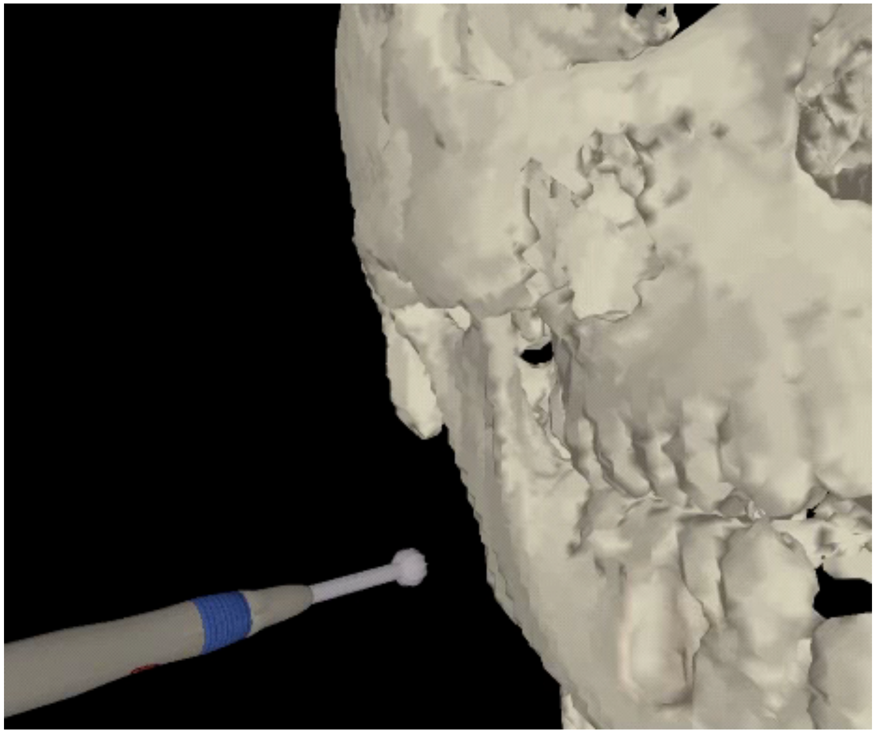
- Runs on a **Windows PC**
- Uses a a SensAble Phantom haptic device (3/6-dof)
- OpenGL is used for stereo rendering



EYESI Surgical Simulator

Key Aspects of Our Simulation Environment

- Haptic and visual drill/bone model
- Surgeon/Trainee can “feel” bone
- Simulated drill sound and vibration based on experimental data
- Simulated neurophysiology monitoring
- Interactive learning



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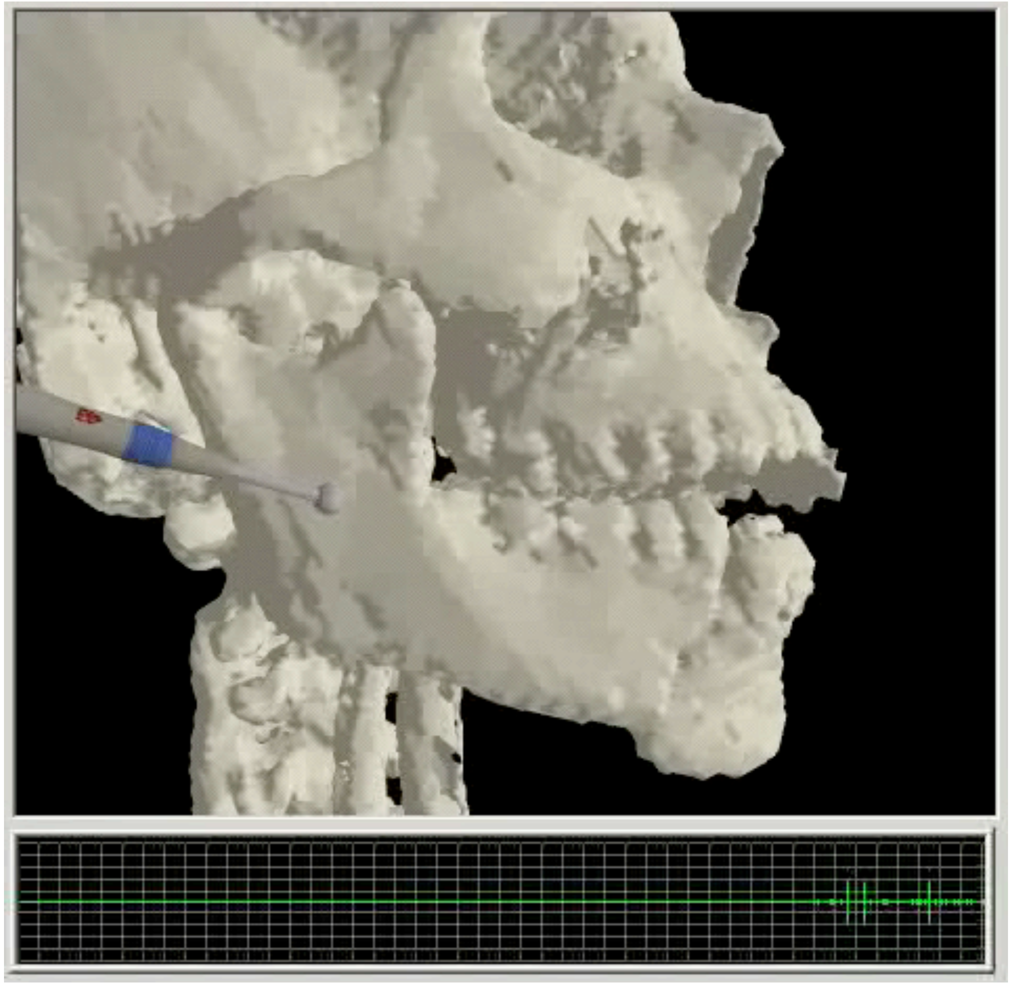
Visuohaptic feedback and nerve monitoring



PLAY VIDEO

Visuohaptic Virtual Environment For Interactive Exploration of CT

- Networked Training and Demo
  - A remote user can log in and interact with the same bone model
- Instructor can monitor the bone
  from arbitrary orientations and zooms
- Instructor can do the drilling
  and let the trainee feel remote forces
- A new training paradigm not available with
  existing training methods

Xbox LIVE is the premier online gaming and entertainment service that enables you to connect your Xbox to the Internet and Play games online. Explore the world of Xbox LIVE!

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Acknowledgements

- Stanford Department of Computer Science
  - (Dan Morris, Fed Barbagli, Ken Salisbury)
- AO Foundation
- BioX

Simulation Activities: LPCH Center of Nursing Excellence

- CNE Nursing Department Orientation
- Pediatric Advanced Life Support (PALS) Simulation
- Collaborative Healthcare Immersive Learning Dynamic (CHILD)
- Versant Residency Program
- Advanced Preceptor Workshop

Cardiovascular Intensive Care Unit Simulation Program

Lucile Packard Children's Hospital
Stanford University Medical Center

Lucile Packard Children's Hospital AT STANFORD

CVICU Simulation Team

PROGRAM COORDINATORS

Andrew Shin, MD

Winnie Yung, RN, MN

Erica Barnum, RN

CAPE-TRAINED INSTRUCTORS

Vicki Arnolde, RT

David Axelrod, MD

Michele Avila-Emerson, NP

Chris Butler, RN

Jodi Hathaway, RN

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Goals

Improve multi-disciplinary team work during crisis situations

Address Knowledge, clinical practice, and communication issues during high-risk situations

Team building

New Unit In-situ Orientation 2009

- Orientation to new unit and new equipment for all MD's, RN's and RT's

  - Scenario

    Neonate post-op from cardiac surgery with cardiac arrest requiring emergent, intubation, sternotomy and blood transfusion

    Objectives

    Locate code bell

    Retrieve Code Cart, Airway Cart and Open Heart Cart

    Retrieve emergency blood

Day 1 of the New CVICU Opening

- Neonate POD 4 following single ventricle palliation suddenly suffered cardiac arrest. Emergent sternotomy and chest exploration required.

- Proper equipment and help was located and acquired immediately per simulation training. No disorientation or delay in retrieving necessary equipment.

- Patient survived and was discharged to home 2 weeks later with no sequelae.

CVICU Simulation Program 2009

- 1 mock code simulation per month at CAPE
  - 2 scenarios per session (4hr) each followed by a debriefing

- Participants:
  - 8-10 Registered Nurses
  - 2 Respiratory Therapist
  - 1 Pharmacist
  - 1 Nurse Practitioners
  - 2 MDs (Attending and Fellows - Cardiology and PICU)

CVICU Simulation Program 2009

- Scenarios specific to the pediatric CVICU

  Examples include:

  - Neonate following complex congenital heart surgery
  - Emergent bedside sternotomy (Open Heart Cart)
  - Adult with congenital heart disease
  - E-CPR and ECMO cannulation

Debriefing

Common Topics/Objectives

- Closed Loop Communication
- Role Clarity
- Resource utilization

Skills, Techniques and Equipment:

- Use of the Zoll pads/Defibrillation
- Broselow (Pediatric) Cart
- Open Heart Cart
- PALS Algorithm/ACLS Algorithm

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Pre-Simulation Questionnaire

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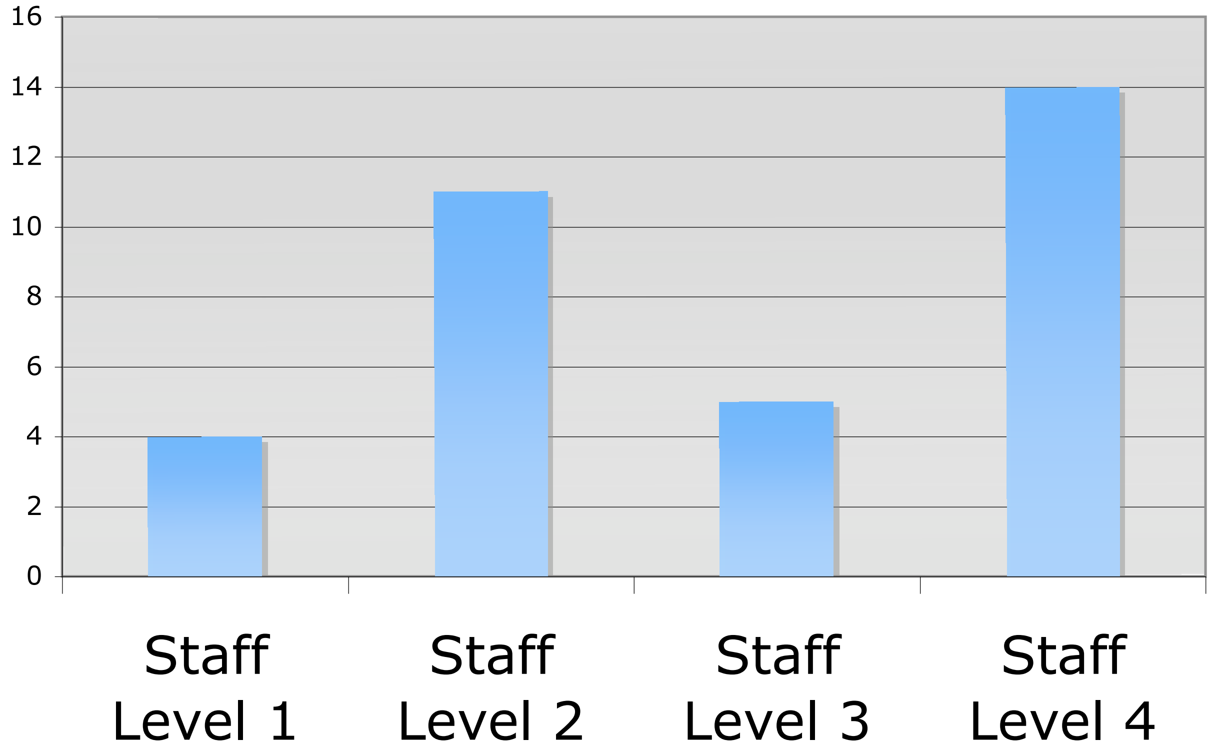
Children's Hospital
AT STANFORD

Demographics: Nursing Staff level



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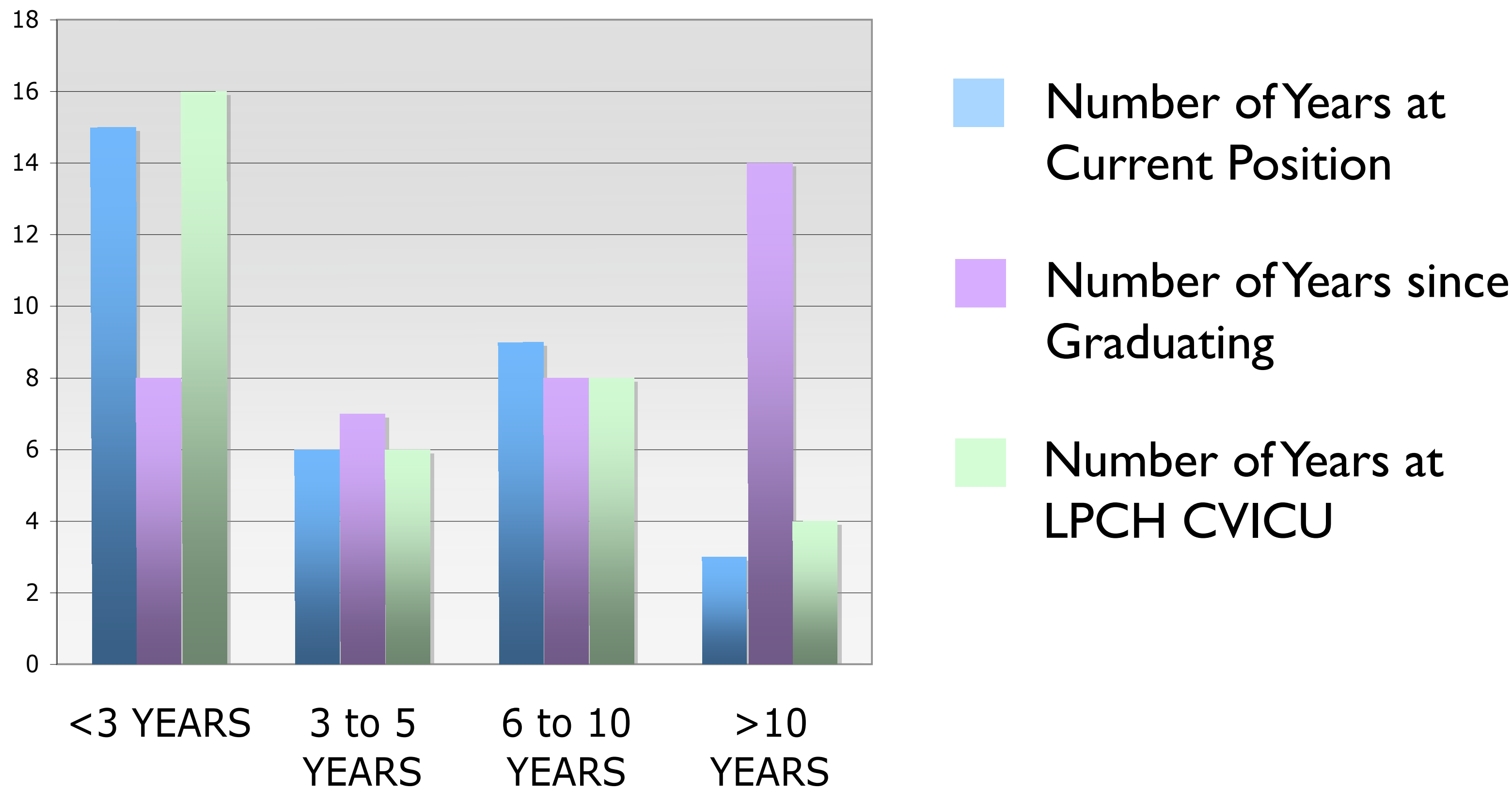
Demographics: Nursing



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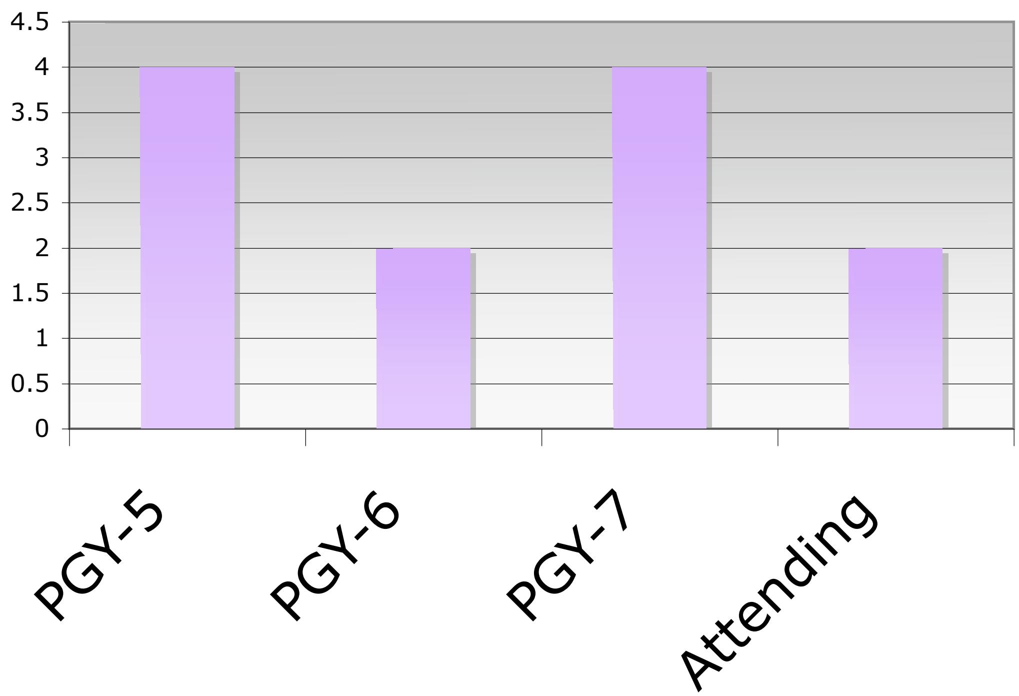
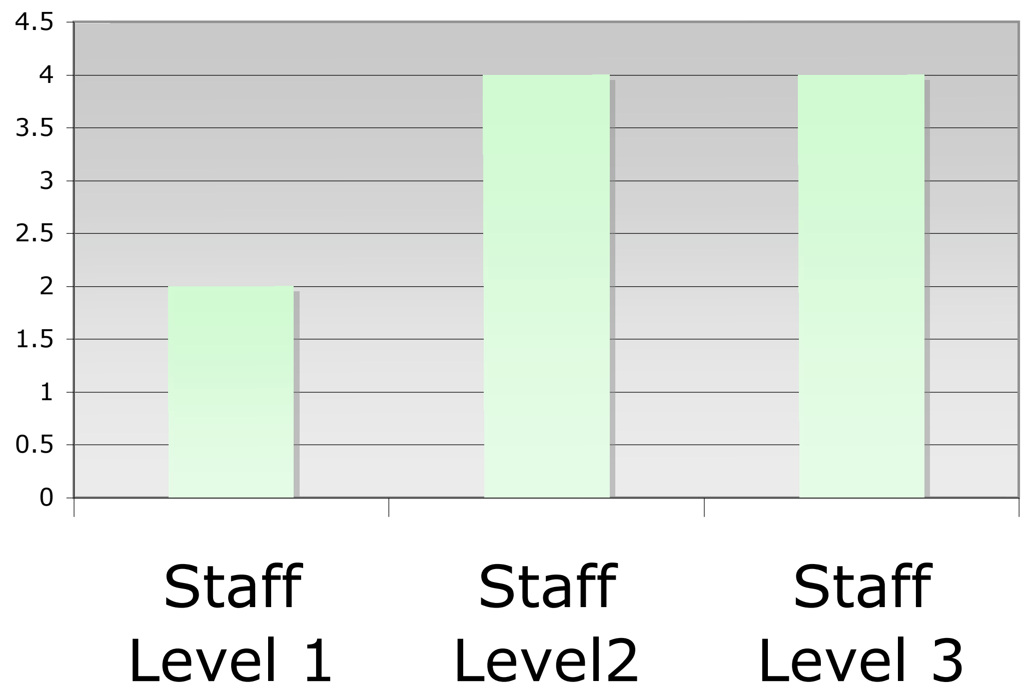
Demographics: Physicians



Demographics: Respiratory Therapists



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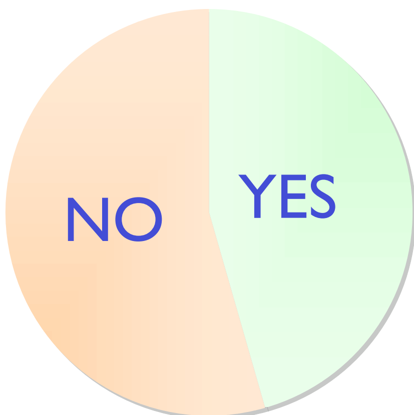
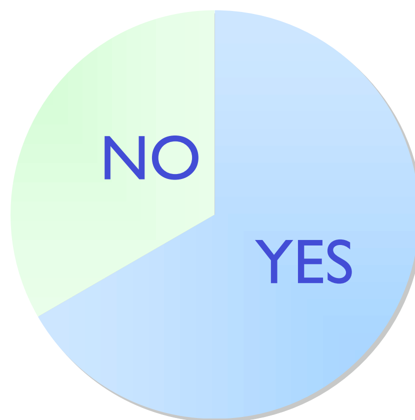
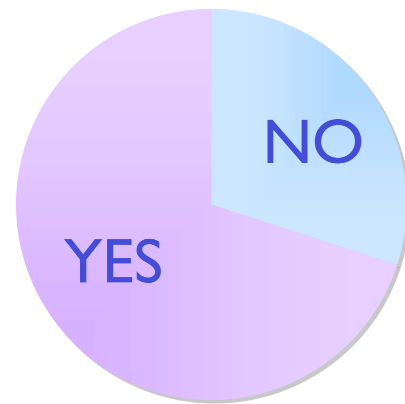
Previous Simulation Experience



NURSING

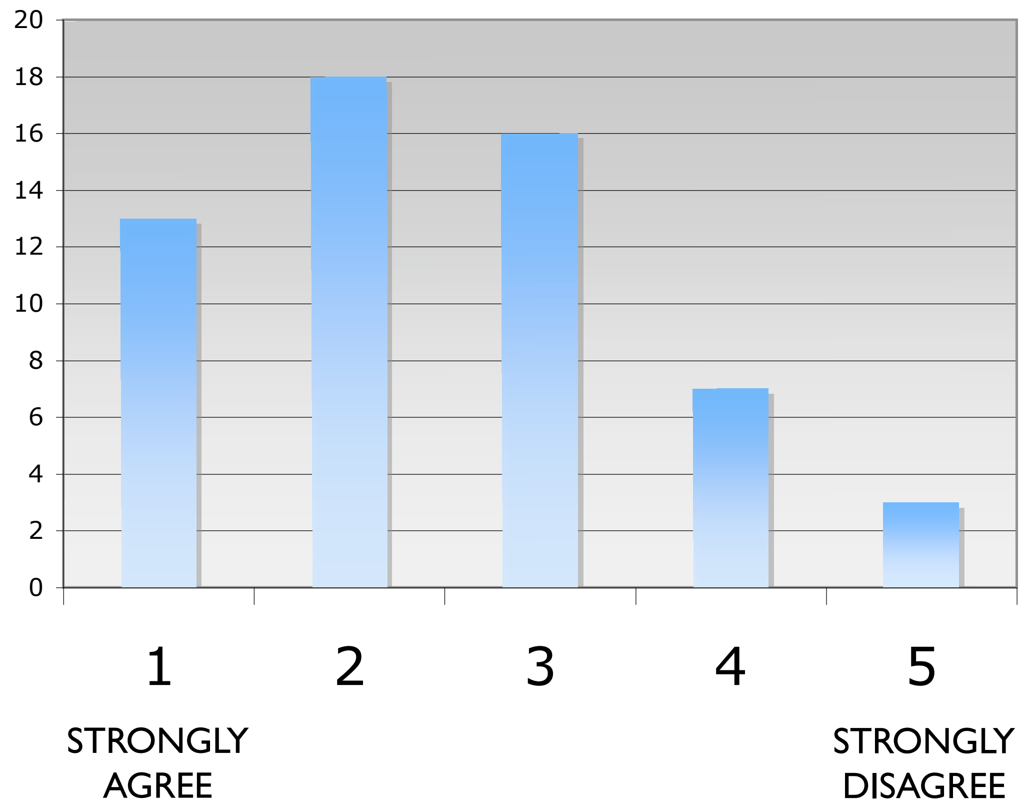


PHYSICIANS



RESPIRATORY THERAPISTS

"I FEEL COMFORTABLE WITH MY CURRENT LEVEL OF KNOWLEDGE, EXPERIENCE AND TRAINING WITH CRISIS EVENTS IN THE CVICU"



