

AD _____

Award Number: W81XWH-12-2-0001

TITLE: Critical Analyses and Development of Training Mechanisms: Cholinergic Crisis and Pediatric/Neonatal Intubation.

PRINCIPAL INVESTIGATOR: Dr. Pamela Andreatta

CONTRACTING ORGANIZATION: University of Minnesota
MINNEAPOLIS, MN 55455

REPORT DATE: February 2015

TYPE OF REPORT: Final

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for Public Release;
Distribution Unlimited

The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision unless so designated by other documentation.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.**

1. REPORT DATE February 2015		2. REPORT TYPE Final		3. DATES COVERED 4 Nov 2011 - 3 Nov 2014	
4. TITLE AND SUBTITLE Critical Analyses and Development of Training Mechanisms: Cholinergic Crisis and Pediatric/Neonatal Intubation.				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER W81XWH-12-2-0001	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Dr. Pamela Andreatta E-Mail: pandreat@umn.edu				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Regents of The University of Minnesota Minneapolis MN, 55466-2009				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Medical Research and Materiel Command Fort Detrick, Maryland 21702-5012				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION / AVAILABILITY STATEMENT Approved for Public Release; Distribution Unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT Validation data were collected for the assessment instruments we developed, as informed by comprehensive task analyses, to evaluate competency in the management of cholinergic crisis and pediatric and neonatal intubation. All assessment instruments were reviewed by experts, and statistical calculations (ANOVA) to evaluate the construct validity for each of the assessment instruments indicated that each were able to differentiate between all provider experience levels at $p < .05$ significance. The assessment instruments demonstrated excellent reliability, with Chronbach's alpha ranging from .70 to .96. Test-retest correlations (Pearson's r) ranged from .96 to .99. 294 subjects completed a training intervention and pre-and post-training assessments in pediatric/neonatal intubation. Subject distribution was Animal (N=127) and Simulator (N=167). In Q1 2014 retention data collection was completed. 171 subjects completed retention assessments, with a distribution of Animal (N=77) and Simulator (N=94). 204 subjects completed a training intervention and pre- and post-training assessment in cholinergic crisis management. Subject distribution was Animal (N=107) and Simulator (N=97). 162 subjects completed a retention assessment in cholinergic crisis management. All subjects significantly improved with both interventions ($p=.000$). There were no significant differences between the post-training outcomes for the two types of training in either pediatric/neonatal intubation or cholinergic crisis clinical management. There were significant ($p < .01$) retention differences for pediatric and neonatal intubation knowledge and performance skills favoring simulation-based training at 18 weeks and 52 weeks post-training, likely due to the opportunity for repeated practice. There were no differences between training groups for knowledge or performance retention in cholinergic crisis clinical management.					
15. SUBJECT TERMS Simulation training, Animal training, Intubation, Pediatric, Neonatal, Cholinergic Crisis, Nerve Agents, Multimedia training, Clinical training					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. TELEPHONE NUMBER (include area code)
U	U	U	UU	193	USAMRMC

Table of Contents

	<u>Page</u>
Introduction.....	4
Body.....	4
Key Research Accomplishments.....	8
Reportable Outcomes.....	9
Conclusion.....	9
References.....	9
Appendices.....	10

Introduction

The purpose of this research is to evaluate the relative benefits of two forms of clinical training: live animal and simulation based methods. There are two arms of the study: 1) recognition and clinical management of a cholinergic event and 2) recognition and clinical management related to the need for pediatric or neonatal intubation (secure airway). The cholinergic crisis arm will consider the relative value of African Green Monkeys and mannequin simulators for 220 subjects gaining short and long term clinical knowledge, skills and affective capabilities. The pediatric/neonatal intubation arm will consider the relative value of domestic cats and mannequin simulators for up to 220 subjects gaining short and long term clinical knowledge, skills and affective capabilities. The results of the study will be used to create evidence-based curricula for the clinical management of cholinergic events and the need for pediatric and neonatal intubation.

Body

Progress towards the completion of each task related to each objective is indicated in the table below. Retention data collection for the pediatric and neonatal arm concluded in Q1 2014. SOW and project administration changes required schedule modification for the cholinergic crisis arm of the study. Data collection for the cholinergic crisis arm began in Q3 2013. The project team established a connection with Plymouth Fire Station to use available facilities for data collection. The relatively large facility allowed the project team to utilize resources most efficiently and provided an excellent training environment. Retention data collection for the cholinergic crisis arm of the study was completed in Q3 2014. Four manuscripts showcasing the results of study objectives have been published in peer-reviewed journals. Two manuscripts are currently in press. We are currently in process of submitting additional manuscripts based on the results of analysis of retention data from the cholinergic crisis arm of the study. We are also in process of finalizing the curriculum for both the cholinergic crisis and pediatric and neonatal study arms. Due to the delay in the schedule for the cholinergic crisis arm and resignation of the research coordinator, the project team has submitted an eight-month no-cost award extension request. The extension will allow us to complete data analysis and reporting for the project.

Table 1: Objective 1 Task Completion Progress

Task	Description	Progress
Hire Program Support Personnel. (Months 1-3).	Hire and train program support personnel, including research coordinators, training evaluators, and administrative personnel.	Complete.
Procurement Equipment (Months 4-6)	Identify and procure equipment to support simulation-based training and data collection; mannequin simulators and tablet.	Complete.
Task 1. <i>Complete Objective 1 (Months 1-10).</i> We will conduct a systematic review of the literature and professional practice guidelines to identify the critical competencies, associated performance standards (metrics), methods of assessment, and current training pedagogies in order to create a defensible framework for determining and evaluating competency in managing a cholinergic crisis and performing pediatric and neonatal intubation.		
Task 1a.	Seek and obtain Institutional Review Board Approval	Complete for All Phases. University of Minnesota IRB#: HSC1308E41582 UMIRB MED # HUM00056754
Task 1b.	Conduct systematic review of the literature, professional practice guidelines, and training pedagogies for managing cholinergic crisis and pediatric/neonatal intubation (PRISMA protocol).	Complete. Appendix 1 for pediatric/neonatal results. See Appendix 2 for cholinergic crisis results.
Task 1c.	Assemble complete task analyses for managing cholinergic crisis and pediatric/neonatal intubation.	Complete. See Appendix 3 for pediatric/neonatal results. See Appendix 4 for cholinergic crisis results.
Task 1d.	Identify critical steps for managing cholinergic	Complete. See Appendix 5 for

Task	Description	Progress
	crisis and pediatric/neonatal intubation.	results.
Task 1e.	Identify potential sources of error for managing cholinergic crisis and pediatric/neonatal intubation.	Complete. See Appendix 5 for results.
Task 1f.	Establish preliminary performance standards for managing cholinergic crisis and pediatric/neonatal intubation.	Complete. See Appendixes 3 and 4 for results.
Task 1g.	Determine instructional needs for managing cholinergic crisis and pediatric/neonatal intubation from the results of Tasks 1a-f.	Complete. See Appendix 6 for results.
Task 1h.	Determine if the instructional needs for managing cholinergic crisis and pediatric/neonatal intubation identified in Task 1g correlate with existing curricula.	Complete. See Appendix 6 for results.
Task 1i.	Select, design or develop performance assessment instruments and methods for assessing competency in managing cholinergic crisis and pediatric/neonatal intubation	Complete. See Appendix 7 for results.
Task 1j.	Collect validity evidence for assessment instruments and methods determined through Task 1i.	Complete. See Appendix 10 for results.
Task 1k.	Modify current instructional pedagogies for managing cholinergic crisis and pediatric/neonatal intubation to bridge gaps identified in Task 1h.	Complete. See Appendix 8 for results.
Task 1l.	Prepare training materials for managing cholinergic crisis and pediatric/neonatal intubation based on the results of Task 1k.	Complete. See Appendix 8 for results.
Task 1m.	Verify assessment instruments and methods based on the results of Task 1j. Modify as required.	Complete. See Appendix 10 for results.
Task 1n.	Prepare assessment materials based on the results of Task 1m, including proposed performance standards.	Complete. See Appendix 7 for results.
Task 1o.	Assemble data-driven, defensible competency assessment program for managing cholinergic crisis and pediatric/neonatal intubation to be evaluated during Objective 2.	Complete. See Appendixes 7 & 10 for results.
Task 1p.	Assemble data-driven, defensible training program for managing cholinergic crisis and pediatric/neonatal intubation to be evaluated during Objective 2. No anticipated delays in schedule.	Complete. See Appendixes 8 & 10 for results.
Task 1q.	Prepare preliminary project report documenting the results of Objective 1.	Complete. Submitted 03 Dec 2012
Task 1r.	Identify multimedia producer for cholinergic crisis application.	Complete.
Task 1s.	Identify video producer for cholinergic crisis live animal arm.	Complete. Manny-O Productions contracted.
Task 1t.	Participate in Program Review 1.	Complete. 24 July 2012
Task 2. <i>Complete Objective 2 (Months 12-33).</i> We will examine the relative benefits of using live animal and simulator models for training subjects to clinically respond to a cholinergic crisis and perform pediatric/ neonatal intubation using competency assessment for cognitive, psychomotor, and affective performance dimensions.		

Task	Description	Progress
Task 2a.	Recruit subjects for Objective 2.	Complete, Pediatric/Neonatal Intubation. See Appendix 11 for results. Estimated Q1 2014 completion for Cholinergic Crisis.
Task 2b.	Script multimedia application.	Complete. See Appendix 8 for results.
Task 2c.	Identify Interactive steps in multimedia application.	Complete. See Appendix 8 for results.
Task 2d.	Script video production for animal portion of multimedia application.	Complete. See Appendix 8 for results.
Task 2e.	Secure animation for simulation portion of multimedia application.	Complete. See Appendix 8 for results.
Task 2f.	Shoot and produce video of animal interaction.	Complete. See Appendix 8 for results.
Task 2g.	Integrate videos into multimedia application.	Complete. See Appendix 8 for results.
Task 2h.	Test multimedia application.	Complete.
Task 2i.	Program SimMan3G for cholinergic crisis events – mild and moderate exposure for vapor and liquid nerve agents.	Complete. See Appendix 8 for results.
Task 2j.	Hire standardized patients.	Complete.
Task 2k.	Train standardized patients.	Complete.
Task 2l.	Complete pre-assessment of subjects to determine baseline abilities managing cholinergic crisis	Complete. See Appendix 11 for results.
Task 2m.	Conduct cholinergic crisis training using either live animal or simulator models	Complete. See Appendix 11 for results.
Task 2n.	Complete 1st post-assessment of subjects to assess their learning of how to manage cholinergic crisis immediately after training.	Complete. See Appendix 11 for results.
Task 2o.	Complete 2nd post-assessment of subjects to assess their retention of how to manage cholinergic crisis at three time intervals after training (6, 18, or 52 weeks).	Complete. See Appendix 11 for results.
Task 2p.	Complete data analyses to assess performance differences between live animal and simulator training for managing cholinergic crisis.	In-process. Estimated Q1 2015 completion.
Task 2q.	Complete pre-assessment of subjects to determine baseline abilities managing pediatric/neonatal intubation	Complete. See Appendix 11 for results.
Task 2r.	Conduct pediatric/neonatal intubation training using either live animal or simulator models	Complete. See Appendix 11 for results.
Task 2s.	Complete 1st post-assessment of subjects to assess their learning of how to manage pediatric/neonatal intubation immediately after training.	Complete. See Appendix 11 for results.
Task 2t.	Complete 2nd post-assessment of subjects to assess their retention of how to manage pediatric/neonatal intubation at three time intervals after training (6, 18, or 52 weeks).	Complete. See Appendix 11 for results.
Task 2u.	Complete data analyses to assess performance differences between live animal and simulator training for managing pediatric/neonatal intubation.	Complete. See Appendix 11 for results.

Task	Description	Progress
Task 2v.	Prepare secondary project report documenting the results of Objective 2.	Complete. Submitted 03 Dec 2013
Task 2w.	Participate in Program Review 2.	Complete. 13 May 2013
Task 3. <i>Complete Objective 3 (Months 10-36).</i> Using the ADDIE model of curriculum design, we will develop comprehensive evidence-based curricula for the management of cholinergic crisis and pediatric/neonatal intubation, inclusive of all curricular components and formal evaluation and transition plans.		
Task 3a.	Write training objectives for cholinergic crisis training	In-process. Estimated Q1 2015 completion.
Task 3b.	Document standards of performance for managing cholinergic crisis for multiple provider levels (novice to expert; medic to physician)	In-process. Estimated Q1 2015 completion.
Task 3c.	Define instructional methods for best facilitation and delivery of cholinergic crisis training	In-process. Estimated Q1 2015 completion.
Task 3d.	Specify optimal material and human resources requirements for cholinergic crisis training	In-process. Estimated Q1 2015 completion.
Task 3e.	Authenticate competency assessment methods in the management cholinergic crisis training using data-derived reliability and validity evidence collected through Objectives 1 and 2.	In-process. Estimated Q1 2015 completion.
Task 3f.	Prepare a formal evaluation plan for the evidence-based cholinergic crisis curriculum using Kirkpatrick's 4-level Model.	In-process. Estimated Q1 2015 completion.
Task 3g.	Write training objectives for pediatric and neonatal intubation training	In-process. Estimated Q1 2015 completion.
Task 3h.	Document standards of performance for managing pediatric and neonatal intubation for multiple provider levels (novice to expert; medic to physician)	In-process. Estimated Q1 2015 completion.
Task 3i.	Define instructional methods for best facilitation and delivery of pediatric and neonatal intubation training	In-process. Estimated Q1 2015 completion.
Task 3j.	Specify optimal material and human resources requirements for pediatric and neonatal intubation training	In-process. Estimated Q1 2015 completion.
Task 3k.	Authenticate competency assessment methods in pediatric and neonatal intubation training using data-derived reliability and validity evidence collected through Objectives 1 and 2.	In-process. Estimated Q1 2015 completion.
Task 3l.	Prepare a formal evaluation plan for the evidence-based pediatric and neonatal intubation curriculum using Kirkpatrick's 4-level Model.	In-process. Estimated Q1 2015 completion.
Task 3m.	Prepare final project report documenting the results of Objective 3.	In-process. Estimated Q2 2015 completion.
Task 3n.	Prepare a formal transition plan for implementing the next steps for transferring project-related outcomes to other identified areas of interest	In-process. Estimated Q2 2015 completion.
Task 3o.	Participate in Program Review 3	Complete. 24 June 2014.

Key Research Accomplishments

Year 1

- Comprehensive literature review and meta-analyses for Pediatric/Neonatal Intubation and Cholinergic Crisis.
 - Identified training gaps:
 - Poor assessment metrics
 - Weak or absent performance standards
 - No statistically validated assessment instruments
 - Identified technology gaps:
 - SimMan3G
 - SimBaby
 - SimNewB
- Derived assessment instruments for Pediatric/Neonatal Intubation
 - Established performance standards
 - Excellent validity
 - Excellent reliability
- Derived instruction materials for Pediatric/Neonatal Intubation
 - Improved performance in both animal and simulation contexts
 - Elevated heart rates (stress induction) in both animal and simulation contexts

Year 2

- Derived assessment instruments for Cholinergic Crisis Recognition and Response
 - Established performance standards
 - Excellent validity
 - Excellent reliability
- Derived instruction materials for Cholinergic Crisis Recognition and Response
 - Improved performance in both animal and simulation contexts
 - Elevated heart rates (stress induction) in both animal and simulation contexts

Year 3

- Evaluated retention of performance abilities for Pediatric/Neonatal Intubation
 - Significant difference in post-training pediatric performance, and 18- and 52-week retention differences, favoring simulation model over animal model. Likely due to the opportunity for repetitive practice.
 - No other significant post-training differences between effectiveness of live animal or simulation training model
 - Experience level correlated to performance, regardless of training model
- Initiated preparation of curriculum for Cholinergic Crisis Recognition and Response and Pediatric/Neonatal Intubation

Reportable Outcomes

See Appendix 12 for a list of publications and presentations resulting from study outcomes.

