Simulation in Critical Care Medicine

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Disclosures

- NONE

Overview

- Education and Simulation
- Task Trainers
- High Fidelity Simulation
- Simulation Integration

Teaching

- Teacher Centered (Traditional approach)

  - Lecture based, dependent upon presenter
  - Learn passively, absorbing concepts /taking notes
  - Outcomes based upon essays and exams

The Teacher as a Manager of Resources

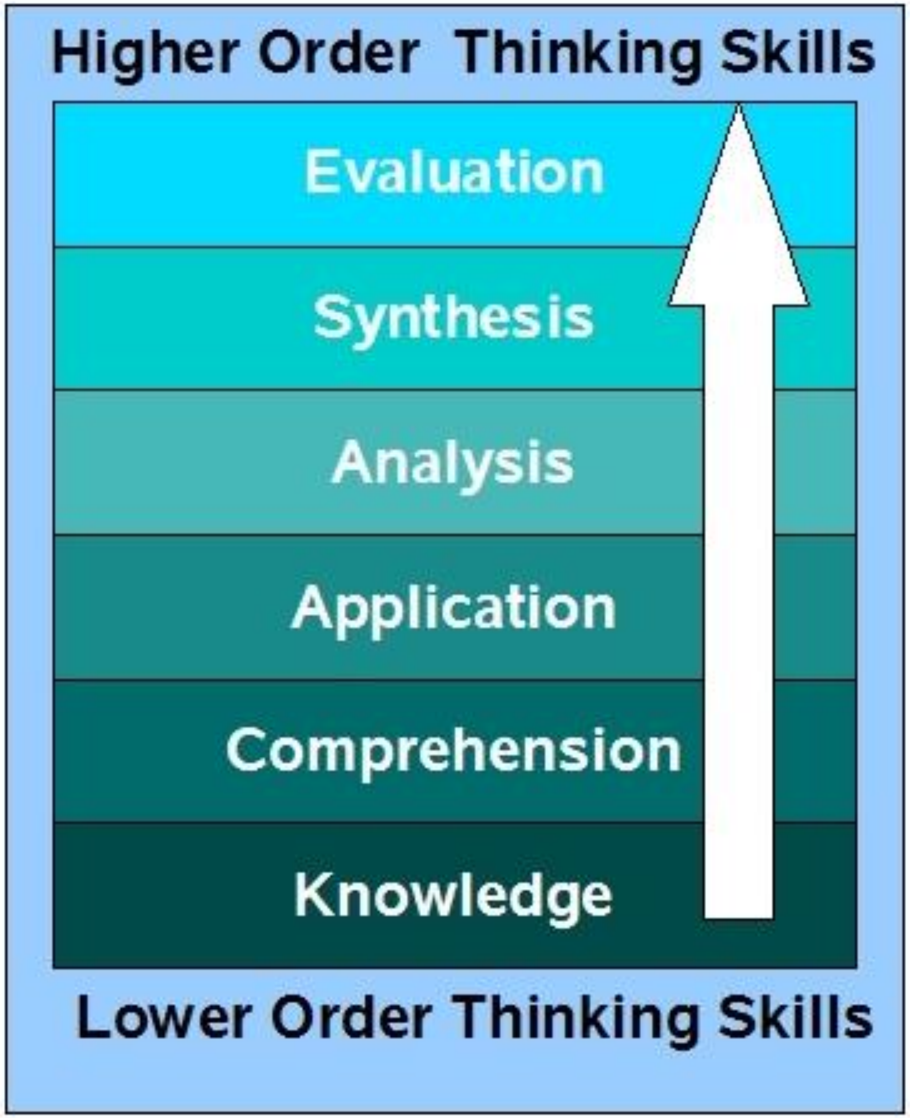
- Develops a curriculum with clear, measurable objectives
- Organizes a variety of learning experiences
- Motivates students to become self-directed learners
- Evaluates student performance
- Provides immediate feedback

Stritter, J. Med. Ed. V42, pg 93-101 1972

Characteristics of Adult Learners

- Self-directed - the teacher acts as a facilitator guiding students to knowledge rather than supplying it
- Goal oriented - students have pre-determined goals and enjoy a curriculum that helps them attain those goals

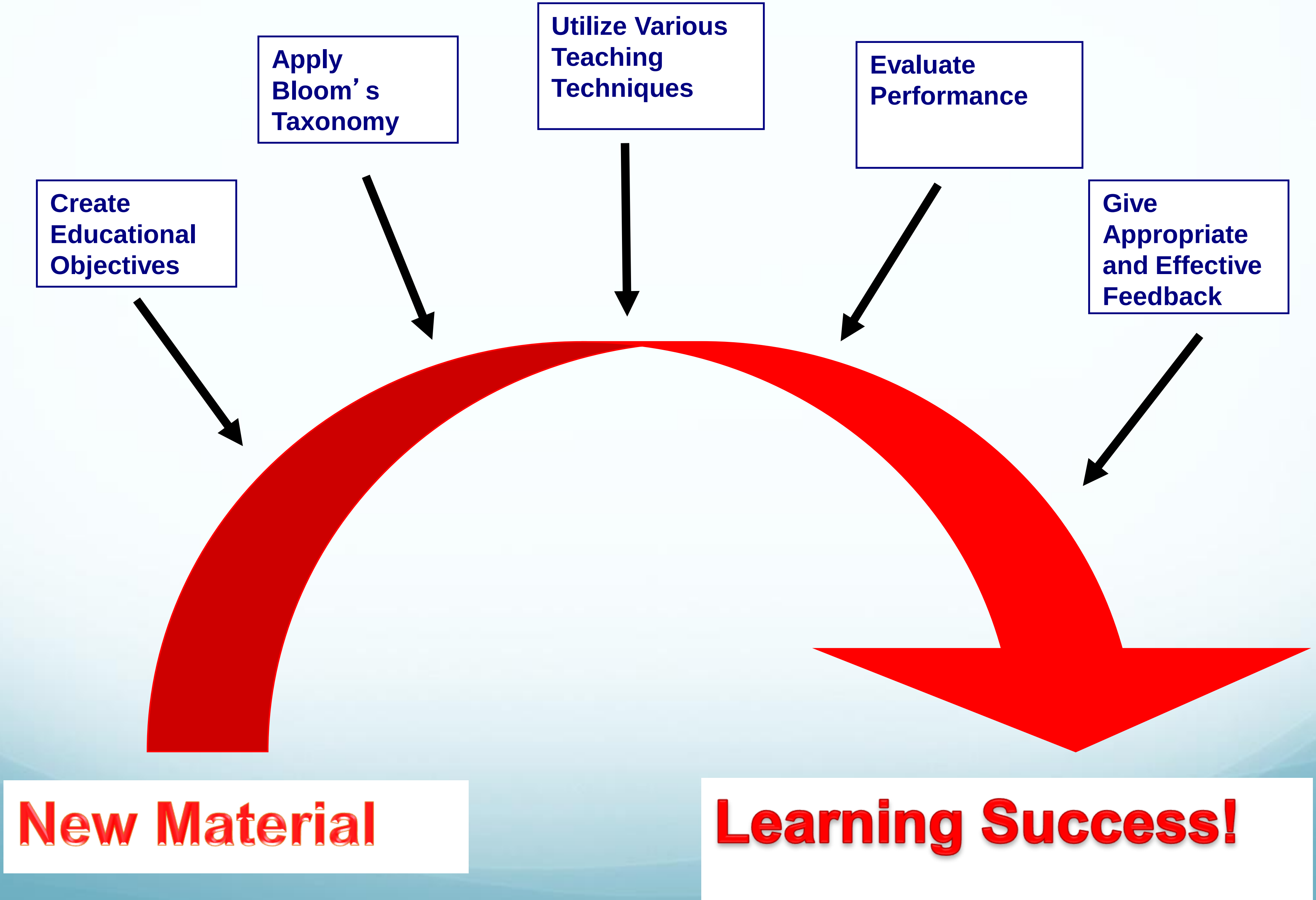
Bloom’s Taxonomy



Characteristics of Adult Learners

- Relevancy oriented – learning must be applicable to training them for their jobs
- Respected – in medical education this includes voicing opinions about management and defending their judgement
- Motivated
- Require feedback

Adapted from Malcolm Knowles



Create Educational Objectives
Apply Bloom's Taxonomy
Utilize Various Teaching Techniques
Evaluate Performance
Give Appropriate and Effective Feedback
New Material
Learning Success!