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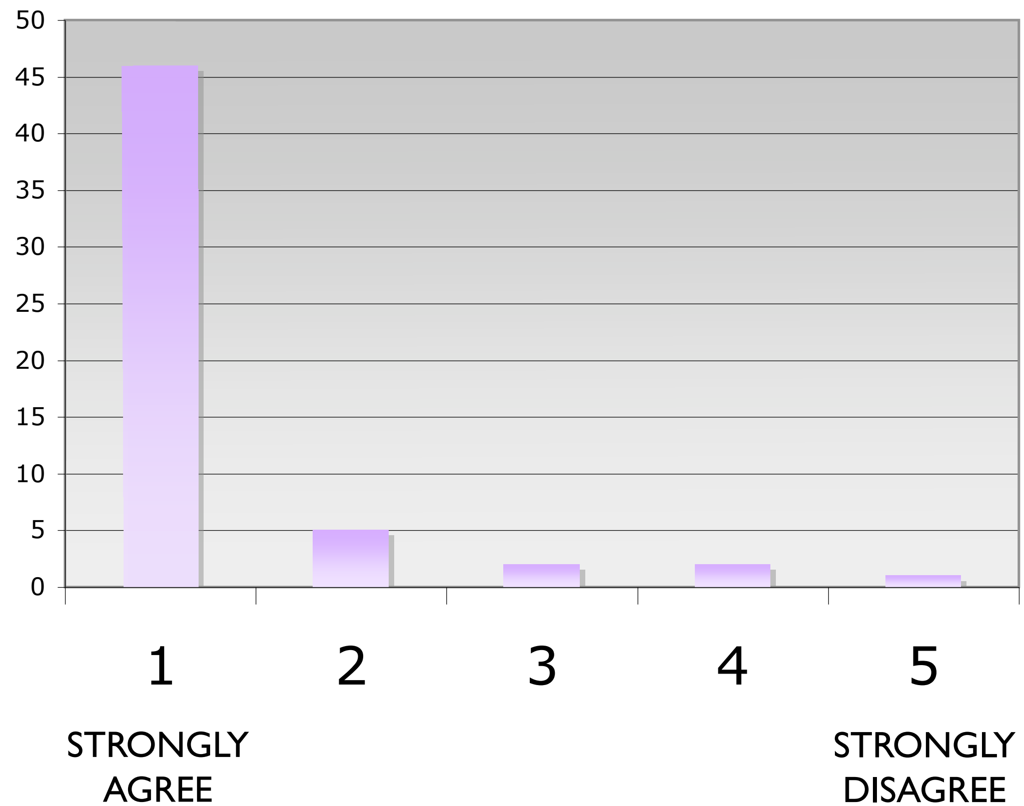
"I THINK THAT MEDICAL SIMULATION IS A VALUABLE TOOL IN MY TRAINING AS PART OF WORKING IN THE CVICU"



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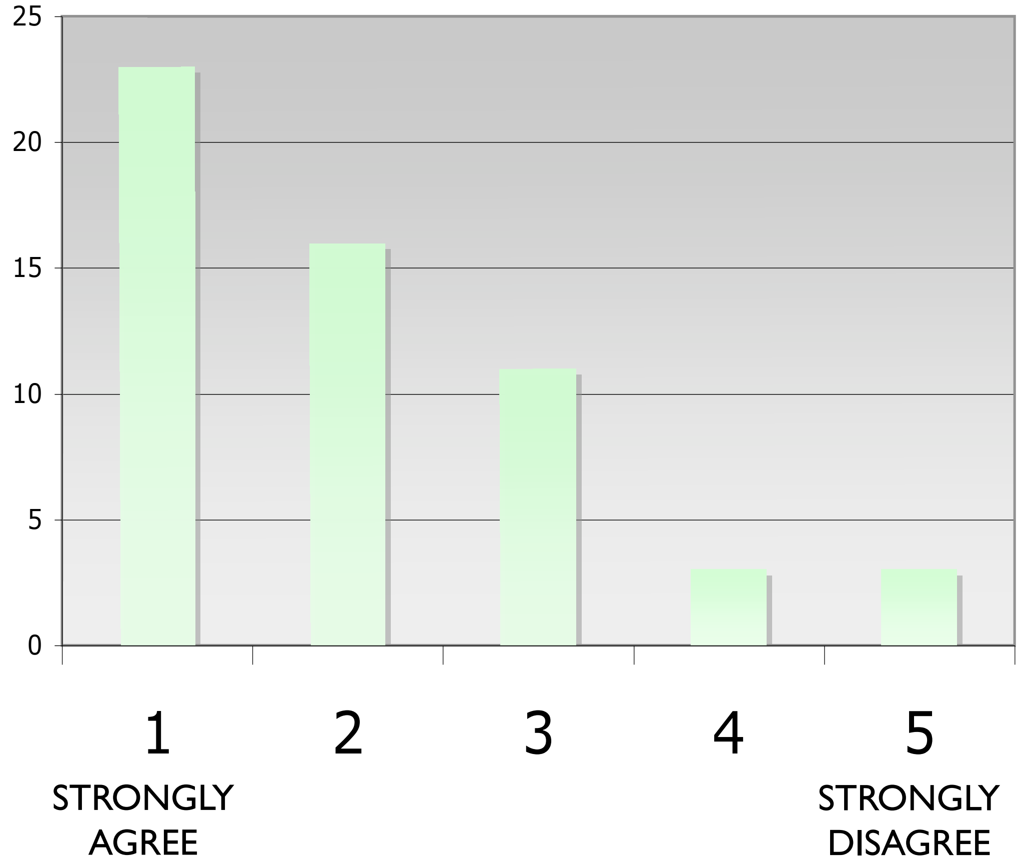
"I AM AWARE OF and PRACTICE the PRINCIPLES of CLOSED LOOP COMMUNICATION"



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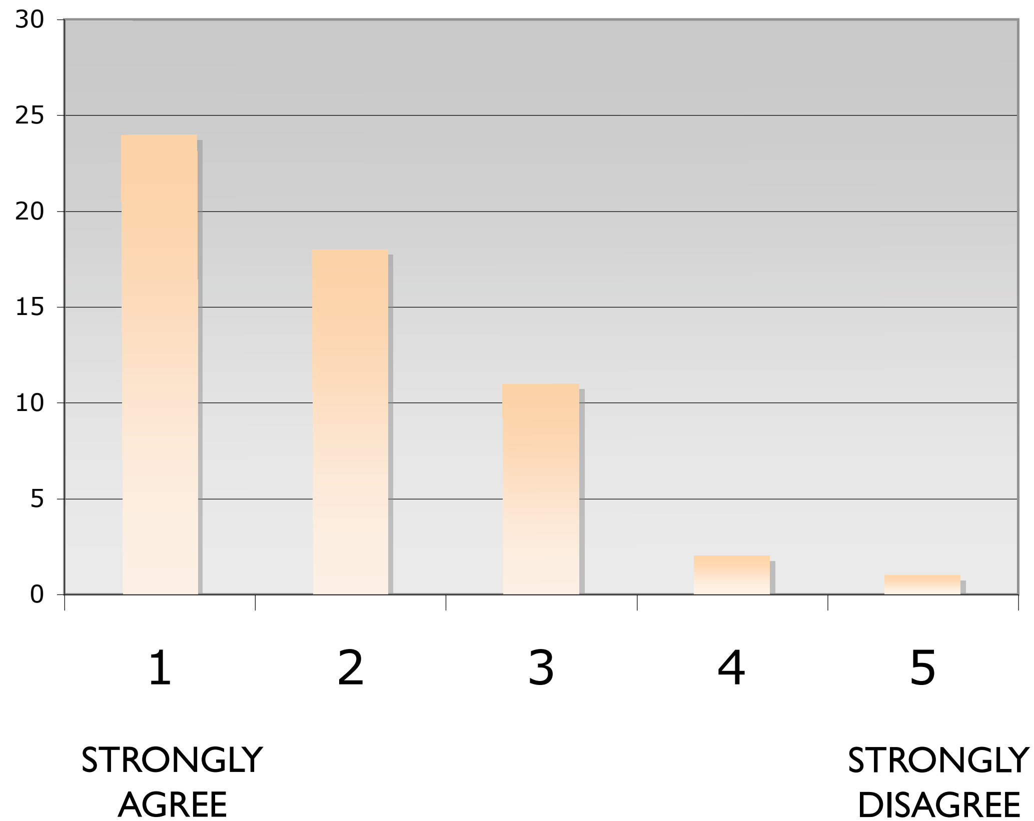
"I AM AWARE OF and PRACTICE the PRINCIPLES of ROLE CLARITY IN A CRISIS EVENT"



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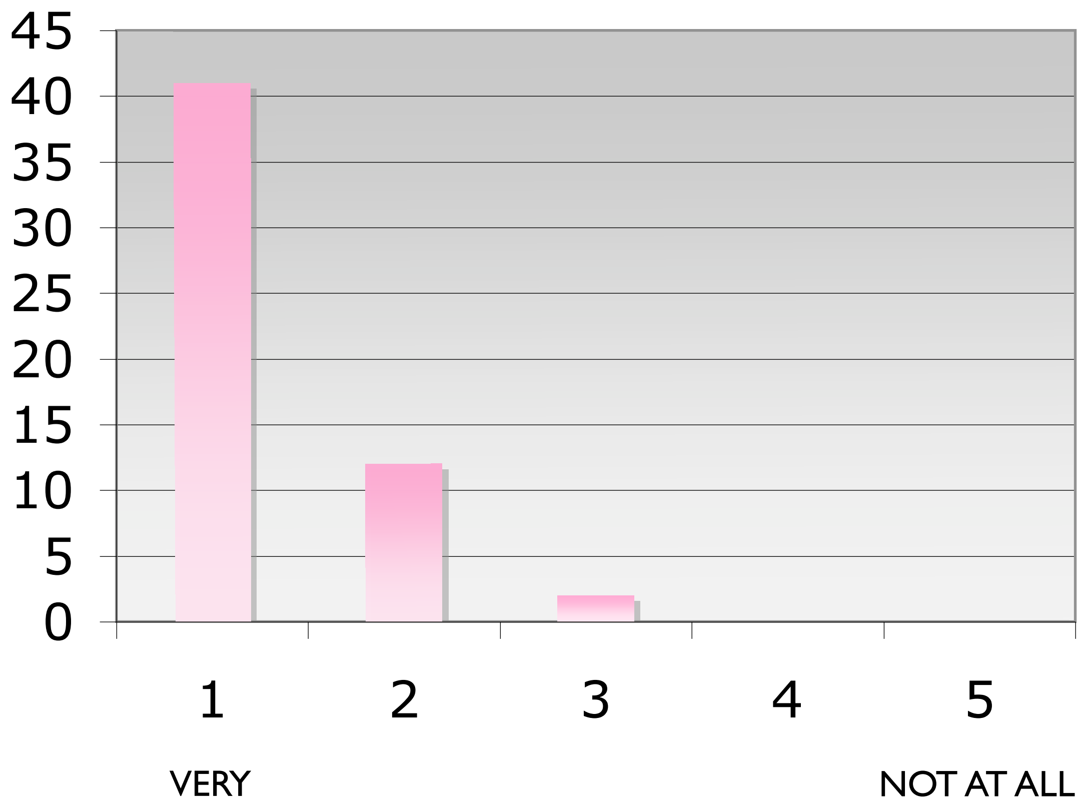
POST-SIMULATION QUESTIONNAIRE

"HOW REALISTIC AND BELIEVABLE WAS THE SCENARIO?"



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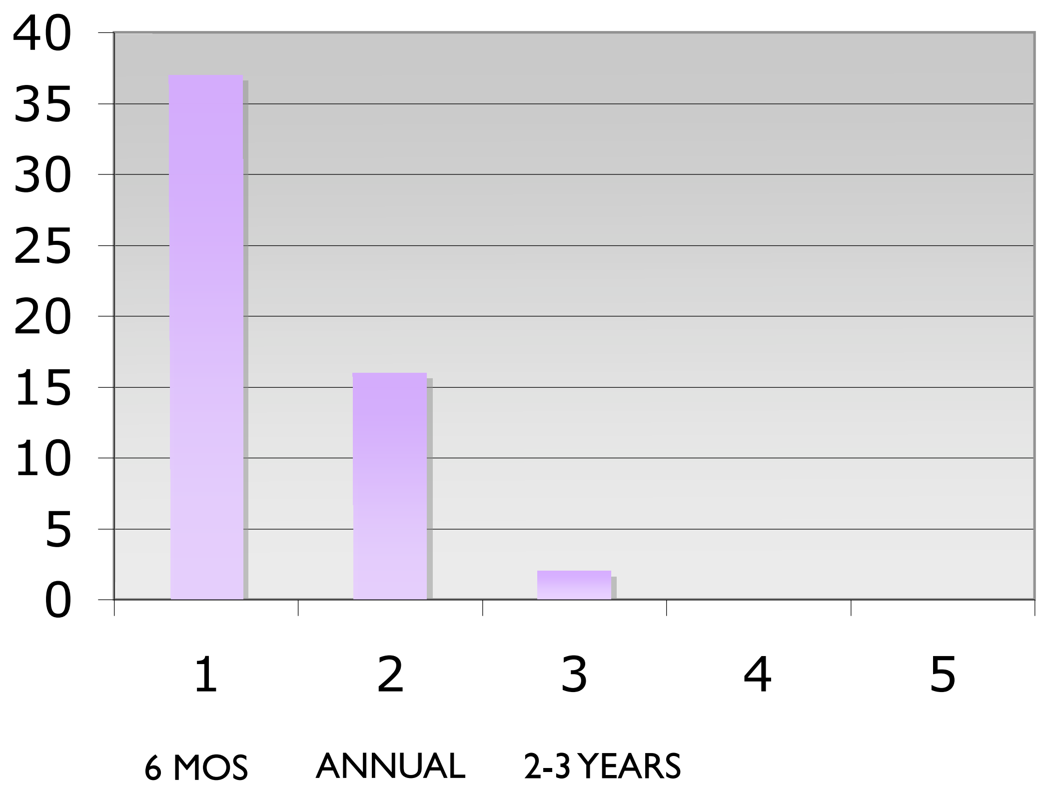
“HOW OFTEN SHOULD AN EXERCISE OF THIS TYPE BE TAKEN?”



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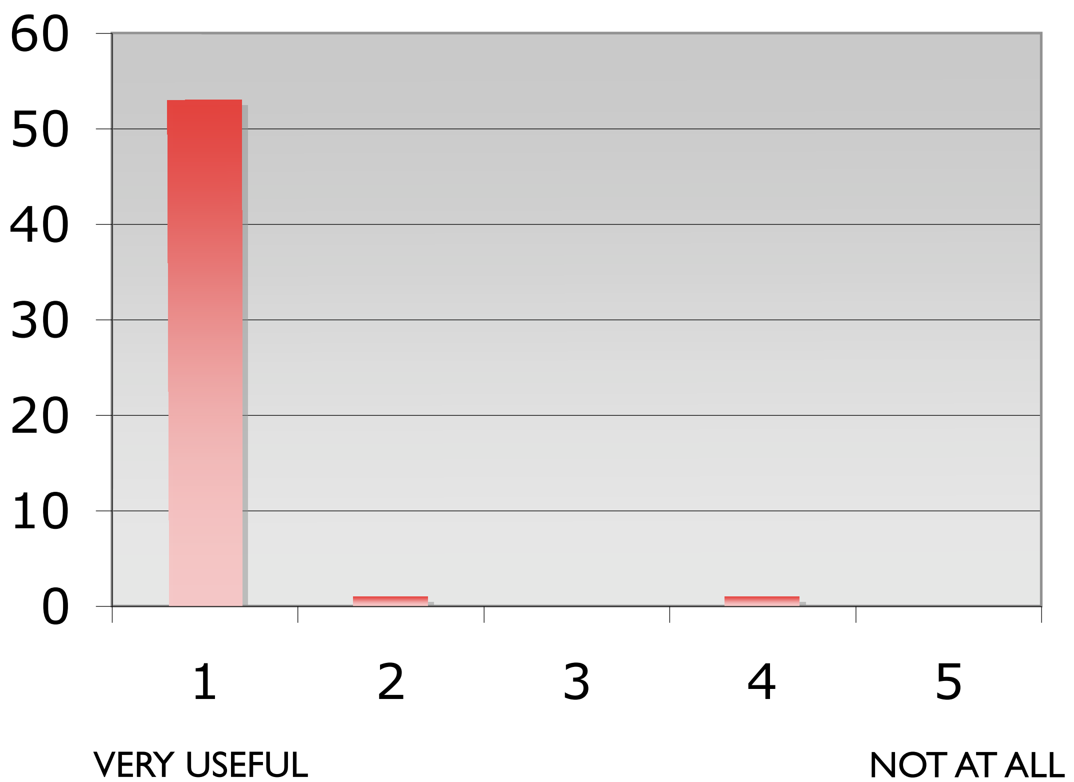
“HOW USEFUL TO YOUR PROFESSIONAL PRACTICE WAS THIS EXERCISE?”



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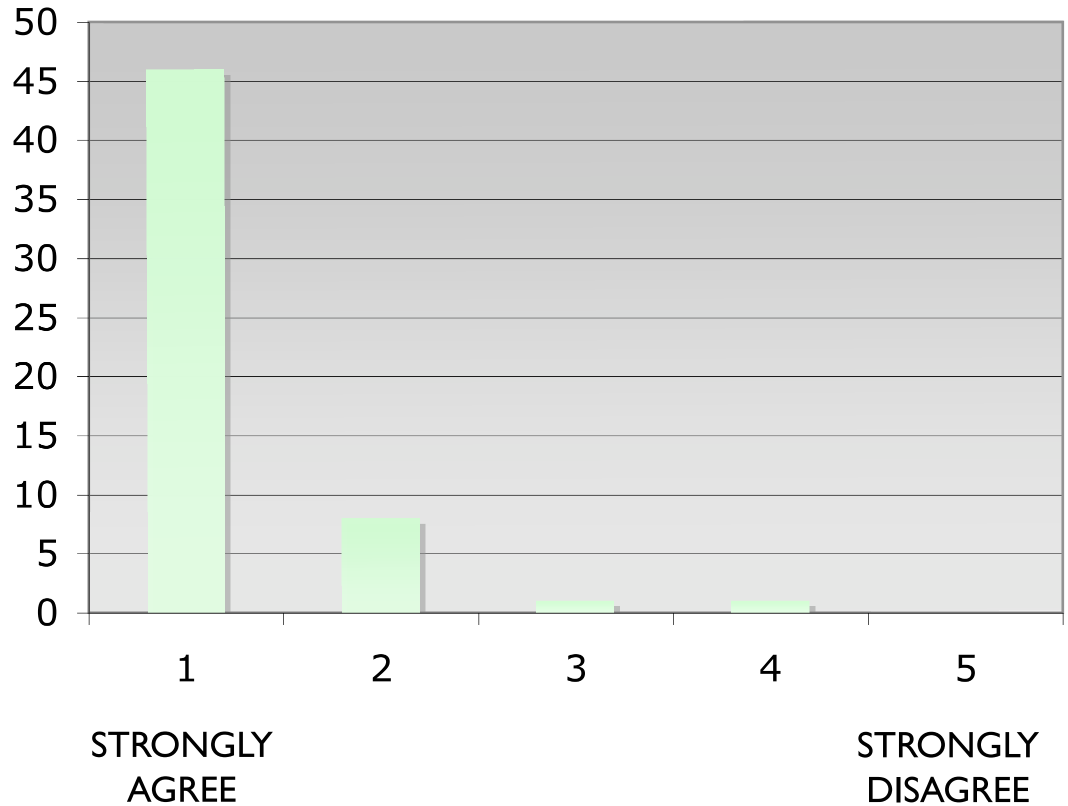
"I FEEL BETTER PREPARED TO HANDLE CRISIS EVENTS IN THE CVICU"



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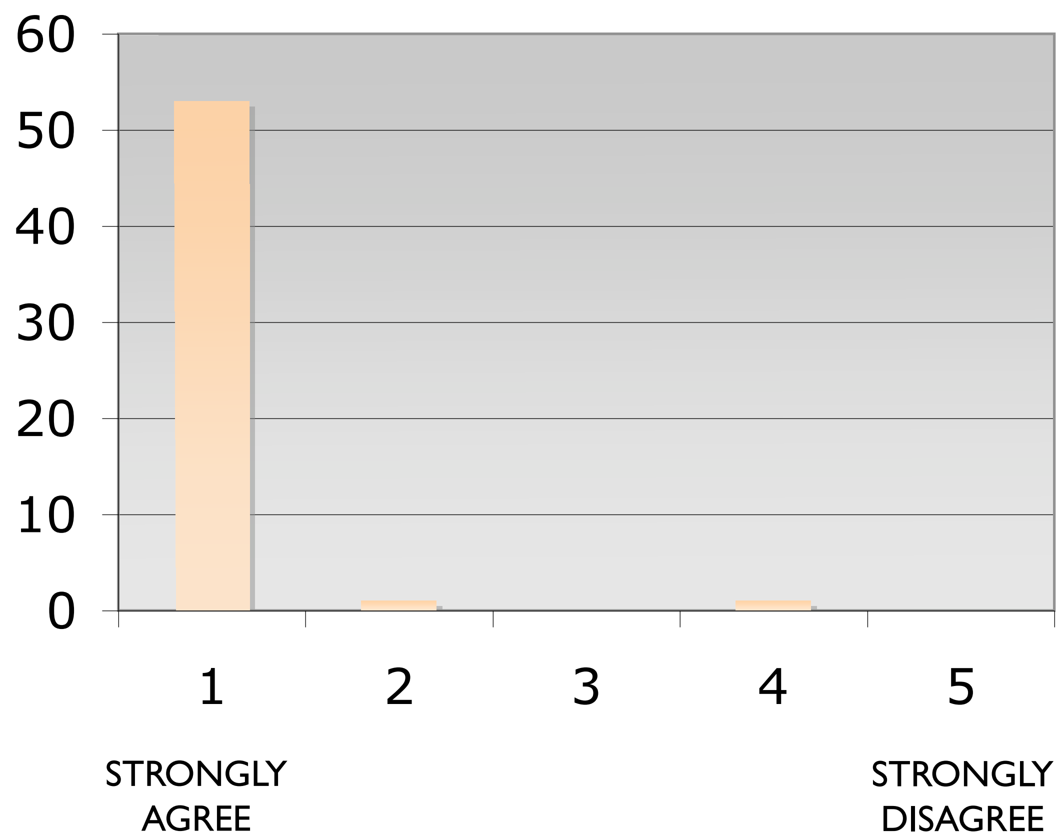
"WOULD YOU RECOMMEND THIS EXERCISE TO OTHERS?"