Conclusion

Clinical education has historically relied on intangible measures of clinical performance, which to date has made it difficult to unequivocally assert effectiveness of any form of training, be that live animal training or simulation-based training. One of the primary obstacles to conducting direct methodological comparisons is a lack of accepted standards of performance and measurement for most clinical processes and procedures. Through comprehensive analyses, we have identified performance standards, critical steps, and potential sources for error for the clinical management of cholinergic crisis and performing pediatric and neonatal intubation. We have used this information to derive assessment instruments to measure applied performance in each clinical area, and assembled validity and reliability evidence for those instruments in the area of pediatric and neonatal. Valid data are critical for any substantive scientific inquiry and mandatory for the accurate assessment and evaluation of clinical proficiency. Without valid metrics, any examination of live animal or simulation-based training effectiveness would simply be qualitative conjecture. The validated metrics we have derived for performing pediatric and neonatal intubation will provide a significant contribution to this and other performance evaluations in pediatric and neonatal intubation. This information is critical for determining optimal, evidence-based training practices that serve to reduce or eliminate the uses of live-animals without diminishing the quality of training. These metrics may be used to assess clinical competence of those trained using data-driven scientific methods, rather than subjective assessment.

There were several delays related to the moratorium placed on the use of the non-human primate colony at USAMRICD post-award, however we have been able to establish an alternate approach using multimedia that includes animal or simulation elements through videotape and animation, respectively. The multimedia application was completed during Q3 2013. All performance standards, critical steps, and potential sources for error for the clinical management of cholinergic crisis have been integrated into assessment instruments. Retention data collection for the cholinergic crisis arm was completed in Q3 2014. The results of data-analysis to date has found no significant differences between the training modalities for the recognition and management of cholinergic crisis and pediatric and neonatal intubation. These results will be used to create evidence-based curricula for the clinical management of cholinergic events and the need for pediatric and neonatal intubation, eliminating the uses of live animals whenever possible.

References

Comprehensive references are presented in Appendixes 1 and 2.

Appendixes

Appendix 1: Pediatric and Neonatal Intubation Literature Review

Appendix 2: Cholinergic Crisis Literature Review

Appendix 3: Pediatric and Neonatal Intubation Task Analyses

Appendix 4: Cholinergic Crisis Task Analyses

Appendix 5: Critical Steps and Sources of Error

Appendix 6: Instructional Gaps

Appendix 7: Assessment Instruments

Appendix 8: Instructional Components

Appendix 9: Training Event Images

Appendix 10: Preliminary Data

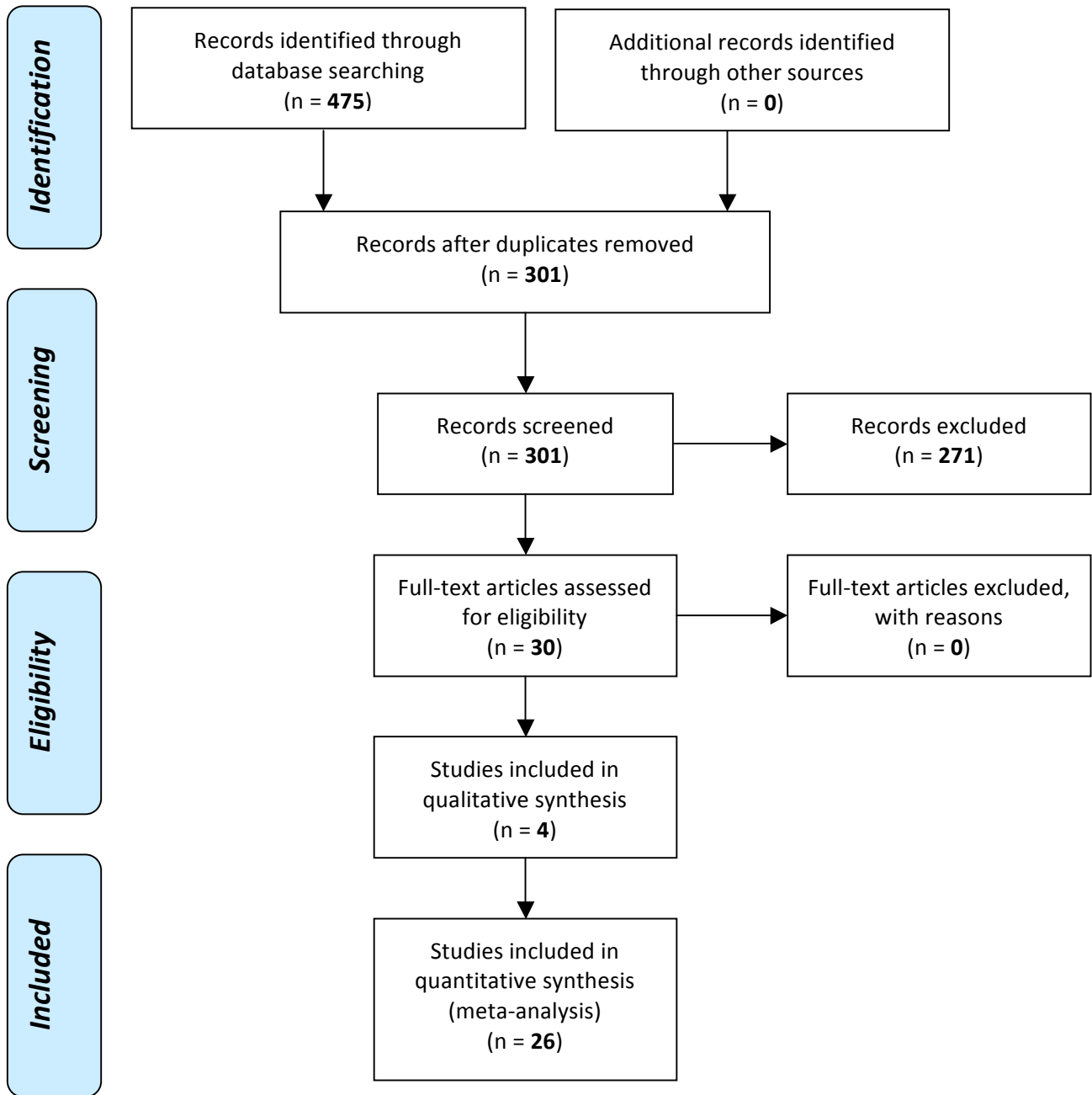
Appendix 11: Publication and Presentation Lists

Appendix 12: Program Review/Summary Report

Appendix 1: Pediatric and Neonatal Intubation Literature Review



PRISMA Pediatric/Neonatal Intubation Training Literature Review Flow Diagram



Terms searched:

Pediatric OR Neonatal

AND

Intubation OR Resuscitation OR Airway

AND

Assessment OR Training/teaching OR Education OR Evaluation

Limited to: English language

Databases searched and number of references located:

PreMedline – 1

Medline – 110 + 109 + 77

Embase – 15 + 8

Web of Science – 62 + 78

Scopus - 2

ERIC - 0

Education Abstracts - 0

Government Printing Office Monthly Catalog - 0

Index to Military Periodicals - 0

CINAHL - 12

ProQuest Dissertations & Theses - 0

Health and Psychosocial Instruments – 1

Total = 475 references

Duplicates Removed = 301 references

Manual Review (Criteria for Elimination):

Guidelines and review articles (not original research)

Overall resuscitation evaluated and not independent skill of intubation

Not correct intubation procedure evaluated (video-assisted, LMA, GlideScope, BVM, etc.)

Commentaries/letters (i.e.- on ethics of use of cadavers for training)

No assessment tool or method used (or described)

Studies not comparing or evaluating methods of or models for training and/or assessment

Articles Relevant: 30

1. Adams, K., et al., *Comparison of intubation skills between interfacility transport team members*. Pediatric Emergency Care, 2000. **16**(1): p. 5-8.
2. Akierman, A., et al., *A comparison of three neonatal intubation training programs in Calgary*. Can.J.Resp.Ther, 2002. **38**(3): p. 31-35.
3. Benfield, D.G., et al., *Teaching intubation skills using newly deceased infants*. . JAMA, 1991. **265**(18): p. 2360-2363.
4. Bismilla, Z., et al., *Failure of pediatric and neonatal trainees to meet Canadian Neonatal Resuscitation Program standards for neonatal intubation*. Journal of Perinatology, 2010. **30**: p. 182-187.
5. Calderwood, H. and M. Ravin, *The Cat as a Teaching Model for Endotracheal Intubation*. Anesthesia and Analgesia, 1972. **51**(2): p. 258=259.
6. Falck, A., et al., *Proficiency of Pediatric Residents in Performing Neonatal Endotracheal Intubation*. Pediatrics, 2003. **112**: p. 1242-1247.
7. Forbes, R.B., D.J. Murray, and M.A. Albanese, *Evaluation of an animal model for teaching fiberoptic tracheal intubation*. Canadian Journal of Anaesthesia, 1989. **36**(2): p. 141-144.
8. Hall, R., et al., *Human Patient Simulation Is Effective for Teaching Paramedic Students Endotracheal Intubation*. Academic Emergency Medicine, 2005. **12**(9): p. 850-855.

9. Baker, T., et al., *The Efficacy of Pediatric Advanced Life Support Training in Emergency Medical Service Providers*. *Pediatric Emergency Care*, 2009. **25**(8): p. 508-512.
10. Duran, R., et al., *Proficiency and knowledge gained and retained by pediatric residents after neonatal resuscitation course*. *Pediatrics International*, 2008. **50**: p. 644-647.
11. Powell, D., C. Gonzales, and R. Gunnels, *Use of the Ferret as a Model fo Pediatric Endotracheal Intubation Training*. *Laboratory Animal Science*, 1991. **41**(1): p. 86-89.
12. Thomson, B. and C. Richardson, *Use of Kittens in Teaching Neonatal Resuscitation to Family Medicine Residents*. *Journal of Family Practice*, 1979. **9**(1): p. 128-129.
13. Gausche-Hill, M., et al., *Design and Implementation of a Controlled Trial of Pediatric Endotracheal Intubation in the Out-of-Hospital Setting*. *Annals of Emergency Medicine*, 2000. **36**(4): p. 356-365.
14. Henderson, D., et al., *Education of paramedics in pediatric airway management: effects of different retraining methods on self-efficacy and skill retention*. *Academic Emergency Medicine*, 1998. **5**: p. 429.
15. Jennings, P., E. Alden, and R. Brenz, *A Teaching Model for Pediatric Intubation Utilizing Ketamine-Sedated Kittens*. *Pediatrics*, 1974. **53**: p. 283-284.
16. Kircher, S.S., L.E. Murray, and M.L. Juliano, *Minimizing trauma to the upper airway: a ferret model of neonatal intubation*. *Journal of the American Association for Laboratory Animal Science: JAALAS*, 2009. **48**(6): p. 780-784.
17. Kisling, J.A. and R.L. Schreiner, *The kitten as a teaching model for intubation of the human neonate*. *Respir.Care*, 1976. **21**(12): p. 1243-1246.
18. Youngquist, S., et al., *Paramedic Self-efficacy and Skill Retention in Pediatric Airway Management*. *Academic Emergency Medicine* 2008. **15**: p. 1295–1303.
19. Terndrup, T., et al., *The impact of a didactic session on the success of feline endotracheal intubation by paramedics*. *Pediatric Emergency Care*, 1989. **5**(3): p. 153-157.
20. Sukys, G., C. Schvartsman, and A. Reis, *Evaluation of rapid sequence intubation in the pediatric emergency department*. *J Pediatr (Rio J)*, 2011. **87**(4): p. 343-349.
21. Sudikoff, S., F. Overly, and M. Shapiro, *High-Fidelity Medical Simulation as a Technique to Improve Pediatric Residents' Emergency Airway Management and Teamwork*. *Pediatr Emer Care* 2009. **25**: p. 651-656.
22. Stewart, R., et al., *Effect of Varied Training Techniques on Field Endotracheal Intubation Success Rates*. *Annals of Emergency Medicine*, 1984. **13**(11): p. 1032-1036.
23. Petrack, E. and I. Hollinger, *Teaching rapid sequence intubation to the pediatric emergency department*. *Resuscitation* 1994. **28**: p. 215-219.
24. Overly, F., S. Sudikoff, and M. Shapiro, *High-Fidelity Medical Simulation as an Assessment Tool for Pediatric Residents' Airway Management Skills*. *Ped Emerg Care*, 2007. **23**(1): p. 11-15.
25. O'Donnell, C., et al., *Endotracheal Intubation Attempts During Neonatal Resuscitation: Success Rates, Duration, and Adverse Effects*. *Pediatrics*, 2006. **117**(e16-21).
26. Nishisaki, A., et al., *Effect of Just-in-time Simulation Training on Tracheal Intubation Procedure Safety in the Pediatric Intensive Care Unit*. *Anesthesiology* 2010. **113**: p. 214-223.
27. Mazzi, E. and R. Gutberlet, *The Maryland State Intensive Care Neonatal Program (MSICNP): Part 1- Education practicing neonatal endotracheal intubation*. *Md.State Med.J*, 1977. **26**(10): p. 86-87.
28. Leone, T., W. Rich, and N. Finer, *NEONATAL INTUBATION: SUCCESS OF PEDIATRIC TRAINEES*. *J Pediatr*, 2005. **146**: p. 638-41.
29. Lane, B., N. Finer, and W. Rich, *Duration of Intubation Attempts During Neonatal Resuscitation*. *J Pediatr* 2004. **145**: p. 67-70.
30. Kendrili, T., et al., *Effect of pediatric advanced life support course on pediatric residents' intubation success*. *Pediatrics International*, 2011. **53**: p. 94-99.

Additional Procedural and Clinical Text References

- Friedlaender ET, Henretig FM. Evaluation of Vital Signs. In King C. Henretig FM. (Eds.), *Textbook of Pediatric Emergency Procedures*, 2nd Edition, 2008. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Pages: 23-31.
- Yen K, Gorelick MH. Use of monitoring devices. In King C. Henretig FM. (Eds.), *Textbook of Pediatric Emergency Procedures*, 2nd Edition, 2008. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Pages: 32-37.