Developing Educational Objectives

- An objective is a statement of purpose
- They describe specifically what the learner is to learn
- This includes three domains
  - Cognitive – intellect “brain / the knowing”
  - Affective – values “heart / the feeling”
  - Psychomotor – skills “hands / the doing”

Sample Educational Objectives

- Be able to manage unresponsive patients

OR

- Check for pulse immediately, check blood glucose, inquire about opiate use, administer 40ug narcan, provide bag-mask ventilation if airway not protected

Sample Educational Objectives

- Manages respiratory distress

OR

- Check respiratory rate, place pulse oximeter, start 100% non-rebreather, call for rapid response team

Feedback Definition

- Method of controlling a ”system” by reinserting into the system the results of its performance
- Providing the learner with specific information about their performance to reinforce or change behavior
- Formative (qualitative feedback)
- Summative (educational outcomes)

Feedback Purpose

- The most powerful teaching tool an instructor has
  - Provides a basis for maintaining or improving performance
  - Provides a mechanism for assessing needs and providing learning experiences

Feedback Timing and Setting

- Established during orientation that feedback will be provided immediately following assessment
- Will be provided daily
- Should be an expected part of the learning experience

Characteristics of Effective Feedback

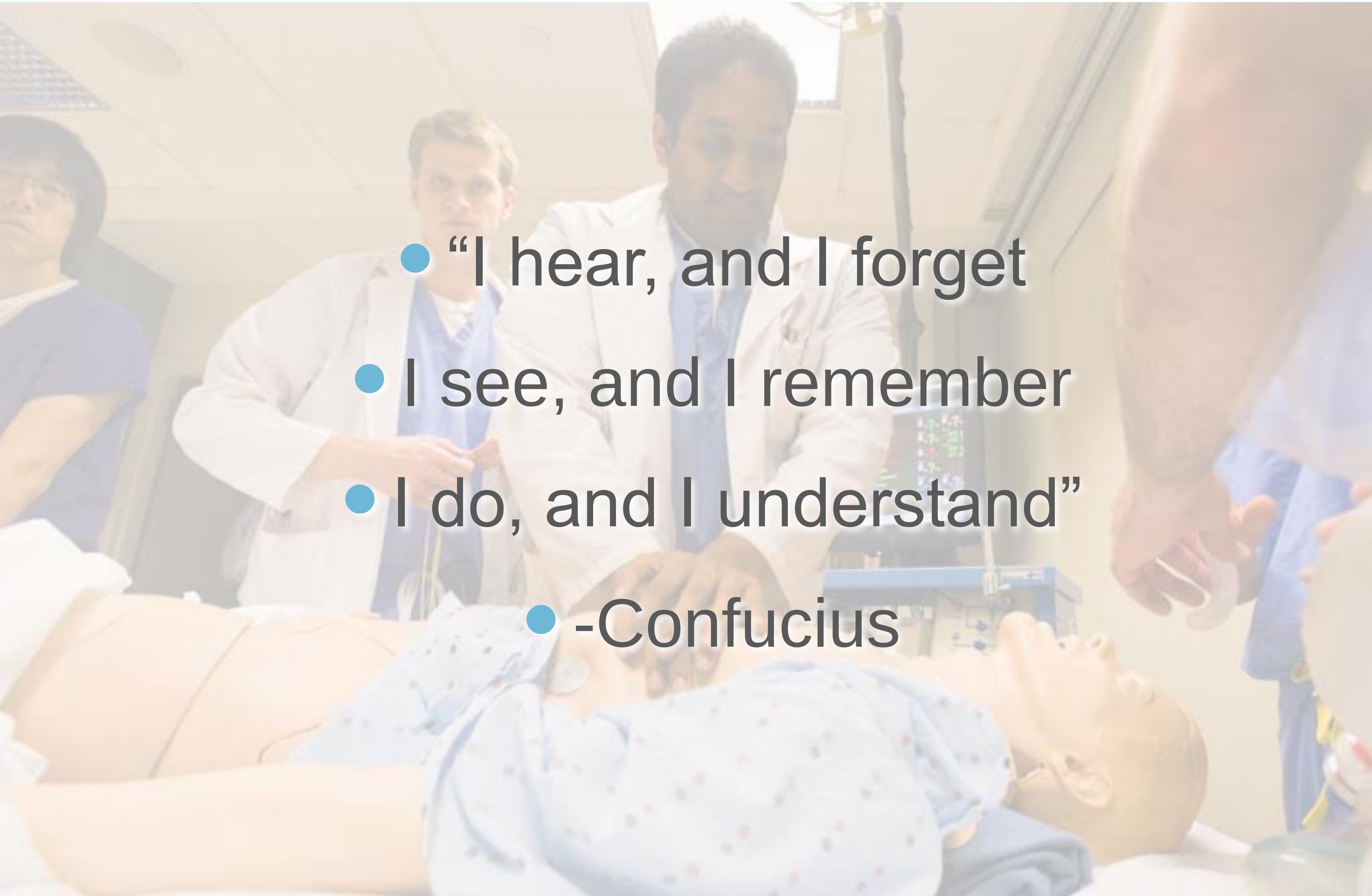
- Begin with clear, unambiguous, specific, achievable goals
- Inform the learner to expect feedback as part of the educational process
- Base feedback on first hand observation
- Delivered as a two way conversation soliciting the learners comments
- Must be credible to the learner

Characteristics of Effective Feedback

- Base feedback on behavior not interpretations of behavior
- Provide feedback privately
- Provide the learner with the way to succeed
- Do not give positive feedback before giving feedback that is intended to change behavior

Without Feedback

- In surveys one of the most frequently cited deficiencies of an educational program is the lack of feedback
  - Failure to effectively evaluate performance
  - Concern it will lead to an unpleasant emotional response
  - May damage learner-teacher relationship
- Mistakes go uncorrected
- Good performance goes unreinforced
- Students generate their own feedback by attacking importance to unintended clues



- “I hear, and I forget
- I see, and I remember
- I do, and I understand”
- -Confucius

Whole Body Simulators

- Is an efficient means of teaching a large group of trainees
- Allows trainees to experience rare, life-threatening conditions
- Allows trainees to make medical errors without harmful consequences to patients
- Enables faculty to provide feedback
- Permits trainees to repeat performances until educational objectives are mastered

Task Trainers

Central Lines

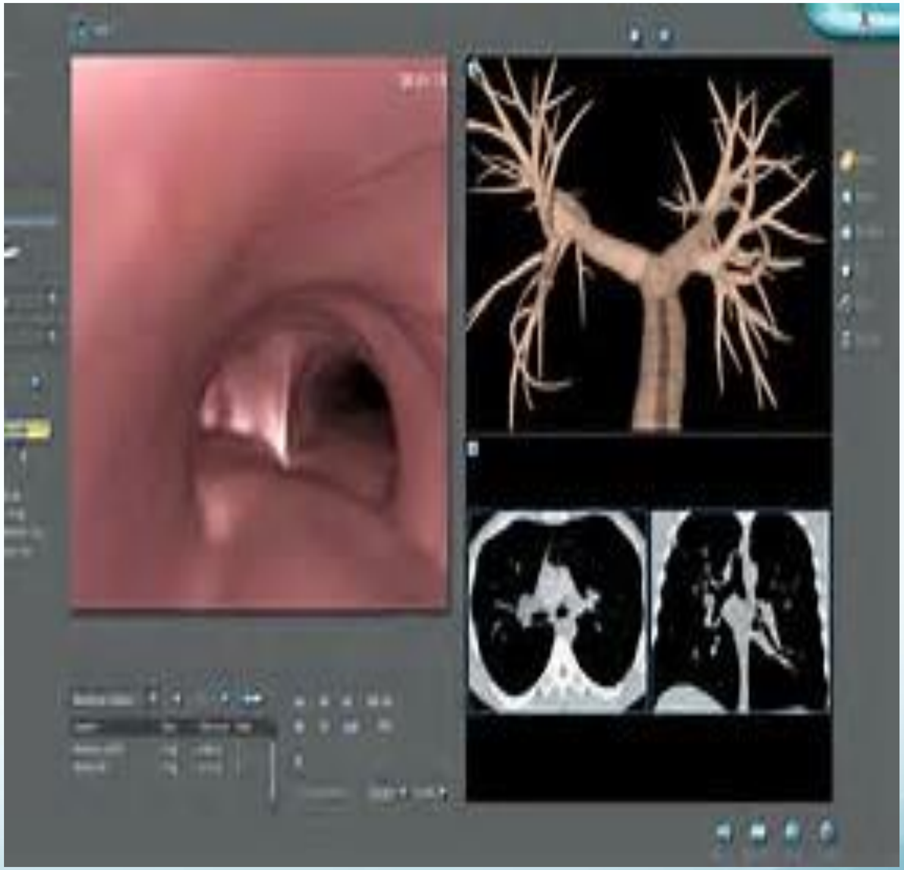
Peripherial IV / Arterial Lines

Ultrasound Trainer

Viamedix (CAE)