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Simulation Program 2010

- Mandatory simulation at CAPE for all RN's, MD's and RT's

- 2 simulations per month at CAPE utilizing a multidisciplinary team

- Incorporate nursing Skills Competencies into monthly simulations

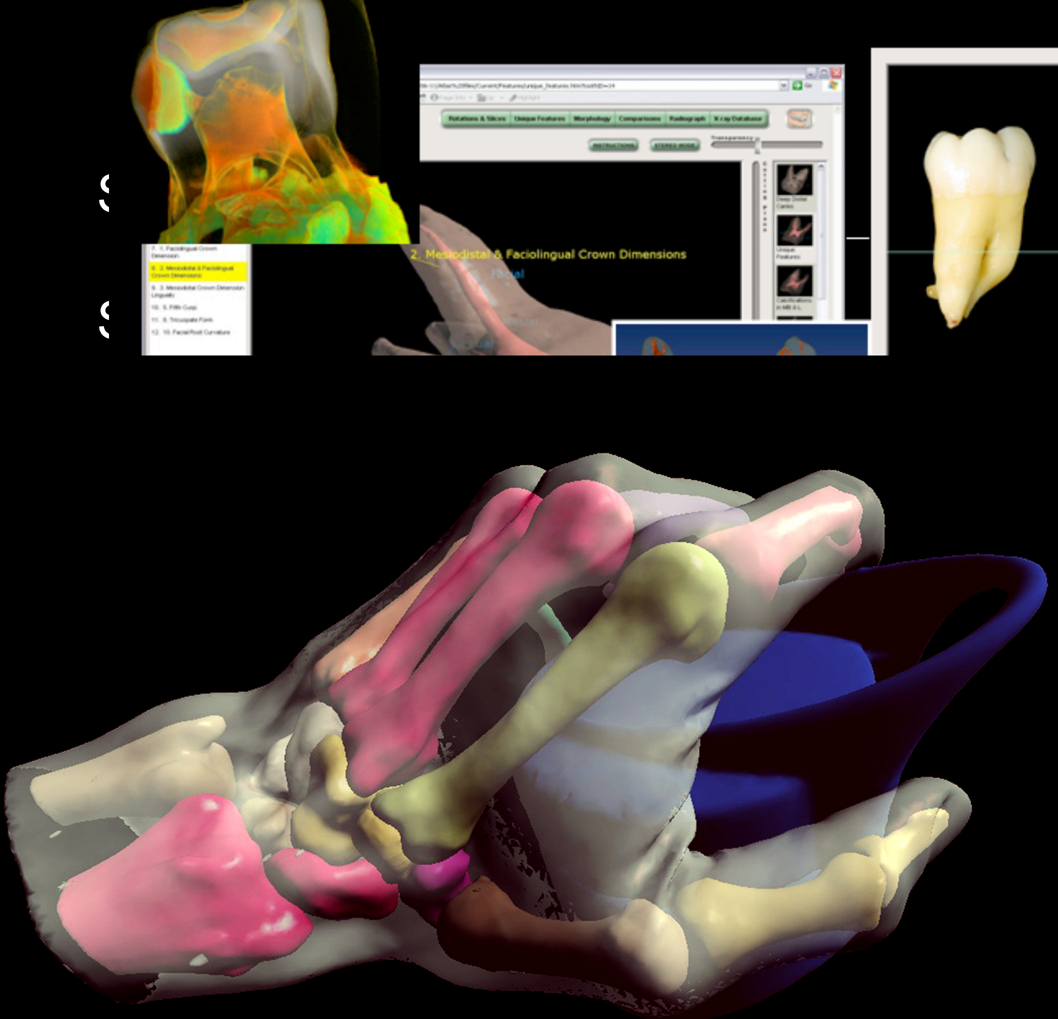
Future Directions

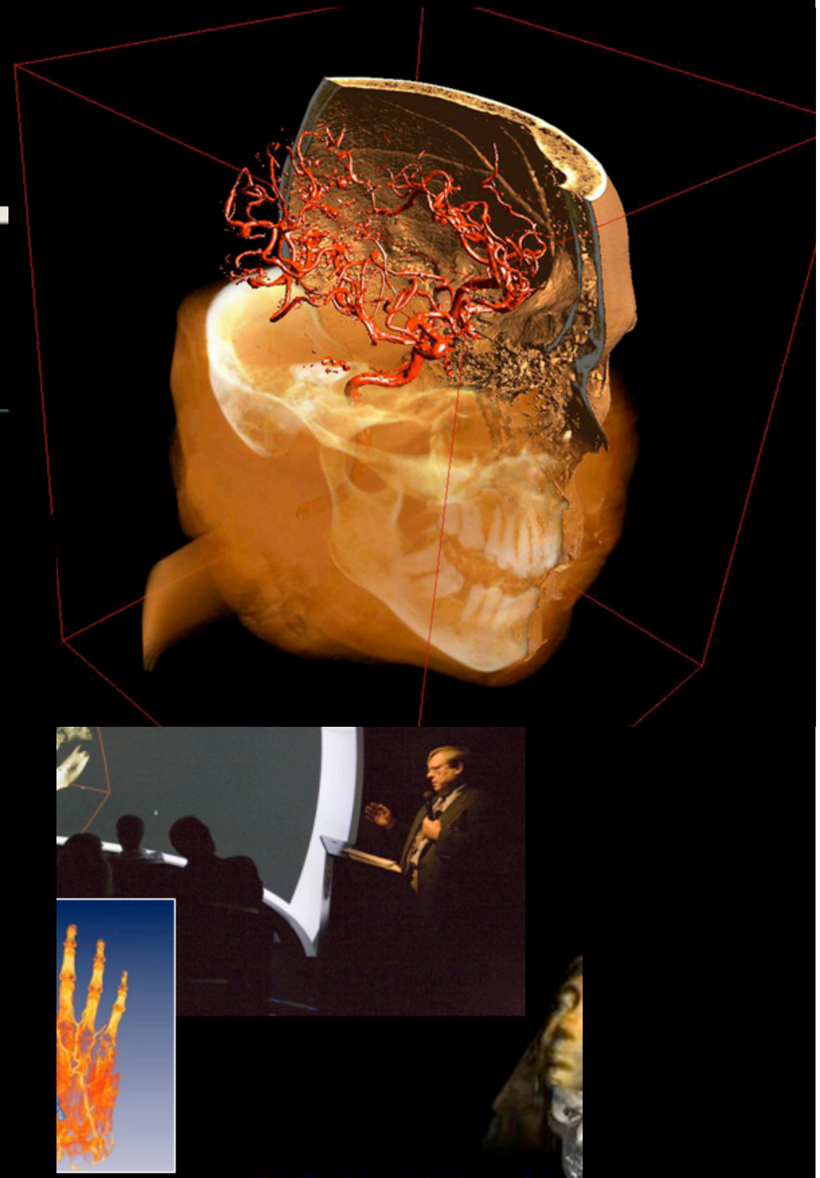
Establish Skill Competency

Simulating ECMO Cannulation

Crisis events with adult patients with congenital heart disease

Stanford University School of Medicine





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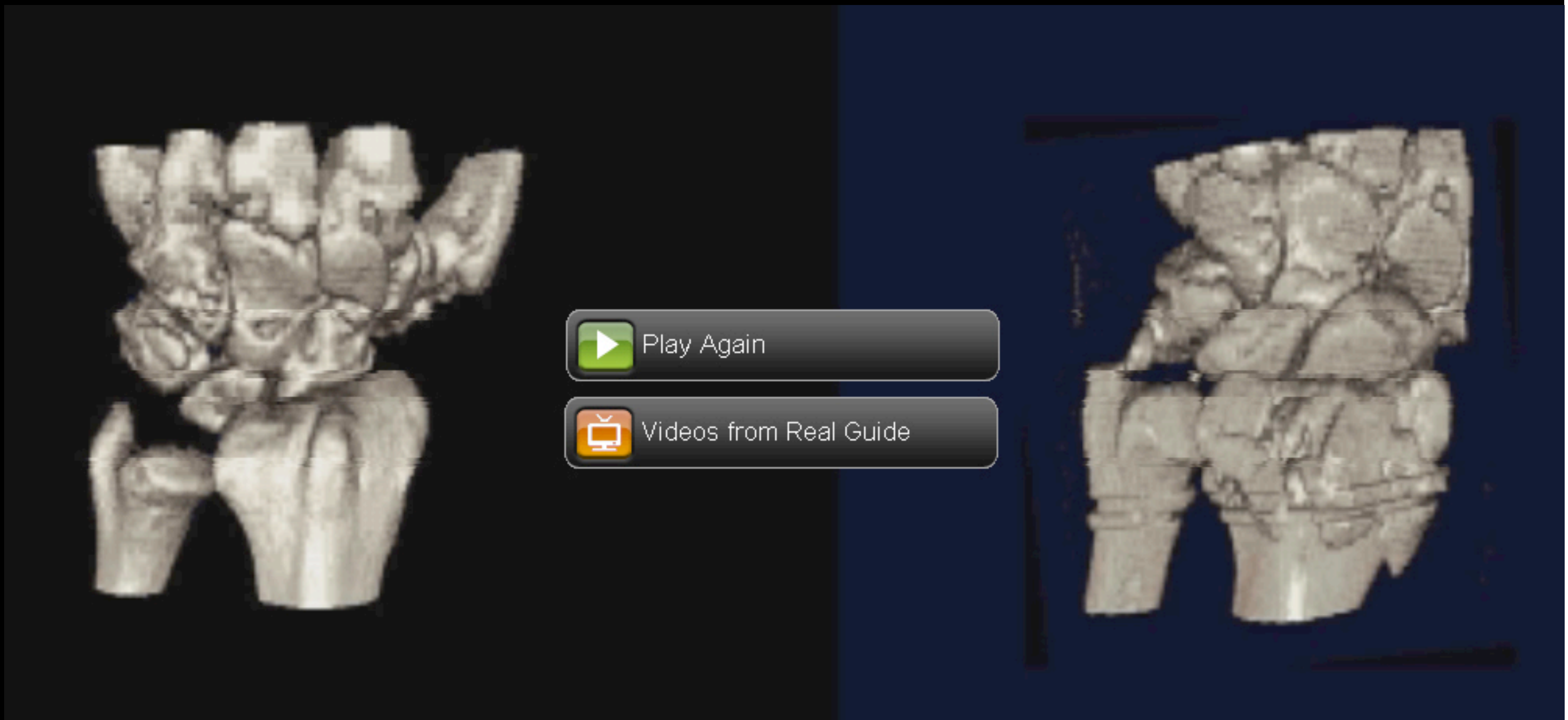
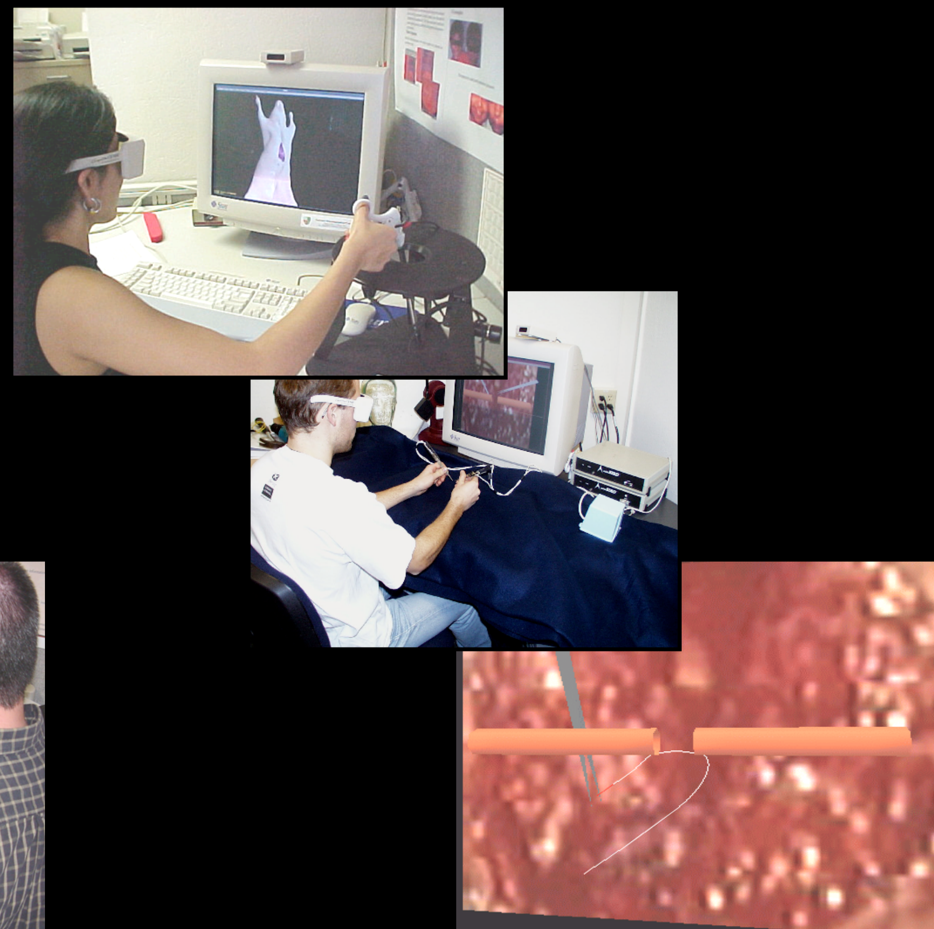
Amy Ladd’s wrist



Surgical Planning & Simulation for Mars Trip



- Building Digital Anatomical Libraries
- Surgical Simulation
  - Virtual Dissection Table
  - Display walls
- Medical Education/Curriculum Development
  - Infrastructure
  - Content

Building Digital Anatomical Libraries

Acquiring anatomical specimens

Acquiring data – CT, MRI, Milling, Photo

Reconstruction & visualization of data

Using data – licensing & building Atlases

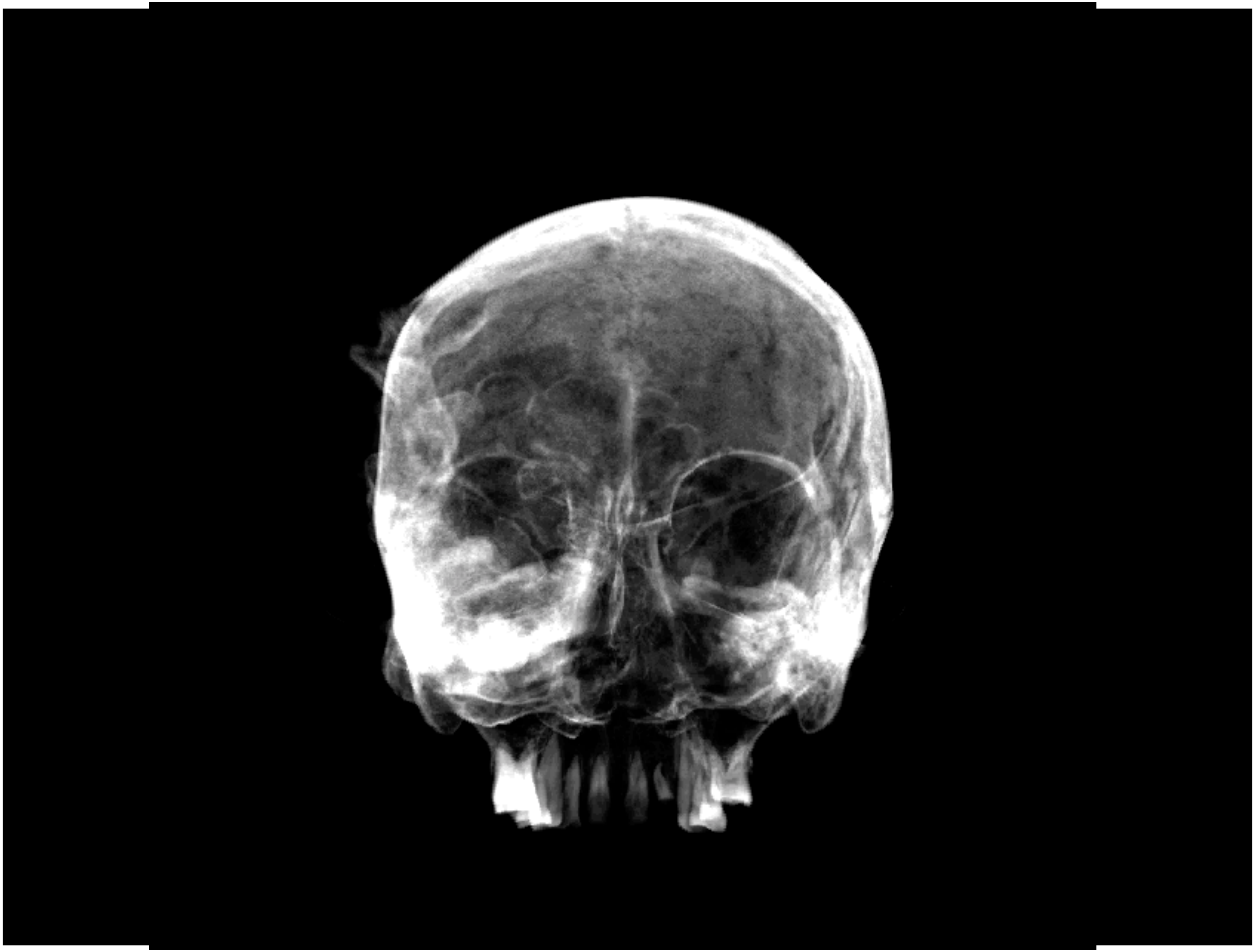
Integrating data into curriculums

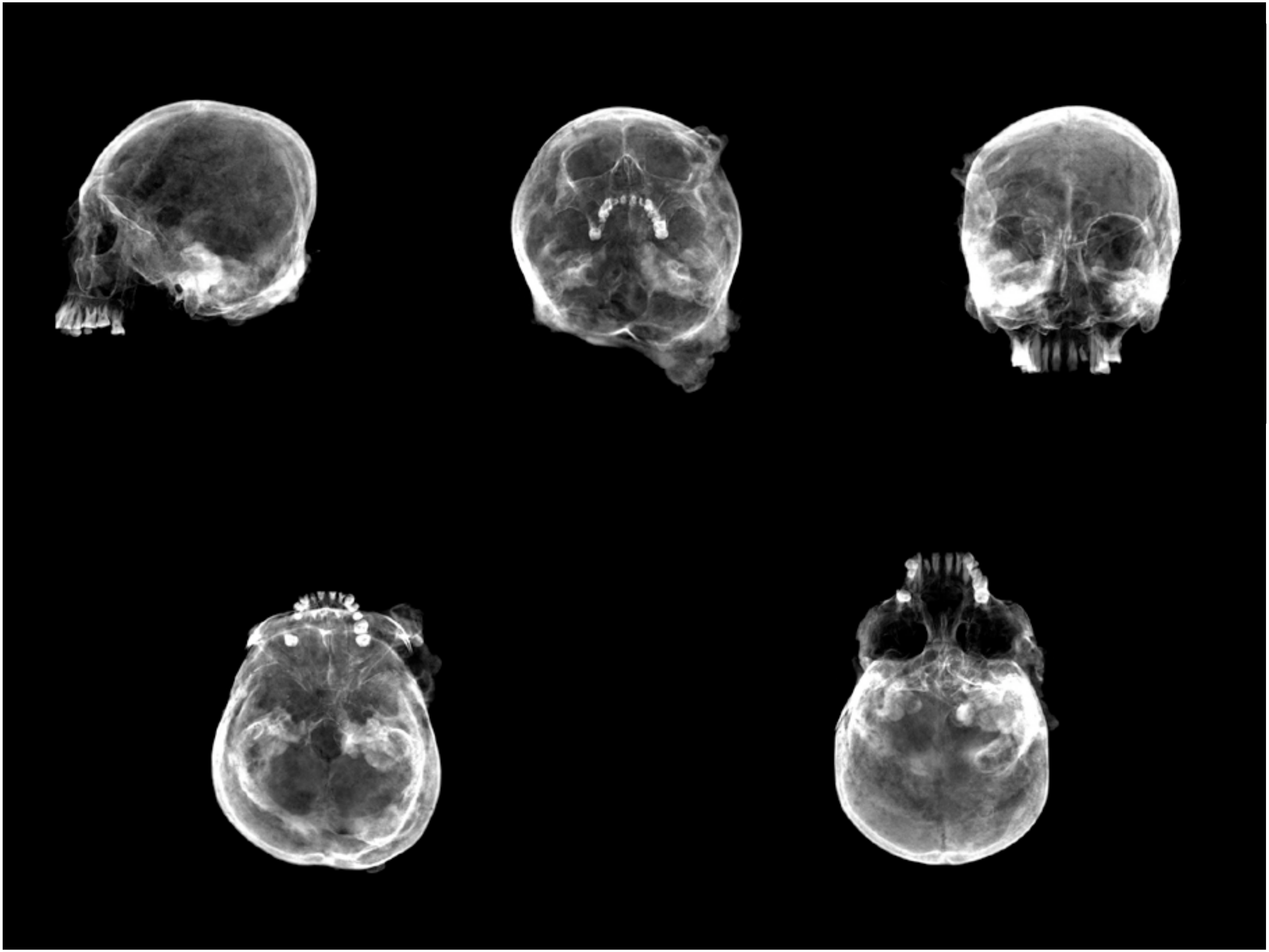
Displaying digital anatomical content

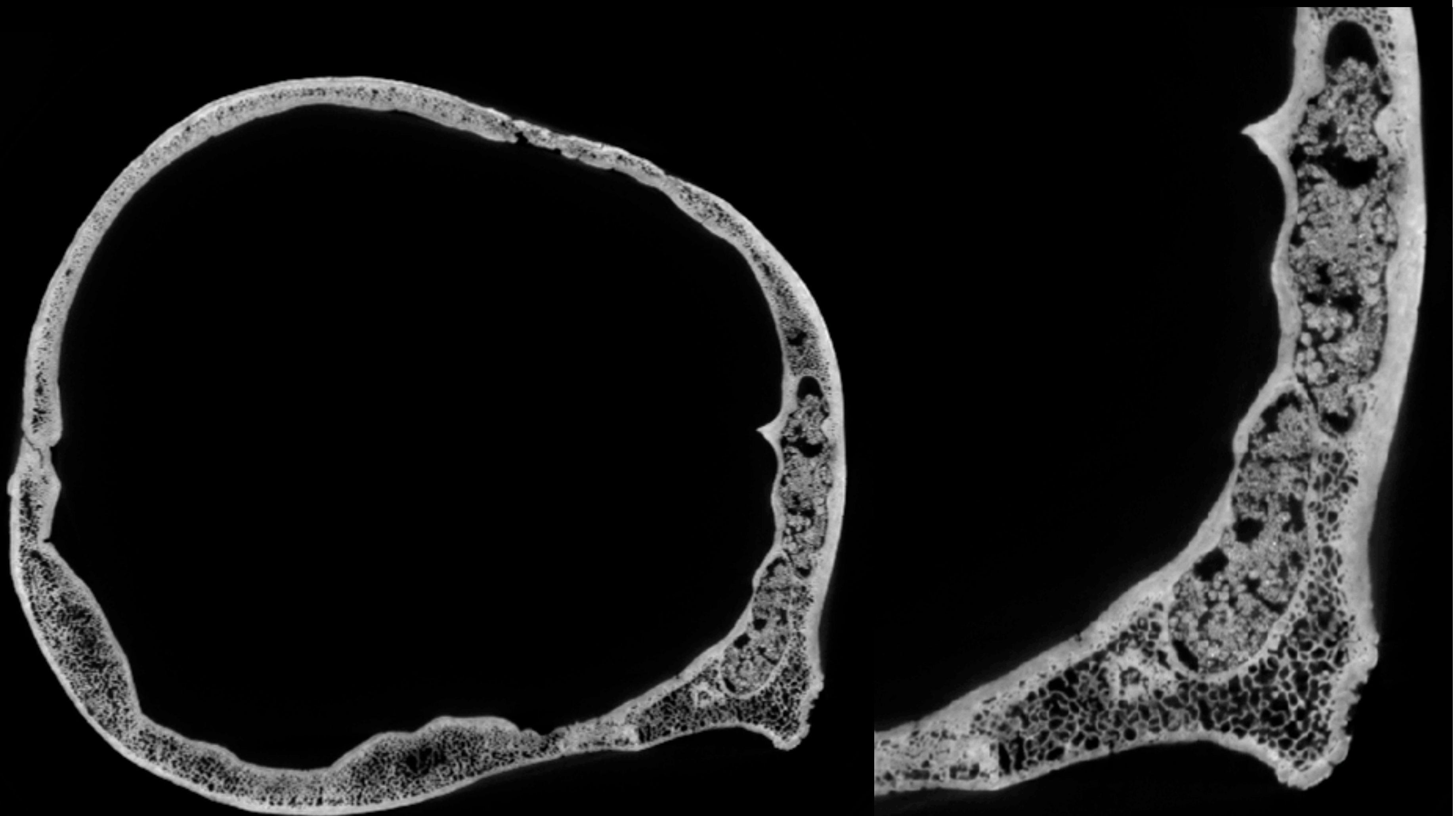
Use in simulators

Cancerous Skull

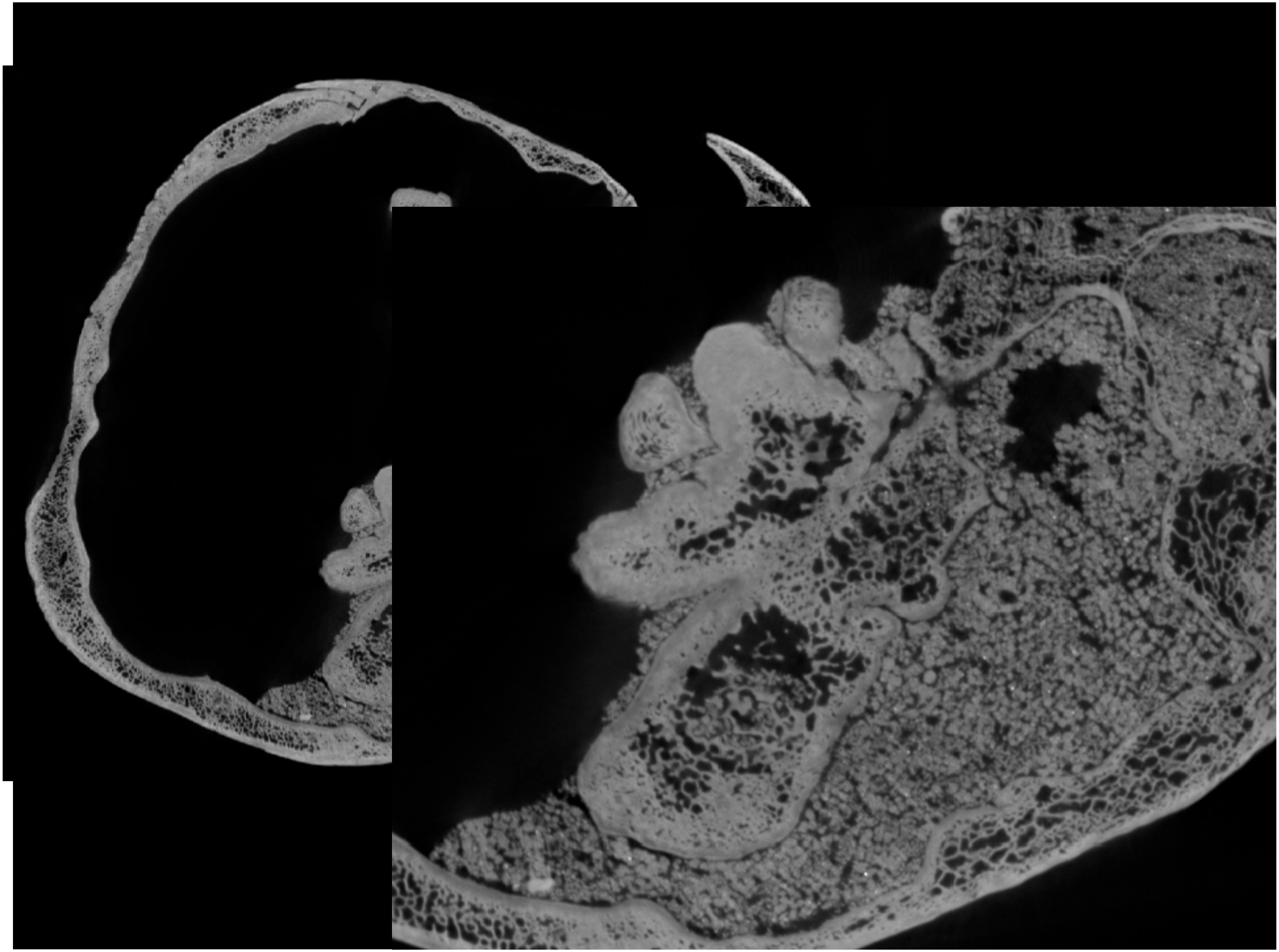
- Skull provided by Dr. David R. Hunt, Smithsonian Institute
- In support of work for Dr. W. Paul Brown, Stanford/NASA Biocomputational Center
- Data acquired on FlashCT® system by HYTEC, Inc., Los Alamos, NM
- Project leader: Terry Kessler