- Luten RC. Emergent drug dosing and equipment selection. In King C. Henretig FM. (Eds.), *Textbook of Pediatric Emergency Procedures*, 2nd Edition, 2008. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Pages: 38-42.
- McAnaney CM. Basic life support. In King C. Henretig FM. (Eds.), *Textbook of Pediatric Emergency Procedures*, 2nd Edition, 2008. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Pages: 79-92.
- Scarfone RJ. Oxygen delivery, suctioning, and airway adjuncts. In King C. Henretig FM. (Eds.), *Textbook of Pediatric Emergency Procedures*, 2nd Edition, 2008. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Pages: 93-108.
- King C, Reynolds SL. Bag-valve-mask ventilation. In King C. Henretig FM. (Eds.), *Textbook of Pediatric Emergency Procedures*, 2nd Edition, 2008. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Pages: 109-126.
- Zuckerbraun N, Pitetti RD. Rapid sequence induction. In King C. Henretig FM. (Eds.), *Textbook of Pediatric Emergency Procedures*, 2nd Edition, 2008. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Pages: 127-145,
- King C, Rappaport LD. Emergency Endotracheal Intubation. In King C. Henretig FM. (Eds.), *Textbook of Pediatric Emergency Procedures*, 2nd Edition, 2008. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Pages: 146-190.
- King BR, Hagberg CA. Management of the difficult airway. In King C. Henretig FM. (Eds.), *Textbook of Pediatric Emergency Procedures*, 2nd Edition, 2008. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Pages: 191-236.
- Fujii, Vinci RJ. Neonatal resuscitation procedures. In King C. Henretig FM. (Eds.), *Textbook of Pediatric Emergency Procedures*, 2nd Edition, 2008. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Pages: 469-477.
- Gomella TL, Cunningham MD, Eyal FG. Neonatology: Management, Procedures, On-Call Problems, Diseases, and Drugs. 6th Edition. 2009. McGraw Hill Lange. Pages: 15-22
- Gomella TL, Cunningham MD, Eyal FG. Neonatology: Management, Procedures, On-Call Problems, Diseases, and Drugs. 6th Edition. 2009. McGraw Hill Lange. Pages: 217-218.
- Gomella TL, Cunningham MD, Eyal FG. Neonatology: Management, Procedures, On-Call Problems, Diseases, and Drugs. 6th Edition. 2009. McGraw Hill Lange. Pages: 270-273.
- Ludwig S, Lavelle JM. Resuscitation-pediatric basic and advanced life support. In Fleisher GR, Ludwig S (Eds.), *Textbook of Pediatric Emergency Medicine*, 6th Edition. 2010. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Chapter 1.
- Aronson PL, Alessandrini EA. Neonatal resuscitation. In Fleisher GR, Ludwig S (Eds.), *Textbook of Pediatric Emergency Medicine*, 6th Edition. 2010. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Chapter 2.
- Rennie JM. Neonatal resuscitation. In Donn, SM, Sinha SK. (Eds.), *Manual of Neonatal Respiratory Care*, 3rd Edition. 2012. Springer. Pages: 121-128.
- Wiseman K, Donn SM. Laryngoscopy and endotracheal intubation. In Donn, SM, Sinha SK. (Eds.), *Manual of Neonatal Respiratory Care*, 3rd Edition. 2012. Springer. Pages: 129-136.
- American Academy of Pediatrics, American Heart Association. Neonatal Resuscitation Textbook, 6th Edition. 2011.
-

Table Heading Descriptions

Citation:	<i>Study reference.</i>
Sample Size and Description:	<i>Number of subjects trained and/or assessed. Who was trained and/or assessed?</i>
Study Methods:	<i>Randomized control trial, case control, observational, etc.</i>
Assessment Mechanism(s):	<i>What model was used for assessment? Conditions/context of assessment; live, simulation, written?</i>

Assessment Instrument(s): *Describe instrument; Checklist vs. global rating scale, etc.*

Assessment Domain(s): *Cognitive, Psychomotor, Affective,*

Training Method(s): *Live animal; Clinical setting; Mannequin/simulation; Computer-based, Cadaver (human, animal); Self-study (written, video).*

Citation	Sample Size & Description	Study Methods	Assessment Mechanism(s)	Assessment Instrument(s)	Assessment Domain(s)	Training Method
[1]Adams	- 132 intubations - EM and peds PGY2s or 3s (trained in kitten lab, NICU and PICU rotations) - Respiratory care practitioners (RCPs) (trained on mannequins, OR, 3.5yrs avg job experience) - All got NRP and PALS training	-Prospective, observational of prehospital intubations on pediatric transport team	- Live	- Number of attempts to pass ETT through oropharynx	-PM	- Varied – not controlled - Authors concluded number of attempts might be more important than method of training.
[2]Airman	- 231 intubations - Respiratory therapists and nurses in NICU	-Prospective (?) vs. chart/records review	-Live	-Number of attempts	-PM	-All used same methods – NRP, cats
[3]Benfield	-Newly dead infants in NICU -50 residents and 21 respiratory therapists -180 total intubations	-Retrospective questionnaire -Self-report	-Cadaver	-Self-report, no assessment of skill	-Affective	-Newly dead infant used as training method
[4]Bismilla	-50 intubations in NICU or L&D -25 residents -13 fellows -12 respiratory therapists	-Prospective observational	-Live	-Global rating scale and 13 item checklist -Primary outcome – success -Secondary –	-PM -Cognitive	Residents/fellows – NRF and clinical training -RTs – experience, didactics, clinical practice -Did not meet NRP standards

				duration and # of attempts, checklist and GRS scores		
[5]Calderwood	-Medical students -Anesthetized cats			-Success	-PM	
[6]Falck	-449 intubation attempts -Pediatric residents	-Prospective, observational	-Live intubations in NICU or L&D	-5 point scale – 4=1 try, 3=2 attempts, 2= 3 attempts, 1=4 attempts, 0= no success, competency = 3 or 4 on 80% or more of attempts	-PM -Affective (confidence assessed with retrospective self-report)	-NRP, intubation (animal) lab
[7]Forbes	-27 anesthesia faculty, fellows and residents	-Assessment of model for teaching fiber optic intubation – realism and effectiveness	-Pig -Mannequin	-Secretions -Anatomy -Appearance Technique	-	
[8]Hall	-36 paramedic students -540 test intubations (15 each)	-Prospective, RCT	-Tested on human in OR	-Time to intubation -Number of attempts -Complications	-PM	-HPS (10 hours) vs. human (15 live) in OR after didactics
[9]Baker		-Chart review of EMS runs		-Procedure success -Mortality	-Outcome	-PALS trained vs. not PALS trained EMS
[10]Duran	-42 pediatric residents – 3 groups based on length of time since NRP training	-Prospective, not randomized	-Written -Neonatal sim	-Time to intubation <20sec = success -# of attempts -Written test (>85%)	-Cognitive -PM	-NRP
[11] Powell	-Peds and EM residents, vet techs, med					-Ferrets used as part of PALS training – evaluated trauma to

	students, CRNAs					ferret by # of intubations
[12] Thompson	-10 FP residents - 1st years intubated ketamine anesthetized kittens			-Residents rated usefulness of content 8.1 and style 8.5 (on 0-9 scale)		-30 minute didactic -90minutes hands-on time
[13] Gaushe-Hill	-Paramedics and paramedics in training			-Pre- and post-self efficacy questionnaire -Written evaluation of course -Follow up self efficacy and skill performance (retention study)		-6 hour Pediatric Airway Management Course
[14]Henderson	-Paramedics					-None -Self-instruction -Video -Lecture-demo -No discussion of models or assessment methods
[15]Jennings						-Describes kitten model -No objective evaluation of model
[16]Kircher						-Looks at trauma to model (ferret) not efficacy of training
[17]Kisling	->100 doctors, RTs, nurses			-Valuable learning experience		-Description of kitten model
[18]Youngquist	Convenience sampling 245 paramedics	Convenience sample with controls	-Questionnaire -Mannequin	-Self-efficacy questionnaire -List of skill components	-Self-efficacy -Psychomotor skills	-No training -Video presentation -Self-directed learning -Instructor-facilitated lecture and demonstration

[19]Terndrup	36 paramedics	RCT	Live, cat	Checklist	-Cognitive -PM skills	Didactic training
[20]Sukys		Prospective, observational, cross-section		Checklist		
[21]Sudikoff	16 PGY II Pediatric Residents	Randomized Crossover	Simulation	-Global competency score -Critical action checklists, -Harmful actions lists, - Behaviorally Anchored Rating Scale.	PM skills	Simulation enhanced session on pediatric airway management and teamwork
[22]Stewart	146 paramedics	RCT	-Simulation -Live	-Checklist -Multiple- choice exam -Oral exam	-Cognitive -PM skills	Didactic presentation vs. didactic w/sim vs. didactic w/ sim and live
[23]Petrack	-9PEM faculty -4 PEM fellows		Written	Questionnaire	Cognitive	PALS course
[24]Overly	16 pediatric residents	Prospective Observational	Simulation	Checklist	PM skills	
[25]O'Donnell	122 video recording of delivery room resuscitations, residents, fellows, consultants	Retrospective Review	Live	Checklist	PM skills	
[26]Nishisaki	Pediatric or EM resident in PICU	Prospective	Live	Checklist	PM skills	20-min multidisciplinary session and 10-min resident skill refresher

[27]Mazzi	PGY 1 HO		-Simulator -Live kitten			Lecture practice on simulation or kittens
[28]Leone	Pediatric Residents		Observation: success and # of attempts	Live	PM skills	
[29]Lane		Retrospective	Video time to completion of task			
[30]Kendirli	16 Pediatric Residents	Prospective	Live	Success and # of attempts	PM Skills	PALS course

Complete Reference List: Pediatric and Neonatal Intubation Training

1. Characterization of tracheal intubation process of care and safety outcomes in a tertiary pediatric intensive care unit. *Pediatr Crit Care Med*. 2012;13(1):e5-10.
2. Addressing airway issues: How to keep ETI a prehospital skill. *JEMS*. 2011;36(7):82.
3. Neonatal intubation: Success of pediatric trainees. *Obstet Gynecol Surv*. 2005;60(11):716-717.
4. Resource guide. airway management. *Emerg Med Serv*. 2001;30(1):80-81.
5. AARC (american association for respiratory care) clinical practice guideline. management of airway emergencies. *Respir Care*. 1995;40(7):749-760.
6. Teaching intubation skills using newly deceased infants. *JAMA*. 1991;266(12):1649-1651.
7. Adams K, Scott R, Perkin RM, Langga L. Comparison of intubation skills between interfacility transport team members. *Pediatr Emerg Care*. 2000;16(1):5-8.
8. Ahmed M, Pai B, Reynolds T. Retention of knowledge of the paediatric life support guidelines. *Jcpsp - Journal of the College of Physicians and Surgeons Pakistan*. 2012;22(3):194-195.
9. Akierman A, Daya K, McPhail K, Singhal N, Steinke C, Thomson B. A comparison of three neonatal intubation training programs in calgary. *CAN J RESPIR THER*. 2002;38(3):31-35.
10. Albrecht E, Yersin B, Spahn DR, Fishman D, Hugli O. Success rate of airway management by residents in a pre-hospital emergency setting: A retrospective study. *Eur J Trauma*. 2006;32(6):516-522.
11. Al-Eissa M, Chu S, Lynch T, et al. Self-reported experience and competence in core procedures among canadian pediatric emergency medicine fellowship trainees. *Canadian Journal of Emergency Medicine*. 2008;10(6):533-538.
12. Amathieu R, Sudrial J, Abdi W, et al. Simulating face-to-face tracheal intubation of a trapped patient: A randomized comparison of the LMA Fastrach[®], the GlideScope[®], and the Airtraq[®]; laryngoscope. *Br J Anaesth*. 2012;108(1):140-145.
13. Ander DS, Hanson A, Pitts S. Assessing resident skills in the use of rescue airway devices. *Ann Emerg Med*. 2004;44(4):314-319.
14. Anderson JM, Warren JB. Using simulation to enhance the acquisition and retention of clinical skills in neonatology. *Semin Perinatol*. 2011;35(2):59-67.
15. Andresen M, Riquelme A, Hasbun P, Diaz C, Montana R, Regueira T. Evaluation of competencies for tracheal intubation among medical students. *Rev Med Chil*. 2011;139(2):165-170.
16. Annan E, Gueverra K, Mathew J, et al. Primary video laryngoscopy improves the first pass success of emergency endotracheal intubation performed by first year fellows. *Chest*. 2011;140(4).
17. Baker TW, King W, Soto W, Asher C, Stolfi A, Rowin ME. The efficacy of pediatric advanced life support training in emergency medical service providers. *Pediatr Emerg Care*. 2009;25(8):508-512.
18. Barsuk D, Ziv A, Lin G, et al. Using advanced simulation for recognition and correction of gaps in airway and breathing management skills in prehospital trauma care. *Anesthesia & Analgesia*. 2005;100(3):803-809.
19. Baskett PJF, Nolan JP, Handley A, Soar J, Biarent D, Richmond S. European resuscitation council guidelines for resuscitation 2005 - section 9. principles of training in resuscitation. *Resuscitation*. 2005;67:S181-S189.
20. Benfield DG, Flaksman RJ, Lin TH, Katak AD, Kokomoor FW, Vollman JH. Teaching intubation skills using newly deceased infants. *JAMA*. 1991;265(18):2360-2363.
21. Berci G, Katz R. Optical stylet: An aid to intubation and teaching. *Annals of Otolaryngology & Laryngology*. 1979;88(Pt 1):828-831.
22. Berg BW, Vincent DS, Murray WB, Boedeker BH. Videolaryngoscopy for intubation skills training of novice military airway managers. *Studies in Health Technology & Informatics*. 2009;142:34-36.
23. Bernhard M, Mohr S, Weigand MA, Martin E, Walther A. Developing the skill of endotracheal intubation: Implication for emergency medicine. *Acta Anaesthesiol Scand*. 2012;56(2):164-171.
24. Biban P. Performing and teaching nonelective tracheal intubation in pediatric intensive care: Finding the right balance between safety and training. *Pediatric Critical Care Medicine*. 2012;13(1):108-109.
25. Bickenbach J, Schalte G, Beckers S, Fries M, Derwall M, Rossaint R. The intuitive use of laryngeal airway tools by first year medical students. *BMC Emergency Medicine*. 2009;9:18.
26. Binstadt E, Donner S, Nelson J, Flottesmesch T, Hegarty C. Simulator training improves fiber-optic intubation proficiency among emergency medicine residents. *Acad Emerg Med*. 2008;15(11):1211-1214.
27. Birmingham PK, Horn B. An infant model to facilitate endotracheal tube fixation in the pediatric ICU patient. *Anesthesiology*. 1989;70(1):163-164.

