Enhancing Respiratory Care Practice and Education Through Simulations

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Learning Objectives

- ***Justify why medical simulations are important***
- ***Describe key terminology***
- ***Examine the evolution of medical simulations in general and in respiratory care***
- ***Illustrate Key applications in:***
  - ***Respiratory Care Education***
  - ***Respiratory Care Practice***
- **Describe where *more work may be needed*.**
- ***Provide additional*** *resources*

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Why Are Medical Simulations Important?

- ***Safety***-Permit the practice and learning of medical procedures in a safe and controlled environment.
- ***Practical***-Augment clinical and laboratory experiences in general, and during special circumstances (e.g., Covid Surge)
- ***Efficient***-Can be less resource intensive than some other form of teaching/learning.
  - Clinical sites and instructors are costly

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Why Aren't Simulations Used More Widely or Universal?

- Require an ***Organizational Commitment*** as a Strategic Priority.
- Involve ***Long-term Investment*** and Payoff is Not Immediate!
- ***Simulation Training & Education Requires Specialized Expertise, which is Rare.***
  - Technical expertise is required to make pre-acquisition evaluation and post-acquisition effective use.

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Key Terms

- ***Medical Simulation:*** *Artificial representation of real-medical practice aiming to facilitate learning through demonstration, practice and feedback, in a safe environment.*
- ***Level of Fidelity:*** *A multi-dimensional concept corresponding to the degree of realism created through the selection of simulation equipment, setting, and scenario.*
  - ***High Fidelity-*** *State of the art fidelity, in which a computer-aided mannequin interacts equipment and trainees to create a high degree of realism. Example: Intubated Sim-Man + Ventilator + Computer.*
  - ***Intermediate fidelity-*** *A series of procedures put together to resemble a simple scenario found in a clinical setting. Example: ACLS Mega-Code.*
  - ***Low fidelity-*** *Demonstrating a single skill on a rudimentary model. Example: Airway management on an intubation head.*
- ***Standardized Patient-*** *A person trained to act as a real patient in order to simulate a condition(s).*

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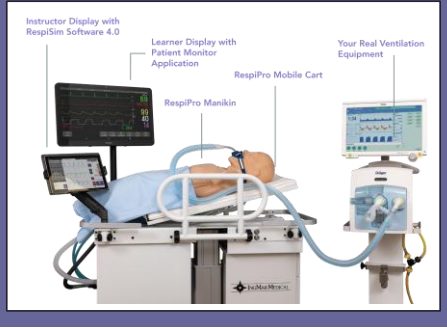
High Fidelity - ASL-5000 Lung Simulator, Interfaced with a mannequin, Ventilator and Computer.



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Key Events in History

- 600-300 BC, the Mayans utilized clay figurines as a primitive form of simulations.
- 1644-1912, Chinese physicians practiced on life-sized bronze statues; later taught anatomy using ivory figurines.
- In the 18th century, Giovanni Galli designed a glass uterus/fetus to train midwives & surgeons.
- In the 19th century, actual anatomical exhibitions of diseases arose in Europe and the US but were eventually closed down because of ethical concerns.

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More Recent History

- Early 20th century, Martha Jenkins Chase made a doll to train nurses to dress, turn, transfer and practice injections.
- In the mid-1900s, the US Army used manikins to teach medical techniques
- In the 1960's
  - Resusci Anne was developed for CPR training.
  - SimOne was developed, which is one of the earliest high-fidelity simulators.
- The 1980s & 1990s were a prominent period for developing simulators by companies such as Laerdal Medical.

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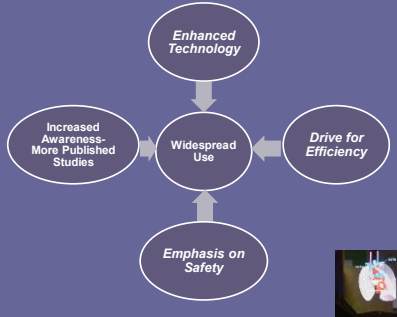
Factors Leading to the Rise of Simulation-Based Training



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Current Trends & Applications in Respiratory Care ***Education***

- SBE Use in Entry-Level Academic Education. Davis (2022)
  - SBE is used by Over ¾ of Accredited RT Programs-Per Survey by Davis (2022).
  - 66% have a mandatory simulation activity.
  - Paradoxically, RT faculty have limited training on the use of SBE.

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Sim-based Education (SBE) Trivia # 1

- Canada, a country with roughly 11% of our population & GDP, and only 19 accredited RT Education Programs, produced almost half of the published in this area.
- Likely linked to their:
  - More centralized healthcare system
  - Accreditation Canada, a formal network dedicated to fostering simulation based education and training.