Slice 492



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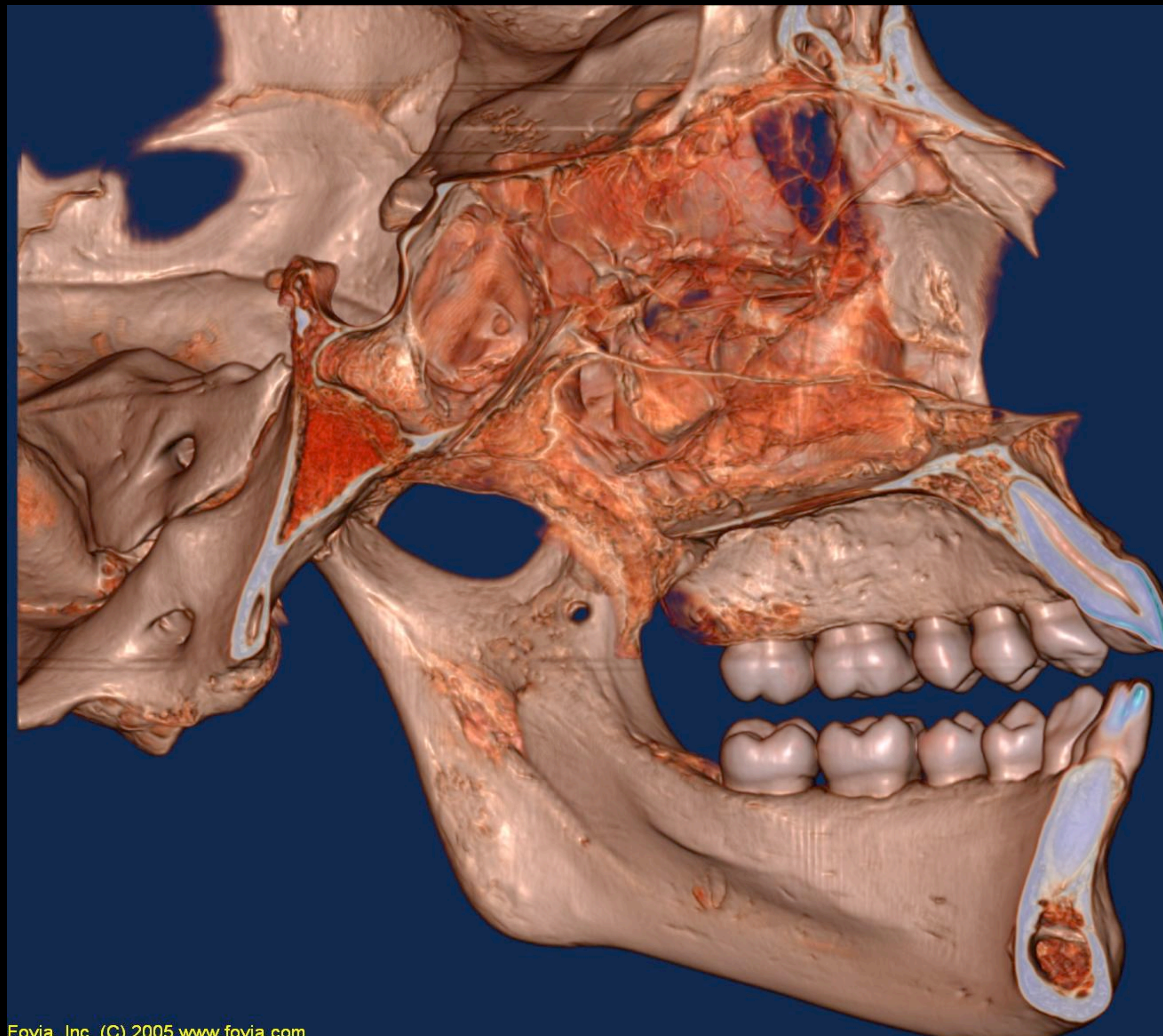
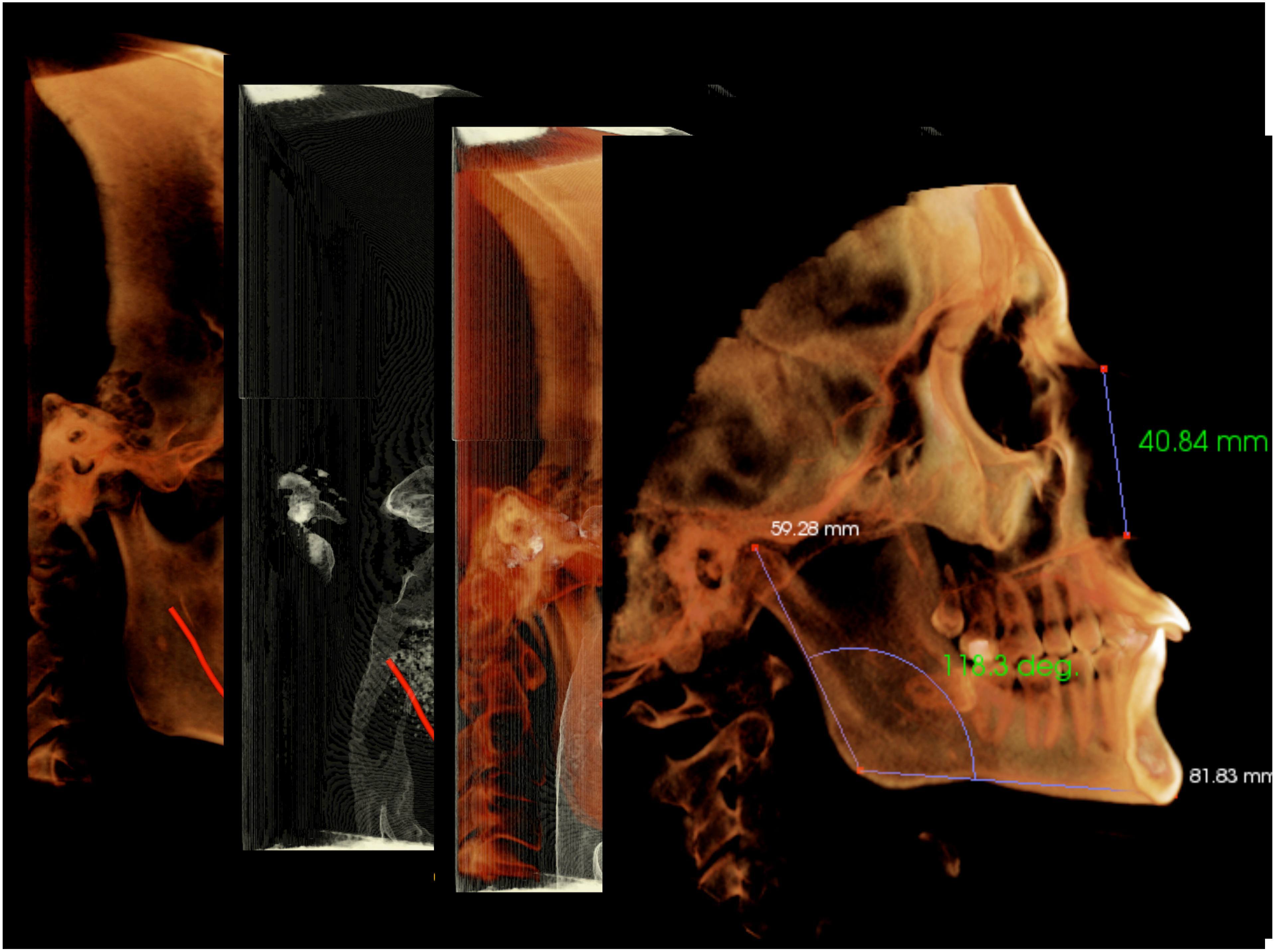
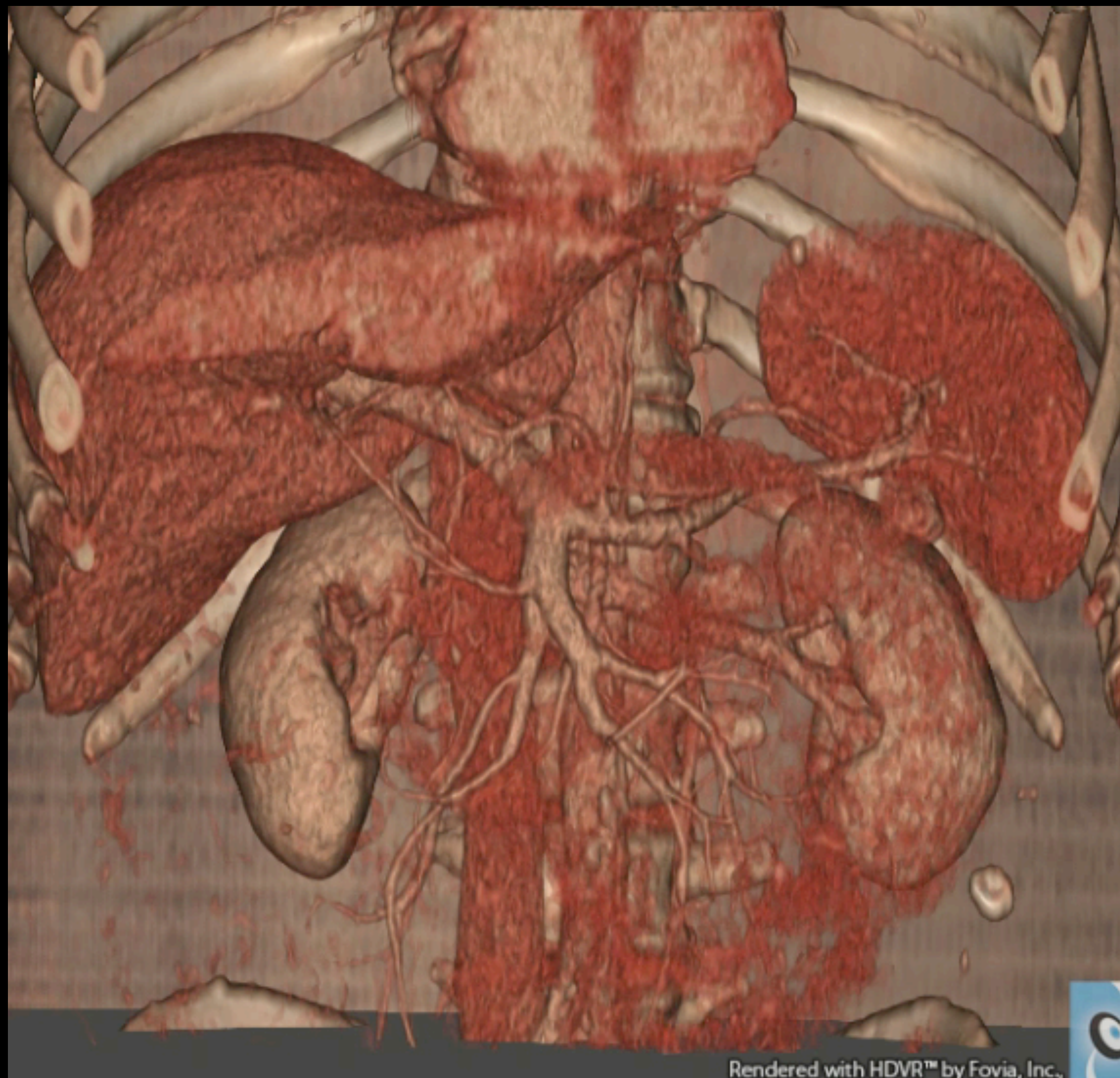
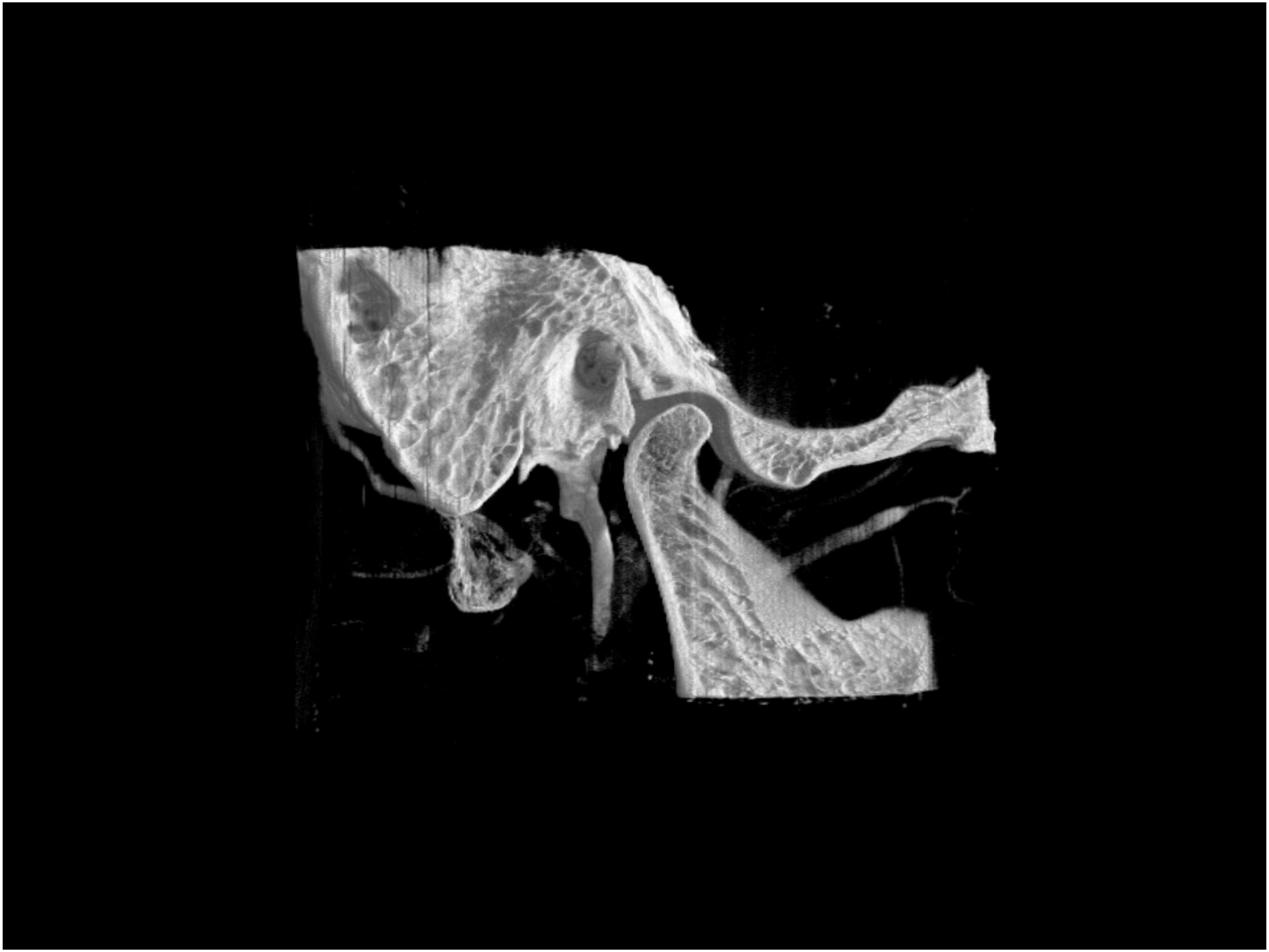
Volume Models

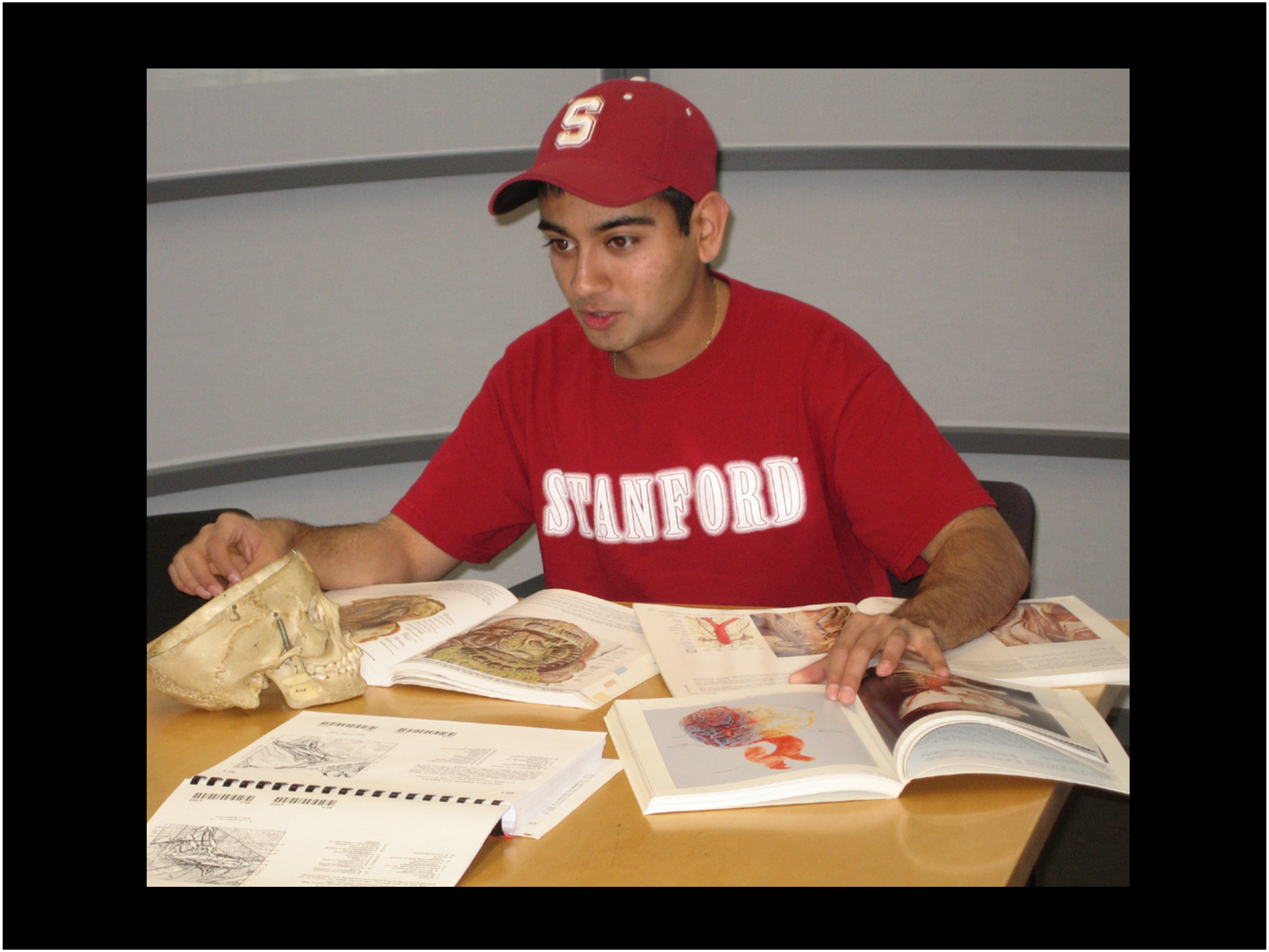




40.84 mm
59.28 mm
118.3 deg.
81.83 mm


Rendered with HDVR™ by Fovia, Inc.,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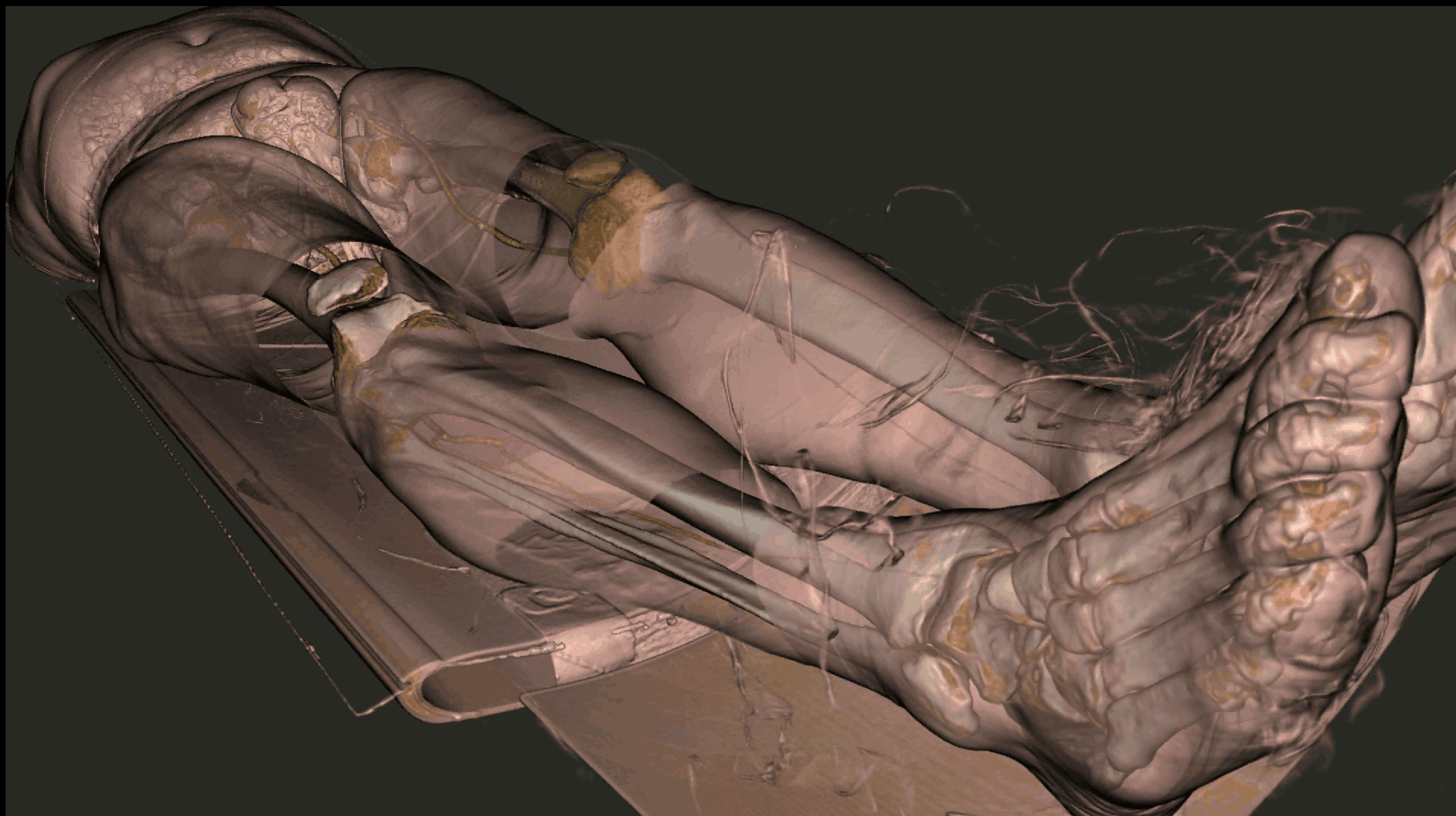
STANFORD

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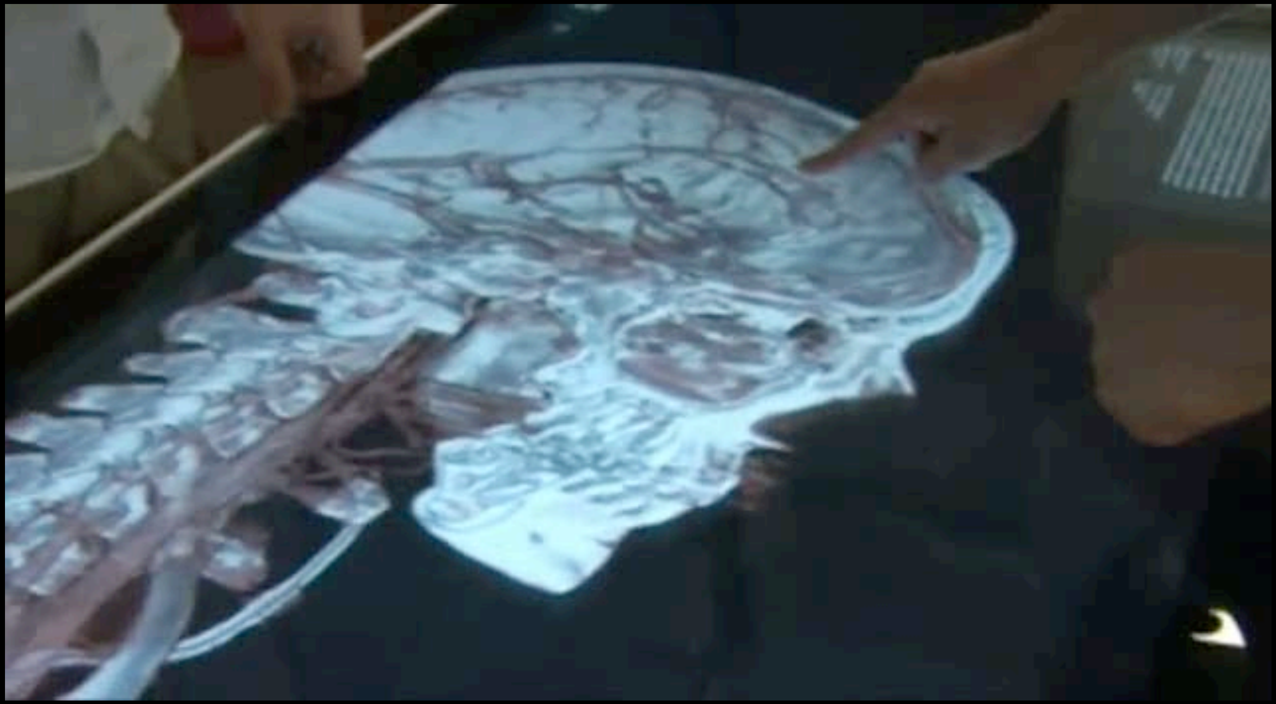
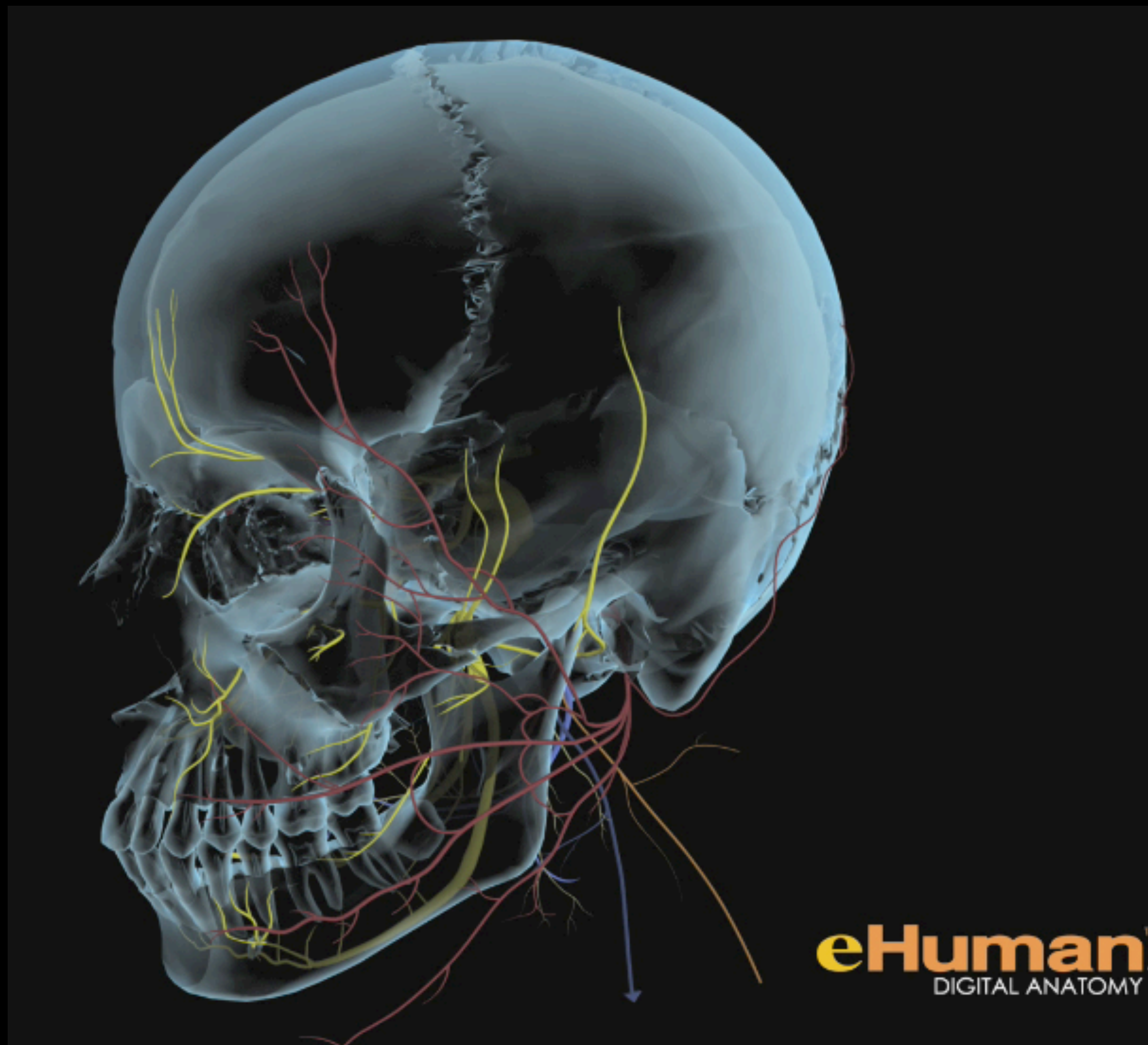
Virtual Dissection Table