28. Bishop MJ, Michalowski P, Hussey JD, Massey L, Lakshminarayan S. Recertification of respiratory therapists' intubation skills one year after initial training: An analysis of skill retention and retraining. *Respir Care*. 2001;46(3):234-237.
29. Bismilla Z, Finan E, McNamara PJ, LeBlanc V, Jefferies A, Whyte H. Failure of pediatric and neonatal trainees to meet canadian neonatal resuscitation program standards for neonatal intubation. *Journal of Perinatology*. 2010;30(3):182-187.
30. Boedeker BH, Hoffman S, Murray WB. Endotracheal intubation training using virtual images: Learning with the mobile telementoring intubating video laryngoscope. *Studies in Health Technology & Informatics*. 2007;125:49-54.
31. Boet S, Naik VN, Diemunsch PA. Virtual simulation training for fiberoptic intubation. *Canadian Journal of Anaesthesia*. 2009;56(1):87-88.
32. Bonow FP, Piva JP, Garcia PCR, Eckert GU. Assessment of intubation procedures at reference pediatric and neonatal intensive care units. *J Pediatr*. 2004;80(5):355-362.
33. Bottor LT. Beyond the basics. rapid sequence intubation in the neonate. *ADV NEONAT CARE*. 2009;9(3):111-119.
34. Boylan JF, Kavanagh BP. Emergency airway management: Competence versus expertise?. *Anesthesiology*. 2008;109(6):945-947.
35. Brattebo G, Wisborg T. Teaching intubation skills using newly deceased infants. *Jama-Journal of the American Medical Association*. 1991;266(12):1650-1650.
36. Brattebo G, Wisborg T, Solheim K, Oyen N. Public opinion on different approaches to teaching intubation techniques. *BMJ*. 1993;307(6914):1256-1257.
37. Breckwoldt J, Klemstein S, Brunne B, Schnitzer L, Arntz H-, Mochmann H-. Expertise in prehospital endotracheal intubation by emergency medicine physicians-comparing 'proficient performers' and 'experts'. *Resuscitation*. 2012;83(4):434-439.
38. Brett-Fleegler MB, Vinci RJ, Weiner DL, Harris SK, Shih M, Kleinman ME. A simulator-based tool that assesses pediatric resident resuscitation competency. *Pediatrics*. 2008;121(3):E597-E603.
39. Broster S, Cornwell L, Kaptoge S, Kesall W. Review of resuscitation training amongst consultants and middle grade paediatricians. *Resuscitation*. 2007;74(3):495-499.
40. Brownstein DR, Quan L, Orr R, Wentz KR, Copass MK. Paramedic intubation training in a pediatric operating room. *Am J Emerg Med*. 1992;10(5):418-420.
41. Bullock G, Kovacs G, Macdonald K, Story BA. Evaluating procedural skills competence: Inter-rater reliability of expert and non-expert observers. *Academic Medicine*. 1999;74(1):76-78.
42. Burton JH, Baumann MR, Maoz T, Bradshaw JR, Lebrun JE. Endotracheal intubation in a rural EMS state: Procedure utilization and impact of skills maintenance guidelines. *Prehospital Emergency Care*. 2003;7(3):352-356.
43. Busch I, Claes D, Thomsin S, et al. Effectiveness of intubating laryngeal mask airway (ILMA fastrach) used by nurses during out of hospital cardiac arrest resuscitation. *Acta Anaesthesiol Belg*. 2009;60(4):235-238.
44. Bushra JS, McNeil B, Wald DA, Schwell A, Karras DJ. A comparison of trauma intubations managed by anesthesiologists and emergency physicians. *Acad Emerg Med*. 2004;11(1):66-70.
45. Buss PW, McCabe M, Evans RJ, Davies A, Jenkins H. A survey of basic resuscitation knowledge among resident paediatricians. *Arch Dis Child*. 1993;68(1):75-78.
46. Butler JM, Clancy M, Robinson N, Driscoll P. An observational survey of emergency department rapid sequence intubation. *Emergency Medicine Journal*. 2001;18(5):343-348.
47. Calkins MD, Robinson TD. Combat trauma airway management: Endotracheal intubation versus laryngeal mask airway versus combitube use by navy SEAL and reconnaissance combat corpsmen. *Journal of Trauma-Injury Infection and Critical Care*. 1999;46(5):927-932.
48. Campbell DM, Barozzino T, Farrugia M, Sgro M. High-fidelity simulation in neonatal resuscitation. *Paediatrics & Child Health*. 2009;14(1):19-23.
49. Carbine DN, Finer NN, Knodel E, Rich W. Video recording as a means of evaluating neonatal resuscitation performance. *Pediatrics*. 2000;106(4):654-658.
50. Casey ZC, Smally AJ, Grant RJ, McQuay J. Trauma intubations: Can a protocol-driven approach be successful?. *Journal of Trauma-Injury Infection & Critical Care*. 2007;63(4):955-960.
51. Cates LA. Simulation training: A multidisciplinary approach. *Advances in neonatal care : official journal of the National Association of Neonatal Nurses*. 2011;11(2):95-100.
52. Chamberlain DA, Hazinski MF, European Resuscitation Council, et al. Education in resuscitation. *Resuscitation*. 2003;59(1):11-43.

53. Chen EH, Cho CS, Shofer FS, Mills AM, Baren JM. Resident exposure to critical patients in a pediatric emergency department. *Pediatr Emerg Care*. 2007;23(11):774-778.
54. Chen PT, Cheng HW, Yen CR, et al. Instructor-based real-time multimedia medical simulation to update concepts of difficult airway management for experienced airway practitioners. *Journal of the Chinese Medical Association: JCMA*. 2008;71(4):174-179.
55. Cheng A, Duff J, Grant E, Kissoon N, Grant VJ. Simulation in paediatrics: An educational revolution. *Paediatrics & Child Health*. 2007;12(6):465-468.
56. Cheng A, Goldman RD, Abu Aish M, Kissoon N. A simulation-based acute care curriculum for pediatric emergency medicine fellowship training programs. *Pediatr Emerg Care*. 2010;26(7):475-480.
57. Cheng A, Hunt EA, Donoghue A, et al. EXPRESS-examining pediatric resuscitation education using simulation and scripting the birth of an international pediatric simulation research collaborative-from concept to reality. *Simulation in Healthcare*. 2011;6(1):34-41.
58. Cheung W, Fugaccia E, Milliss D, Thanakrishnan G. Operator anaesthesiology training and complications after endotracheal intubation in the intensive care unit: A 3-year, prospective, observational study. *Critical Care & Resuscitation*. 2009;11(1):20-27.
59. Choi HJ, Je SM, Kim JH, Kim E. The factors associated with successful paediatric endotracheal intubation on the first attempt in emergency departments: A 13-emergency-department registry study. *Resuscitation*. 2012.
60. Clark RK, Trethewy CE. Assessment of cricoid pressure application by emergency department staff. *Emergency Medicine Australasia*. 2005;17(4):376-381.
61. Coe PA, King TA, Towey RM. Teaching guided fiberoptic nasotracheal intubation. an assessment of an anaesthetic technique to aid training. *Anaesthesia*. 1988;43(5):410-413.
62. Cooke JM, Larsen J, Hamstra SJ, Andreatta PB. Simulation enhances resident confidence in critical care and procedural skills. *Fam Med*. 2008;40(3):165-167.
63. Cosgrove JF, Gascoigne AD. Inadequate assessment of the airway and ventilation in acute poisoning. A need for improved education?. *Resuscitation*. 1999;40(3):161-164.
64. Crabtree NA, Chandra DB, Weiss ID, Joo HS, Naik VN. Fiberoptic airway training: Correlation of simulator performance and clinical skill. *Canadian Journal of Anaesthesia*. 2008;55(2):100-104.
65. Curran VR, Aziz K, O'Young S, Bessell C. Evaluation of the effect of a computerized training simulator (ANAKIN) on the retention of neonatal resuscitation skills. *Teach Learn Med*. 2004;16(2):157-164.
66. da Silva PS, de Aguiar VE, Neto HM, de Carvalho WB. Unplanned extubation in a paediatric intensive care unit: Impact of a quality improvement programme. *Anaesthesia*. 2008;63(11):1209-1216.
67. Dalal PG, Dalal GB, Pott L, Bezinover D, Prozesky J, Murray WB. Learning curves of novice anesthesiology residents performing simulated fiberoptic upper airway endoscopy. *Canadian Journal of Anesthesia-Journal Canadien D Anesthesie*. 2011;58(9):802-809.
68. Darling JR, Keohane M, Murray JM. A split laryngeal mask as an aid to training in fiberoptic tracheal intubation. A comparison with the berman II intubating airway. *Anaesthesia*. 1993;48(12):1079-1082.
69. Davis DP, Fisher R, Buono C, et al. Predictors of intubation success and therapeutic value of paramedic airway management in a large, urban EMS system. *Prehospital Emergency Care*. 2006;10(3):356-362.
70. Dawson AJ, Marsland C, Baker P, Anderson BJ. Fiberoptic intubation skills among anaesthetists in new zealand. *Anaesthesia & Intensive Care*. 2005;33(6):777-783.
71. de Oliveira GR. The construction of learning curves for basic skills in anesthetic procedures: An application for the cumulative sum method. *Anesth Analg*. 2002;95(2):411-416.
72. DeGarmo N, Rodriguez N, Amer M, Wang EE. Simulation in neonatal resuscitation. *Dm Disease-A-Month*. 2011;57(12):775-779.
73. Denver Metro Airway Study G. A prospective multicenter evaluation of prehospital airway management performance in a large metropolitan region. *Prehospital Emergency Care*. 2009;13(3):304-310.
74. Dibble C, Maloba M. Best evidence topic report. rapid sequence induction in the emergency department by emergency medicine personnel. *Emergency Medicine Journal*. 2006;23(1):62-64.
75. Donald CB. Training and competency in rapid sequence intubation: The perspective from a scottish teaching hospital emergency department. *Emergency Medicine Journal*. 2011;28(9):775-777.
77. Donoghue A, Nishisaki A, Ades A, Nadkarni V. Errors in pediatric tracheal intubation technique: A simulation-based needs assessment. *Crit Care Med*. 2009;37(12):A278.
78. Donoghue A, Nishisaki A, Sutton R, Hales R, Boulet J. Reliability and validity of a scoring instrument for clinical performance during pediatric advanced life support simulation scenarios. *Resuscitation*. 2010;81(3):331-336.

79. Doran JV, Tortella BJ, Drivet WJ, Lavery RF. Factors influencing successful intubation in the prehospital setting. *Prehospital & Disaster Medicine*. 1995;10(4):259-264.
80. Downes KJ, Narendran V, Meinzen-Derr J, McClanahan S, Akinbi HT. The lost art of intubation: Assessing opportunities for residents to perform neonatal intubation. *Journal of Perinatology*. 2012.
81. Drigalla D, Brown J, Bollinger R, Rush C, Kjar D, Stallard T. Successful endotracheal intubation by experienced emergency physicians using direct and glidescope(registered trademark) laryngoscopes. *Ann Emerg Med*. 2009;54(3):S138.
82. Duran R, Aladag N, Vatansever U, Kucukugurluoglu Y, Sut N, Acunas B. Proficiency and knowledge gained and retained by pediatric residents after neonatal resuscitation course. *Pediatrics International*. 2008;50(5):644-647.
83. Durojaiye L, O'Meara M. Improvement in resuscitation knowledge after a one-day paediatric life-support course. *J Paediatr Child Health*. 2002;38(3):241-245.
84. Dykes MH, Ovassapian A. Dissemination of fiberoptic airway endoscopy skills by means of a workshop utilizing models. *Br J Anaesth*. 1989;63(5):595-597.
85. Eich C, Roessler M, Nemeth M, Russo SG, Heuer JF, Timmermann A. Characteristics and outcome of prehospital paediatric tracheal intubation attended by anaesthesia-trained emergency physicians. *Resuscitation*. 2009;80(12):1371-1377.
86. Eppich WJ, Adler MD, McGaghie WC. Emergency and critical care pediatrics: Use of medical simulation for training in acute pediatric emergencies. *Curr Opin Pediatr*. 2006;18(3):266-271.
87. Erb T, Hampl KF, Schurch M, Kern CG, Marsch SCU. Teaching the use of fiberoptic intubation in anesthetized, spontaneously breathing patients. *Anesth Analg*. 1999;89(5):1292-1295.
88. Erb T, Marsch SC, Hampl KF, Frei FJ. Teaching the use of fiberoptic intubation for children older than two years of age. *Anesthesia & Analgesia*. 1997;85(5):1037-1041.
89. Falck AJ, Escobedo MB, Baillargeon JG, Villard LG, Gunkel JH. Proficiency of pediatric residents in performing neonatal endotracheal intubation. *Pediatrics*. 2003;112(6 Pt 1):1242-1247.
90. Fernandes CM. Practice of procedures on the newly dead. *Ann Emerg Med*. 1995;26(1):106-107.
91. Fiedor ML. Pediatric simulation: A valuable tool for pediatric medical education. *Crit Care Med*. 2004;32(2):S72-S74.
92. Fitton N, Chandan GS. Basic airway management by junior doctors. *Anaesthesia*. 2006;61(12):1221-1222.
93. Fonte M, Oulego-Eroz I, Nadkarni L, Sanchez-Santos L, Iglesias-Vasquez A, Rodriguez-Nunez A. A randomized comparison of the GlideScope videolaryngoscope to the standard laryngoscopy for intubation by pediatric residents in simulated easy and difficult infant airway scenarios. *Pediatr Emerg Care*. 2011;27(5):398-402.
94. Frascone RJ, Russi C, Lick C, et al. Comparison of prehospital insertion success rates and time to insertion between standard endotracheal intubation and a supraglottic airway. *Resuscitation*. 2011;82(12):1529-1536.
95. Frei FJ, aWengen DF, Rutishauser M, Ummenhofer W. The airway endoscopy mask: Useful device for fiberoptic evaluation and intubation of the paediatric airway. *Paediatr Anaesth*. 1995;5(5):319-324.
96. Frei FJ, Ummenhofer W. A special mask for teaching fiberoptic intubation in pediatric-patients. *Anesth Analg*. 1993;76(2):458-458.
97. Friedman L, Vilke GM, Chan TC, et al. Emergency department airway management before and after an emergency medicine residency. *J Emerg Med*. 1999;17(3):427-431.
98. Friedman SM, Sowerby RJ, Guo R, Bandiera G. Perceptions of emergency medicine residents and fellows regarding competence, adverse events and reporting to supervisors: A national survey. *Canadian Journal of Emergency Medicine*. 2010;12(6):491-499.
99. From RP, Pearson KS, Albanese MA, Moyers JR, Sigurdsson SS, Dull DL. Assessment of an interactive learning-system with sensorized mannequin head for airway management instruction. *Anesth Analg*. 1994;79(1):136-142.
100. Gaies MG, Landrigan CP, Hafler JP, Sandora TJ. Assessing procedural skills training in pediatric residency programs. *Pediatrics*. 2007;120(4):715-722.
101. Gaiser RR. Teaching airway management skills. how and what to learn and teach. *Crit Care Clin*. 2000;16(3):515-525.
102. Gaiser RR, McGonigal ET, Litts P, Cheek TG, Gutsche BB. Obstetricians' ability to assess the airway. *Obstetrics & Gynecology*. 1999;93(5 Pt 1):648-652.
103. Gaszynski T, Ratajczyk P, Machala W, Gaszynski W. Evaluation of videolaryngoscope and optical laryngoscope for simulated difficult intubation. *Anest Intens Ter*. 2007;39(4):172-174.

