Emergency Medicine Training References: Research and Reviews

Updated: March 9, 2016

Listed in reverse chronological order. Restricted to emergency procedural training in peer-reviewed publications since 2011 and emergency medicine training reviews since 2008. Comparative studies of simulation and animal use are labeled (C).

Iverson K, Riojas R, Sharon D, Hall AB. Objective comparison of animal training versus artificial simulation for initial cricothyroidotomy training. *The American Surgeon* 2015;81:515-518. (C)

69 U.S. Air Force volunteer airmen received cricothyroidotomy "training to proficiency" using either dead pigs (36) or TraumaMan (33). Two weeks later all trainees were tested for retained proficiency using human cadavers. Endpoints were time to completion, incision size, incision start location, initial placement attempt, and final accuracy. "There was no statistically significant, objective difference in any metric between animal- and simulator-trained groups after cricothyroidotomy training. For initial training, there is no objective benefit of animal training."

Hall AB, Riojas R, Sharon D. Comparison of self-efficacy and its improvement after artificial simulator or live animal model emergency procedure training. *Military Medicine* 2014;179(3):320-323. (C)

111 U.S. Air Force volunteer airmen received emergency procedures training using either live pigs (78) or TraumaMan (33). Procedures trained were cricothyroidotomy, diagnostic peritoneal lavage, and thoracostomy (chest tube placement). All participants then rated their self-efficacy using a standardized ten-point scale. "[P]ost-training self-efficacy scores were not statistically different between live animal and artificial simulator training for diagnostic peritoneal lavage ($p = 0.555$), chest tube ($p = 0.486$), and cricothyroidotomy ($p = 0.329$). We conclude that artificial simulator and live animal training produce equivalent levels of self-efficacy after initial training."

Sweet R. Comparing live animal and simulator alternatives for training and assessing hemorrhage and airway procedures in a tactical field situation. *Military Health System Research Symposium*, Ft. Lauderdale, FL, August 18-21, 2014. (C)

Department of Defense-sponsored study at University of Minnesota compared combat medic performance after training using live animals or simulation for hemorrhage control and emergency airway management. There were no significant differences between animal use and simulation regarding procedural proficiency or degrees of participant stress related to the training.

Lee MO, Brown LL, Bender J, Machan JT, Overly FL. A medical simulation-based educational intervention for emergency medicine residents in neonatal resuscitation. *Academic Emergency Medicine* 2012;19:577-585.

27 emergency medicine residents (PG2-PG4) at Rhode Island Hospital were trained in neonatal resuscitation, either using usual curriculum components (15) or using usual curricular components plus simulation-based neonatal resuscitation training (12) using the SimNewB simulator programmed with critically ill parameters. Simulation procedures included CPR, intubation, umbilical vein cannulation, and

intraosseous access. The simulation group (+11.8), but not the control group (-0.5), improved on the standard Neonatal Resuscitation Program performance assessment score after training. The authors concluded: "Our simulation-based educational intervention significantly improved EM residents' knowledge and performance of the critical initial steps in neonatal resuscitation."

Kharasch M, Aitchison P, Pettineo C, Pettineo L, Wang EE. Physiological stress responses of emergency medicine residents during an immersive medical simulation scenario. *Disease-A-Month* 2011;57:700-705.

12 emergency medicine residents volunteered to undergo training using the METI Emergency Care Simulator, with pre-training and intra-training measurement of heart rate and blood pressure. The stress of evaluation pressure was eliminated by assuring participants that the study was voluntary and had no influence on their residency evaluation or grades. The programmed training scenario included sequential "patient" deterioration requiring recognition and treatment of lethal cardiac dysrhythmias and airway emergencies. Heart rate and blood pressure were measured at regular intervals during the scenarios. All participants had significant increases in heart rate (mean 42 bpm; range 21-72 bpm) and blood pressure (mean 23 mm; range not reported). One participant was stopped because of concern when heart rate reached 170 bpm.

The authors concluded: "These findings suggest that treating a patient simulator can indeed be similar to treating a real critically ill patient. Physiological arousal suggests that the residents developed a sense of urgency and responsibility for managing the simulated patient" and "We were able to demonstrate that residents adequately 'suspended disbelief' and performed 'as if' it were real." Comparing this result to learning during actual patient encounters, the authors stated that "a trainee can learn to harness their own stress response without placing patients' lives at risk."

Hall AB. Randomized objective comparison of live tissue training versus simulators for emergency procedures. *The American Surgeon* 2011;77(5):561-565. (C)

24 U.S. Air Force volunteer airmen without previous medical training participated in a randomized comparison of tube thoracostomy and cricothyroidotomy (12 using pigs; 12 using TraumaMan). One week after training, performance was measured (completion time, incision size, correct location, and success rate) using human cadavers. "There was no statistically significant difference in chest tube and cricothyroidotomy outcomes or confidence in the groups trained with live animal models or simulators at the 95 per cent confidence interval."

Reviews and opinion statements supporting the equivalence or superiority of simulation compared to animal use for emergency procedure training.

The listed articles describe the benefits of simulation compared to animal use regarding anatomical accuracy, training-related stress and emotional responses, functional v. physical fidelity, comparative skills for emergency procedures, objective evaluation of trainees, identification of performance gaps, and other areas essential for emergency medicine training. Often noted is the singular role that simulation can play in combining recognition of emergency situations, cognitive and communication skills, technical and procedural skills, stress management, team leadership and coordination, self-paced learning and improvement, and repetition without consequences—elements often addressed less well or not at all when animals are used for training.

Hall A. Letter to the editor. *Military Medicine* 2014;179(7):vii.

Menon S, Kharasch M, Wang EE. High-fidelity simulation – emergency medicine. *Disease-A-Month* 2011;57:734-743.

Yager PH, Lok J, King JE. Advances in simulation for pediatric critical care and emergency medicine. *Current Opinion in Pediatrics* 2011;23:293-297.

Ten Eyck RP. Simulation in emergency medicine training. *Pediatric Emergency Care* 2011;27(4):333-341.

"The Accreditation Council for Graduate Medical Education transitioned to a competency-based assessment of residency programs in 2001 and included simulation as a method for incorporating the 6 core competencies into graduate medical education curricula. Over the past decade, numerous peer-reviewed publications have promoted simulation as an effective educational tool for each of the core competencies."

McLaughlin S, Fitch MT, Goyal DG, et al. Simulation in graduate medical education 2008: a review for emergency medicine. *Academic Emergency Medicine* 2008;15:1117-1129.

Rosen MA, Salas E, Wu TS, et al. Promoting teamwork: An event-based approach to simulation-based teamwork training for emergency medicine residents. *Academic Emergency Medicine* 2008;15:1190-1198.

Wang EE, Quinones J, Fitch MT, et al. Developing technical expertise in emergency medicine – the role of simulation in procedural skill acquisition. *Academic Emergency Medicine* 2008;15:1046-1057.