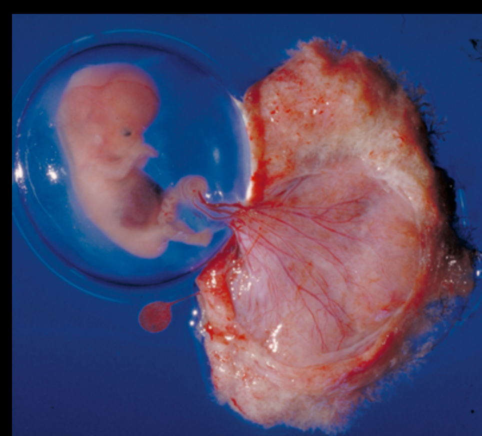
Display Wall - 3D Interactive Content

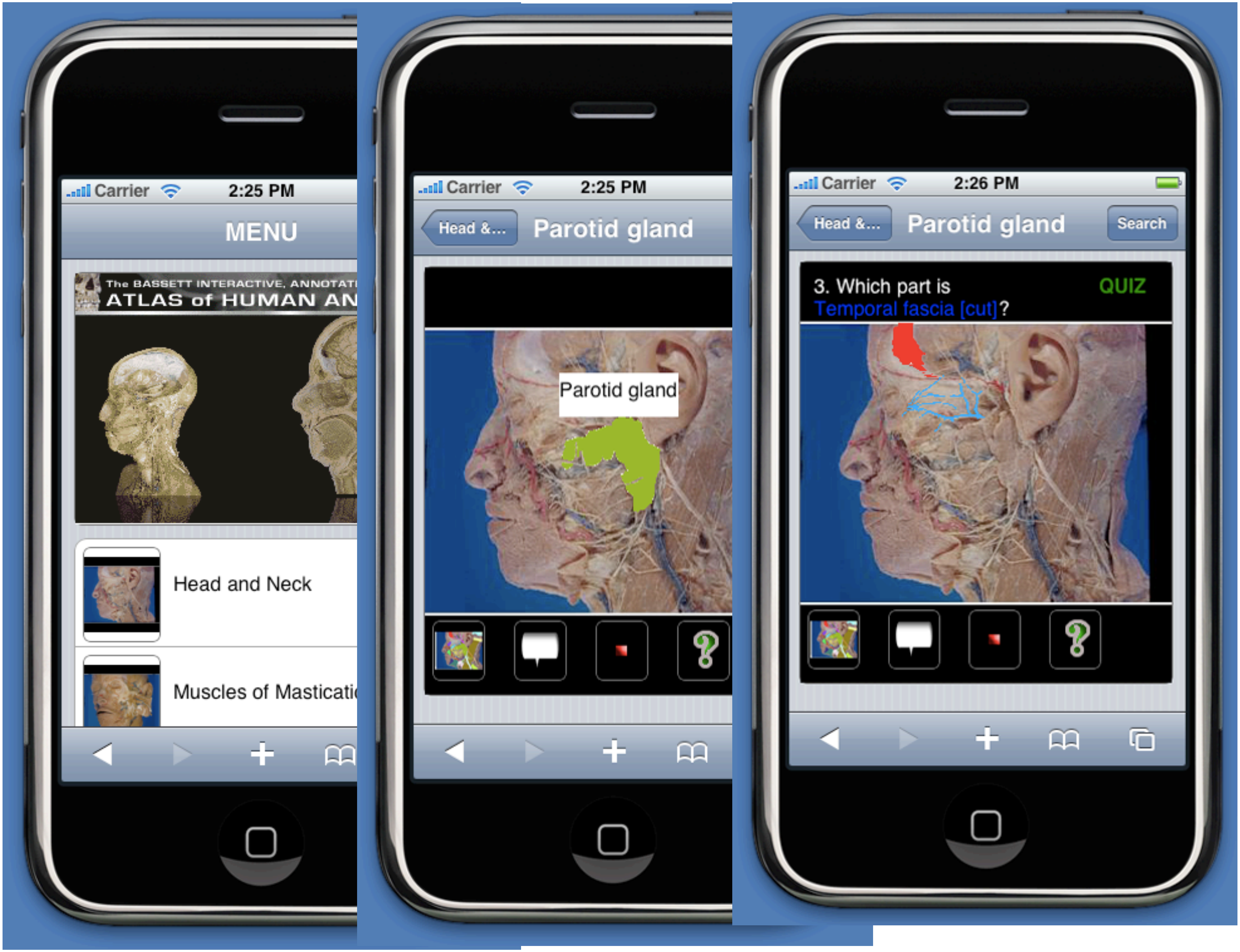
Surgical Simulators


eHuman
DIGITAL ANATOMY



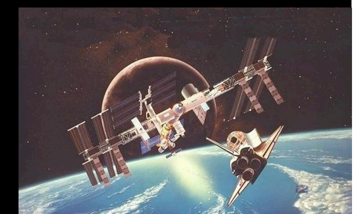
The Bassett Dissection Series

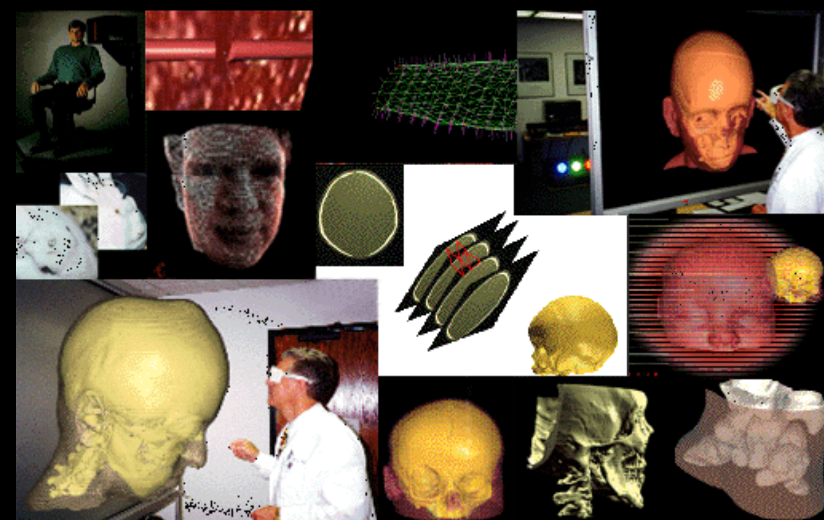



Carrier
2:25 PM
MENU
The BASSETT INTERACTIVE, ANNOTATI
ATLAS of HUMAN AN
Head and Neck
Muscles of Masticati
Carrier
2:25 PM
Head &...
Parotid gland
Parotid gland
Carrier
2:26 PM
Head &...
Parotid gland
Search
3. Which part is
Temporal fascia [cut]?
QUIZ

National Biocomputation Center



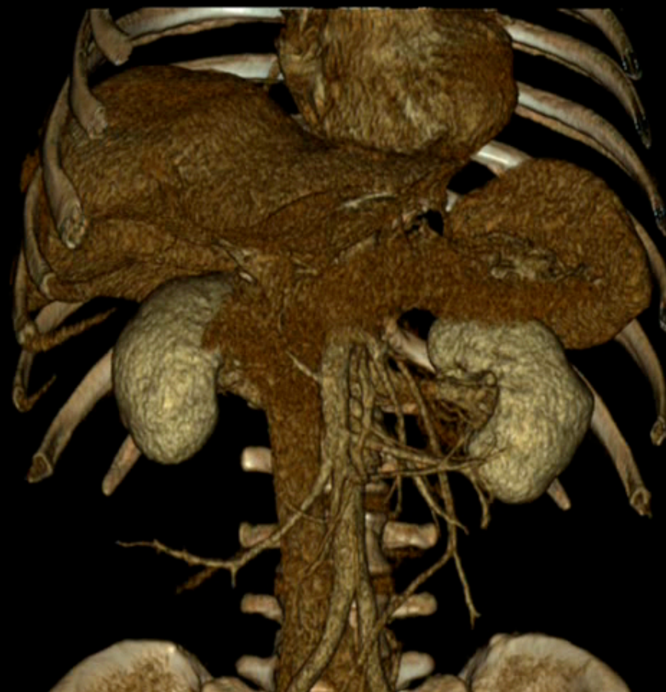
A joint NASA-Stanford institute applying advanced computation and visualization in medicine and surgery



Formed in February 1998

- **Surgical Planning**
- **Human Augmentation**
- **Training/Education**
- **Human Phys Monitoring**

- Focus on medical care for long-duration spaceflight



Cardiovascular Intensive Care Unit Simulation Program

Lucile Packard Children's Hospital
Stanford University Medical Center

Lucile Packard Children's Hospital AT STANFORD

CVICU Simulation Team

PROGRAM COORDINATORS

Andrew Shin, MD

Winnie Yung, RN, MN

Erica Barnum, RN

CAPE-TRAINED INSTRUCTORS

Vicki Arnolde, RT

David Axelrod, MD

Michele Avila-Emerson, NP

Chris Butler, RN

Jodi Hathaway, RN

Lucile Packard Children's Hospital AT STANFORD

Goals

Improve multi-disciplinary team work during crisis situations

Address Knowledge, clinical practice, and communication issues during high-risk situations

Team building

New Unit In-situ Orientation 2009

- Orientation to new unit and new equipment for all MD's, RN's and RT's

  - Scenario

    Neonate post-op from cardiac surgery with cardiac arrest requiring emergent, intubation, sternotomy and blood transfusion

    Objectives

    Locate code bell

    Retrieve Code Cart, Airway Cart and Open Heart Cart

    Retrieve emergency blood

Day 1 of the New CVICU Opening

- Neonate POD 4 following single ventricle palliation suddenly suffered cardiac arrest. Emergent sternotomy and chest exploration required.

- Proper equipment and help was located and acquired immediately per simulation training. No disorientation or delay in retrieving necessary equipment.

- Patient survived and was discharged to home 2 weeks later with no sequelae.

CVICU Simulation Program 2009

- 1 mock code simulation per month at CAPE
  - 2 scenarios per session (4hr) each followed by a debriefing

- Participants:
  - 8-10 Registered Nurses
  - 2 Respiratory Therapist
  - 1 Pharmacist
  - 1 Nurse Practitioners
  - 2 MDs (Attending and Fellows - Cardiology and PICU)

CVICU Simulation Program 2009

- Scenarios specific to the pediatric CVICU

  Examples include:

  Neonate following complex congenital heart surgery

  Emergent bedside sternotomy (Open Heart Cart)

  Adult with congenital heart disease

  E-CPR and ECMO cannulation

Debriefing

Common Topics/Objectives

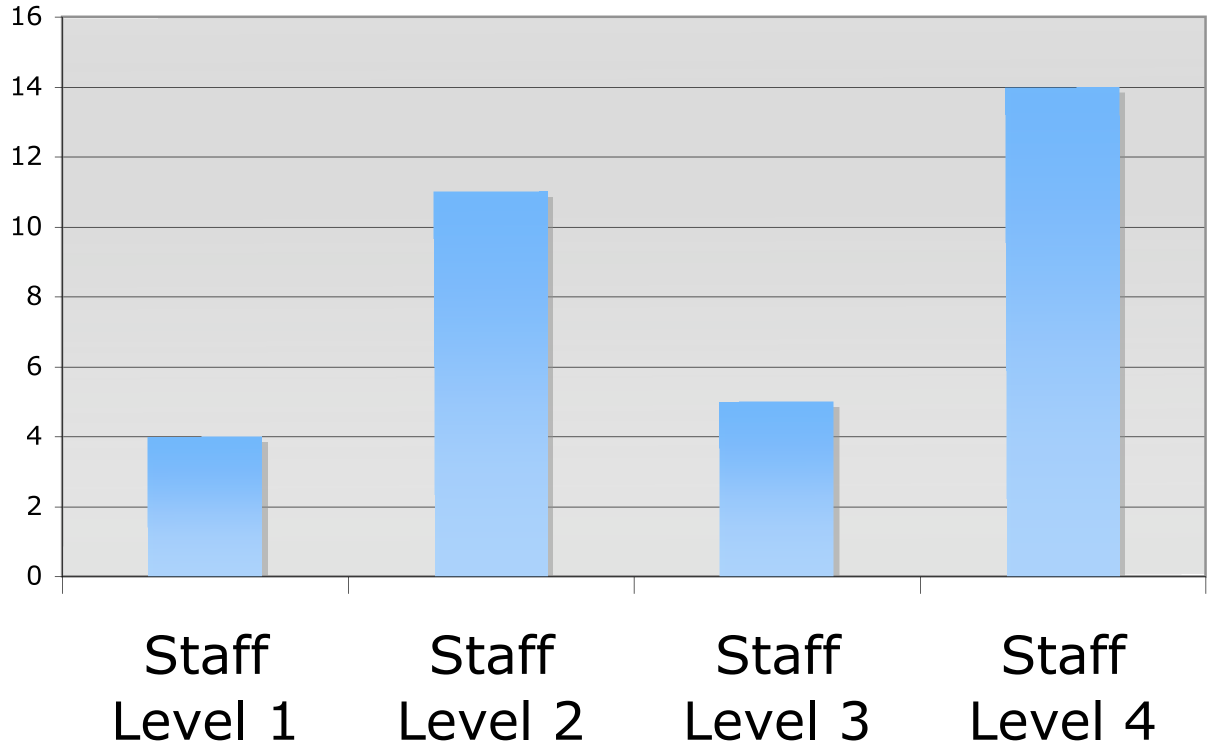
- Closed Loop Communication
- Role Clarity
- Resource utilization

Skills, Techniques and Equipment:

- Use of the Zoll pads/Defibrillation
- Broselow (Pediatric) Cart
- Open Heart Cart
- PALS Algorithm/ACLS Algorithm

Pre-Simulation Questionnaire

Demographics: Nursing Staff level



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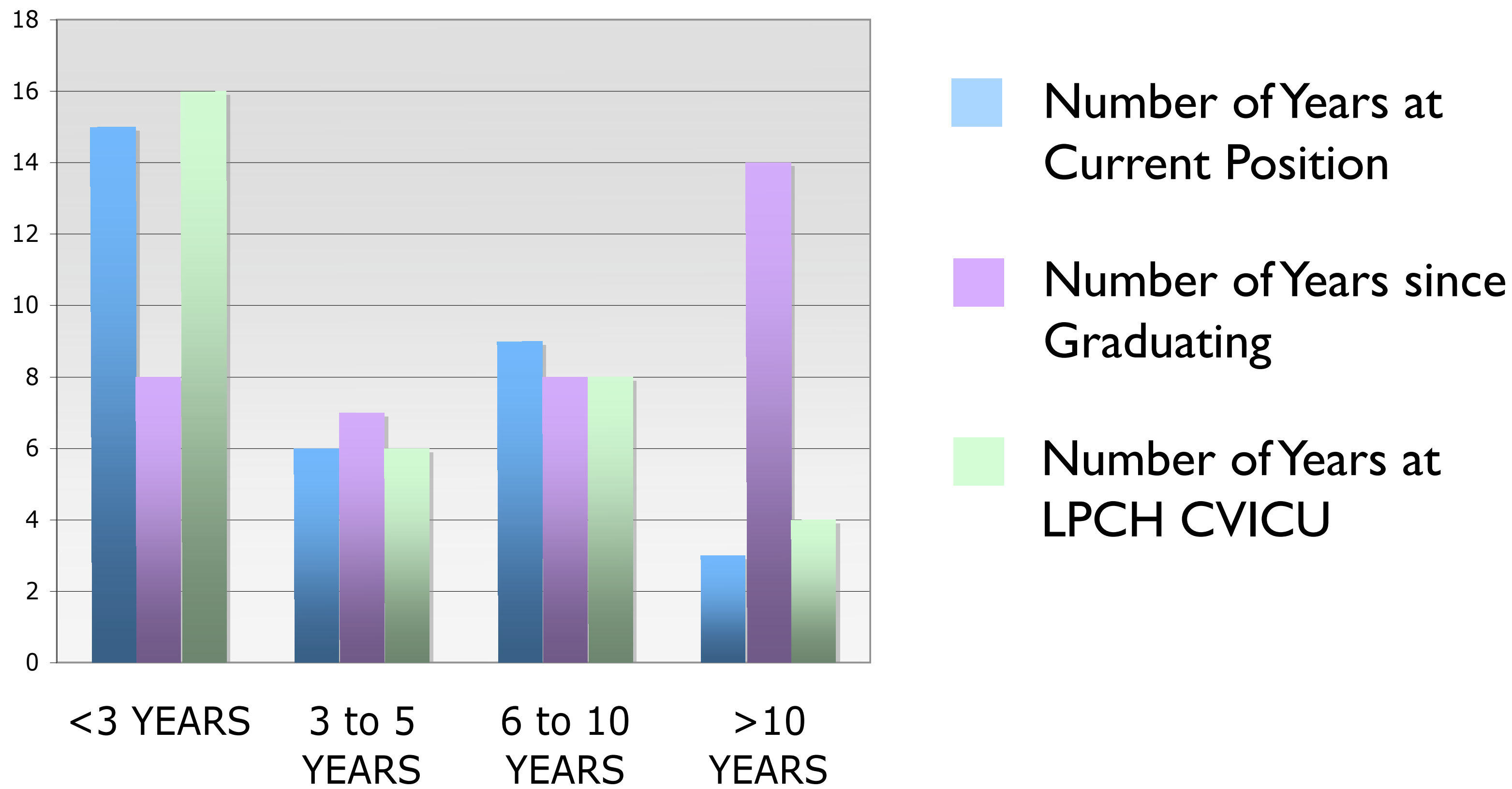
Demographics: Nursing



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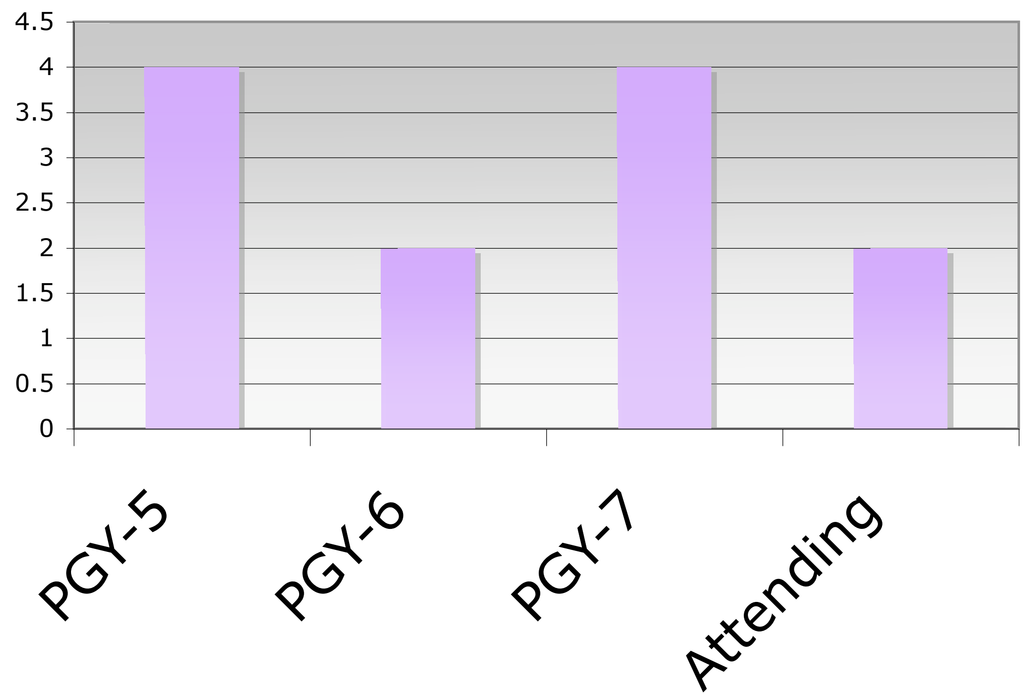
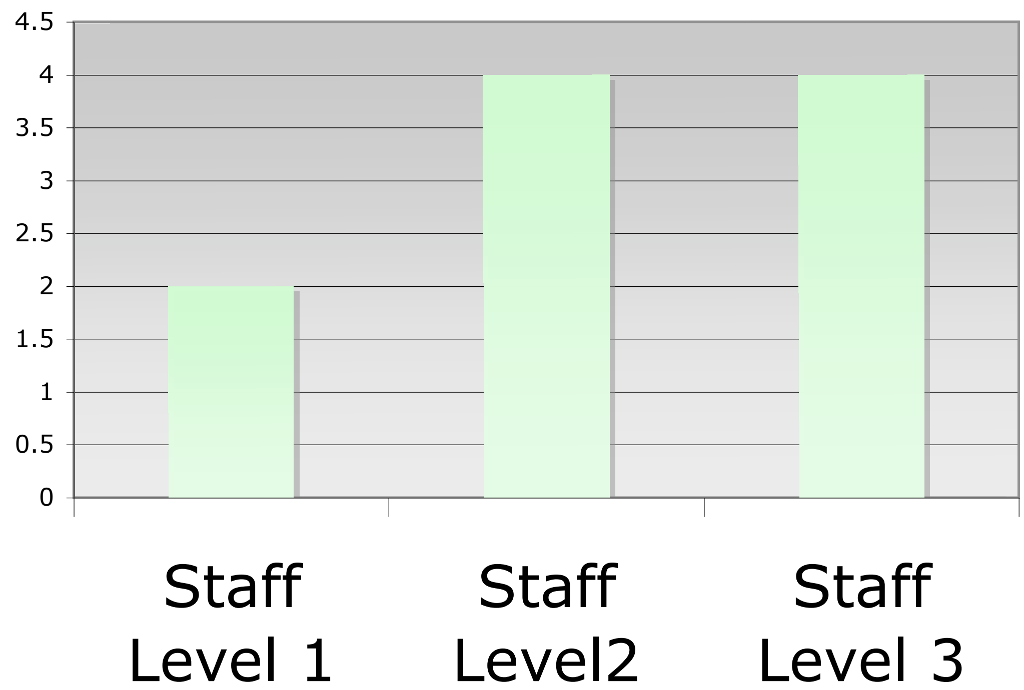
Demographics: Physicians



Demographics: Respiratory Therapists



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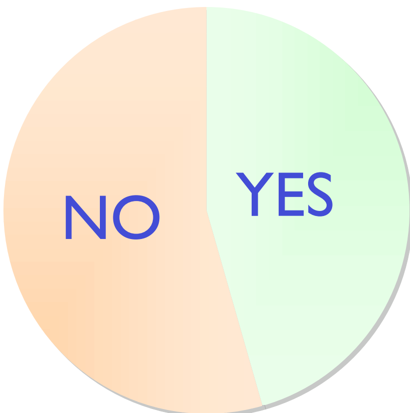
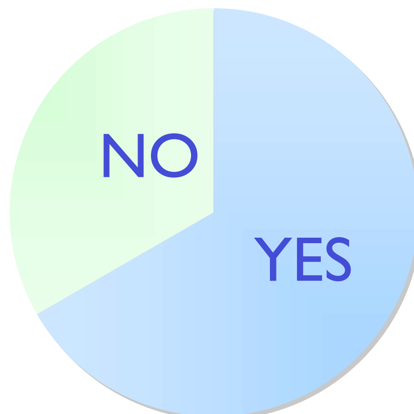
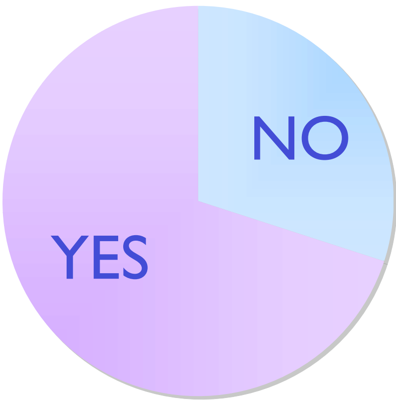
Previous Simulation Experience