104. Gausche M. Education of prehospital providers in pediatrics. national task force studies EMS pediatric care. *Journal of Emergency Medical Services*. 1998;23(3):74-76.
105. Gerard JM, Scalzo AJ, Laffey SP, Sinks G, Fendya D, Seratti P. Evaluation of a novel web-based pediatric advanced life support course. *Arch Pediatr Adolesc Med*. 2006;160(6):649-655.
106. Germann CA, Baumann MR, Kendall KM, Strout TD, McGraw K. Performance of endotracheal intubation and rescue techniques by emergency services personnel in an air medical service. *Prehospital Emergency Care*. 2009;13(1):44-49.
107. Gibbison B. Airway management skills for novices: Is there a role for tracheal intubation?. *Anaesthesia*. 2007;62(7):747-748.
108. Ginifer C, Kelly AM. Teaching resuscitation skills using the newly deceased. *Med J Aust*. 1996;165(8):445-447.
109. Goldmann K, Ferson DZ. Education and training in airway management. *Best Practice & Research. Clinical Anaesthesiology*. 2005;19(4):717-732.
110. Goldmann K, Steinfeldt T. Acquisition of basic fiberoptic intubation skills with a virtual reality airway simulator. *J Clin Anesth*. 2006;18(3):173-178.
111. Graber MA, Wyatt C, Kasperek L, Xu Y. Does simulator training for medical students change patient opinions and attitudes toward medical student procedures in the emergency department?. *Acad Emerg Med*. 2005;12(7):635-639.
112. Grant EC, Marczynski CA, Menon K. Using pediatric advanced life support in pediatric residency training: Does the curriculum need resuscitation? *Pediatric Critical Care Medicine*. 2007;8(5):433-439.
113. Green L. Can't intubate, can't ventilate! A survey of knowledge and skills in a large teaching hospital. *Eur J Anaesthesiol*. 2009;26(6):480-483.
114. Guilfoyle FJ, Milner R, Kissoon N. Resuscitation interventions in a tertiary level pediatric emergency department: Implications for maintenance of skills. *Canadian Journal of Emergency Medicine*. 2011;13(2):90-95.
115. Halamek LP, Kaegi DM, Gaba DM, et al. Time for a new paradigm in pediatric medical education: Teaching neonatal resuscitation in a simulated delivery room environment. *Pediatrics*. 2000;106(4):art. no.-e45.
116. Hall RE, Plant JR, Bands CJ, Wall AR, Kang J, Hall CA. Human patient simulation is effective for teaching paramedic students endotracheal intubation. *Acad Emerg Med*. 2005;12(9):850-855.
117. Han JS, Shon YD, Lee WW. Assessing individual proficiency in orotracheal intubation using cumulative sum analysis (CUSUM). *Resuscitation*. 2011;82:S10-S11.
118. Hanham TM, McDonald PF. Survey of pediatric continuing professional development undertaken by consultant anesthetists. *Pediatric Anesthesia*. 2009;19(4):385-389.
119. Harris T, Lockey D. Success in physician prehospital rapid sequence intubation: What is the effect of base speciality and length of anaesthetic training?. *Emergency Medicine Journal*. 2011;28(3):225-229.
120. Harrison MJ. Tracking the early acquisition of skills by trainees. *Anaesthesia*. 2001;56(10):995-998.
121. Harrison TH, Thomas SH, Wedel SK. Success rates of pediatric intubation by a non-physician-staffed critical care transport service. *Pediatr Emerg Care*. 2004;20(2):101-107.
122. Hartley M, Morris S, Vaughan RS. Teaching fiberoptic intubation. effect of alfentanil on the haemodynamic response. *Anaesthesia*. 1994;49(4):335-337.
123. Hatton KW, Price S, Craig L, Grider JS. Educating anesthesiology residents to perform percutaneous cricothyrotomy, retrograde intubation, and fiberoptic bronchoscopy using preserved cadavers. *Anesth Analg*. 2006;103(5):1205-1208.
124. Hawkes CP, Hanotin S, O'Flaherty B, Woodworth S, Ryan CA, Dempsey EM. Using smart phone technology to teach neonatal endotracheal intubation (NeoTube): Application development and uptake. *Acta Paediatrica*. 2012;101(3):e134-6.
125. Hayden SR, Panacek EA. Procedural competency in emergency medicine: The current range of resident experience. *Acad Emerg Med*. 1999;6(7):728-735.
126. Heard CM, Gunnarsson B, Fletcher JE. Teaching fiberoptic intubation in the pediatric patient. *Anesthesia & Analgesia*. 2000;91(4):1044.
128. Heber AJ. A training model for endotracheal intubation in infants. *Anaesthesia*. 1968;23(2):280-&.
129. Heidegger T, Gerig HJ, Ulrich B, Schnider TW. Structure and process quality illustrated by fiberoptic intubation: Analysis of 1612 cases. *Anaesthesia*. 2003;58(8):734-739.
130. Hein C, Owen H, Plummer J. A training program for novice paramedics provides initial laryngeal mask airway insertion skill and improves skill retention at 6 months. *Simulation in Healthcare: The Journal of The Society for Medical Simulation*. 2010;5(1):33-39.

131. Herbstreit F, Fassbender P, Haberl H, Kehren C, Peters J. Learning endotracheal intubation using a novel videolaryngoscope improves intubation skills of medical students. *Anesthesia & Analgesia*. 2011;113(3):586-590.
132. Hodzovic I, Janakiraman C, Sudhir G, Goodwin N, Wilkes AR, Latto IP. Fiberoptic intubation through the laryngeal mask airway: Effect of operator experience*. *Anaesthesia*. 2009;64(10):1066-1071.
133. Hohlrieder M, Brimacombe J, von Goedecke A, Keller C. Guided insertion of the ProSeal laryngeal mask airway is superior to conventional tracheal intubation by first-month anesthesia residents after brief manikin-only training. *Anesthesia & Analgesia*. 2006;103(2):458-462.
134. Howard-Quijano KJ, Huang YM, Matevosian R, Kaplan MB, Steadman RH. Video-assisted instruction improves the success rate for tracheal intubation by novices. *Br J Anaesth*. 2008;101(4):568-572.
135. Hubble MW, Brown L, Wilfong DA, Hertelendy A, Benner RW, Richards ME. A meta-analysis of prehospital airway control techniques part I: Orotracheal and nasotracheal intubation success rates. *Prehospital Emergency Care*. 2010;14(3):377-401.
136. Hudson TS. Is it ethical to practice intubations on the deceased? *JONA's Healthcare Law, Ethics, & Regulation*. 2000;2(1):22-28.
137. Huter L, Schwarzkopf K, Rodiger J, Preussler NP, Schreiber T. Students insert the laryngeal tube quicker and more often successful than the esophageal-tracheal combitube in a manikin. *Resuscitation*. 2009;80(8):930-934.
138. Hwang J, Han S, Hwang J, Oh A, Park S, Kim J. The Mclvor blade improves insertion of the LMA ProSeal™ in children. *Canadian Journal of Anaesthesia*. 2011;58(9):796-801.
139. Iacovidou N, Bassiakou E, Stroumpoulis K, et al. Conventional direct laryngoscopy versus videolaryngoscopy with the GlideScope[REGISTERED]: A neonatal manikin study with inexperienced intubators. *Am J Perinatol*. 2011;28(3):201-206.
140. Jennings PB, Alden ER, Brenz RW. Teaching model for pediatric intubation utilizing ketamine-sedated kittens. *Pediatrics*. 1974;53(2):283-&.
141. Jensen JL, Cheung KW, Tallon JM, Travers AH. Comparison of tracheal intubation and alternative airway techniques performed in the prehospital setting by paramedics: A systematic review. *CJEM Canadian Journal of Emergency Medical Care*. 2010;12(2):135-140.
142. Jewkes F, Phillips B. Resuscitation training of paediatricians. *Arch Dis Child*. 2003;88(2):118-121.
143. Johnson C, Roberts JT. Clinical competence in the performance of fiberoptic laryngoscopy and endotracheal intubation: A study of resident instruction. *J Clin Anesth*. 1989;1(5):344-9.
144. Jokela J, Nurmi J, Genzwuerker HV, Castren M. Laryngeal tube and intubating laryngeal mask insertion in a manikin by first-responder trainees after a short video-clip demonstration. *Prehospital & Disaster Medicine*. 2009;24(1):63-66.
145. Jones JH, Weaver CS, Rusyniak DE, Brizendine EJ, McGrath RB. Impact of emergency medicine faculty and an airway protocol on airway management. *Acad Emerg Med*. 2002;9(12):1452-1456.
146. Kaplan MB, Ward DS, Berci G. A new video laryngoscope - an aid to intubation and teaching. *J Clin Anesth*. 2002;14(8):620-626.
147. Katz RL, Berci G. Optical stylet - new intubation technique for adults and children with specific reference to teaching. *Anesthesiology*. 1979;51(3):251-254.
148. Katzman GH. On teaching endotracheal intubation. *Pediatrics*. 1982;70(4):656.
149. Kaye K, Frascione RJ, Held T. Prehospital rapid-sequence intubation: A pilot training program. *Prehospital Emergency Care*. 2003;7(2):235-240.
150. Kendirli T, Caltik A, Duman M, et al. Effect of pediatric advanced life support course on pediatric residents' intubation success. *Pediatrics International*. 2011;53(1):94-99.
151. Kidner K, Laurence AS. Basic airway management by junior doctors: Assessment and training on human apnoeic subjects in the anaesthetic room. *Anaesthesia*. 2006;61(8):739-742.
152. Kim SJ, Choi SH, Lee SW, Hong YS, Cho H. The analysis of self and tutor assessment in the skill of basic life support (BLS) and endotracheal intubation: Focused on the discrepancy in assessment. *Resuscitation*. 2011;82(6):743-748.
153. King BR, Woodward GA. Procedural training for pediatric and neonatal transport nurses: Part 1 - training methods and airway training. *Pediatr Emerg Care*. 2001;17(6):461-464.
154. Kircher SS, Murray LE, Juliano ML. Minimizing trauma to the upper airway: A ferret model of neonatal intubation. *Journal of the American Association for Laboratory Animal Science*. 2009;48(6):780-784.
155. Kisling JA, Schreiner RL. The kitten as a teaching model for intubation of the human neonate. *Respir Care*. 1976;21(12):1243-1246.

156. Kiyani S, Yanturali S, Musal B, Gursel Y, Aksay E, Turkcuier I. Determination of advanced life support knowledge level of residents in a Turkish university hospital. *J Emerg Med.* 2008;35(2):213-222.
157. Knudson MM, Khaw L, Bullard MK, et al. Trauma training in simulation: Translating skills from SIM time to real time. *Journal of Trauma-Injury Infection and Critical Care.* 2008;64(2):255-263.
158. Kolata G. Hospitals use bodies of dead for practice. *New York Times.* 1994:A22.
159. Kory PD, Eisen LA, Adachi M, Ribaud VA, Rosenthal ME, Mayo PH. Initial airway management skills of senior residents - simulation training compared with traditional training. *Chest.* 2007;132(6):1927-1931.
160. Laiou E, Clutton-Brock TH, Lilford RJ, Taylor CA. The effects of laryngeal mask airway passage simulation training on the acquisition of undergraduate clinical skills: A randomised controlled trial. *BMC Medical Education.* 2011;11:57.
161. Landwirth J. Ethical issues in pediatric and neonatal resuscitation. *Ann Emerg Med.* 1993;22(2 Part 2):502-507.
162. Lane B, Finer N, Rich W. Duration of intubation attempts during neonatal resuscitation. *J Pediatr.* 2004;145(1):67-70.
163. Lane BP, Rich W, Finer NN, Goodmar J. Neonatal intubation: Duration and success rates by training. *Pediatr Res.* 2003;53(4):376A-376A.
164. Lenclen R, Narcy P, Castela F, Huard F. Evaluation of an educational intervention on the standard of neonatal resuscitation: Orotracheal versus nasotracheal intubation. *Archives De Pediatrie.* 2009;16(4):337-342.
165. Leone TA, Rich W, Finer NN. Neonatal intubation: Success of pediatric trainees. *J Pediatr.* 2005;146(5):638-641.
166. Levitan RM, Rosenblatt B, Meiner EM, Reilly PM, Hollander JE. Alternating day emergency medicine and anesthesia resident responsibility for management of the trauma airway: A study of laryngoscopy performance and intubation success. *Ann Emerg Med.* 2004;43(1):48-53.
167. Lockyer J, Singhal N, Fidler H, Weiner G, Aziz K, Curran V. The development and testing of a performance checklist to assess neonatal resuscitation megacode skill. *Pediatrics.* 2006;118(6):E1739-E1744.
168. Losek JD, Bonadio WA, Walsh-Kelly C, Hennes H, Smith DS, Glaeser PW. Prehospital pediatric endotracheal intubation performance review. *Pediatr Emerg Care.* 1989;5(1):1-4.
169. Losek JD, Olson LR, Dobson JV, Glaeser PW. Tracheal intubation practice and maintaining skill competency: Survey of pediatric emergency department medical directors. *Pediatr Emerg Care.* 2008;24(5):294-299.
170. Lowe L, Sagehorn K, Madsen R. The effect of a rapid sequence induction protocol on intubation success rate in an air medical program. *Air Med J.* 1998;17(3):101-104.
171. Lum ME, Galletly DC. Resuscitation skills of first year postgraduate doctors. *N Z Med J.* 1989;102(873):406-408.
172. MacNab AJ, MacPhail I, MacNab MK, Noble R, O'Flaherty D. A comparison of intubation success for paediatric transport team paramedics using lighted vs regular tracheal tube stylets. *Paediatr Anaesth.* 1998;8(3):215-220.
173. Maharaj CH, Costello JF, Higgins BD, Harte BH, Laffey JG. Learning and performance of tracheal intubation by novice personnel: A comparison of the airtraq and macintosh laryngoscope. *Anaesthesia.* 2006;61(7):671-677.
174. Marsland CP, Robinson BJ, Chitty CH, Guy BJ. Acquisition and maintenance of endoscopic skills: Developing an endoscopic dexterity training system for anesthesiologists. *J Clin Anesth.* 2002;14(8):615-619.
175. Martin PD, Chambers WA. Teaching airway management on anaesthetised patients. *Scott Med J.* 1994;39(4):111-113.
176. Mayo PH, Hegde A, Eisen LA, Kory P, Doelken P. A program to improve the quality of emergency endotracheal intubation. *J Intensive Care Med.* 2011;26(1):50-56.
177. Mazzi E, Gutberlet R. Maryland state intensive-care neonatal program (msicnp) .1. education practicing neonatal endotracheal intubation. *Md State Med J.* 1977;26(10):86-87.
178. McBeth Turner N, Dierselhuis MP, Draaisma JMT, ten Cate OTJ. The effect of the advanced paediatric life support course on perceived self-efficacy and use of resuscitation skills. *Resuscitation.* 2007;73(3):430-436.
179. McNarry AF, Dovell T, Dancy FM, Peard ME. Perception of training needs and opportunities in advanced airway skills: A survey of British and Irish trainees. *Eur J Anaesthesiol.* 2007;24(6):498-504.