X-Porte (Sonosite)

Bronch Mentor



Sim-ECMO

Krystal Shaffer, MD
Lillian Emlet, MD
Christopher Brackney, DO

Background

- Gap Analysis
  - Fellows exposed to high volume, reputable, ECMO program
  - Pre-rotation preparation includes written manual and a 3hr on-line lecture series
  - Fellows struggle to identify and treat common ECMO complications
- Purpose
  - Serve as a training tool to educate critical care fellows on how to recognize, diagnose, and treat complications related to ECMO

Setup

Personel

- Perfusionist
- Respiratory Therapist
- Bedside Nurse
- CCM Fellow

Equipment

- Laerdal 3G SimMan
- Ventilator
- Ultrasound
- CPB Machine with tubing
  - Red food coloring

Scenario #1 - Hypovolemia

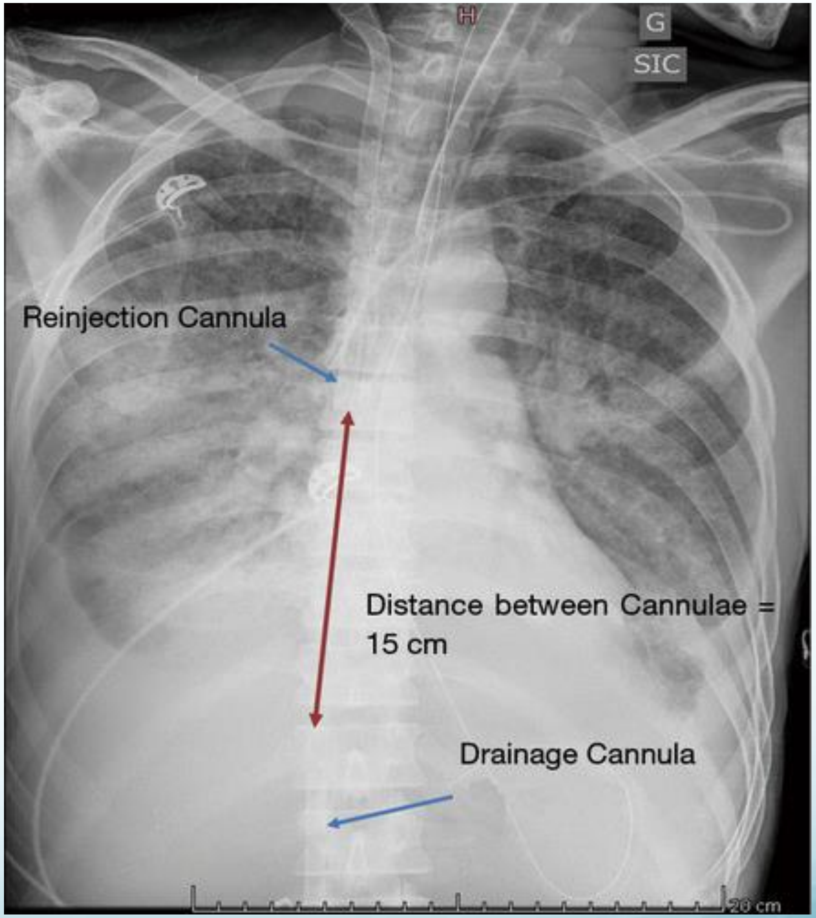
<u>Learning Objectives</u>

- ID low flow rates/chatter as signs of hypovolemia
- Establish DDX for hypovolemia in setting of ECMO
- Discuss risks benefits of stopping anticoagulation

Scenario #2 Recirculation

Learning Objectives

- Recognize persistant hypoxemia after VV ECMO cannulation and develop an appropriate differential diagnosis for hypoxia while on an ECMO circuit
- Recognize flash on ECMO cannulas and move femoral cannula back to prevent recirculation
- Identify PTX as a complication of ECMO cannula placement



Scenario #3 Obstructive Shock

Learning Objectives

- Correctly identify alarms on the ECMO circuit as indicative of low flow
- Formulate a differential diagnosis for causes of low ECMO flow and hemodynamic deterioration
- Reinforce concepts of diagnosis and treatment of pericardial tamponade