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SBE Trivia Fact # 2

- Most publications on SBE in respiratory care academic education reported ***subjective outcomes*** such as participants' perceptions of more confidence, not objectively measured proficiency & speed.
- This finding may be linked to the ease at measuring perceptions versus objectively measured proficiency and speed.

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SBE Trivia Fact # 3

- Most publications on SBE in respiratory care education related to ***interprofessional collaboration/teamwork.***
- This finding was also unexpected, but may be related to:
  - 1.) an increased level of acceptance which RC has gained as a key discipline in patient care planning and execution
  - 2.) Adherence to The Commission on Accreditation for Respiratory Care's (CoARC's) Standard 4.05: "Graduates must be able to function within interprofessional teams…"
- Small Amount of Published work in Clinical Procedures:
  - Violatto (2022)- Simulation could be used to help RT students interact with physicians in airway management scenarios.
  - Collins (2017)-Simulation in performing ABG's.

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Current Trends & Applications in Respiratory Care ***Practice***

- Much more well published work in RT practice than in RT academic education.
- More published work in RT than many other health professions.
- More published work in clinical procedures.
- Still tend to emphasize 'Perceptions of improvement" than objective outcomes.
  - Procedural competency.

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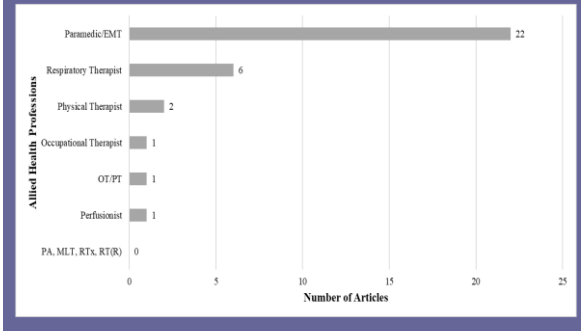
Published Simulation Use in ***Practice*** of Selected Allied Health Professions

(Heuer, et al, 2022)



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Establishment and Maintenance of Intubation Skills

- ***Author(s)/Year***: Miller (2017)
- ***Aim(s)***: Explore methods currently used to train RTs to intubate, explore skill maintenance and evaluation…
- ***Findings:***
  - Significant variation exists in training methods, skill maintenance, and recertification.
  - HF simulation training may reduce number of intubations needed to develop/maintain skills.

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Pediatric Difficult Airway & Skills

- ***Author(s)/Year***: Perretta (2019)
- ***Aim(s)***: Assess pediatric RTs' called to a simulated infant in severe respiratory distress who is difficult to ventilate.
- ***Findings:***
  - Simulation exposed deficits in skillset.
  - Established care algorithm was not effectively implemented and skill retention was poor.
  - Change in training and re-training is warranted.

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Simulation in Bag-Valve-Mask Ventilation Performance

- ***Author(s)/Year***: Mumma (2018)
- ***Aim(s)***: Examine BVM use in expert and novice providers using simulation.
- ***Findings:***
  - ***Novice RTs depend strongly on automated technology, whereas expert RTs rely on patient observation*** as their main source of information.
  - Performance of novices suffered when certain electronic data was unavailable

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Advanced Ventilation Modes: Tested Via Computer Simulator

- ***Author(s)/Year***: Dincel (2021)
- ***Aim(s)***: PRVC, PAV, and ASV were designed and simulated on the computer via *MATLAB/Simulink*
  - A multipurpose computer simulation application to test a variety of complex systems and models, including ventilator mode algorithms.
- ***Findings:***
  - Advance vent mode algorithms can be designed and simulated on the computer successfully.
  - Helps us to understand the working principles of the advanced modes and the effect of the parameter changes.
  - Algorithms can be improved quickly and efficiently.

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The Ability to Correctly Identify Patient-Ventilator Asynchronies

- ***Author(s)/Year***: Silva, et al, (2023)
- ***Aim(s)***: Testing if ASL-5000 Lung Simulator created waveforms could help clinicians identify patient-ventilator asynchronies.
- ***Findings:***
  - Display of ASL-5000-created waveforms improved recognition of patient-ventilator asynchronies.