180. Mercurio MR. Teaching intubation with cadavers: Generosity at a time of loss. *Hastings Cent Rep.* 2009;39(4):7-8.
181. Mitchell MS, White ML, King WD, Wang HE. Paramedic king laryngeal tube airway insertion versus endotracheal intubation in simulated pediatric respiratory arrest. *Prehospital Emergency Care.* 2012;16(2):284-288.
182. Morris F, Tordoff SG, Wallis D, Skinner DV. Cardiopulmonary resuscitation skills of preregistration house officers: Five years on. *BMJ.* 1991;302(6777):626-627.
183. Mulcaster JT, Mills J, Hung OR, et al. Laryngoscopic intubation - learning and performance. *Anesthesiology.* 2003;98(1):23-27.
184. Naczka A. Endotracheal intubation skills of medical students [7]. *J R Soc Med.* 1993;86(10):619.
185. Nadel FM, Lavelle JM, Fein JA, Giardino AP, Decker JM, Durbin DR. Assessing pediatric senior residents' training in resuscitation: Fund of knowledge, technical skills, and perception of confidence. *Pediatr Emerg Care.* 2000;16(2):73-76.
186. Nadel FM, Lavelle JM, Fein JA, Giardino AP, Decker JM, Durbin DR. Teaching resuscitation to pediatric residents - the effects of an intervention. *Arch Pediatr Adolesc Med.* 2000;154(10):1049-1054.
187. Naik VN, Matsumoto ED, Houston PL, et al. Fiberoptic orotracheal intubation on anesthetized patients - do manipulation skills learned on a simple model transfer into the operating room? *Anesthesiology.* 2001;95(2):343-348.
188. Nakstad AR, Sandberg M. Airway management in simulated restricted access to a patient--can manikin-based studies provide relevant data?. *Scandinavian Journal of Trauma, Resuscitation & Emergency Medicine.* 2011;19:36.
189. Nishisaki A, Donoghue AJ, Colborn S, et al. Effect of just-in-time simulation training on tracheal intubation procedure safety in the pediatric intensive care unit. *Anesthesiology.* 2010;113(1):214-223.
190. Nishisaki A, Nadkarni VM, Berg RA. Pediatric advanced airway management training for non-anesthesia residents. *Yearbook of Intensive Care and Emergency Medicine 2009.* 2009:322-331.
191. Nishisaki A, Nguyen J, Colborn S, et al. Evaluation of multidisciplinary simulation training on clinical performance and team behavior during tracheal intubation procedures in a pediatric intensive care unit. *Pediatric Critical Care Medicine.* 2011;12(4):406-414.
192. Nishisaki A, Scratish L, Boulet J, et al. Effect of cervical spine immobilization technique on pediatric advanced airway management: A high-fidelity infant simulation model. *Pediatr Emerg Care.* 2008;24(11):749-756.
193. Nishisaki A. The missing link: Demonstration that multidisciplinary tracheal intubation simulation training improves patient safety and team behavior during real procedures in a pediatric intensive care unit. *Circulation.* 2009;120(18):S1454-S1454.
194. Nishiyama J, Kaneda T, Ito K, Ito M, Suzuki T. Training of tracheal intubation for emergency medical technicians - issues and measures implemented at a university hospital in result of five years. *Anesth Resusc.* 2010;46(2):35-37.
195. Noblett KE, Meibalane R. Respiratory care practitioners as primary providers of neonatal intubation in a community hospital: An analysis. *Respir Care.* 1995;40(10):1063-1067.
196. Noh Y, Segawa M, Shimomura A, et al. WKA-1R robot assisted quantitative assessment of airway management. *Int J Comput Assisted Radiol Surg.* 2008;3(6):543-550.
197. Nouruzi-Sedeh P, Schumann M, Groeben H. Success rate of orotracheal intubation via glidescope(registered trademark) versus direct laryngoscopy in manikin-only-trained medical personnel. *Anesthesiology.* 2009;111(2):447.
198. O'Donnell CPF, Kamlin COF, Davis PG, Morley CJ. Endotracheal intubation attempts during neonatal resuscitation: Success rates, duration, and adverse effects. *Pediatrics.* 2006;117(1):E16-E21.
199. O'Flaherty D, Adams AP. Endotracheal intubation skills of medical students. *J R Soc Med.* 1992;85(10):603-604.
200. Oglesby AJ, Graham CA, Beard D, McKeown DW. Paediatric intubation in scottish emergency departments. *Paediatr Anaesth.* 2003;13(7):589-595.
201. Olsen JC, Gurr DE, Hughes M. Video analysis of emergency medicine residents performing rapid-sequence intubations. *J Emerg Med.* 2000;18(4):469-472.
202. Overly FL, Sudikoff SN, Shapiro MJ. High-fidelity medical simulation as an assessment tool for pediatric residents' airway management skills. *Pediatr Emerg Care.* 2007;23(1):11-15.
203. Patel DA, Gowdar K, Gora P. One year's experience with a neonatal resuscitation training program. *PERINATOL NEONATOL.* 1983;7(3):67-69.

204. Paterson A. The case for the role of advanced simulators in trauma management training was not made. *Anesthesia & Analgesia*. 2005;101(5):1564-1565.
205. Pedroso A, de Magalhaes A. Performance analysis of venous puncture, and nasogastric and nasointestinal tube placement in a pediatric ward [portuguese]. *REV GAUCHA ENFERMAGEM*. 2008;29(1):18-25.
206. Pennant JH, Walker MB. Comparison of the endotracheal tube and laryngeal mask in airway management by paramedical personnel. *Anesthesia & Analgesia*. 1992;74(4):531-534.
207. Petrack EM, Hollinger I. Teaching rapid-sequence intubation to pediatric emergency physicians - a pilot course. *Resuscitation*. 1994;28(3):215-219.
208. Phelan MP, Glauser J, Yuen HW, Sturges-Smith E, Schrupp SE. Airway registry: A performance improvement surveillance project of emergency department airway management. *American Journal of Medical Quality*. 2010;25(5):346-350.
209. Platts-Mills TF, Campagne D, Chinnock B, Snowden B, Glickman LT, Hendey GW. A comparison of GlideScope video laryngoscopy versus direct laryngoscopy intubation in the emergency department. *Acad Emerg Med*. 2009;16(9):866-871.
210. Pointer JE. Clinical characteristics of paramedics' performance of pediatric endotracheal intubation. *Am J Emerg Med*. 1989;7(4):364-366.
211. Powell DA, Gonzales C, Gunnels RD. Use of the ferret as a model for pediatric endotracheal intubation training. *Lab Anim Sci*. 1991;41(1):86-89.
212. Quan L, Shugerman RP, Kunkel NC, Brownlee CJ. Evaluation of resuscitation skills in new residents before and after pediatric advanced life support course. *Pediatrics*. 2001;108(6):art. no.-e110.
213. Quigley P, Jeffrey P. Cricoid pressure: Assessment of performance and effect of training in emergency department staff. *Emergency Medicine Australasia*. 2007;19(3):218-222.
214. Rahman T, Chandran S, Kluger D, et al. Tracking manikin tracheal intubation using motion analysis. *Pediatr Emerg Care*. 2011;27(8):701-705.
215. Rai MR, Popat MT. Evaluation of airway equipment: Man or manikin? *Anaesthesia*. 2011;66(1):1-3.
216. Randolph AG. Learning airway management-skills - guidelines for pediatrics. *Arch Pediatr Adolesc Med*. 1994;148(2):227-228.
217. Reeder TJ, Brown CK, Norris DL. Managing the difficult airway: A survey of residency directors and a call for change. *J Emerg Med*. 2005;28(4):473-478.
218. Reich AJ. Good intubators do it more often. the frequency of training, more than total hours spent, seems to correlate with higher ETI success rates. *EMS magazine*. 2009;38(9):58-60.
219. Rodriguez-Nunez A, Oulego-Erroz I, Perez-Gay L, Cortinas-Diaz J. Comparison of the GlideScope videolaryngoscope to the standard macintosh for intubation by pediatric residents in simulated child airway scenarios. *Pediatr Emerg Care*. 2010;26(10):726-729.
220. Roppolo LP, White PF, Hatten B, Hynan LS, Pepe PE. Use of the TrachView videoscope as an adjunct to direct laryngoscopy for teaching orotracheal intubation. *Eur J Emerg Med*. 2012;19(3):196-199.
221. Rosenstock C, Hansen EG, Kristensen MS, Rasmussen LS, Skak C, Ostergaard D. Qualitative analysis of unanticipated difficult airway management. *Acta Anaesthesiol Scand*. 2006;50(3):290-297.
222. Rovamo L, Mattila M, Andersson S, Rosenberg P. Assessment of newborn resuscitation skills of physicians with a simulator manikin. *Archives of Disease in Childhood-Fetal and Neonatal Edition*. 2011;96(5):F383-F389.
223. Rowe R, Cohen RA. An evaluation of a virtual reality airway simulator. *Anesth Analg*. 2002;95(1):62-66.
224. Rubens AJ. Testing airway management skills: Interactive video courseware vs ACLS instructor. *Respir Care*. 1991;36(8):849-856.
225. Rubens AJ, Stoy W, Piane G. Using interactive videodisc to test advanced airway management skills. *Prehospital & Disaster Medicine*. 1995;10(4):251-258.
226. Ruetzler K, Roessler B, Potura L, et al. Performance and skill retention of intubation by paramedics using seven different airway devices--a manikin study. *Resuscitation*. 2011;82(5):593-597.
227. Russo SG, Eich C, Barwing J, et al. Self-reported changes in attitude and behavior after attending a simulation-aided airway management course. *J Clin Anesth*. 2007;19(7):517-522.
228. Sagarin MJ, Barton ED, Chng YM, Walls RM, National Emergency Airway Registry I. Airway management by US and canadian emergency medicine residents: A multicenter analysis of more than 6,000 endotracheal intubation attempts. *Ann Emerg Med*. 2005;46(4):328-336.
229. Sagarin MJ, Barton ED, Chng YM, Walls RM, NEAR Investigators. Airway management by US and canadian emergency medicine residents: A multicenter analysis of more than 6,000 endotracheal intubation attempts. *Ann Emerg Med*. 2005;46(4):328-336.

230. Sakles JC, Laurin EG, Rantapaa AA, Panacek EA. Airway management in the emergency department: A one-year study of 610 tracheal intubations. *Ann Emerg Med.* 1998;31(3):325-332.
231. Schalte G, Stoppe C, Aktas M, et al. Laypersons can successfully place supraglottic airways with 3 minutes of training. A comparison of four different devices in the manikin. *Scandinavian Journal of Trauma, Resuscitation & Emergency Medicine.* 2011;19:60.
232. Schuster M, Kotjan T, Fiege M, Goetz AE. Influence of resident training on anaesthesia induction times. *Br J Anaesth.* 2008;101(5):640-647.
233. Shegog Ruddell J. Endotracheal intubation skills of medical students [3]. *J R Soc Med.* 1993;86(3):182.
234. Shulman GB, Nordin NG, Connelly NR. Teaching with a video system improves the training period but not subsequent success of tracheal intubation with the bullard laryngoscope. *Anesthesiology.* 2003;98(3):615-620.
235. Siela D. Evaluation standards for management of artificial airways. *Crit Care Nurse.* 2010;30(4):76-78.
236. Silverman E, Dunkin BJ, Todd SR, et al. Nonsurgical airway management training for surgeons. *Journal of Surgical Education.* 2008;65(2):101-108.
237. Simpson GD, Ross MJ, McKeown DW, Ray DC. Tracheal intubation in the critically ill: A multi-centre national study of practice and complications. *Br J Anaesth.* 2012;108(5):792-799.
238. Singh J, Santosh S, Wyllie JP, Mellon A. Effects of a course in neonatal resuscitation--evaluation of an educational intervention on the standard of neonatal resuscitation. *Resuscitation.* 2006;68(3):385-389.
239. Smith JE, Jackson AP, Hurdley J, Clifton PJ. Learning curves for fiberoptic nasotracheal intubation when using the endoscopic video camera. *Anaesthesia.* 1997;52(2):101-106.
240. Smith R. To the rescue. special circumstances; special skills. *RT.* 2006;19(3):31.
241. Soar J, Monsieurs K, Ballance J, et al. European resuscitation council guidelines for resuscitation 2010 section 9. principles of education in resuscitation. *Notfall & Rettungsmedizin.* 2010;13(7):723-736.
242. Soleimanpour H, Gholipouri C, Panahi JR, et al. Role of anesthesiology curriculum in improving bag-mask ventilation and intubation success rates of emergency medicine residents: A prospective descriptive study. *BMC Emergency Medicine.* 2011;11:8.
243. Sosis MB, Shaner L. Teaching intubation skills using newly deceased infants. *Jama-Journal of the American Medical Association.* 1991;266(12):1650-1651.
244. Soundararajan P, Reddy NP, Lin TH. A dynamic physical model of the upper respiratory passage of the neonate for use in-training of endotracheal intubation. *Faseb Journal.* 1994;8(4):A572-A572.
245. Stephens CT, Kahntroff S, Dutton RP. The success of emergency endotracheal intubation in trauma patients: A 10-year experience at a major adult trauma referral center. *Anesthesia & Analgesia.* 2009;109(3):866-872.
246. Stevenson GW, Roth AG, Wheeler M, Hall SC. Use of the olympus LF-P fiberoptic laryngoscope by trainees in paediatric anaesthesia. *Anaesthesia.* 1996;51(2):201-202.
247. Stroumpoulis K, Isaia C, Bassiakou E, et al. A comparison of the i-gel and classic LMA insertion in manikins by experienced and novice physicians. *European Journal of Emergency Medicine.* 2012;19(1):24-27.
248. Stroumpoulis K, Xanthos T, Bassiakou E, et al. Macintosh and glidescope[REGISTERED] performance by advanced cardiac life support providers: A manikin study. *Minerva Anesthesiol.* 2011;77(1):11-16.
249. Sudikoff SN, Overly FL, Shapiro MJ. High-fidelity medical simulation as a technique to improve pediatric residents' emergency airway management and teamwork: A pilot study. *Pediatr Emerg Care.* 2009;25(10):651-656.
250. Sukys GA, Schvartsman C, Reis AG. Evaluation of rapid sequence intubation in the pediatric emergency department. *J Pediatr.* 2011;87(4):343-349.
251. Tachakra SS, Robinson SM, Mitchell M. Teaching intubation skills using newly deceased infants. *Jama-Journal of the American Medical Association.* 1991;266(12):1649-1650.
252. Tait C. On the differences between a child and a kitten. *Journal of Emergency Nursing.* 2010;36(1):78-80.
253. Tam RK, Maloney J, Gaboury I, et al. Review of endotracheal intubations by ottawa advanced care paramedics in canada. *Prehospital Emergency Care.* 2009;13(3):311-315.
254. Tansatit T, Apinuntrum P, Phetudom T. Snake scope camera assisted endotracheal intubation: A procedural skills training in cadaver to prepare preclinical students for their clerkships. *Journal of the Medical Association of Thailand.* 2012;95(2):205-211.
255. Tayal VS, Riggs RW, Marx JA, Tomaszewski CA, Schneider RE. Rapid-sequence intubation at an emergency medicine residency: Success rate and adverse events during a two-year period. *Acad Emerg Med.* 1999;6(1):31-37.