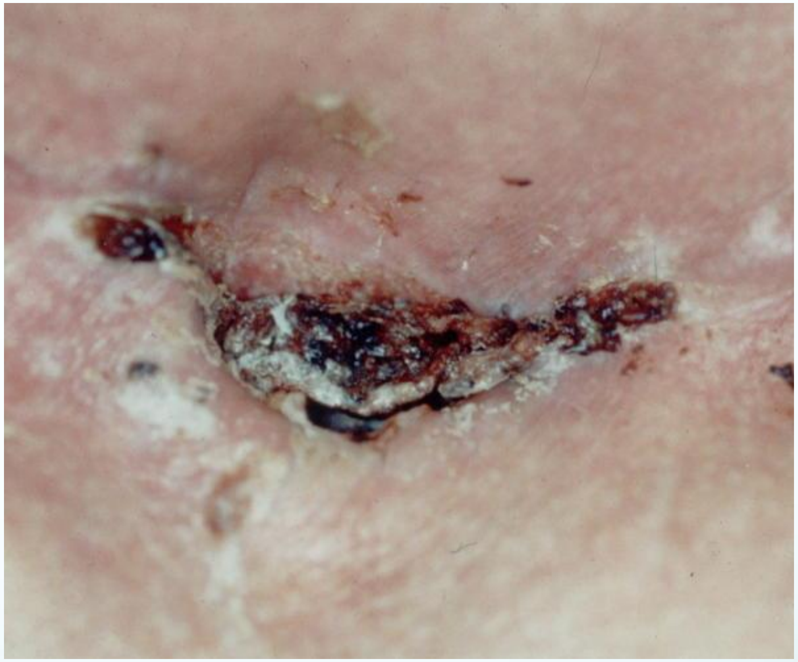
Assessment

- Pre/Post test which mimics CCM board questions
- Post Simulation survey

Sim-Trach

- Kavita Dedhia, MD
- Christopher Brackney, DO
- David Eibling, MD

Horror Stories



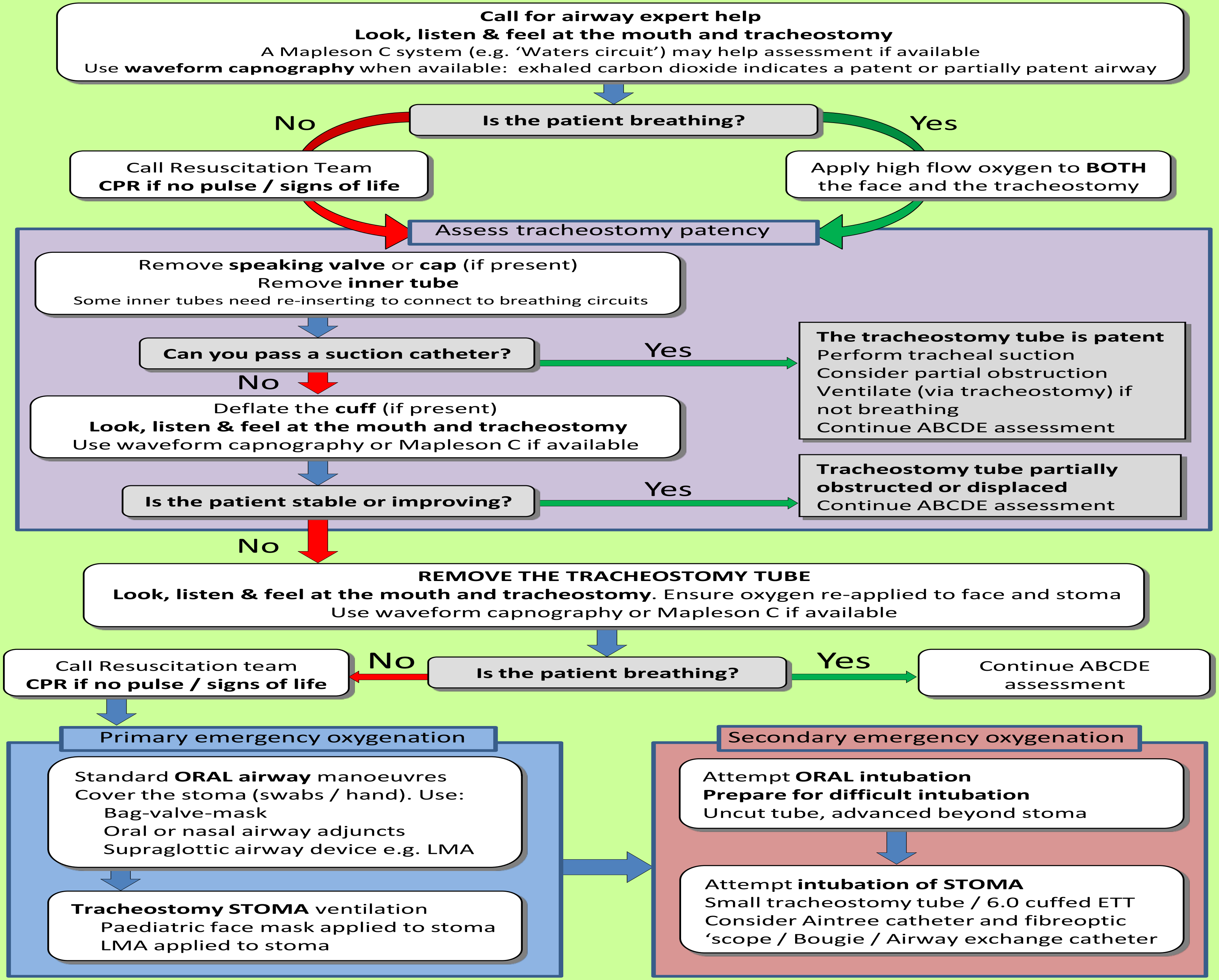
Background

- Growing number of hospitalized patients with tracheostomies
- Common procedure performed by: ENT, Thoracic surgery, general surgery, and pulmonary/critical care team
- 2009 study by McGrath: 75% of the 453 incidents associated w/tracheostomy were associated with patient harm
  - 6% required life saving care
  - 15 patients died
- Complications and death associated with laryngectomy patients
- No current training at UPMC

NHS RESOURCES

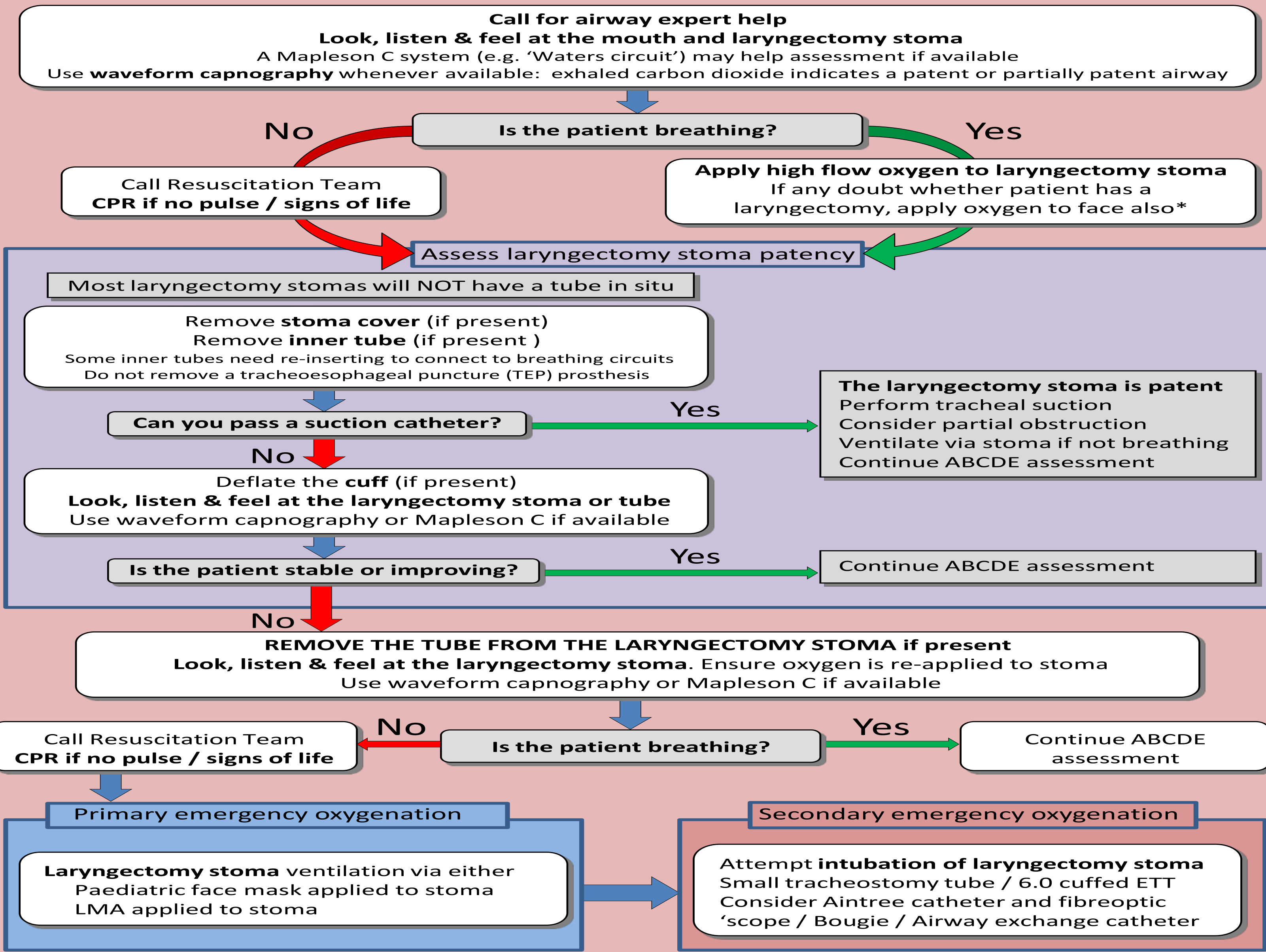
- National Tracheostomy Safety Project
- Joint NHS project
- Online resources www.tracheostomy.org.uk
  - What is tracheostomy, different types of tubes
  - Surgical procedure
  - Emergency management of tracheostomy and laryngectomy
  - Management of day-today needs of tracheostomy patients

Emergency tracheostomy management - Patent upper airway



National Tracheostomy Safety Project. Review date 1/4/14. Feedback & resources at **www.tracheostomy.org.uk**

Emergency laryngectomy management



* Laryngectomy patients have an end stoma and **cannot be oxygenated via the mouth or nose**
Applying oxygen to the face and stoma is the default emergency action for all patients with a tracheostomy

National Tracheostomy Safety Project. Review date 1/4/14. Feedback & resources at **www.tracheostomy.org.uk**

Targeted LEARNERS

- Critical Care Physicians and Fellows
- Other professionals involved in the care of both tracheostomy and laryngectomy patients
  - Hospitalists
  - ER physicians
  - General surgeons
  - Nurses
  - Respiratory therapists

Pre-course PowerPoint

- Viewed online on own time prior to course
- Key Learning Points
  - Anatomy of tracheotomy, laryngectomy
  - Role of different types of trach tubes
    - Cuffed vs uncuffed
    - Inner cannula vs no inner canula
    - Fenestrated vs non fenestrated
    - Normal vs extended length
      - proximal vs distal
  - Manufacturers, sizing of tubes
  - Pluging, decannulation, speaking valve use
  - Tracheostomy complications
  - Difficult tracheostomy/laryngectomy algorithm
    - Management of trach displacement
    - DO NOT INTUBATE LARYNGECTOMY PATIENT
    - Know when to intubate!

Course Components

- Examine multiple different tracheostomy tubes
- Practice intubating using surgical laryngoscope
  - Fellows already familiar with standard scopes and Glide Scope
- High fidelity scenarios
  - Displaced tracheostomy
  - Plugged laryngectomy tube

HIGH FIDELITY Simulation Scenarios

- Displaced Tracheostomy tube scenario
  - Tube occluded with tape, slipped under chest flap
    - Airway blocked with tape to make reinsertion difficult
    - May leave small aperature if goal is reinsertion
  - Patient wheezing, coughing, desating
  - Goal is to recognize tube not in airway
    - Secure airway by bag-mask and intubation
  - If bag trach, sats will crash in 1 minute due to pneumothorax
- Laryngectomy senario
  - Plugged laryngectomy tube (use Gorilla glue)
  - Tape over larynx, set tongue to maximum pressure
  - Patient wheezing, coughing, desating
  - Goal is to recognize and remove laryngectomy tube
  - If Attempted oral intubation will crash immediately

Scenario Video

Post-Course Survey

- Administered 8 months following course
- All respondents strongly positive
- All had encountered similar event in 8 months
  - All thought useful in addressing event
- All thought scenarios most useful part.