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Combining Approaches: Innovative Use of High-Fidelity Lung Simulators & Mannequin to Test a Ventilator Splitter Device

- ***Author(s)/Year***: Boyer, et al, (2020)
- ***Aim(s)***: Testing ventilator splitters (ventilator sharing) using two high-fidelity lung simulators (Mannequin and ASL-5000).
- ***Findings:*** Ventilator sharing is theoretically possible but not recommended due to several patient safety concerns, including:
  - Difficulties in attributing volume delivery to each patient
    - Volume delivery to the most compliant lung regions in each patient;
  - Inaccurate respiratory parameter measurements for each patient;
  - Alarm response and troubleshooting delays;

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Combining Approaches: Virtual Reality (VR) for CPR Training With & Without Mannequin

- ***Author(s)/Year***: Buttussi (2020)
- ***Aim(s)***: Multidisciplinary CPR training using virtual reality (VR) with, and without a physical mannequin.
- ***Findings:***
  - VR for CPR training improves procedural knowledge, manual skills, and self-efficacy, with and without a physical mannequin.
  - Supports the adoption of a hybrid model using both VR to reduce instruction and mannequin time to practice.

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Resources- What is SEVA?

- **Standardized Education for Ventilatory Assistance**
- **Created by the Cleveland Clinic**
  - **Rob Chatburn & Eduardo Morales**
- **Available at:**
  - **https://my.clevelandclinic.org/search?q=SEVA**
  - **https://www.youtube.com/watch?v=dfOS99E7Hmk**
- **Vision**
  - A unique platform for standardizing MV training by unifying the terminology, physics, and physiology.
  - SEVA provides a globally available program, endorsed by national societies, for health care professionals to master the skills of ventilatory support.

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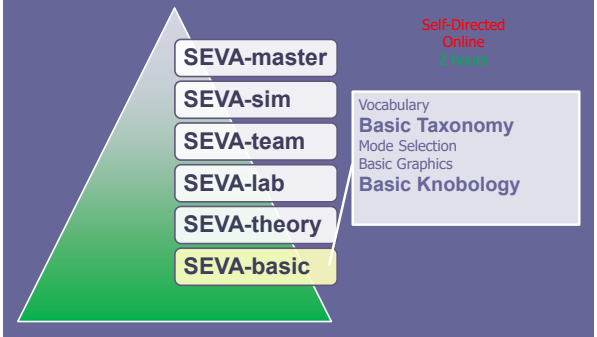
SEVA Curriculum Descriptions



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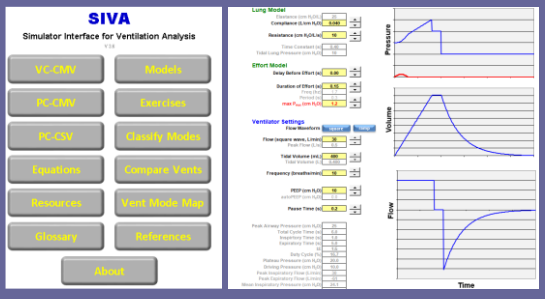
SEVA Course tool: Patient-vent Simulator



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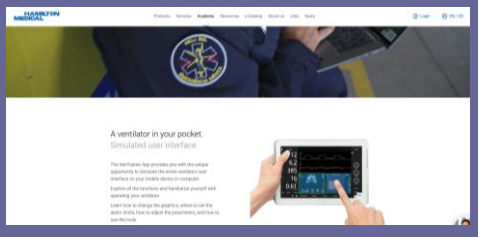
Hamilton Medical—VenTrainer, Virtual Ventilation Training App.

* A Free app for simulated ventilation training
* Includes a physiological patient model-Changes in resistance/compliance
* Available at: www.hamilton-medical.com



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Resources (cont.) - Heathy Simulation

https://www.healthysimulation.com/

- A world-wide organization dedicated to promoting simulation in healthcare

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Strategies To Enhance SBE Usage and Availability

- RT Academic Education
  - Internal Funding-Make the Case to Administration—Long-term pay-off.
  - External Funding-Perkins Grant Program
  - If you use SBE, structure it as research and publish!!!
- RT Practice
  - Internal Funding
    - Mini-grant Programs
    - Departmental Budgets
  - External Funding
    - Healthcare Foundation of New Jersey
    - Agency for Healthcare Research and Quality
  - Again, if you use SBE, structure it as research and publish!!!
- Partner with an Expert & Use Available Free Resources

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Take Home Messages

- Simulation can be an invaluable resource in RT academic education and training practicing clinicians.
- Simulation can enhance educational experience, efficiency, safety and potentially outcomes.
- However, they require leadership commitment of resources, expertise and follow through.
- More simulation experiences need to be structured as research and published as scholarship
- There is also more work to be done in terms of:
  - Increasing awareness
  - Creating true experts
  - Acquiring resources
  - Creating and following through on simulation based curricula
  - Measuring both subjective and objective outcomes.

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