NURSING

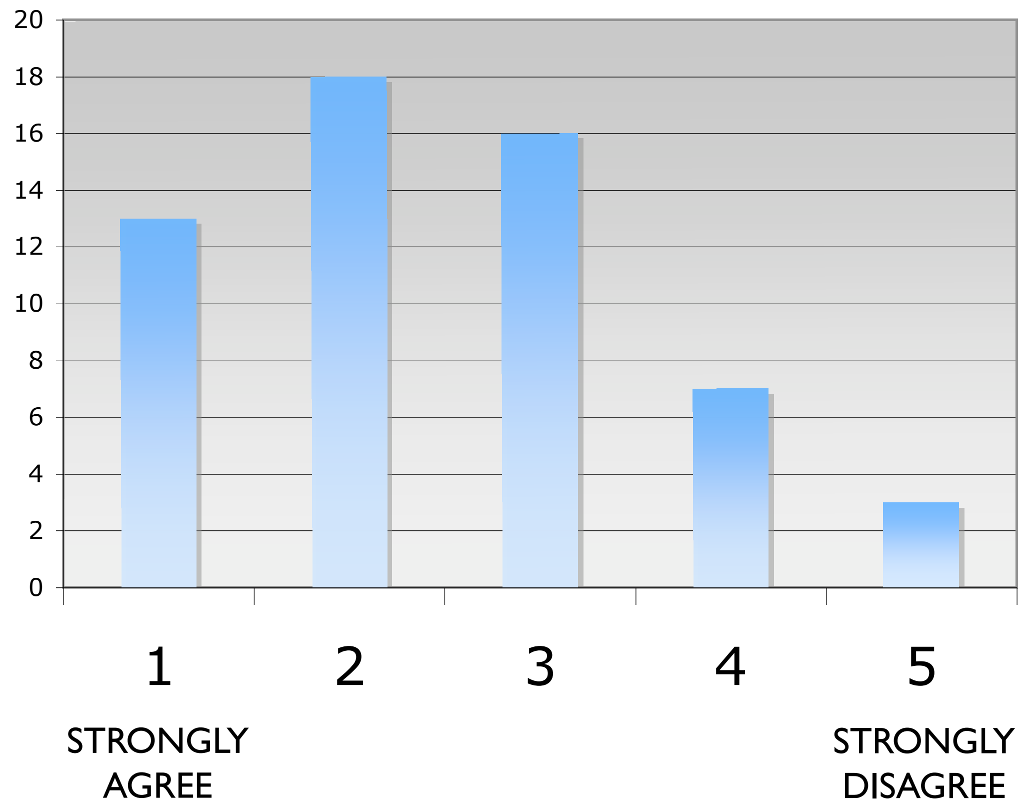


PHYSICIANS



RESPIRATORY THERAPISTS

"I FEEL COMFORTABLE WITH MY CURRENT LEVEL OF KNOWLEDGE, EXPERIENCE AND TRAINING WITH CRISIS EVENTS IN THE CVICU"



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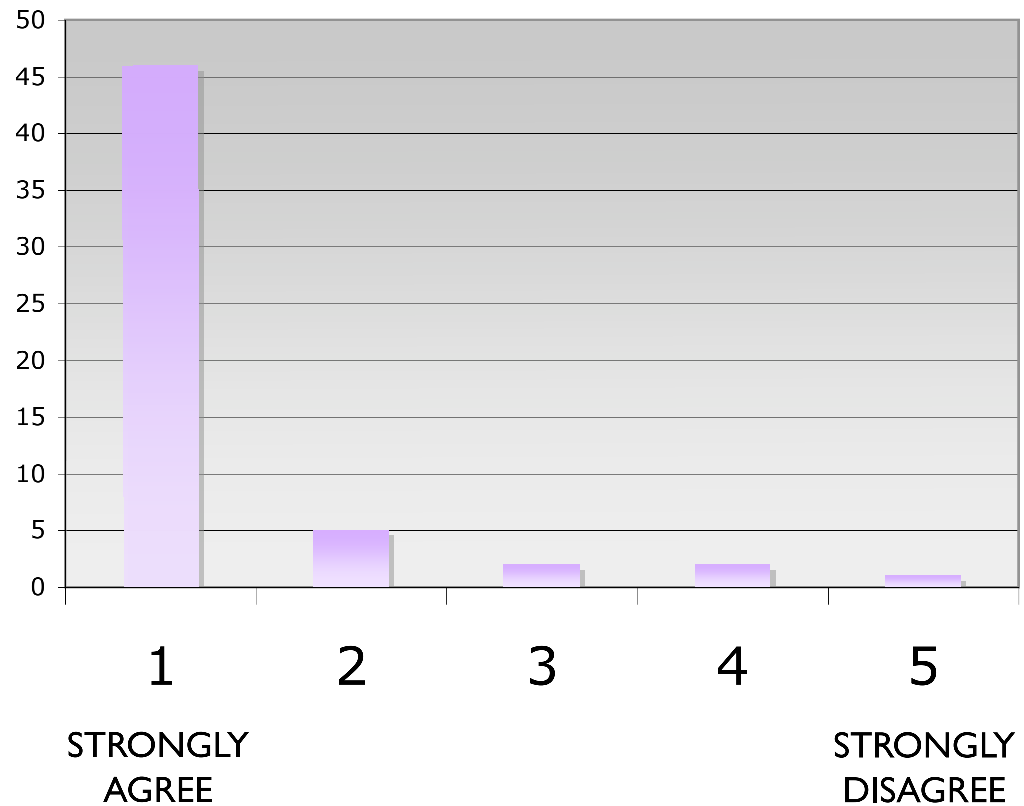
"I THINK THAT MEDICAL SIMULATION IS A VALUABLE TOOL IN MY TRAINING AS PART OF WORKING IN THE CVICU"



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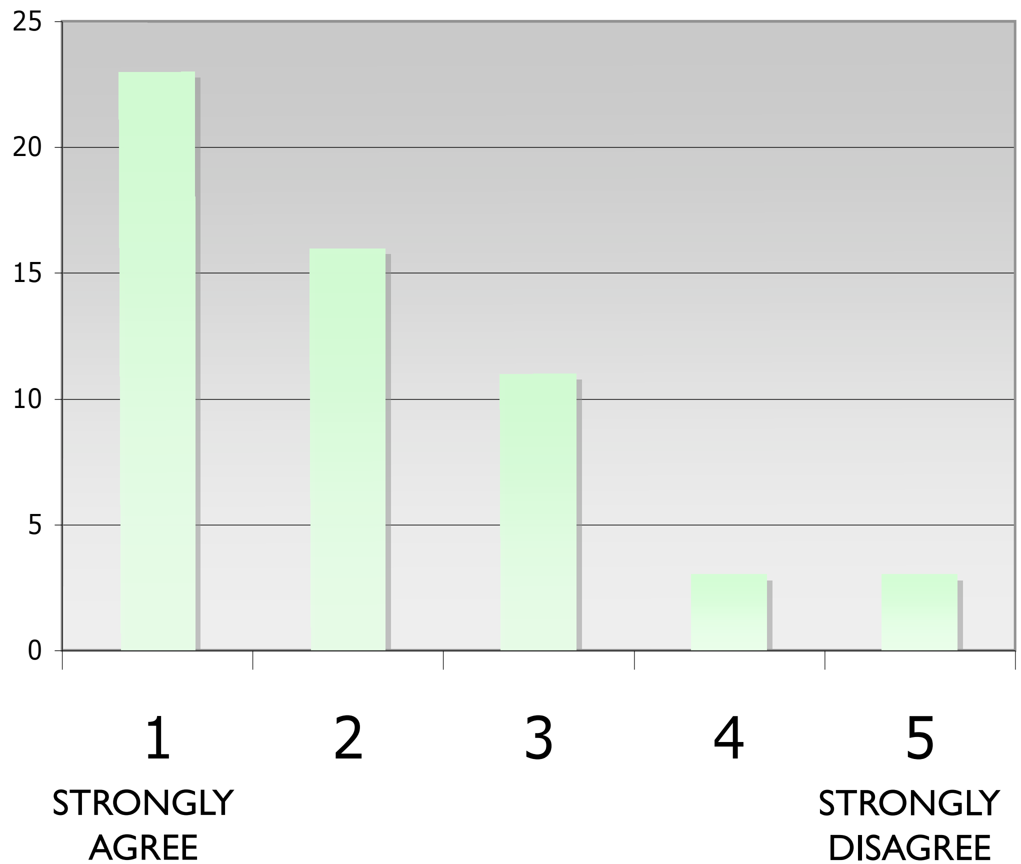
"I AM AWARE OF and PRACTICE the PRINCIPLES of CLOSED LOOP COMMUNICATION"



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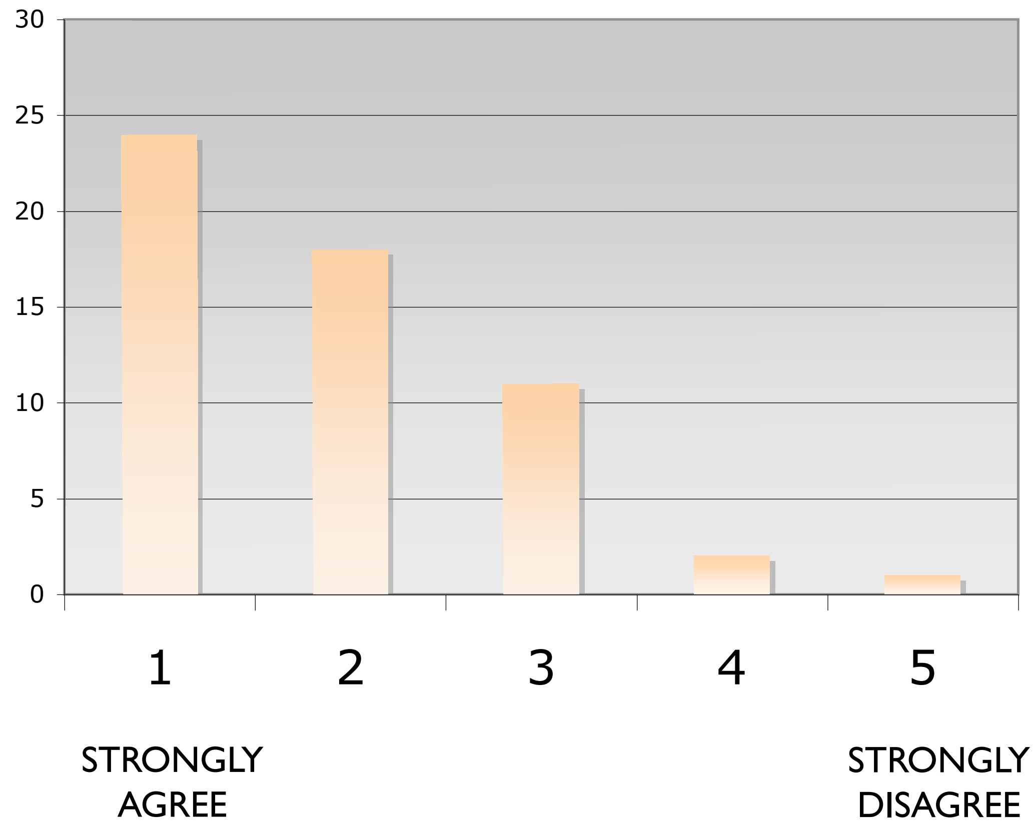
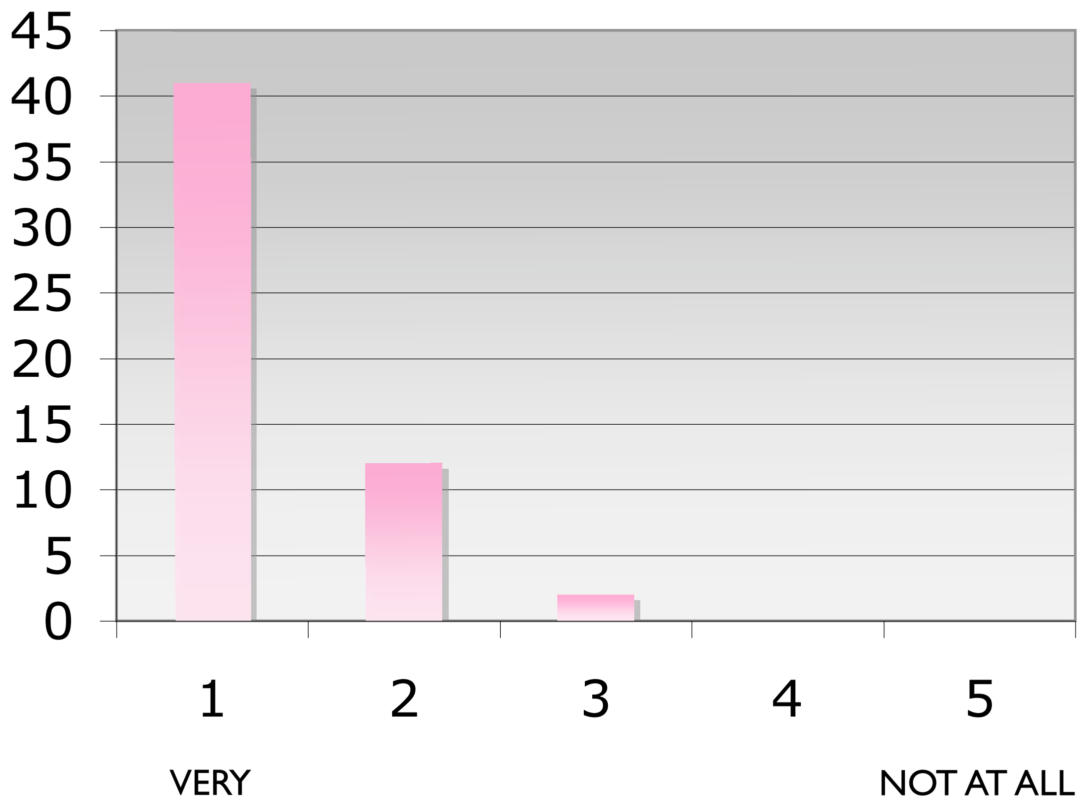
“I AM AWARE OF and PRACTICE the PRINCIPLES of ROLE CLARITY IN A CRISIS EVENT”



POST-SIMULATION QUESTIONNAIRE

"HOW REALISTIC AND BELIEVABLE WAS THE SCENARIO?"



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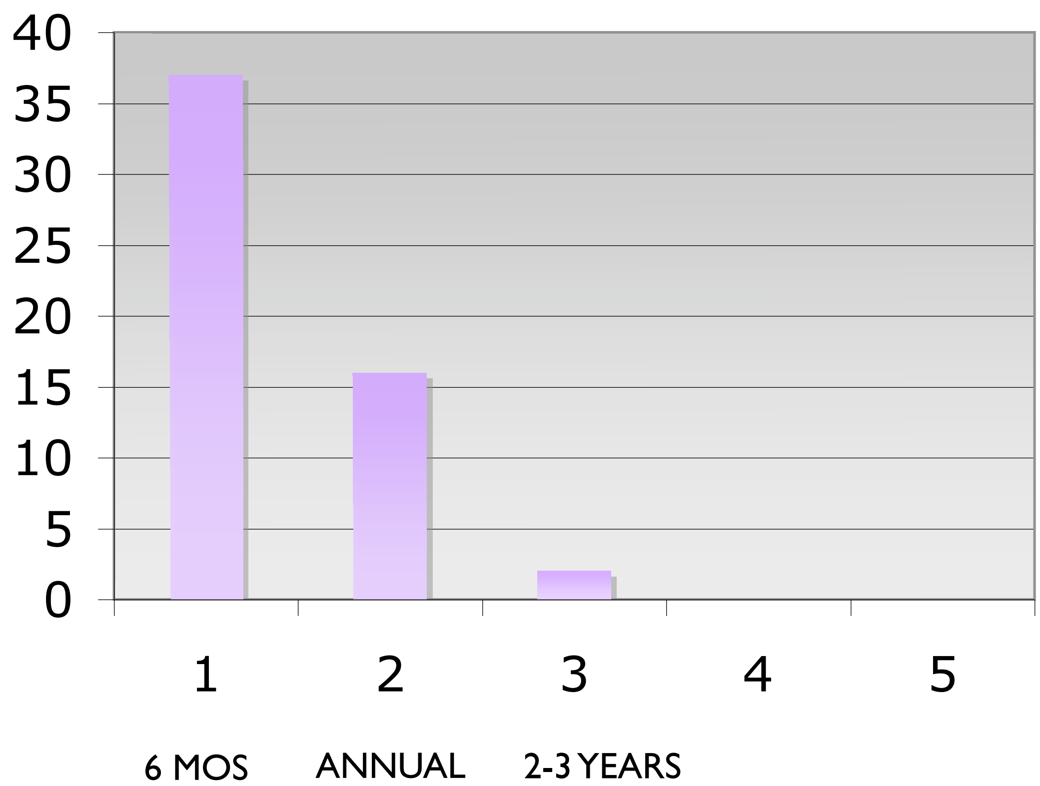
"HOW OFTEN SHOULD AN EXERCISE OF THIS TYPE BE TAKEN?"



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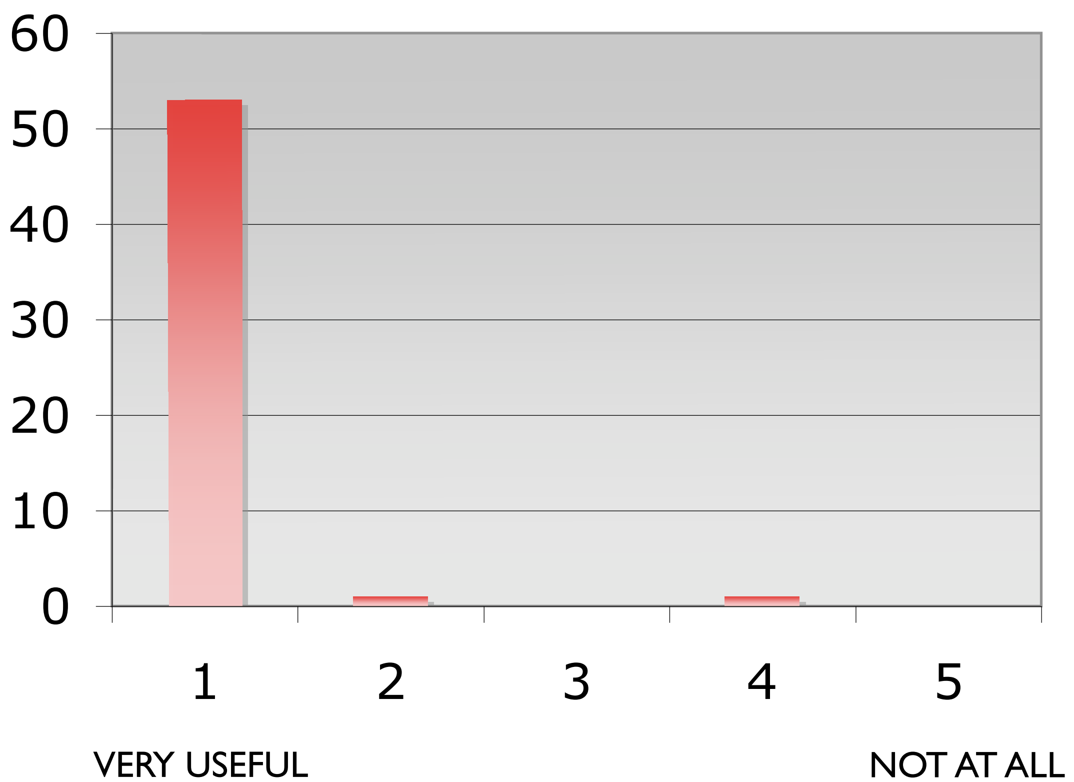
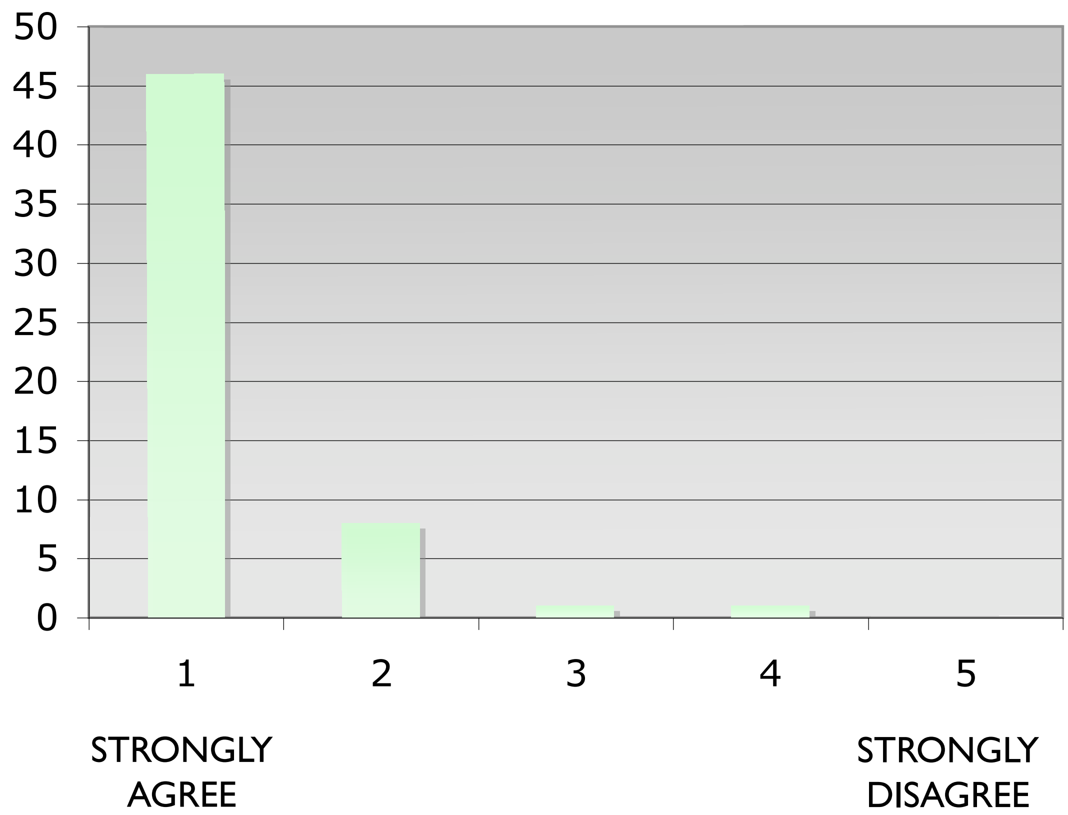
"HOW USEFUL TO YOUR PROFESSIONAL PRACTICE WAS THIS EXERCISE?"



"I FEEL BETTER PREPARED TO HANDLE CRISIS EVENTS IN THE CVICU"



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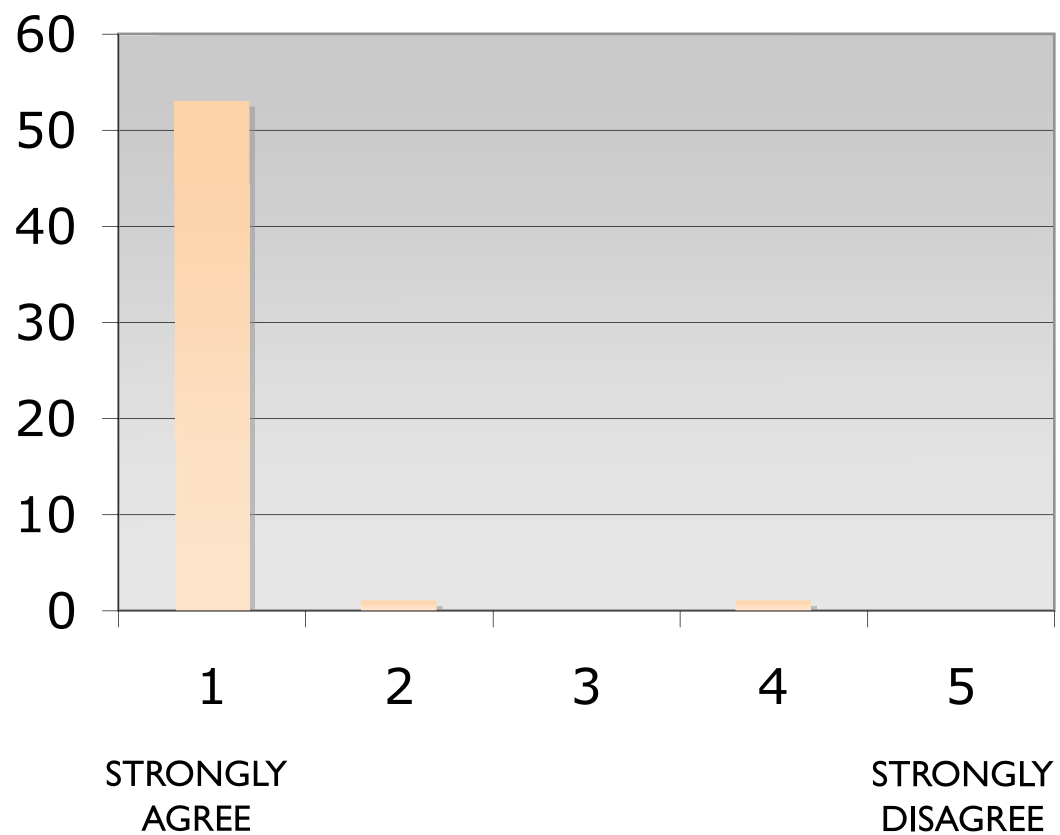
“WOULD YOU RECOMMEND THIS EXERCISE TO OTHERS?”



Lucile Packard Children's Hospital AT STANFORD

Simulation Program 2010

- Mandatory simulation at CAPE for all RN's, MD's and RT's
- 2 simulations per month at CAPE utilizing a multidisciplinary team
- Incorporate nursing Skills Competencies into monthly simulations

Future Directions

Establish Skill Competency

Simulating ECMO Cannulation

Crisis events with adult patients with congenital heart disease

Cognitive Aids: Lessons on their Use and Development

Sara Goldhaber-Fiebert M.D. with
Multiple members of
VA Palo Alto Simulation Group

Overview

- Value of Cognitive Aids
- Circumstances for Use
- Influences on Successful Use
- Examples we have created
- Moving Forward

Value of Cognitive Aids

- Learning from other industries
- Too many total details to remember them all
- Management of rare events
- Humans forget key details under pressure

Circumstances for use

- General Review: Passive and Active
- Use during an emergency
- After a patient is semi-stable
- Post facto Review after an emergency

Influences on successful use

- **Culture**
- **Familiarity**
- Content
- Design and Usability
- Location and Availability
- Person dedicated to reading aid?