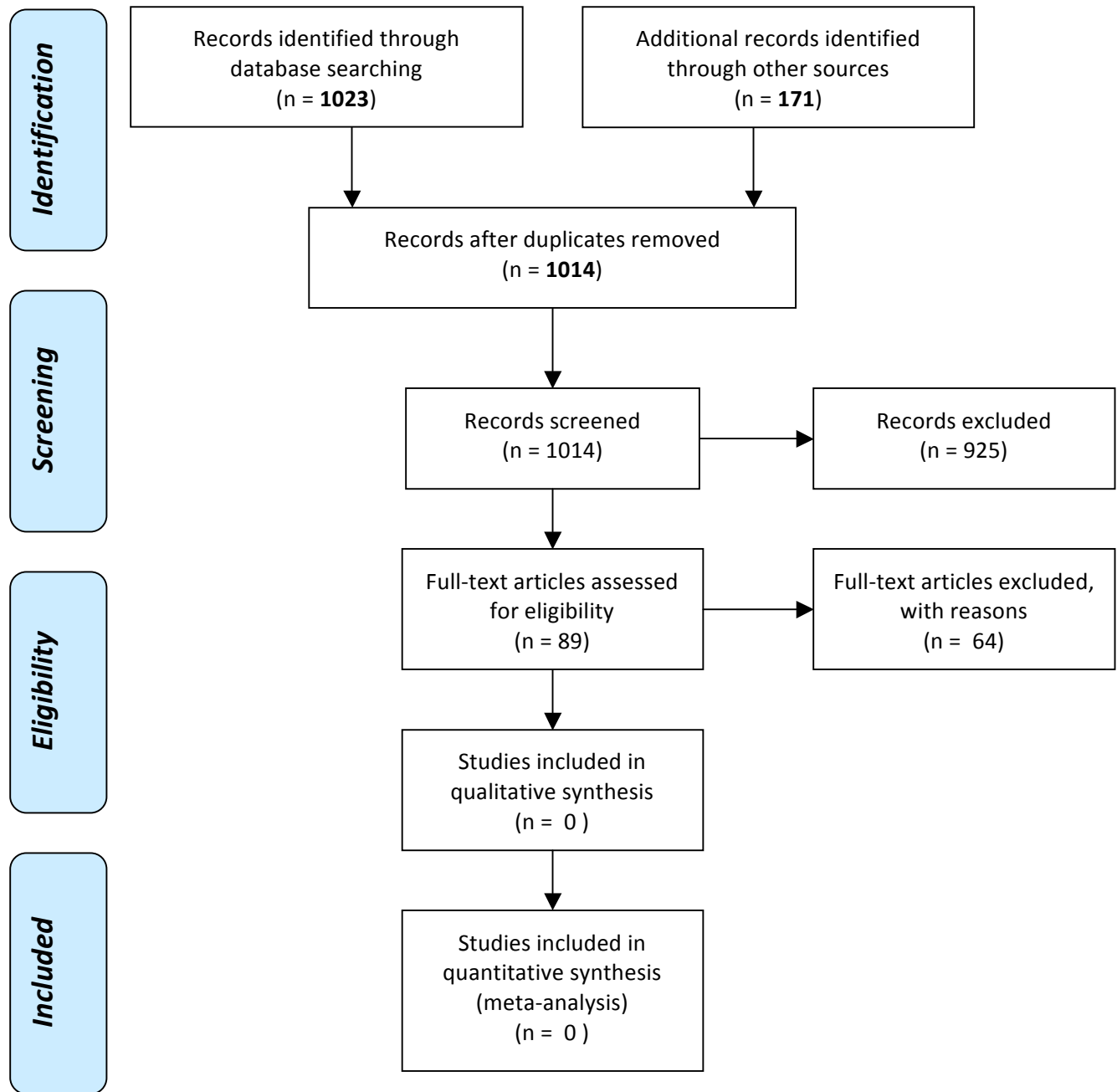
256. Ten Eyck RP. Simulation in emergency medicine training. *Pediatr Emerg Care*. 2011;27(4):333-344.
257. Terndrup TE, Cherry RA, Madden CM, Cantor RM, McCabe JB. The impact of a didactic session on the success of feline endotracheal intubation by paramedics. *Pediatr Emerg Care*. 1989;5(3):153-157.
258. Thomas F, Carpenter J, Rhoades C, Holleran R, Snow G. The usefulness of design of experimentation in defining the effect difficult airway factors and training have on simulator oral-tracheal intubation success rates in novice intubators. *Acad Emerg Med*. 2010;17(4):460-463.
259. Thomas F, Rhoades C, Carpenter J, Holleran R, Handrahan D. Difficult airway simulator intubation success rates using commission on accreditation of medical transport systems training standards. *Air Med J*. 2011;30(4):208-215.
260. Thompson B, Richardson CJ. Use of kittens in teaching neonatal resuscitation to family medicine residents. *J Fam Pract*. 1979;9(1):128-129.
261. Thompson CB, Balasz K, Goltermann J, et al. Intubation quality assurance thresholds. *Air Med J*. 1995;14(2):55-60.
262. Ti LK, Chen FG, Tan GM, et al. Experiential learning improves the learning and retention of endotracheal intubation. *Med Educ*. 2009;43(7):654-660.
263. Tiah L, Wong E, Chen MF, Sadarangani SP. Should there be a change in the teaching of airway management in the medical school curriculum?. *Resuscitation*. 2005;64(1):87-91.
264. Toofan M, Bhakta N, Greenberg R, Rush C, Kjar D, Drigalla D. Endotracheal intubation success in an ambulance by emergency medical out-of-hospital personnel using direct and glidescope(registered trademark) laryngoscopes. *Ann Emerg Med*. 2009;54(3):S63.
265. Trotter CW. Video reviews. intubating the newborn. *NEONAT NETW*. 1997;16(5):59-59.
266. Tyrrell J, Rudd P, Osborne J, Cain R. Practising intubation on cadavers. *BMJ*. 1992;305(6857):831.
267. Ural K, Subaiya C, Taylor C, Ramadhyani U, Scuderi-Porter H, Nossaman BD. Analysis of orotracheal intubation techniques in the intensive care unit. *Critical Care & Resuscitation*. 2011;13(2):89-96.
268. van der Heide PA, van Toledo-Eppinga L, van der Heide M, van der Lee JH. Assessment of neonatal resuscitation skills: A reliable and valid scoring system. *Resuscitation*. 2006;71(2):212-221.
269. Vanderhal AL, Berci G, Simmons CF, Jr, Hagiike M. A videolaryngoscopy technique for the intubation of the newborn: Preliminary report. *Pediatrics*. 2009;124(2):e339-46.
270. Ventre KM, Collingridge DS, DeCarlo D, Schwid HA. Performance of a consensus scoring algorithm for assessing pediatric advanced life support competency using a computer screen-based simulator. *Pediatric Critical Care Medicine*. 2009;10(6):623-635.
271. Vilke GM, Steen PJ, Smith AM, Chan TC. Out-of-hospital pediatric intubation by paramedics: The san diego experience. *J Emerg Med*. 2002;22(1):71-74.
272. Vlatten A, Aucoin S, Litz S, Macmanus B, Soder C. A comparison of the STORZ video laryngoscope and standard direct laryngoscopy for intubation in the pediatric airway - a randomized clinical trial. *Pediatric Anesthesia*. 2009;19(11):1102-1107.
273. Waddington MS, Paech MJ, Kurowski IH, et al. The influence of gender and experience on intubation ability and technique: A manikin study. *Anaesthesia & Intensive Care*. 2009;37(5):791-801.
274. Walker DE, Balvert L. A practical program to maintain neonatal resuscitation skills. *Can Med Assoc J*. 1994;151(3):299-304.
275. Wang HE, Abo BN, Lave JR, Yealy DM. How would minimum experience standards affect the distribution of out-of-hospital endotracheal intubations?. *Ann Emerg Med*. 2007;50(3):246-252.
276. Wang HE, Sweeney TA, O'Connor RE, Rubinstein H. Failed prehospital intubations: An analysis of emergency department courses and outcomes. *Prehospital Emergency Care*. 2001;5(2):134-141.
277. Wang HE, Yealy DM. How many attempts are required to accomplish out-of-hospital endotracheal intubation?. *Acad Emerg Med*. 2006;13(4):372-377.
278. Watts RW, Bassham M. Training, skills and approach to potentially difficult anaesthesia in general practitioner anaesthetists. *Anaesthesia & Intensive Care*. 1994;22(6):706-709.
279. Wayne DB, Butter J, Siddall VJ, et al. Simulation-based training of internal medicine residents in advanced cardiac life support protocols: A randomized trial. *Teach Learn Med*. 2005;17(3):210-216.
280. Weinberg ER, Auerbach MA, Shah NB. The use of simulation for pediatric training and assessment. *Curr Opin Pediatr*. 2009;21(3):282-287.
281. Weiner GM, Menghini K, Zaichkin J, Caid AE, Jacoby CJ, Simon WM. Self-directed versus traditional classroom training for neonatal resuscitation. *Pediatrics*. 2011;127(4):713-719.
282. Weinstock PH, Kappus LJ, Kleinman ME, Grenier B, Hickey P, Burns JP. Toward a new paradigm in hospital-based pediatric education: The development of an onsite simulator program. *Pediatric critical*

- care medicine : a journal of the Society of Critical Care Medicine and the World Federation of Pediatric Intensive and Critical Care Societies.* 2005;6(6):635-41.
283. Weiss M, Schwarz U, Dillier CM, Gerber AC. Teaching and supervising tracheal intubation in paediatric patients using videolaryngoscopy. *Paediatr Anaesth.* 2001;11(3):343-348.
 284. Weksler N, Tarnopolski A, Klein M, et al. Insertion of the endotracheal tube, laryngeal mask airway and oesophageal-tracheal combitube. A 6-month comparative prospective study of acquisition and retention skills by medical students. *Eur J Anaesthesiol.* 2005;22(5):337-340.
 285. Weller J, Segal R. The acquisition of airway skills by new trainee anaesthetists. *Anaesthesia & Intensive Care.* 2008;36(4):487-488.
 286. Wetsch WA, Carlitscheck M, Spelten O, et al. Success rates and endotracheal tube insertion times of experienced emergency physicians using five video laryngoscopes: A randomised trial in a simulated trapped car accident victim. *Eur J Anaesthesiol.* 2011;28(12):849-858.
 287. Wheeler M, Roth AG, Dsida RM, et al. Teaching residents pediatric fiberoptic intubation of the trachea: Traditional fiberscope with an eyepiece versus a video-assisted technique using a fiberscope with an integrated camera. *Anesthesiology.* 2004;101(4):842-846.
 288. White JRM, Shugerman R, Brownlee C, Quan L. Performance of advanced resuscitation skills by pediatric housestaff. *Arch Pediatr Adolesc Med.* 1998;152(12):1232-1235.
 289. White JRM, Shugerman R, Brownlee C, et al. Resuscitation skills questionnaire. *Archives of Pediatric and Adolescent Medicine.* 1998;152:1232-1235.
 290. White M, Weale N, Nolan J, Sale S, Bayley G. Comparison of the cobalt glidescope video laryngoscope with conventional laryngoscopy in simulated normal and difficult infant airways. *Paediatr Anaesth.* 2009;19(11):1108-1112.
 291. Whittaker JD, Moulton C. Emergency intubation of infants: Does laryngoscope blade design make any difference?. *J Accid Emerg Med.* 1998;15(5):308-311.
 292. Whyte C, Moores A, MacLeod AD. A scottish national prospective study of airway management skills in new-start SHOs. *Br J Anaesth.* 2006;97(4):473-475.
 293. Whyte KL, Levin R, Powls A. Clinical audit: Optimal positioning of endotracheal tubes in neonates. *Scott Med J.* 2007;52(2):25-27.
 294. Wong DT, Apichatibutra N, Arora G, Woo JA, Lee VY, Raghavan LV. Repeated attempts improve tracheal tube insertion time using the intubating laryngeal airway in a mannequin. *J Clin Anesth.* 2010;22(8):619-624.
 295. Wongyingsinn M, Songarj P, Assawinvinijkul T. A prospective observational study of tracheal intubation in an emergency department in a 2300-bed hospital of a developing country in a one-year period. *Emergency Medicine Journal.* 2009;26(8):604-608.
 296. Woollard M, Mannion W, Lighton D, et al. Use of the airtraq laryngoscope in a model of difficult intubation by prehospital providers not previously trained in laryngoscopy. *Anaesthesia.* 2007;62(10):1061-1065.
 297. Xue FS, Tian M, Liao X, Xu YC. Safe and successful intubation using the GlideScope videolaryngoscope in children with craniofacial anomalies. *Plastic & Reconstructive Surgery.* 2009;123(3):1127-1129.
 298. Xue FS, Zhang YM, Liao X, Xu YC. Measures to decrease failed intubation with the pediatric bonfils fiberscope by the obscure vision. *Paediatr Anaesth.* 2009;19(4):419-421.
 299. Yaeger KA, Arateh JMR. Making the move - from traditional neonatal education to simulation-based training. *J Perinat Neonatal Nurs.* 2008;22(2):154-158.
 300. Yager PH, Lok J, Klig JE. Advances in simulation for pediatric critical care and emergency medicine. *Curr Opin Pediatr.* 2011;23(3):293-297.
 301. Yentis SM, Lee DJ. Evaluation of an improved scoring system for the grading of direct laryngoscopy. *Anaesthesia.* 1998;53(11):1041-1044.
 302. Youngquist ST, Henderson DP, Gausche-Hill M, Goodrich SM, Poore PD, Lewis RJ. Paramedic self-efficacy and skill retention in pediatric airway management. *Acad Emerg Med.* 2008;15(12):1295-1303.
 303. Zaichkin J, Weiner GM. Neonatal resuscitation program (NRP) 2011: New science, new strategies. *Advances in neonatal care : official journal of the National Association of Neonatal Nurses.* 2011;11(1):43-51.

Appendix 2: Cholinergic Crisis Literature Review



PRISMA Cholinergic Crisis Management Training Literature Review Flow Diagram



Terms searched:

exp Organophosphorus Compounds/ OR exp Cholinesterase Inhibitors/ OR exp Cholinesterases/ OR cholinergic crisis.mp/ OR nerve gas.mp/ OR exp Chemical Warfare/ = 165474 results

AND

training.mp/ OR exp Teaching/exp Education/ = 700731 results

combined = 853 results

AND

management.mp/ OR exp Therapeutics/ = 3559026 results

combined = 274 results

exp Mass Casualty Incidents/ =710 results

AND

training.mp/ OR exp Teaching/exp Education/ =700731 results

combined = 179 results

Specific search terms:

casualty

chemical

chemical warfare

cholinergic

cholinergic crisis

cholinesterase

cholinesterase inhibitors

cholinesterases

compounds

crisis

education

gas

incidents

inhibitors

management

mass

mass casualty incidents

nerve

nerve gas

organophosphorus

organophosphorus compounds

sarin

teaching

therapeutics

training

warfare

Limited to: English language

Databases searched:

PreMedline

Medline

Embase

Web of Science

Scopus

ERIC

Education Abstracts

Government Printing Office Monthly Catalog

Index to Military Periodicals

Manual Review (Criteria for Elimination):

Duplicates
Guidelines and review articles (not original research)
Commentaries/letters (not original research)
Bisphosphonates
Studies not comparing or evaluating methods of or models for training and/or assessment

Articles Relevant: 25

1. Yu, X. and A. Ganz, *MiRTE: Mixed Reality Triage and Evacuation game for Mass Casualty information systems design, testing and training*. Conference Proceedings: ... Annual International Conference of the IEEE Engineering in Medicine & Biology Society, 2011. **2011**: p. 8199-202.
2. Pelaccia, T., *Preparing health care students for mass casualty events*. Medical Education, 2008. **42**(11): p. 1135.
3. Weiser, T.G., *Mass casualty incident training in a resource-limited environment (Br J Surg 2012; 99: 356-361)*. British Journal of Surgery, 2012. **99**(3): p. 361.
4. Heinrichs, W.L., et al., *Training healthcare personnel for mass-casualty incidents in a virtual emergency department: VED II*. Prehospital & Disaster Medicine, 2010. **25**(5): p. 424-32.
5. Ingrassia, P.L., et al., *Evaluation of medical management during a mass casualty incident exercise: an objective assessment tool to enhance direct observation*. Journal of Emergency Medicine, 2010. **39**(5): p. 629-36.
6. Scott, L.A., D.S. Carson, and I.B. Greenwell, *Disaster 101: a novel approach to disaster medicine training for health professionals*. Journal of Emergency Medicine, 2010. **39**(2): p. 220-6.
7. Pelaccia, T., et al., *Can teaching methods based on pattern recognition skill development optimise triage in mass-casualty incidents?* Emergency Medicine Journal, 2009. **26**(12): p. 899-902.
8. Vincent, D.S., B.W. Berg, and K. Ikegami, *Mass-casualty triage training for international healthcare workers in the Asia-Pacific region using manikin-based simulations*. Prehospital & Disaster Medicine, 2009. **24**(3): p. 206-13.
9. Vincent, D.S., et al., *Teaching mass casualty triage skills using iterative multimanikin simulations*. PREHOSPITAL EMERGENCY CARE, 2009. **13**(2): p. 241-6.
10. Wilkerson, W., et al., *Using immersive simulation for training first responders for mass casualty incidents*. Academic Emergency Medicine, 2008. **15**(11): p. 1152-9.
11. Gillett, B., et al., *Simulation in a disaster drill: comparison of high-fidelity simulators versus trained actors*. Academic Emergency Medicine, 2008. **15**(11): p. 1144-51.
12. Vincent, D.S., et al., *Teaching mass casualty triage skills using immersive three-dimensional virtual reality*. Academic Emergency Medicine, 2008. **15**(11): p. 1160-5.
13. Schobitz, E.P., J.M. Schmidt, and M.P. Poirier, *Biologic and chemical terrorism in children: an assessment of residents' knowledge*. Clinical Pediatrics, 2008. **47**(3): p. 267-70.
14. Sapp, R.F., et al., *Triage performance of first-year medical students using a multiple-casualty scenario, paper exercise*. Prehospital & Disaster Medicine, 2010. **25**(3): p. 239-45.
15. Collander, B., et al., *Development of an "all-hazards" hospital disaster preparedness training course utilizing multi-modality teaching*. Prehospital & Disaster Medicine, 2008. **23**(1): p. 63-7; discussion 68-9.
16. Subbarao, I., et al., *Using innovative simulation modalities for civilian-based, chemical, biological, radiological, nuclear, and explosive training in the acute management of terrorist victims: A pilot study*. Prehospital & Disaster Medicine, 2006. **21**(4): p. 272-5.
17. FitzGerald, D.J., M.D. Sztajnkrycer, and T.J. Crocco, *Chemical weapon functional exercise--Cincinnati: observations and lessons learned from a "typical medium-sized" city's response to simulated terrorism utilizing Weapons of Mass Destruction*. Public Health Reports, 2003. **118**(3): p. 205-14.
18. Siegel, D., et al., *Operation Castle Cascade: managing multiple casualties from a simulated chemical weapons attack*. Military Medicine, 2003. **168**(5): p. 351-4.