- Course was incredibly helpful!
- This course is very pertinent and useful.
- Understanding how to trouble shoot new trachs and why to prefer intubation in those case
- Never before knew the difference between a Shiley, Bivona, etc. tubes
- Overall, a very helpful course. Also, appropriate length/depth.
- Other comments? None... just that we need more training like this

SAVE-ME

Mechanical Ventilator Simulator

John Hotchkiss, MD
Chris Brackney, DO

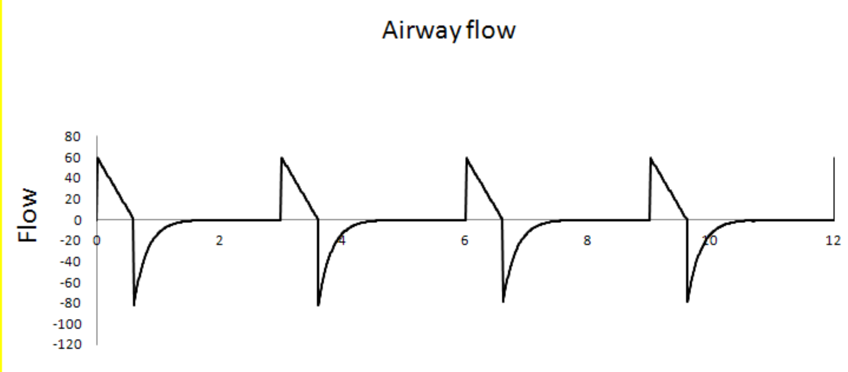
SAVE-ME tool comprises

- Simulation model
  - Non-linear, multicompartment mechanics and gas exchange modules
  - Acid/base and hemodynamic modules
- Dynamically responsive virtual patient population
  - COPD, asthma, acute lung injury, restriction, pneumonia
  - Represent major categories of acute respiratory failure
- Modules providing real-time learner debriefing
  - Conventional metrics
  - Metrics based on practice patterns
- Algorithms providing real-time learner guidance
  - “At this point in time, your patient has the following problems”
  - “At this time, you should consider these changes for your patient”

Initial presentation of standardized patient case

Mode (1= VCV; 2=PCV)	1
Push to change ventilator mode	
Tidal volume, L	0.3
PEEP	10
Peak inspiratory flow rate, lpm	60
Frequency	20
Inspiratory pause duration, s	0
Inspired fraction of oxygen, %	40

Outcomes from your settings	
Machine tidal volume	0.3
Measured minute ventilation	6.0
Peak Airway Pressure	31.0
Mean Airway Pressure	14.0
I/E ratio	0.3
Plateau pressure	28.0
End expiratory pressure	10.0



GOALS

Minimum saturation
90
Minimum pH
7.25
Maximum pH
7.45
Maximum Pplateau
30
Minimum mean arterial pressure
65

Push to generate new patient simulation when starting or if targeted outcomes are satisfied

Push to generate new patient simulation if unable to attain targeted outcomes

Push to completely reset tool

Push to run simulation with new inputs

Push to administer fluid bolus

	Arterial Sat,%	PaO2	pH	PaCO2	cHCO3
Blood gas data	87	56	7.24	67	27
Mean arterial pressure	60				

YOUR PATIENTS OXYGEN SATURATION IS	Too low
YOUR PATIENTS BLOOD PRESSURE IS	Too low
YOUR PATIENTS PLATEAU PRESSURE IS	Acceptable
YOUR PATIENTS PH IS	Too low

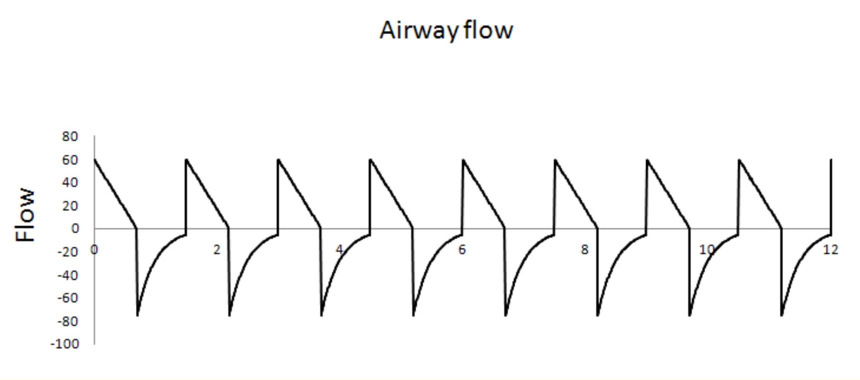
YOUR PATIENTS MIXED VENOUS OXYGEN SATURATION IS LOW

Oops– bad choice

Mode (1= VCV; 2=PCV) 1

Push to change ventilator mode

Tidal volume, L	0.35
PEEP	10
Peak inspiratory flow rate, lpm	60
Frequency	40
Inspiratory pause duration, s	0
Inspired fraction of oxygen, %	40



GOALS

Minimum saturation
90

Minimum pH
7.25

Maximum pH
7.45

Maximum Pplateau
30

Minimum mean arterial pressure
65

Outcomes from your settings

Machine tidal volume	0.4
Measured minute ventilation	14.0
Peak Airway Pressure	26.0
Mean Airway Pressure	18.0
I/E ratio	0.9
Plateau pressure	25.0
End expiratory pressure	11.0

Push to generate new patient simulation when starting or if targeted outcomes are satisfied

Push to completely reset tool

Push to generate new patient simulation if unable to attain targeted outcomes

Push to run simulation with new inputs

	Arterial Sat,%	PaO2	pH	PaCO2	cHCO3
Blood gas data	94	77	7.28	44	20
Mean arterial pressure	50				

Push to administer fluid bolus

YOUR PATIENTS OXYGEN SATURATION IS	Acceptable
YOUR PATIENTS BLOOD PRESSURE IS	Too low
YOUR PATIENTS PLATEAU PRESSURE IS	Acceptable
YOUR PATIENTS PH IS	Acceptable

YOUR PATIENTS MIXED VENOUS OXYGEN SATURATION IS LOW

Interventions have corrected pH

Mode (1= VCV; 2=PCV) 1

Push to change ventilator mode

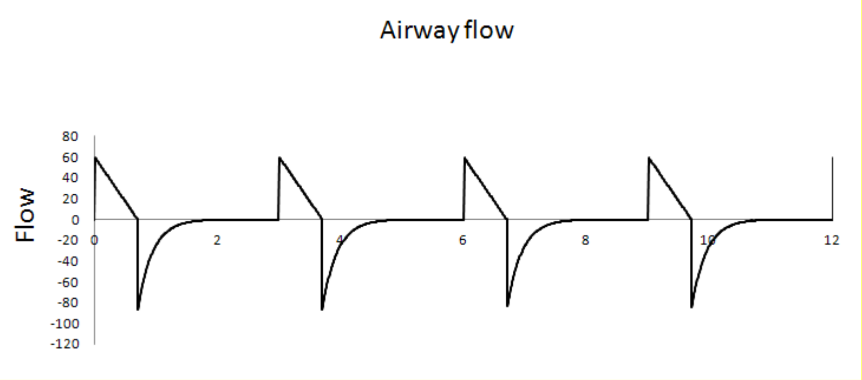
Tidal volume, L	0.35
PEEP	10
Peak inspiratory flow rate, lpm	60
Frequency	20
Inspiratory pause duration, s	0
Inspired fraction of oxygen, %	40

Outcomes from your settings

Machine tidal volume	0.4
Measured minute ventilation	7.0
Peak Airway Pressure	32.0
Mean Airway Pressure	15.0
I/E ratio	0.3
Plateau pressure	29.0
End expiratory pressure	10.0

Push to run simulation with new inputs

Push to administer fluid bolus



Push to generate new patient simulation when starting or if targeted outcomes are satisfied

Push to generate new patient simulation if unable to attain targeted outcomes

	Arterial Sat,%	PaO2	pH	PaCO2	cHCO3
Blood gas data	89	59	7.31	54	26
Mean arterial pressure	58				