Examples

Hypotension

Immediate Lifesaving Actions

- Check other vitals (especially HR and rhythm)
- Check surgical field and Feel for pulse
- Open IVF; add access if necessary
- Pressors to temporize (choice based on other vitals and PMH)
- Turn off or down volatile agent
- Check for low $ETCO_2$ and/or O_2 sat with severe hypotension
- If severe hypotension: consider 100% O_2 at high flows to flush anesthetics
- Consider T-berg or pt legs up
- Check PEEP, TV for decreased preload
- Listen for Breath Sounds (Bilateral? Clear?)
- Check for Rash
- Call for HELP, especially if no clear cause or worsening
- Communicate problem to surgeon and team
- Consider Code Cart if arrhythmia or severe hypotension
- Consider artifact Last (only if all else ok).

    NIBP: Check size and position of cuff.

    A-line: waveform? kinked?

    Try flushing and repositioning while checking NIBP

Hypotension

Differential Diagnosis

MAP=CO x SVR; CO=SV x HR

SV from preload, afterload, contractility

Low Stroke Volume

Decreased preload: Hypovolemia from bleeding or other decreased volume, Tamponade, PTX, PEEP, surgical compression/retraction, insufflations, PE, tachycardia or arrhythmia

Increased afterload: Heart unable to eject enough blood against high afterload

Decreased Contractility: Low Calcium, Cardiomyopathy, MI/ischemia, prolonged hypoxemia, valvular disease

Low HR if on BB may not get tachycardic compensation for low SV

Low SVR (vasodilation): Anaphylaxis, Cement/emboli, Anesthetics and drugs (volatiles, induction agents, ACEI/CCB/other anti-HTN), Sepsis, Neuraxial blockade, Spinal shock

Follow up Actions (if Refractory)

More IV access

Call for **Blood**

Place **A-line**: send ABG including blood gas, Hgb, lytes, Calcium; send Type and Cross

Vasopressin 0.04u/min drip for refractory hypotension (particularly if pt on ACEI)

Epinephrine (100mcg) if refractory or suspect anaphylaxis

Consider **TEE or PA line** if unclear cause

Foley catheter if not present

PEA

CPR

Call for **Help** & **Crash Cart**

100 compressions/minute

2 minutes continuous **CPR**

Check

Always ...

- Backboard
- Establish airway
- IV Access

In the OR ...

- Turn OFF Volatile
- 100% O_2
- Check vent rate (6 breaths/minute)

Treat

Epinephrine - 1 mg IV push q 3-5 minutes

If rate slow: **Atropine** - 1 mg IV q 3-5 minutes

Consider: **Vasporessin** - 40 units

Diagnose

Find & Treat Cause – more details on back:

❶ Hypovolemia
❷ Hypoxia
❸ Hydrogen ion - acidosis
❹ Hyper- or Hypokalemia
❺ Hypoglycemia or Hypocalcemia
❻ Hypo- or Hyperthermia
❼ Toxins (overdose)
❽ Tamponade - cardiac
❾ Tension pneumothorax
❿ Thrombosis coronary
⓫ Thrombosis pulmonary

PEA

Find & Treat Cause - H & Ts

1. **Hypovolemia** - Administer rapid bolus of IV fluid and check hemoglobin/hematocrit. Give blood for anemia or massive hemorrhage.

2. **Hypoxia** - 100% FiO_2. Confirm oxygen connections. Check for bilateral breath sounds. Suction ET tube Reconfirm ET tube placement. Consider chest x-ray.

3. **Hydrogen ion (acidosis)** - Check blood gas for acidosis. Administer sodium bicarbonate. Consider increasing ventilation rate but realize this will decrease effectiveness of CPR.

4. **Hyperkalemia** - Check blood gas for electrolyte abnormalities. Give sodium bicarbonate; glucose + insulin; calcium chloride; possibly albuterol.

   Hypokalemia - Rapid but controlled infusion of potassium + magnesium.

5. **Hypoglycemia or Hypocalcemia** - Check blood gas or finger stick.

6. **Hypothermia** - Active warming by forced air blanket, warm IV. Consider cardiopulmonary bypass.

   Hypethermia - Cool with axillary ice packs, cold IV. Consider peritoneal lavage. If anesthetic exposure, consider Malignante Hyperthermia. Call for MH Cart. Treat with Dantrolene. MH Hotline 800-644-9737 (MH-Hyper)

7. **Toxins** - Consider overdose of medication. Confirm no infusions are running. Confirm volatile anesthetic off.

8. **Tamponade** (Cardiac) - Consider placing transesophageal (TEE) or transthoracic (TTE) echo to rule out. Treat with pericardiocentesis.

9. **Tension Pneumothorax** - Unilateral breath sounds with distended neck veins and deviated trachea (late signs), consider emergent chest x-ray. Plan emergent needle decompression followed by chest tube placement.

10. **Thrombosis (Myocardial Infarction)** - Consider using TEE to evaluate wall motion of ventricle. Consider emergent coronary revascularization or fibrinolytic agents.

- **Thrombosis (Pulmonary Embolus)** - Consider TEE to evaluate right ventricle. Consider fibrinolytic agents.

Moving Forward

- Integrating cognitive aids on departmental website
- Publishing as educational resource, sharing nationally and interdepartmentally
- Pocket cards
- Anesthesia resident handbook
- Reference Binders for each operating room
- Editing and creation of new cognitive aids

Trigger Video:
Crisis Resource Management of Cardiac Arrest

Sara Goldhaber-Fiebert M.D.

VA Palo Alto Health Care System and
Stanford University School of Medicine

Observations from Emergencies

1. Think about emergencies you have seen handled well or poorly
2. What specific desirable or undesirable patient **results** have you observed during medical emergencies?
3. What specific **actions** did or did not produce desirable results?
   - Give specific examples for physical actions or quotes for verbal actions

CRM Key Points

Trigger Video

USING HAND-HELD VIDEO TO PREPARE STUDENTS FOR CLERKSHIPS

CISL Symposium

December 14, 2009

Ian Tong, Peter Rudd, Lars Osterberg

PROBLEM STATEMENT

- BEDSIDE EXAM
  - Suboptimal physical examination by organ system rather than patient position
  - Suboptimal examining of the bed-bound patient
  - Limited addressing of psychosocial issues during the patient exam
- ORAL CASE PRESENTATION
  - Difficulty with presenting cases clearly and concisely
  - Difficulty: Problem list → Differential diagnosis
- PRACTICUM LOGISTICS
  - 1 preceptor for 3+ POM trainees when all are simultaneously evaluating patients

PROJECT GOALS & OBJECTIVES

Improve physical examination mechanics at the bedside, especially for patients with limited mobility and/or constraining equipment

Foster students' comfort, confidence, and skills in addressing patients' pain, fear, sadness, or non-engagement

Facilitate clinical reasoning skills in

1) Linking presenting symptoms to key physical exam maneuvers and findings
2) Compiling a succinct, prioritized problem list and appropriate differential
3) Performing a focused, concise oral presentation

FLIP ULTRAHD

Introducing the all new ultra & ultraHD

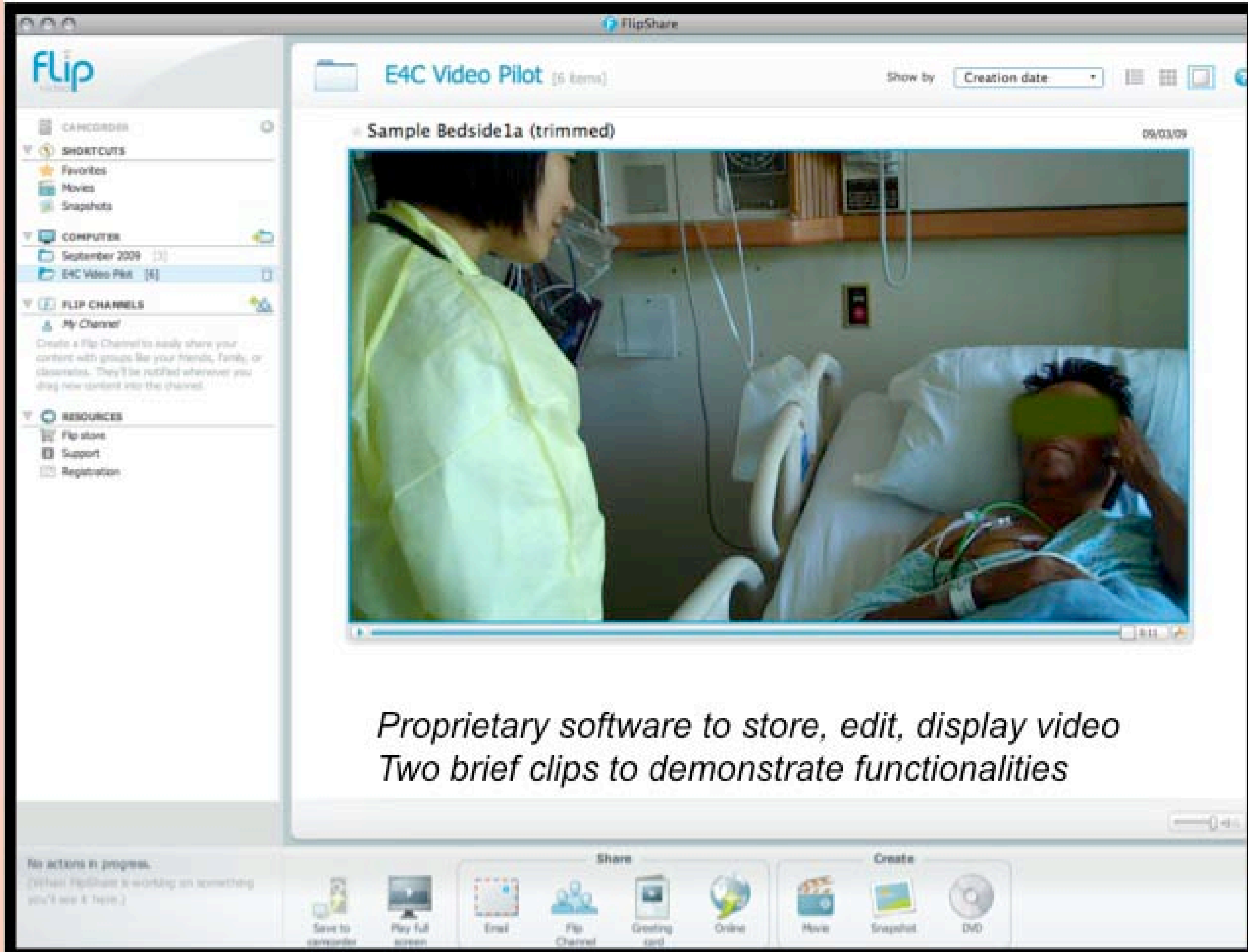
Shoot Anything. Share Everything.™

ultraHD

Simple to Shoot

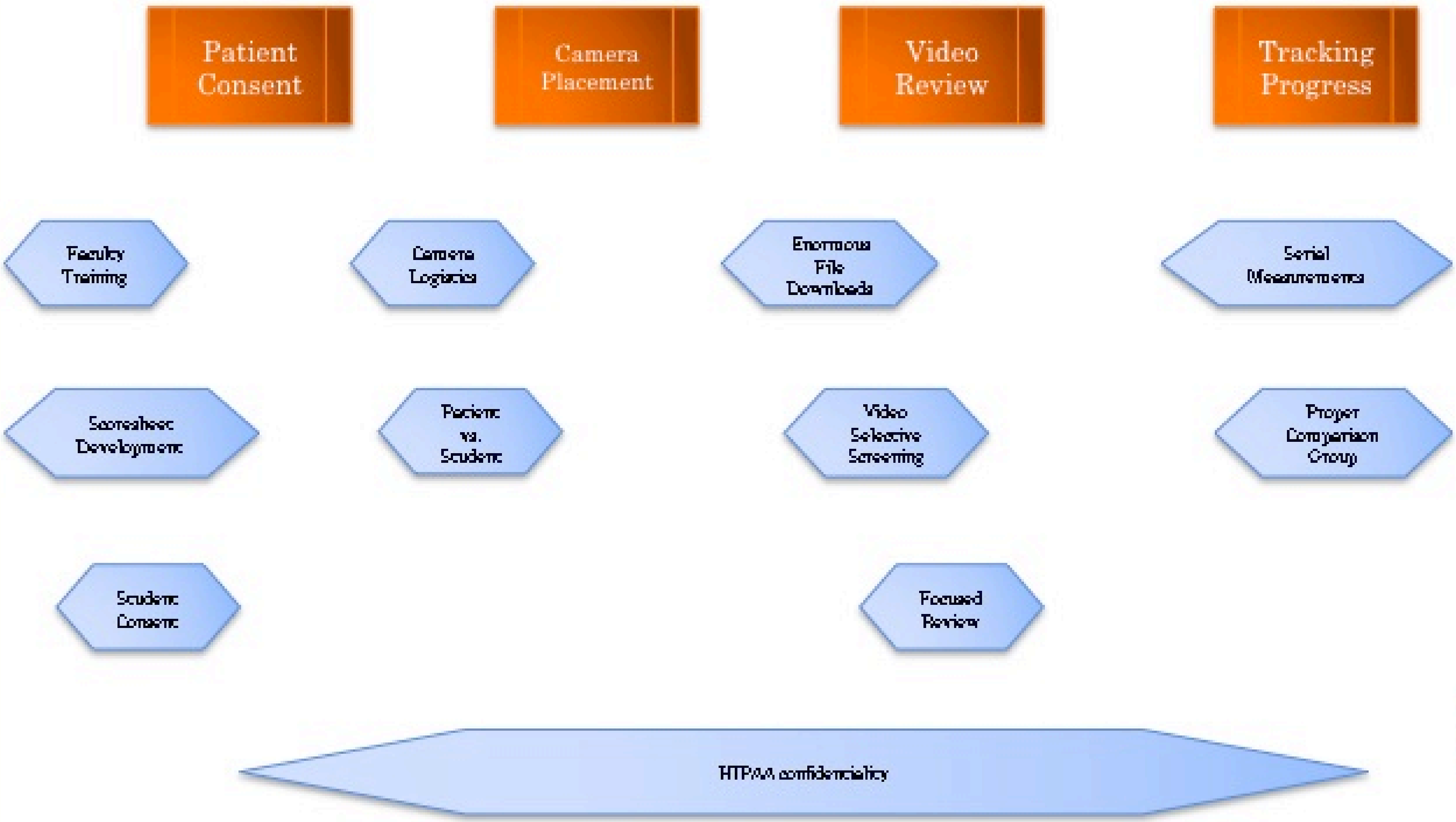
Simple to Share

- Handheld video camera
- Immediate vs. delayed review
- Dedicated viewing and editing software



Proprietary software to store, edit, display video
Two brief clips to demonstrate functionalities

WORK FLOW AND EMERGING ISSUES



PROGRESS TO DATE

- 10 Flip camera received
- IRB summary submitted → judged "non-research"
- SHC videotaping consent adapted and approved
- Bedside pilot-tested in Qtr 1

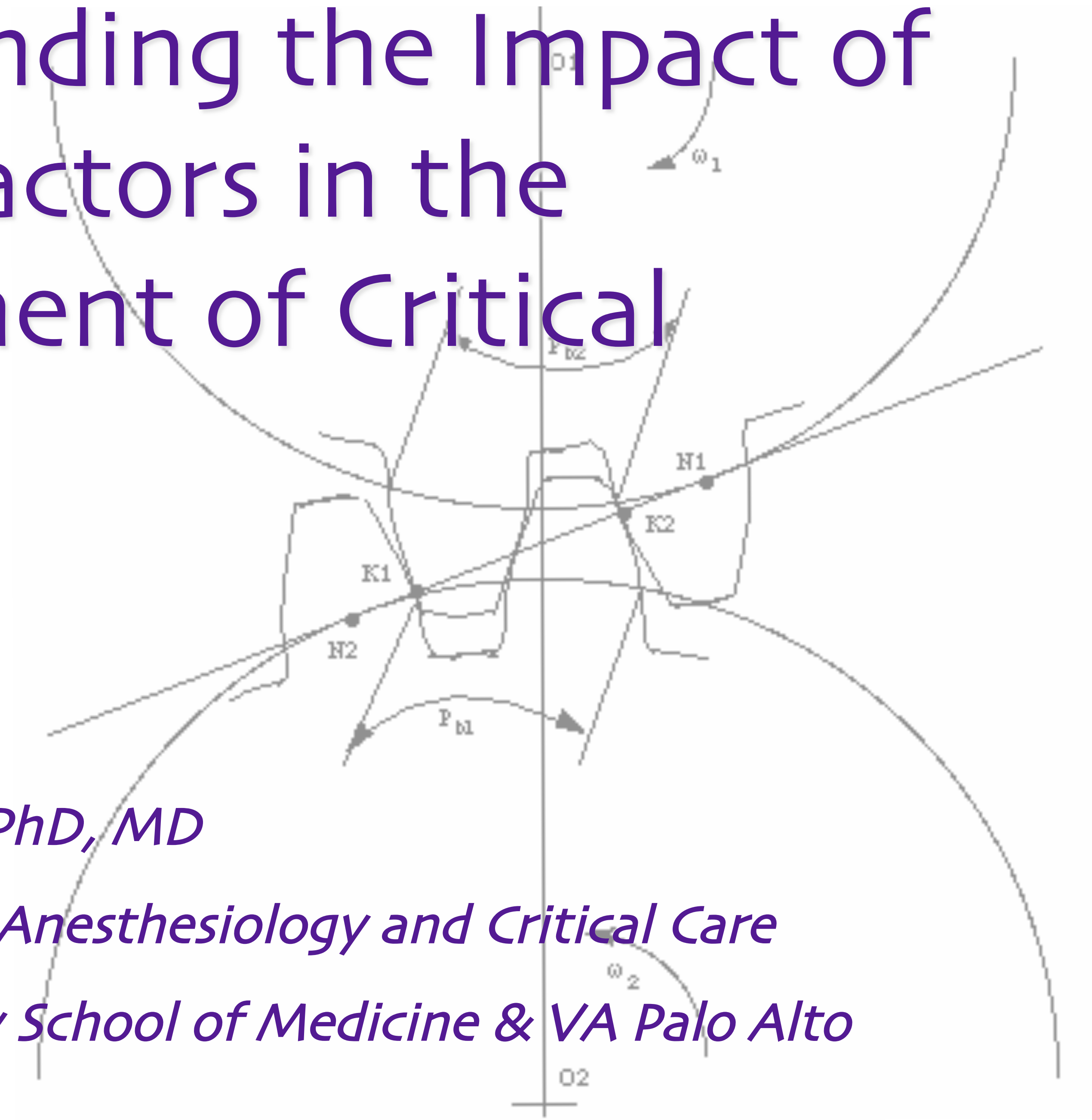
- ISSUES
  - Many patients difficult to consent
  - Optimal camera placement
  - Mechanics and logistics of downloading of video under HIPAA

NEXT STEPS

- Finalize bedside and oral presentation protocols
- Design and implement faculty training
  - Camera logistics
  - Teaching with video input
- Design, pilot test, and implement evaluation
  - Satisfaction (trainee & preceptor)
  - Student skill acquisition

Thanks to CISL for support !

Understanding the Impact of System Factors in the Management of Critical Events



Geoffrey Lighthall PhD, MD

Assoc. Professor of Anesthesiology and Critical Care

Stanford University School of Medicine & VA Palo Alto

A typical case

- 63M, on the medicine service admitted for management of SBP; has Childs B cirrhosis and portal hypertension
- While treated, develops variceal bleed
- Blood everywhere
- Help called
- Blood requested . . . .

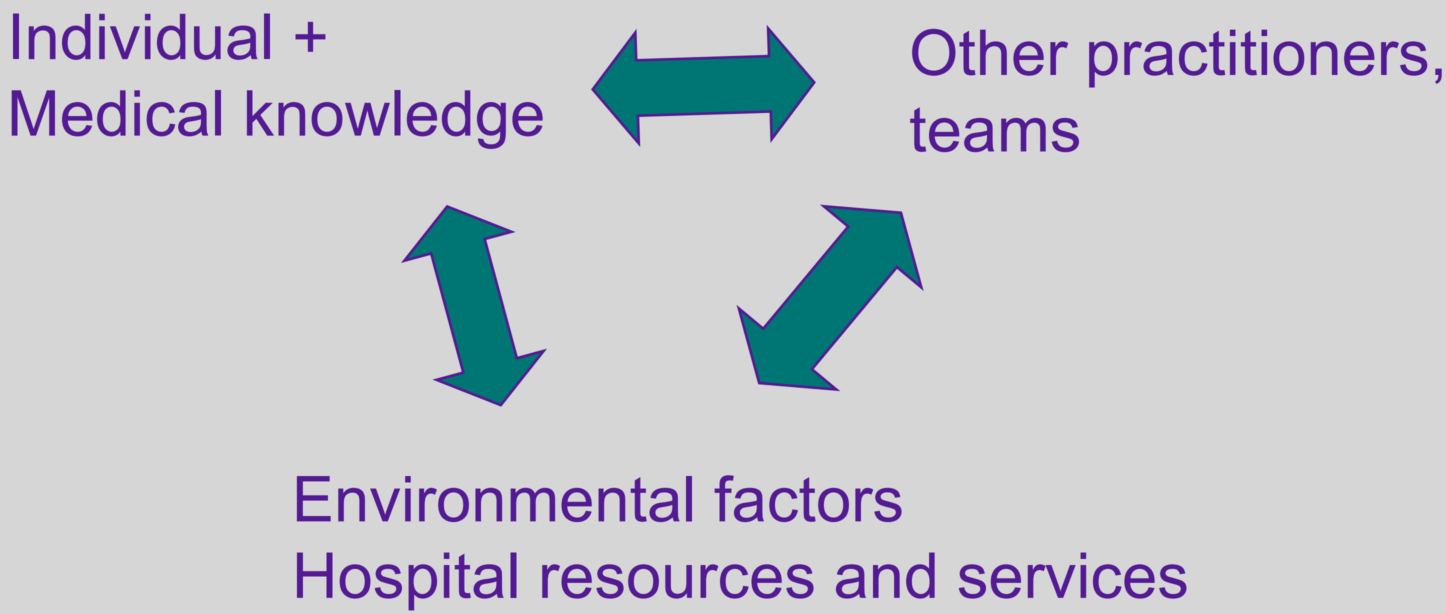
Medical management

- Source control
- Create a pipeline between the blood bank and patient's right atrium
  - Blood in sufficient qty
  - Big IVs, warm lines
  - Safeguard against incompatible blood
  - Get blood in at an appropriate speed

Obtaining blood can be difficult.

- Too slow
- Urgency never know by blood bank
- Oxymoron: blood runners
- Glitches with ordering
- Options not really known

Success involves a high degree of dependency upon a system that has many dormant components that are reconstituted only in crises. . .



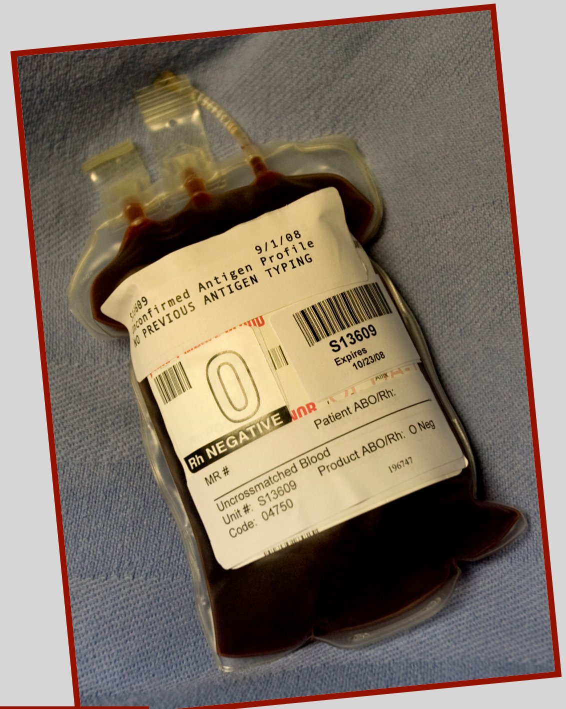
So what did we do??

- In situ simulation of bleeding event throughout the hospital
- Embedded patient, ancillary services essentially blinded to "simulation status" prior to arrival
- Allow for full utilization of hospital services
- Qualitative review of events

General goals. . .

- Identify system elements that impair or facilitate management of life-threatening hemorrhage at SUH
- Differentiate between site-specific concerns and problems that are likely to occur throughout the *whole* hospital
- Identify areas for improvements

The embedded patient




O
Rh Negative


5:47 00
REMINDER:
1ST BP SHOULD BE TAKEN MANUALLY ON ALL TRAUMA PATIENTS


STANFORD
EMERGENCY MEDICINE RESIDENT
LAURA EDGERLEY-GIBB, MD


Today's
20 21
CRASH CART
MANUAL

General results I

- Success facilitated by:
  - Ad hoc and established teams in ED and ICU that have experience with massive blood loss
  - RRT members and other ICU RNs and MDs that are experienced with decision making and use of system resources during hemorrhage emergencies

General results II

- Success hindered by:
  - Vital communication relegated to chains of personnel (sometime 4-5 people) with insufficient training and authority to make medical decisions
  - Non-standardized communication between treatment team and transfusion service (TS) in emergencies
    - Specific policies by TS not well understood by providers
    - TS does not seem to have tailored protocols and restrictions to realistic models of clinician behavior during emergencies

Problems with rapid acquisition of blood

- Communication
  - Long communication circuits for both requests and follow ups
  - Poor articulation of situation and goals
  - Creative "work arounds," some productive and some not

Problems with rapid acquisition of blood

What to get:

- Different products for different settings, no uniform understanding of what to get where
- Familiarity with rapid transfusion based on discipline and location
- Familiarity with transfusion options often limited
- Apparently some education by transfusion service, but little working knowledge related to these points

Problems with administration of blood

How to give it:

- Little understanding of rapid infusion outside of ER/ ICU
- Such knowledge deficits impaired optimizing team function
- No parallel work on IVs while blood in transit
- Poor teamwork: unable to get blood in once it did arrive

Problems with rapid acquisition of blood

- Communication
  - Long communication circuits for both requests and follow ups
  - Poor articulation of situation and goals
  - Creative "work-arounds," some productive and some not

Recommendations

- All key communication with transfusion service should take place from the patient's room
- Communicate urgency
- Consider multiple options
- Read back the plan, ask to have plan read back
- Confirm route of delivery

- Designate "checkers" and "infusers"
- Use point-of-care testing

Recommendations

Create "experts," export knowledge and materials to other sites

Advertise expertise or protocolize certain categories of risk

Create opportunities to train as a team

Time to Receive	Option	Contents
5 min	Trauma bucket	2 units Type O RBC*
10 min	Emergency Release	2-4 units Type O RBC 2+ units type specific
10 min	MTG: Massive Transfusion Guideline	6u RBC (0-/ A/ B)** 1 pack Platelets 4u FFP
15 min	Type specific blood	A / B / AB / O
30 min	Computer antigen Screen	A / B / AB / O
60 min	Full crossmatch	A / B / AB / O

* RH- Males may receive RH+ products if desperate
** Can receive 'own type' of cells (A, B...) if blood type is kn

Call 3-6445 or 3-4745

!!! Do not leave the room !!!

