Emerging and innovative methods and technology

Virtual Infant Patients, Families, and Staff Collaboration: Simulating Situational Medical Scenarios with a Virtual Living World

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INTRODUCTION: Medical training simulations mirroring the immersive environment of commercial video games offer benefits superior to physical mannequins. These include the ability to quickly and accurately produce numerous low-volume/high-risk medical situations, the opportunity to practice frequently and obtain feedback privately in a variety of situations and the potential to virtually encounter different patient, family and staff behaviors and cultures. We have created a new type of virtual training, driven by behavior and cultural models. We have developed a recursive platform for the development and visualization of dynamic socio-cultural models in medical situations. The model integrates visualization, sound design, and behavioral/cultural modeling with recursive assessment tools to create a ***living world*** that is sensory and culturally realistic. Key elements of the living world are the virtual infant patient, the virtual family and the virtual staff.

METHODS: The test scenario for the ***living world*** construct presents the trainee with two 24-day-old Hispanic neonatal patients, one male and one female, to monitor in NICU beds in adjoining rooms. Both patients initially have as normal stable physical exam. Over the course of the demo, one or both patients decompensate, one from respiratory distress, and the other septic shock. Within the ***living world*** construct the trainee will provide care that requires assessments of patient condition and implementation of procedures/intervention; all delivered within optimum time frames. Importantly, the trainee simultaneously deals with a variety of less tangible factors, such as cultural differences with the patients' families, doctors with different work styles and personalities, less-than-ideal hospital environments, timing, and general distraction under pressure. The patient outcome is dependent on the trainee's successful dealings with the patient's medical condition in a timely manner and all of the behavioral and cultural issues presented in the ***living world***.

RESULTS: The same demo trains general RNs and NNPs. As the severity of each patient's illness escalates, the challenge for each trainee will be different. Nursing trainees will need to focus on monitoring vital signs, recognizing when a patient has become unstable by changes in the patient's vital signs and/or the physical exam, and knowing when to call in a doctor or NP. Nurse practitioners will need to address specific procedures, diagnostic data and/or medications to help each patient at later stages of illness progression. The trainer ends with an in-depth assessment of the trainee's actions, including a root cause analysis of failure and sentinel event recreation. Eventually, multiple kinds of distress, patient age groups, and so on will be variable.

DISCUSSION/CONCLUSIONS: Our medical training ***living world*** acts very closely to the environment it represents incorporating realistic complexities here-to-fore not found in 3-D simulations. Further, the ***living world*** simulates patient outcomes based on the variables within the virtual environment, such as level of team collaboration, proper utilization and availability of experts, level of family cooperation and inherent cultural practices and informed decision-making. The ***living world*** construct is a promising technology that incorporates physical, cultural and behavioral modeling to substantially raise the bar on the level of realism in medical simulations.

REFERENCES (Optional):

J.L. LeFlore, None.

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Evaluation of Respiratory Mechanics on the METI ECS, METI HPS, and Laerdal SimMan Full-Scale Simulator Mannequins

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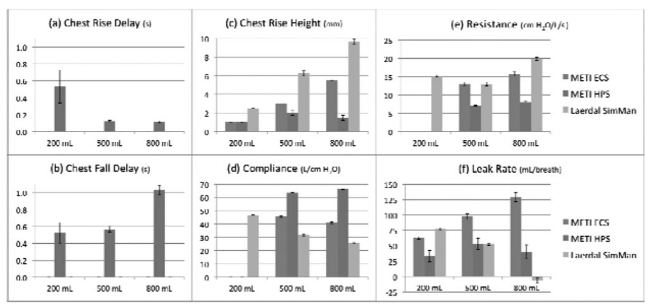
INTRODUCTION: Simulations often require participants to provide respiratory support, but there is little research on the fidelity of respiratory mechanics in full-scale simulator mannequins.

METHODS: Respiratory parameters were measured on three intubated, mechanically-ventilated simulators. Independent variables were Simulator (METI ECS, METI HPS, Laerdal SimMan) and Tidal Volume (200, 500, 800 mL). Dependent variables were: a) delay between the start of inspiration and chest rise, b) delay between expiration and chest fall, c) degree of chest rise, d) lung compliance, e) airflow resistance, and f) "apparent" leak. Mannequins were ventilated at 10 bpm for 10 breaths using a Datex AS/3 anesthesia machine. Data was recorded on video and with a Respironics NICO®2 respiratory monitor and analyzed using repeated-measures ANOVAs.

RESULTS: There were significant effects of Simulator and Tidal Volume for all dependent variables ($p<0.001$). There was a significant delay between the start of inspiration/expiration and chest rise/fall on the HPS, but not with ECS and SimMan. The height of the chest rise increased as the tidal volume increased on ECS and SimMan, but not on HPS. The compliance and resistance values measured on the HPS were within normal ranges of healthy adult patients, but ECS and SimMan had a substantially lower compliance and higher resistance. The HPS had a relatively constant leak and the ECS' leaks increased with tidal volume, whereas the SimMan's leak decreased as tidal volume increased.



CONCLUSIONS: Abnormal chest expansion on the HPS may cause confusion or misdiagnoses during clinical assessment of ventilation adequacy. ECS and SimMan's low compliance and high resistance may be misdiagnosed or trigger "false" alarms, but they may be more suitable for scenarios incorporating bag ventilation and minimal respiratory monitoring. HPS may perform better with modern ventilators. However, problems will be encountered with all three mannequins when transitioning from bag ventilation to mechanical ventilation.

D. Liu, None.