YOUR PATIENTS OXYGEN SATURATION IS Too low

YOUR PATIENTS BLOOD PRESSURE IS Too low

YOUR PATIENTS PLATEAU PRESSURE IS Acceptable

YOUR PATIENTS PH IS Acceptable

YOUR PATIENTS MIXED VENOUS OXYGEN SATURATION IS LOW

GOALS

Minimum saturation
90

Minimum pH
7.25

Maximum pH
7.45

Maximum Pplateau
30

Minimum mean arterial pressure
65

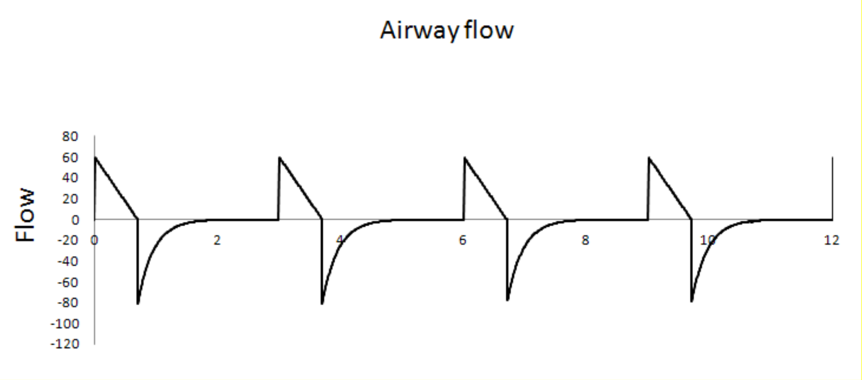
Push to completely reset tool

Interventions have corrected pH and SaO2

Mode (1= VCV; 2=PCV) 1

Push to change ventilator mode

Tidal volume, L	0.35
PEEP	12
Peak inspiratory flow rate, lpm	60
Frequency	20
Inspiratory pause duration, s	0
Inspired fraction of oxygen, %	80



GOALS

Minimum saturation
90

Minimum pH
7.25

Maximum pH
7.45

Maximum Pplateau
30

Minimum mean arterial pressure
65

Outcomes from your settings

Machine tidal volume	0.4
Measured minute ventilation	7.0
Peak Airway Pressure	33.0
Mean Airway Pressure	17.0
I/E ratio	0.3
Plateau pressure	29.0
End expiratory pressure	12.0

Push to generate new patient simulation when starting or if targeted outcomes are satisfied

Push to generate new patient simulation if unable to attain targeted outcomes

Push to completely reset tool

Push to run simulation with new inputs

Push to administer fluid bolus

	Arterial Sat,%	PaO2	pH	PaCO2	cHCO3
Blood gas data	92	67	7.31	54	26
Mean arterial pressure	55				

YOUR PATIENTS OXYGEN SATURATION IS Acceptable

YOUR PATIENTS BLOOD PRESSURE IS Too low

YOUR PATIENTS PLATEAU PRESSURE IS Acceptable

YOUR PATIENTS PH IS Acceptable

YOUR PATIENTS MIXED VENOUS OXYGEN SATURATION IS LOW

Acidosis, hypoxia, and hypotension repaired: Learner commits to settings

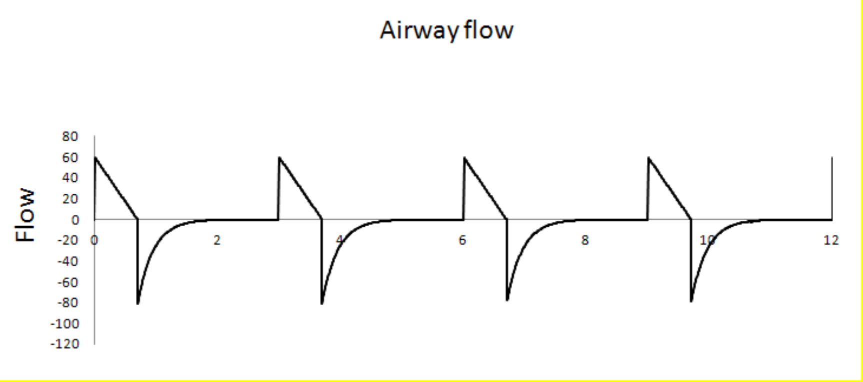
Mode (1= VCV; 2=PCV)	1
Push to change ventilator mode	
Tidal volume, L	0.35
PEEP	12
Peak inspiratory flow rate, lpm	60
Frequency	20
Inspiratory pause duration, s	0
Inspired fraction of oxygen, %	80

Outcomes from your settings

Machine tidal volume	0.4
Measured minute ventilation	7.0
Peak Airway Pressure	33.0
Mean Airway Pressure	17.0
I/E ratio	0.3
Plateau pressure	29.0
End expiratory pressure	12.0

Push to run simulation with new inputs

Push to administer fluid bolus



Push to generate new patient simulation when starting or if targeted outcomes are satisfied

Push to generate new patient simulation if unable to attain targeted outcomes

	Arterial Sat,%	PaO2	pH	PaCO2	cHCO3
Blood gas data	92	68	7.31	54	26
Mean arterial pressure	68				

YOUR PATIENTS OXYGEN SATURATION IS Acceptable

YOUR PATIENTS BLOOD PRESSURE IS Acceptable

YOUR PATIENTS PLATEAU PRESSURE IS Acceptable

YOUR PATIENTS PH IS Acceptable

GOALS

Minimum saturation
90

Minimum pH
7.25

Maximum pH
7.45

Maximum Pplateau
30

Minimum mean arterial pressure
65

Push to completely reset tool

New virtual patient is immediately presented

Mode (1= VCV; 2=PCV) 1

Push to change ventilator mode

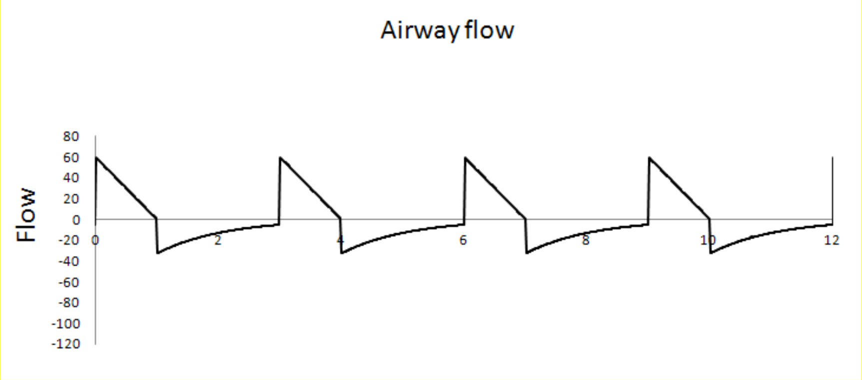
Tidal volume, L	0.5
PEEP	5
Peak inspiratory flow rate, lpm	60
Frequency	20
Inspiratory pause duration, s	0
Inspired fraction of oxygen, %	21

Outcomes from your settings

Machine tidal volume	0.5
Measured minute ventilation	10.0
Peak Airway Pressure	18.0
Mean Airway Pressure	8.0
I/E ratio	0.5
Plateau pressure	11.0
End expiratory pressure	6.0

Push to run simulation with new inputs

Push to administer fluid bolus



Push to generate new patient simulation when starting or if targeted outcomes are satisfied

Push to generate new patient simulation if unable to attain targeted outcomes

	Arterial Sat,%	PaO2	pH	PaCO2	cHCO3
Blood gas data	86	54	7.36	44	24
Mean arterial pressure	85				

YOUR PATIENTS OXYGEN SATURATION IS	Too low
YOUR PATIENTS BLOOD PRESSURE IS	Acceptable
YOUR PATIENTS PLATEAU PRESSURE IS	Acceptable
YOUR PATIENTS PH IS	Acceptable