1. Patient's Name and Number
2. Establish severity of situation
3. State what products you will need in next hour
4. Confirm Route of delivery (tube, courier)

Remember:

- Source control
- Keep patient warm
- Warm all inflow lines, Consider Level-1
- Upgrade IV access
- $CaCl_2$ via central line or Ca-Gluconate via peripheral
- Get iStat in room
  - 67 and G8 cartridges will give you Hct, iCa^{++}
- Designate a trained MD or RN to communicate with transfusion service
- Need two people to check in products
- Designate others (if possible) to administer product

Patient			Compatible Products	
ABO Group	Antigen on RBC	Serum Antibodies	RBC	FFP
O	No A or B	Anti A Anti B	O	O, A, B, AB
A	A	Anti B	A, O	A, AB
B	B	Anti A	B, O	B, AB
AB	A and B	None	A, B, AB, O	AB

Rh Compatability (not applicable to FFP, Plts)

RH+	D	Rh+ or Rh-
RH-	no D	Rh- Rh+ if male

Platelets have fewer compatability problems, but type-specific is desirable

Special thanks to the project team

Kyle Harrison

Kam McKowan

Sandy Feaster

David Gaba

Sara Goldhaber-Fiebert

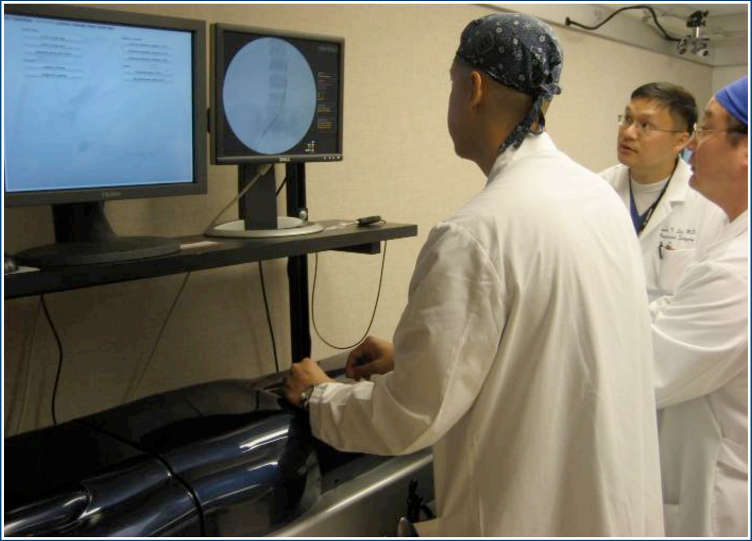
Steve Howard

Ruth Fanning

Financial support from Risk Management Dept.

STANFORD
SCHOOL OF MEDICINE
Stanford University Medical Center

The Impact of a Simulation-based Endovascular Curriculum on Trainee Performance and Clinical Outcomes in Vascular Surgery



Jason T. Lee, MD
Director of Endovascular Surgery
Assistant Professor of Surgery
Associate Program Director
Vascular Surgery Fellowship/Residency

Emily Lilo, MPH
Project Manager
Division of Vascular Surgery

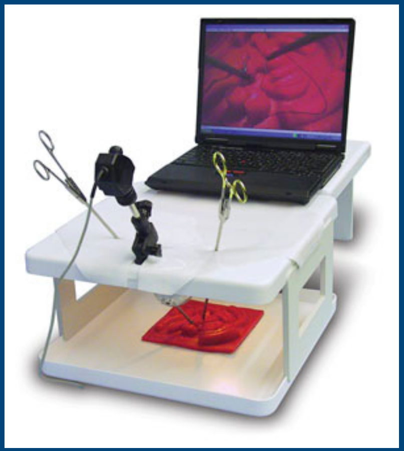
CISL
2009 Annual Meeting
December 14, 2009

Current state of surgical education

- Apprenticeship model, graduated level of responsibility
- Work hour restrictions
- Emergence of new technology and minimally invasive techniques
- Emphasis on patient safety and quality of care
- Paradox: patient centered procedural learning, need for more efficient training and patient safety/quality assurance

Simulation-based education

- Stress free environment to practice procedures in realistic back-drop
- Practice to proficiency prior to patient contact
- Improves trainee operative performance in laparoscopy & endovascular surgery[1,2]
- Intended to improve patient safety



1. Seymour, et al. Virtual reality training improves operating room performance: Results of a randomized double blinded study. *Annals of Surgery* 2002; 236:458-463
2. Chaer, et al. Simulation improves resident performance in catheter based intervention: Results of a randomized controlled study. *Annals of Surgery* 2006; 244:343-349

Training Methodologies

Endovascular Simulation

- Iliac angioplasty/stenting
- SFA angioplasty/stenting
- Renal angioplasty/stenting
- Carotid Stenting

Training Methodologies

Endovascular Simulation

- PROS
  - Already a 2-D environment
  - Potentially reduces equipment costs from inefficient/poorly-planned procedures
  - Objectively grade performance
  - Can identify individuals well-suited for image-based specialties
- CONS
  - Costs
  - Needs to be validated

Hypothesis

A structured simulation-based endovascular surgery curriculum will increase trainee operative performance and will result in improved patient outcomes, safety, and operative measures

Specific Aims

- Trainee performance
  – To determine if a simulation-based endovascular surgery curriculum improves trainee performance measured by technical skill, didactic knowledge, and learner satisfaction
- Operative efficiency
  – To assess endovascular simulation as a tool to promote procedural efficiency and reduce procedural errors by determining metrics that translate into improved patient outcome
- Clinical outcomes
  – To determine if the implementation of a structured educational program improves patient outcomes and patient safety

Endovascular Simulation-based Curriculum

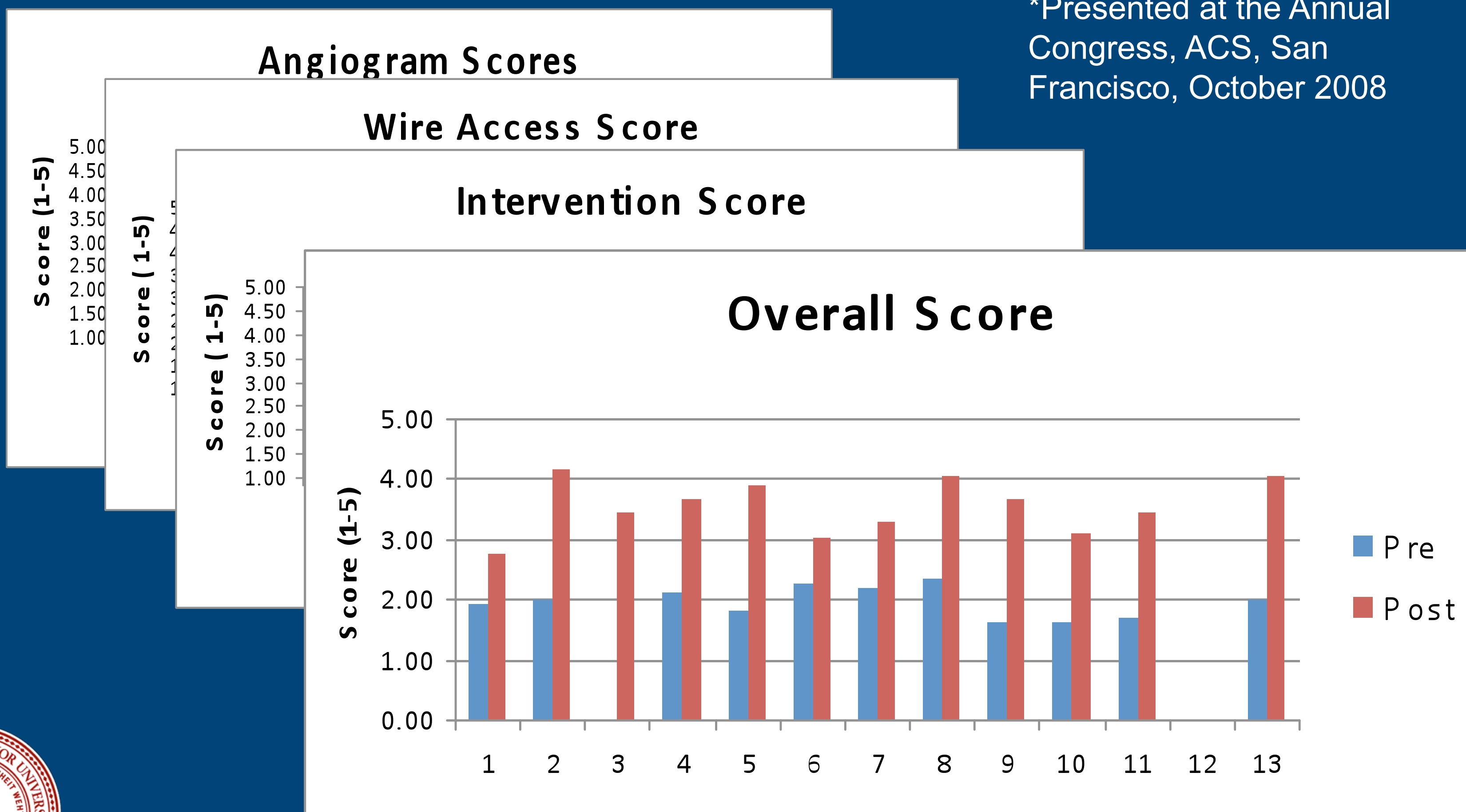
- Web-based interactive modules
- Encouraged self-study
- Emphasis on practicing to proficiency
- Weekly modules
  - Introduction to wires/catheters
  - Diagnostic angiography
  - Aorto-iliac disease
  - SFA disease
  - Renal artery disease

Study Design

- Senior residents (R3)
- 8 week rotations
- Randomized to traditional education or experimental model (mentored simulation-based curriculum)
- Total study period: 4 years
- Total N=30

Simulation Based Training Improves Medical Student Performance on An Endovascular Simulator*

*Presented at the Annual Congress, ACS, San Francisco, October 2008



THE GOODMAN SIMULATION CENTER

KNOWLEDGE + EXPERIENCE

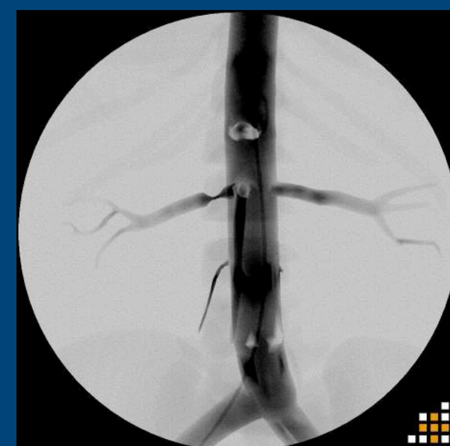
How to Assess Training?

From the Western Vascular Society

Simulation-based endovascular skills assessment: The future of credentialing?

Maureen M. Tedesco, MD, Jimmy J. Pak, MD, E. John Harris Jr, MD, Thomas M. Krummel, MD, Ronald L. Dalman, MD, and Jason T. Lee, MD, *Stanford, Calif*

Objectives: Simulator-based endovascular skills training measurably improves performance in catheter-based image-guided interventions. The purpose of this study was to determine whether structured global performance assessment during endovascular simulation correlated well with trainee-reported procedural skill and prior experience level.
Methods: Fourth-year and fifth-year general surgery residents interviewing for vascular fellowship training provided detailed information regarding prior open vascular and endovascular operative experience. The pretest questionnaire responses were used to separate subjects into low (<20 cases) and moderate (20 to 100) endovascular experience groups. Subjects were then asked to perform a renal angioplasty/stent procedure on the Procedicus Vascular Intervention System Trainer (VIST) endovascular simulator (Mentice Corporation, Gothenburg, Sweden). The subjects' performance was supervised and evaluated by a blinded expert interventionalist using a structured global assessment scale based on angiography setup, target vessel catheterization, and the interventional procedure. Objective measures determined by the simulator were also collected for each subject. A postsimulation questionnaire was administered to determine the subjects' self-assessment of their performance.
Results: Seventeen surgical residents from 15 training programs completed questionnaires before and after the exercise and performed a renal angioplasty/stent procedure on the endovascular simulator. The beginner group (n = 8) reported prior experience of a median of eight endovascular cases (interquartile range [IQR], 6.5-17.8; range, 4-20), and intermediate group (n = 9) had previously completed a median of 42 cases (IQR, 31-44; range, 25-89, $P = .01$). The two groups had similar prior open vascular experience (79 cases vs 75, $P = .60$). The mean score on the structured global assessment scale for the low experience group was 2.68 of 5.0 possible compared with 3.60 for the intermediate group ($P = .03$). Scores for subcategories of the global assessment score for target vessel catheterization ($P = .02$) and the interventional procedure ($P = .05$) contributed more to the differentiation between the two experience groups. Total procedure time, fluoroscopy time, average contrast used, percentage of lesion covered by the stent, placement accuracy, residual stenosis rates, and number of cine loops utilized were similar between the two groups ($P > .05$).
Conclusion: Structured endovascular skills assessment correlates well with prior procedural experience within a high-fidelity simulation environment. In addition to improving endovascular training, simulators may prove useful in determining procedural competency and credentialing standards for endovascular surgeons. (J Vasc Surg 2008;47:1008-14.)



Global Rating Scale (1-5)

Angiography	• advance wire into suprarenal aorta without forming a J or pushing against obstruction • place pigtail catheter into renal angiogram position/wire manipulation • knowledge of renal anatomy/perform angiogram
Wire Access	• select proper catheter/wire for renal canalization • safely traverse lesion
Intervention	• select guiding catheter • select appropriate renal stent • deploy renal stent • select proper balloon for renal angioplasty post-stent • perform completion angiogram

The Utility of Endovascular Simulation to Improve Technical Performance and Stimulate Continued Interest of Preclinical Medical Students in Vascular Surgery

Jason T. Lee, MD, Mary Qiu, BS, Mediget Teshome, MD, Shyam S. Raghavan, BS, Maureen M. Tedesco, MD, and Ronald L. Dalman, MD

Division of Vascular Surgery, Stanford University School of Medicine, Stanford, California

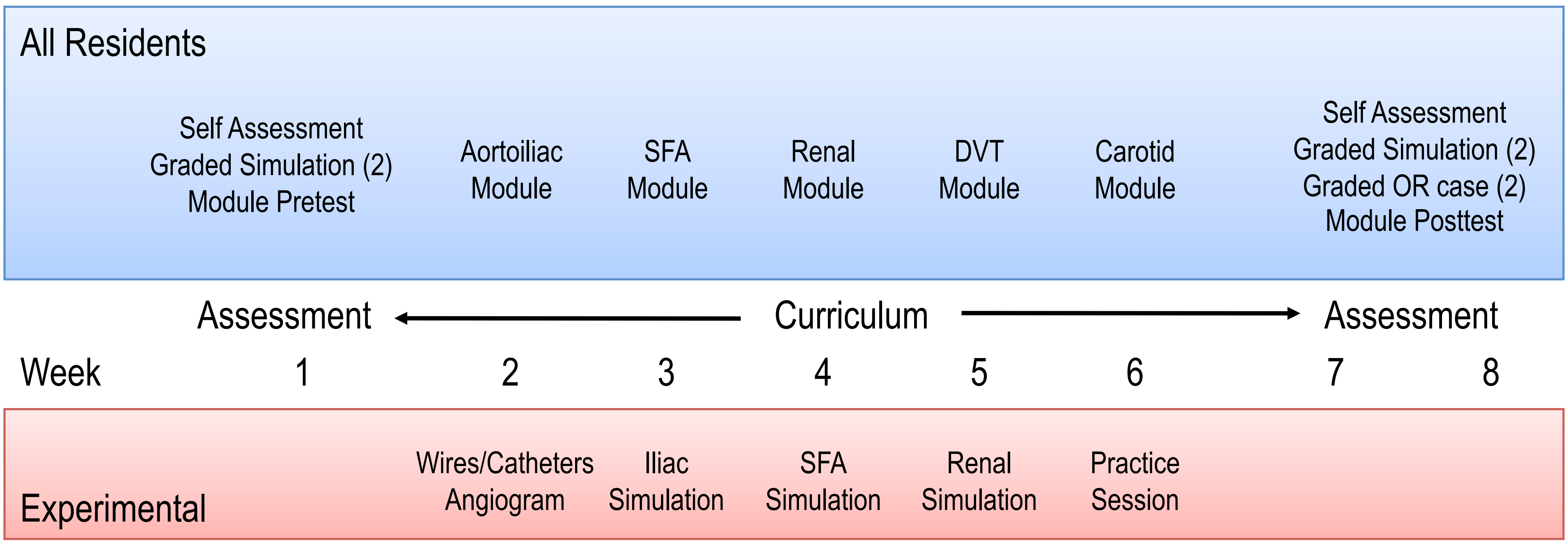
A survey of demographics, motivations, and backgrounds among applicants to the integrated 0 + 5 vascular surgery residency

Jason T. Lee, MD,[a] Mediget Teshome, MD,[a] Christian de Virgilio, MD,[b] Brandon Ishaque, BA,[b] Mary Qiu, BS,[a] and Ronald L. Dalman, MD,[a] *Stanford, Calif*

Objective: The 0 + 5 integrated vascular surgery residency has altered the training paradigm for future vascular specialists.

- Collaborators
  - School of Education
  - Stanford Comprehensive Center for Outcomes Research (SCCOR)
  - Center for Immersive and Simulation Based Learning
  - Oregon Health Sciences University
  - University of Rochester
  - University of Pittsburgh

Curriculum and assessment of participants



Evaluation

Global Assessment Scale-revised

Stanford University Medical Center
Division of Vascular Surgery 2009
Jason T. Lee, MD

Name/ID: ______
Date: ______
Grader: ______

RENAL ANGIOPLASTY/STENT

Procedural Assessment

35	ANGIOGRAM			
36	1. Selects appropriate starter wire (0.035" Bentson/J wire)	YES	NO	
37–38	2. Visualizes wire tip during advancement into juxtarenal aorta	YES	NO	
39	3. Places wire into appropriate juxtarenal location	YES	NO	
40	4. Selects appropriate non-selective catheter to perform angiogram (pigtail or omniflush)	YES	NO	
41–42	5. Advances catheter without losing wire position	YES	NO	
43	6. Withdraws wire in preparation for contrast injection	YES	NO	
44	7. Moves C-arm/table to correct position to visualize infrarenal aorta	YES	NO	
45	8. Selects appropriate rate and amount of contrast (15 for 15 or 20)	YES	NO	ed,
46	9. Gives proper breathing instructions	YES	NO	
47	10. Performs appropriate subtraction run on first attempt	YES	NO	
48	11. Identifies anatomy (% stenosis of lesion)	YES	NO	jes
49	INTERVENTION			
50	12. Verbalizes appropriate intervention (balloon-expandable stent)	YES	NO	
51–52	13. Gives appropriate anticoagulation (80mg/kg bolus)	YES	NO	
53	14. Focuses C-arm on area of interest	YES	NO	
54	15. Plans appropriate wire/sheath combination (.014"/guide cath or .035"/guide sheath)	YES	NO	
55–56	16. Withdraws angiographic catheter without losing wire position	YES	NO	
57	17. Chooses appropriate catheter/sheath for renal artery catheterization (Cobra/RDC)	YES	NO	ns
58				
59	**Overall Assessment**			
60	**Demonstrates competence**	**YES**	**NO**	
61				

Design and implementation of a prospective randomized trial to improve resident operative performance: Utility of a simulation-based endovascular curriculum

*To be presented the Association for Surgical Education Meeting, April 2010

	SIMULATION	CONTROL
N	3	4
Pretest	1.9	2.1
Posttest	4.0	2.3
Live OR	2.3	1.6

SUMMARY

- Simulation provides a powerful tool in the broad scope of learning endovascular procedures
  - Education
  - Skills acquisition
  - Procedural planning
  - Assessment
  - Credentialing
  - Adaptable to changing face of vascular surgery
  - Can be applied to other disciplines of cardiovascular medicine, cardiac surgery, radiology, and general surgery
- Research necessary into validity and costs

Acknowledgements

- Project funded 2009-2012
- $300,000 award

Cordis.
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- Vascular Education
- Technical grants

David Gaba, MD
Sandi Feaster

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BEDSIDE ENHANCED AUSCULTATION TEACHING

CISL Symposium

December 7, 2009

Problem Statement

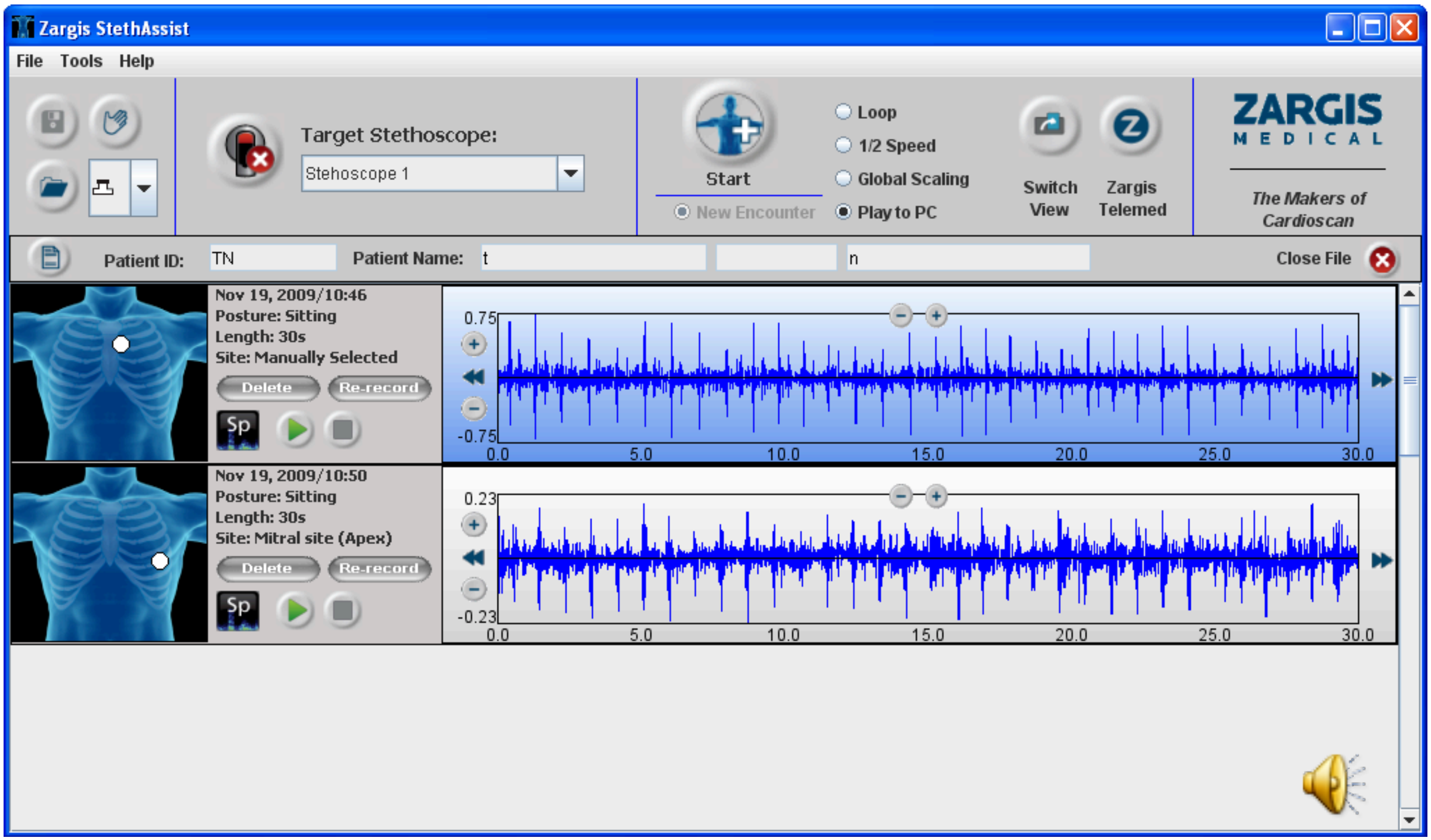
- Medical students lack confidence and proficiency in auscultation skills
- Medical Literature
  - Cardiac auscultation proficiency is less than 40% amongst primary care physicians
  - 20% of medical students and fewer medical residents can identify 12 cardiac findings by auscultation
- Practice of Medicine course evaluations show students score auscultation confidence levels lower than other physical examination skills

BEAT 1 and 2 Program Objectives

- Enhance bedside auscultation skills through the use of electronic stethoscopes and cardio-phonogram visual displays
- Create a Virtual Sound Lab to enhance on-line access to heart and lung sounds for self-paced learning
- Enhance Practice of Medicine course ability to assess proficiency in auscultation skills

Littman 3200 with Zargis Stethassist Software

Demonstration



Progress

- 9 Littman 3200 electronic stethoscopes purchased
- Virtual Sound Lab construction plan in planning stage
- Sound files are being collected
- Challenges
  - Stethoscopes were purchased late due to release of new product
  - Only one sound file can be stored at a time
  - Pilot not yet established for self-paced learning

Next Steps

- Collect complete library of heart and lung sounds
- Partner with EdTech to establish format for virtual sound lab
- Incorporate stethoscopes into bedside teaching rounds
- Develop and pilot student evaluation tool

Thank you to CISL
Grants for sponsorship