YOUR PATIENTS MIXED VENOUS OXYGEN SATURATION IS LOW

GOALS

Minimum saturation
90

Minimum pH
7.35

Maximum pH
7.45

Maximum Pplateau
30

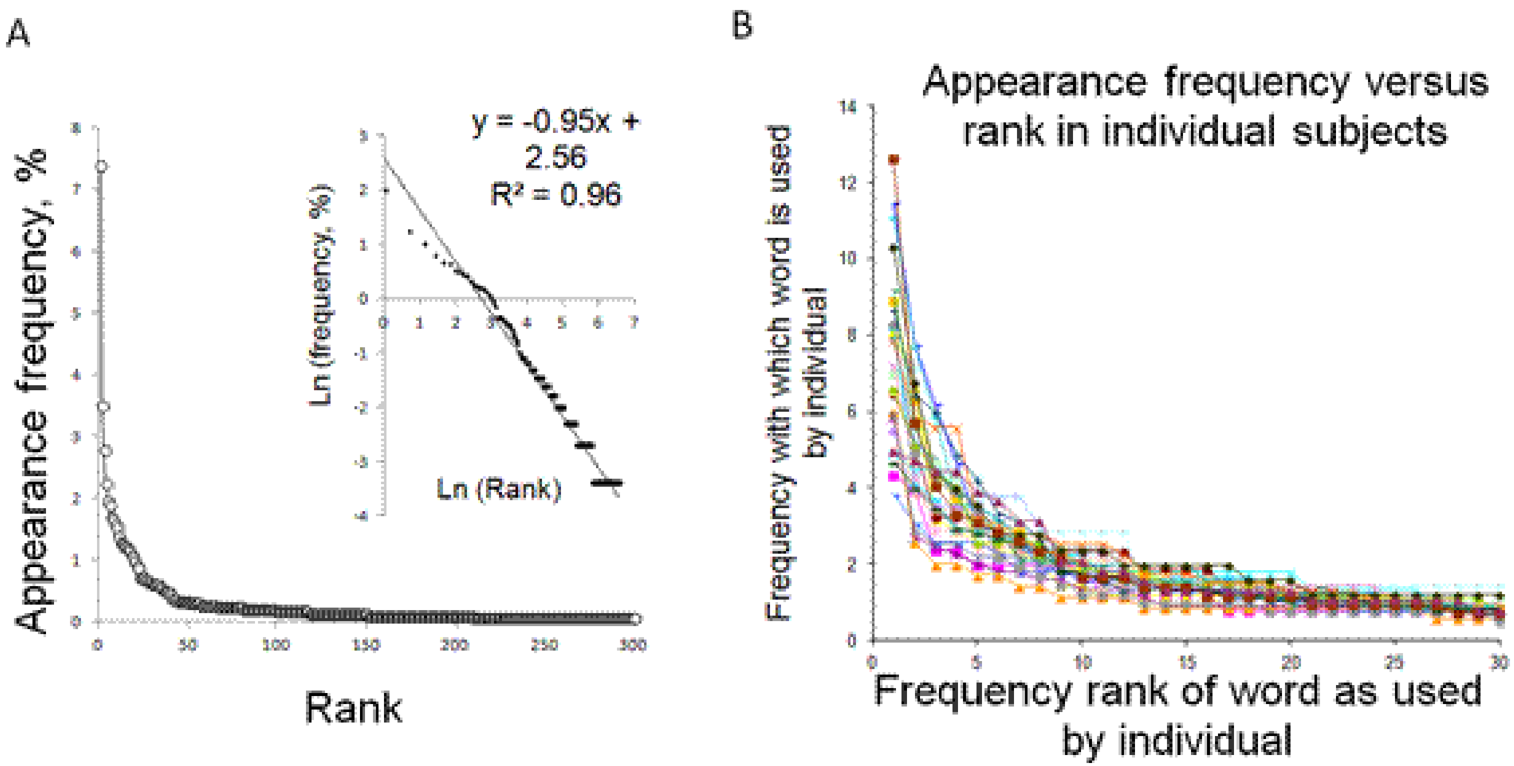
Minimum mean arterial pressure
65

Push to completely reset tool

Freeware tool has garnered an international audience

- Simulator ranked # 1 on Bing search and #2 on Google search
- Generating ~ 20 unique downloads per day spanning 98 countries; pace is accelerating

Practice patterns show statistical characteristics of spoken languages

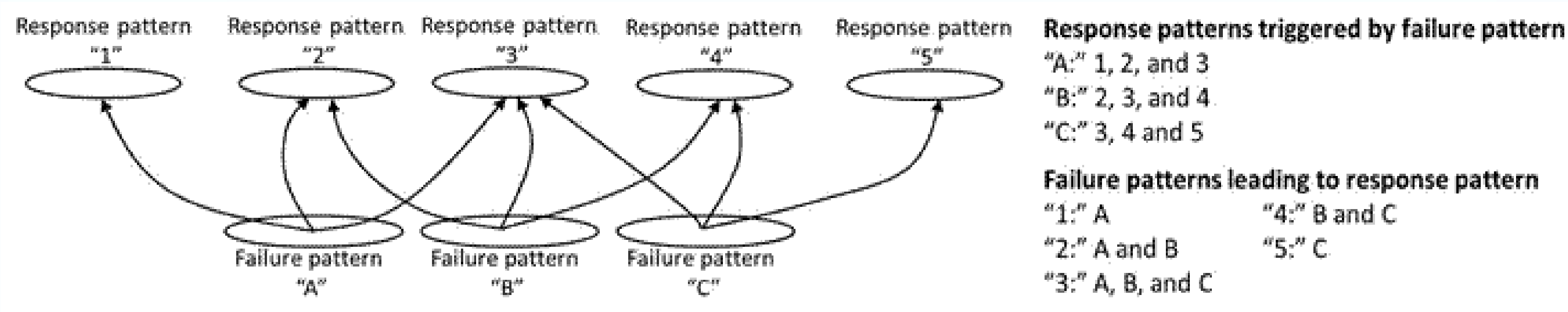


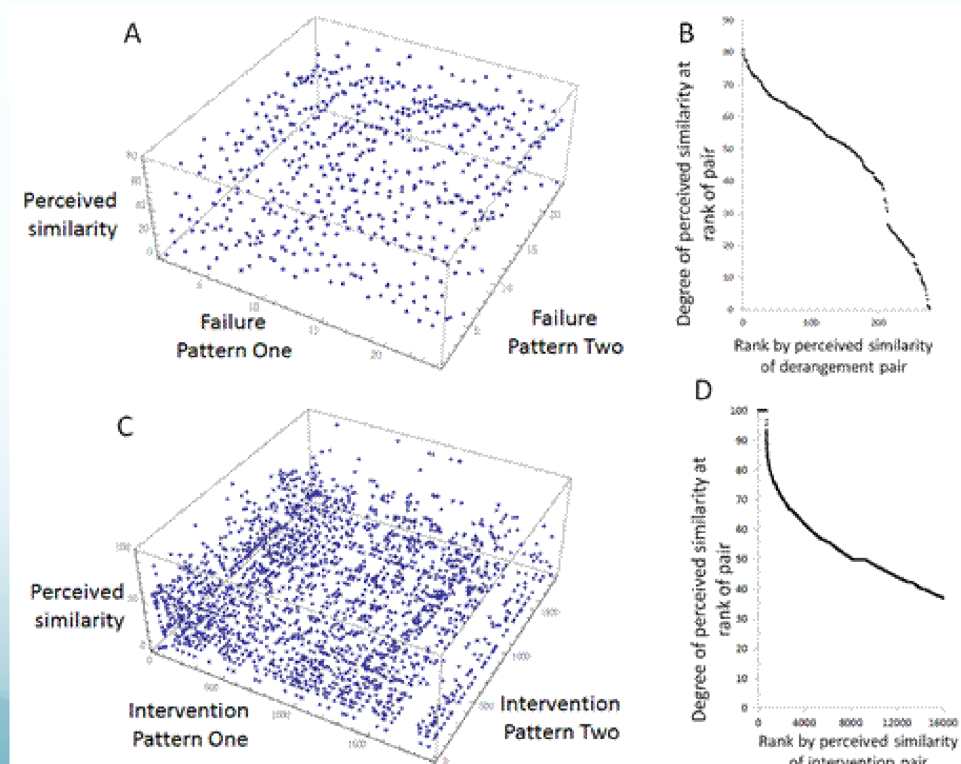
Table

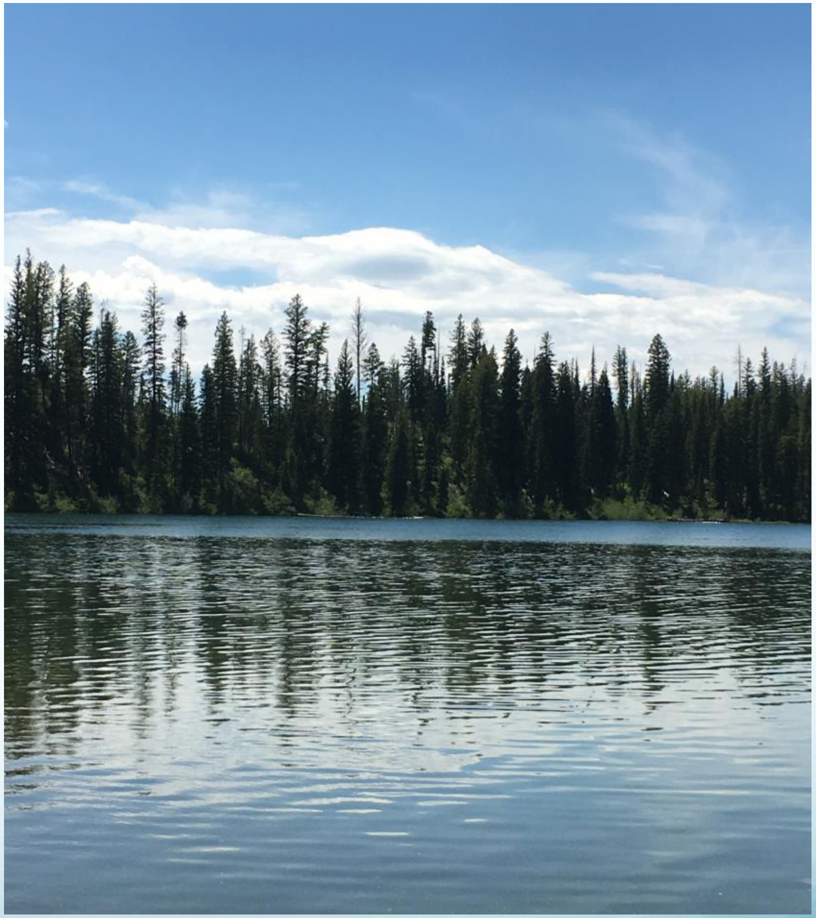
Ln(f) versus Ln (rank)

Subject	Slope	Intercept	Correlation
1	-0.49066	1.34227	-0.92467
2	-0.67663	1.966141	-0.96442
3	-0.7093	2.268071	-0.94879
4	-0.63961	1.753141	-0.96264
5	-0.66862	2.116836	-0.94795
6	-0.7713	2.445422	-0.96962
7	-0.83327	2.530182	-0.97483
8	-0.67077	2.073671	-0.95234
9	-0.47904	2.003416	-0.91829
10	-0.74113	2.257393	-0.96451
11	-0.82851	2.457209	-0.96524
12	-0.74579	2.201507	-0.95274
13	-0.60552	1.917579	-0.94886
14	-0.8607	2.491803	-0.97223
15	-0.66854	2.068369	-0.95715
16	-0.64028	1.794449	-0.95606
17	-0.91878	2.768178	-0.98093
18	-0.71522	2.196932	-0.95898
19	-0.79435	2.384277	-0.96682
20	-0.4856	1.144477	-0.9242
21	-0.93062	2.840335	-0.97048
22	-0.81475	2.401042	-0.96802
23	-0.64022	1.70992	-0.94852
24	-0.88483	2.648319	-0.9777
25	-0.88289	2.641962	-0.97721
26	-0.84413	2.391197	-0.96287
27	-0.85119	2.685667	-0.95978
28	-0.84711	2.628433	-0.97896
29	-0.8048	2.41266	-0.96239

Evidence of cognitive conceptual clustering is readily apparent





Your Being Sued!

When bad things happen to good doctors

Deanna Blisard, MD

Purpose

- The goal of the workshop is to offer the Critical Care fellows the opportunity to participate in a mock medical malpractice lawsuit that would provide a basic understanding of the litigation process.
- At the end of the workshop, the fellows should be able to:
  - Have a general understanding of the procedural aspects of a malpractice case
  - Recognize the pitfalls inherent in poor documentation and communication and the potential consequences of both at trial
  - Better defend their actions in litigation
  - Document more intelligently

A Longitudinal Curriculum!

Video
- Actual case involving previous fellow and a failed reintubation
- Video was made recreating the attempted reintubation
- The video was viewed by fellows and used for documentation exercise
- Viewed in October

Deposition
- Notes collected and reviewed and one fellow selected
- Fellow underwent mock deposition with real lawyers
- Co-fellows were in the audience observing
- Held in April

Mock trial
- Standardized Patients (SPs) played the defendant, plaintiff expert, and defense expert
- Scripted testimony and real lawyers
- Fellows acted as jury and deliberated

Documentation Video

- Recreation of the failed re-intubation using Critical Care program directors and VA Pittsburgh simulation fellows
- Key moments time-stamped with actual times documented in the patient chart
- Fellows viewed the video as part of their difficult airway workshop (embedded into their known curriculum), and asked to document what transpired

Mock Deposition

- One fellow was selected to be deposed
- Received a redacted copy of the initial complaint and a letter from the insurance company stating he was being sued
- Actual lawyers deposed the fellow using the redacted chart
- Facilitated debriefing and Q&A session after the deposition with faculty, lawyers, and the VP of Risk Management

Mock Trial

- Scripted from the actual patient chart, depositions, and expert witness summaries
- Standardized Patients (SP) used to play the part of defendant and expert witnesses
- Fellows acted as jurors, deliberated the case, and rendered a verdict
- Fellows were unable to come to a unanimous decision but favored acquittal 9-4
- Actual case settled by UPMC

Future Goals and Applications

- Documentation checklist in process: Delphi model utilizing local critical care faculty to provide feedback on key aspects of fellow documentation
- 2^{nd} year fellows to play roles in future mock trials
  - Real-life experience being an expert witness
  - Increase fidelity and reality for fellows
- Possible affiliation/collaboration with Pitt Law School
- Mediation vs Mock Trial
  - Most are mediated and settled before getting to a trial

VAPHS
Center for Medical Product End-user Testing

Jamie L. Estock, MA
Director
Human Factors Psychologist
Co-Director, Inter-professional Patient Safety Fellowship

David E. Eibling, MD
Associate Director
Assistant Chief of Surgery
Co-Director, Inter-professional Patient Safety Fellowship

MISSION

Facilitate the safest use of medical products in the delivery of care to Veterans

USER-CENTER PRODUCTS → BETTER PERFORMANCE → SAFER CARE

APPROACH

Conduct human factors evaluations to measure product safety in situations that mirror the real clinical practice settings

- Leverage high-fidelity simulation
- Involve a representative set of users
- Incorporate real-world scenarios

APPROACH

Measure the effects of **interface design** on **user decisions and actions** with the goal of maximizing performance and minimizing errors

USER-CENTER PRODUCTS → BETTER PERFORMANCE → SAFER CARE

PSCI GOALS

1. Advise the purchase of the safest medical products across VHA

2. Identify and mitigate safety issues before products are used on Veterans

3. Inform the future design, development, and approval of safe medical products

USER-CENTER PRODUCTS → BETTER PERFORMANCE → SAFER CARE

Completed Evaluations

Decision	Completed HF Evaluations	
Purchasing *Which product has the fewest use-related hazards?*		Automated Chest Compression (ACC) Devices
Implementation/Use *How can we mitigate use-related hazards associated with the products?*		External Defibrillators
Design *How can we design products to reduce/eliminate use-related hazards?*		Intravenous Medication Labels

USER-CENTER PRODUCTS → BETTER PERFORMANCE → SAFER CARE

ACC Device Evaluation

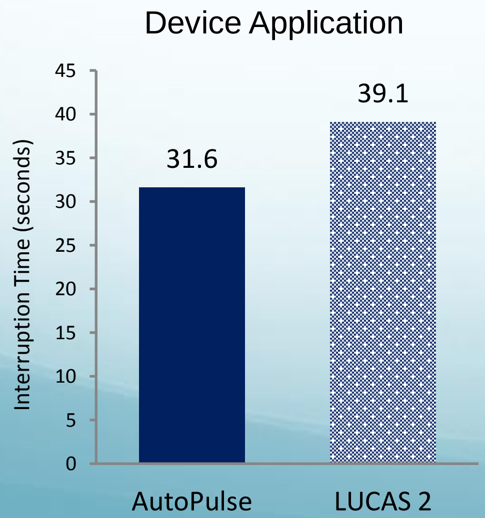
OBJECTIVE

Identify whether an ACC device would be safe and beneficial for use at VA Pittsburgh

METHODS

Simulated resuscitation scenario involving an unconscious 45-year-old man in cardiac arrest

RESULTS



IMPACT

Prevented the purchase of an unwarranted device resulting in improved patient care and cost savings

American Heart Association
GUIDELINES CPR ECC 2010

The American Journal of Emergency Medicine

Estock JL, Curinga HK, Li A, Grieve LB, Brackney CR. Comparison of chest compression interruption times across 2 automated devices: a randomized, crossover simulation study. Am J Emerg Med. 2016 Jan;34(1):57-62. PMID: 26472511

Medication Label Evaluation

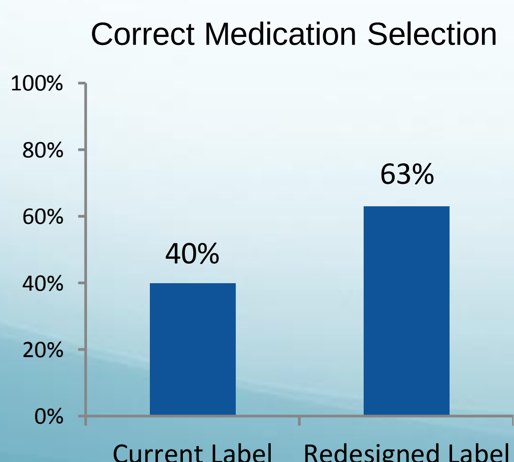
OBJECTIVE

Quantify the impact of label design on medication safety in a realistic, high-stress, clinical situation

METHODS

Operating room scenario involving an unexpected vascular injury and "incorrectly stocked" lidocaine bag

RESULTS



IMPACT

VA Pittsburgh redesigned the labels placed on operating room medications compounded in-house