19. Knudson, G.B., *Nuclear, biological, and chemical training in the U.S. Army Reserves: mitigating psychological consequences of weapons of mass destruction*. *Military Medicine*, 2001. **166**(12 Suppl): p. 63-5.
20. Hendler, I., et al., *The effect of full protective gear on intubation performance by hospital medical personnel*. *Military Medicine*, 2000. **165**(4): p. 272-4.
21. Carter, B.J. and M. Cammermeyer, *Human responses to simulated chemical warfare training in U.S. Army Reserve personnel*. *Military Medicine*, 1989. **154**(6): p. 281-8.
22. Coule, P.L. and R.B. Schwartz, *The national disaster life support programs: a model for competency-based standardized and locally relevant training*. *Journal of Public Health Management & Practice*, 2009. **15**(2 Suppl): p. S25-30.
23. Johnson, D., A. Flagg, and T.L. Dremsa, *Effects of using human patient simulator versus a CD-ROM on learning the management of patients exposed to chemical agents*. *US Army Medical Department Journal*, 2010: p. 9-16.
24. O'Brien, C., S. Selod, and K.V. Lamb, *A national initiative to train long-term care staff for disaster response and recovery*. *Journal of Public Health Management & Practice*, 2009. **15**(2 Suppl): p. S20-4.
25. Smith, N.T. and K.R. Starko, *Physiologic and chemical simulation of cyanide and sarin toxicity and therapy*. *Studies in Health Technology & Informatics*, 2005. **111**: p. 492-7.

Additional Procedural and Clinical Text References

- Chemical Casualty Care Division. *Field Management of Chemical Casualties Quick Reference Guide*, 2nd Edition. USAMRICD, Aberdeen Proving Ground, MD. <http://ccc.apgea.army.mil>.
- Chemical Casualty Care Division. *Nerve Agents. Field Management of Chemical Casualties Handbook* 3rd Edition. Hurst CG, Tuorinsky S, et al. Eds. 2007. USAMRICD, Aberdeen Proving Ground, MD. Pages 3-29.
- Chemical Casualty Care Division. *Nerve Agents. In Medical Management of Chemical Casualties Handbook*, 4th Edition. Hurst CG, Tuorinsky S, et al. Eds. 2007. USAMRICD, Aberdeen Proving Ground, MD. Pages 122-156.
- Sidell FR, Newmark J, McDonough JH. *Nerve Agents. Medical Aspects of Chemical Warfare*. Tuorinsky SD. Ed. 2008. Office of the Surgeon General, Department of the Army, United States of America. Pages 155-205.

Table Heading Descriptions

Citation:	<i>Study reference.</i>
Sample Size and Description:	<i>Number of subjects trained and/or assessed. Who was trained and/or assessed?</i>
Study Methods:	<i>Randomized control trial, case control, observational, etc.</i>
Assessment Mechanism(s):	<i>What model was used for assessment? Conditions/context of assessment; live, simulation, written?</i>
Assessment Instrument(s):	<i>Describe instrument; Checklist vs. global rating scale, etc.</i>
Assessment Domain(s):	<i>Cognitive, Psychomotor, Affective,</i>
Training Method(s):	<i>Live animal; Clinical setting; Mannequin/simulation; Computer-based, Cadaver (human, animal); Self-study (written, vi).</i>

Citation	Sample Size and Description	Study Methods	Assessment Mechanism(s)	Assessment Instrument(s)	Assessment Domain(s)	Training Method
[1]	-3 paramedics	- descriptive				– development of virtual reality simulation game to teach triage skills
[2]	- Medical and nursing students (?#)	- observational	-live (observation) -written	-correct triage categorization -participation satisfaction scale	-cognitive - affective	- Combined didactics and procedure workshops – 10 day course -no comparison
[3]	-105 total participants (multi-agency)	-observational	-live (observation of mock disaster) -written	-patient care errors, system errors -pre-/post-knowledge tests -survey re: benefits of training	-cognitive - affective	-didactics -interactive exercise -mock disaster -no comparison
[4]	-10 physicians -12 nurses		-written (Likert scale)	-subjective measurement of “immersion”, level of confidence		-online virtual reality simulation -no comparison
[5]	-17 medical responders	-observational	-live (observation of mock disaster) -checklist and anecdotal observations	-triage -clinical procedures -radio usage	-cognitive -PM	-assessment only – mock disaster exercise
[6]	-68 medical students		-written pre-/post-	-confidence, perceptions -knowledge of disaster medicine	-cognitive	-didactic and simulation -no comparison
[7]	-128 medical and nursing students	-observational	-written	-triage skill	-cognitive	-comparison of 2 different didactics – pattern recognition vs traditional
[8]	-182 healthcare - providers		-written	-self-confidence -triage skill	-cognitive -affective	-simulation (mannequin-based) -no comparison
[9]	-21 medical	-observational	-written	-triage score	-cognitive	-podcasts and

Citation	Sample Size and Description	Study Methods	Assessment Mechanism(s)	Assessment Instrument(s)	Assessment Domain(s)	Training Method
	students		-checklist -timing	-intervention score -speed -self-efficacy	-PM -affective	mannequin-based simulation -no comparison (compares 3 different simulated scenarios)
[10]	-12 paramedics	-observational	-checklist	-triage decisions -actions taken	-cognitive -PM	-combined virtual reality and mannequin-based simulation -no comparison
[11]	-physicians, medical students, clerks	-prospective cohort	-checklist -written	-critical actions -satisfaction with model	-cognitive -PM -affective	-simulation vs live actors
[12]	-24 medical students	-observational	-written -checklist -timing	-triage score -intervention score -speed -self-efficacy	-cognitive -PM -affective	-podcasts and virtual reality simulation -no comparison
[13]	-34 pediatric residents -15 EM residents	-prospective	-written pre-/post-	-medical management	-cognitive	-lecture only -only compared those who attended lecture and those who didn't
[14]	-315 first year medical students	-observational	-written	-triage decisions	-cognitive	-START training (didactic) -no comparison
[15]	-11 physicians -40 nurses -23 administrators -10 other hospital personnel	-prospective	-written	-knowledge of disaster management	-cognitive	-multi-modality - lectures, skills sessions, tabletop sessions, and disaster exercises -no comparison
[16]	-54 first responders	-prospective	-written	-recognition, triage and decontamination	-cognitive	-mannequin-based simulation -video clinical vignettes -no comparison
[17]	-EMS personnel	-descriptive				-describes development and implementation of mass casualty drill (live patients)

Citation	Sample Size and Description	Study Methods	Assessment Mechanism(s)	Assessment Instrument(s)	Assessment Domain(s)	Training Method
						-no testing or comparison
[18]	-military medical personnel	-descriptive				-describes development of simulated disaster with 50 "patients" -no testing or comparison
[19]	-US Air Force reserves	-descriptive	-written	-confidence		-no specific descriptions of training -no comparisons
[20]	- 8 anesthesiologists - 8 nurses		-observation -written	-time -quality of intubation rating		-simulation of intubating while wearing protective equipment
[21]	-182 military personnel	-descriptive	-written -biological responses		-affective	-describes reactions to simulated scenarios -prior training not controlled for -tested with simulation
[22]		-descriptive				-describes development of multi-modality training curriculum -no testing or comparison
[23]	-92 military reserve nurses	-prospective experimental	-score on management of chemical warfare patients performance instrument (observation, 105 elements/actions)	-management of chemical exposure	-cognitive	-high fidelity simulation vs CD-ROM vs control (no teaching)

Citation	Sample Size and Description	Study Methods	Assessment Mechanism(s)	Assessment Instrument(s)	Assessment Domain(s)	Training Method
[24]		-descriptive				<p>-describes 2 day multi-modality “train the trainer” course development and implementation</p> <p>-no testing or comparison</p>
[25]		-descriptive				<p>-describes development of model for computer-based simulation of nerve gas exposure.</p> <p>-no testing or comparison</p>

Appendix 3: Pediatric and Neonatal Intubation Task Analyses

Task Analyses: Recognition Of Need And Clinical Management Of Pediatric & Neonatal Endotracheal Intubation

References List

- Friedlaender ET, Henretig FM. Evaluation of Vital Signs. In King C. Henretig FM. (Eds.), *Textbook of Pediatric Emergency Procedures*, 2nd Edition, 2008. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Pages: 23-31.
- Yen K, Gorelick MH. Use of monitoring devices. In King C. Henretig FM. (Eds.), *Textbook of Pediatric Emergency Procedures*, 2nd Edition, 2008. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Pages: 32-37.
- Luten RC. Emergent drug dosing and equipment selection. In King C. Henretig FM. (Eds.), *Textbook of Pediatric Emergency Procedures*, 2nd Edition, 2008. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Pages: 38-42.
- McAneney CM. Basic life support. In King C. Henretig FM. (Eds.), *Textbook of Pediatric Emergency Procedures*, 2nd Edition, 2008. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Pages: 79-92.
- Scarfone RJ. Oxygen delivery, suctioning, and airway adjuncts. In King C. Henretig FM. (Eds.), *Textbook of Pediatric Emergency Procedures*, 2nd Edition, 2008. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Pages: 93-108.
- King C, Reynolds SL. Bag-valve-mask ventilation. In King C. Henretig FM. (Eds.), *Textbook of Pediatric Emergency Procedures*, 2nd Edition, 2008. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Pages: 109-126.
- Zuckerbraun N, Pitetti RD. Rapid sequence induction. In King C. Henretig FM. (Eds.), *Textbook of Pediatric Emergency Procedures*, 2nd Edition, 2008. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Pages: 127-145.
- King C, Rappaport LD. Emergency Endotracheal Intubation. In King C. Henretig FM. (Eds.), *Textbook of Pediatric Emergency Procedures*, 2nd Edition, 2008. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Pages: 146-190.
- King BR, Hagberg CA. Management of the difficult airway. In King C. Henretig FM. (Eds.), *Textbook of Pediatric Emergency Procedures*, 2nd Edition, 2008. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Pages: 191-236.
- Fujii, Vinci RJ. Neonatal resuscitation procedures. In King C. Henretig FM. (Eds.), *Textbook of Pediatric Emergency Procedures*, 2nd Edition, 2008. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Pages: 469-477.
- Gomella TL, Cunningham MD, Eyal FG. Neonatology: Management, Procedures, On-Call Problems, Diseases, and Drugs. 6th Edition. 2009. McGraw Hill Lange. Pages: 15-22
- Gomella TL, Cunningham MD, Eyal FG. Neonatology: Management, Procedures, On-Call Problems, Diseases, and Drugs. 6th Edition. 2009. McGraw Hill Lange. Pages: 217-218.
- Gomella TL, Cunningham MD, Eyal FG. Neonatology: Management, Procedures, On-Call Problems, Diseases, and Drugs. 6th Edition. 2009. McGraw Hill Lange. Pages: 270-273.
- Ludwig S, Lavelle JM. Resuscitation-pediatric basic and advanced life support. In Fleisher GR, Ludwig S (Eds.), *Textbook of Pediatric Emergency Medicine*, 6th Edition. 2010. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Chapter 1.
- Aronson PL, Alessandrini EA. Neonatal resuscitation. In Fleisher GR, Ludwig S (Eds.), *Textbook of Pediatric Emergency Medicine*, 6th Edition 2010. Philadelphia, PA: Lippincott Williams & Wilkins (LWW). Chapter 2.
- Rennie JM. Neonatal resuscitation. In Donn, SM, Sinha SK. (Eds.), *Manual of Neonatal Respiratory Care*, 3rd Edition. 2012. Springer. Pages: 121-128.
- Wiseman K, Donn SM. Laryngoscopy and endotracheal intubation. In Donn, SM, Sinha SK. (Eds.), *Manual of Neonatal Respiratory Care*, 3rd Edition. 2012. Springer. Pages: 129-136.
- American Academy of Pediatrics, American Heart Association. Neonatal Resuscitation Textbook, 6th Edition. 2011

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
Factual	<u>Anatomy</u> 1. Understand the functions of the	<u>Anatomy</u> 1. Identify the functions of	<u>Anatomy</u> 1. Correctly identifies the	<u>Anatomy</u> N/A	<u>Anatomy</u> N/A	<u>Anatomy</u> N/A

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
	<p>following organ systems:</p> <ul style="list-style-type: none"> • Respiratory • Cardiovascular • Neurological • Musculoskeletal • Endocrine • Gastrointestinal <p>2. Understand the differences between adult and pediatric and neonatal airway anatomy:</p> <ul style="list-style-type: none"> • Epiglottis (floppier, u-shaped) • Tongue (relatively larger) • Hyoid bone • Airway (more anterior, higher) • Vocal cords (less narrow) • Thyroid cartilage • Cricoid ring (narrowest) • Trachea (more flexible) • Funnel shaped vs. cylindrical 	<p>the listed organ systems on a written test.</p> <p>2. Identify the differences between adult and pediatric and neonatal airway anatomy on a written test.</p>	<p>functions of the listed organ systems.</p> <p>2. Correctly identifies the differences between adult and pediatric and neonatal airway anatomy.</p>			
Factual	<p>Physiology</p> <p>1. The normal action of respiration in pediatric and neonatal patients.</p> <p>2. The effect of altered, obstructed, inadequate, and cessation of</p>	<p>Physiology</p> <p>1. Identify the normal function of respiration in pediatric and neonatal patients in a written test.</p>	<p>Physiology</p> <p>1. Correctly explain the normal function of respiration in pediatric and neonatal patients.</p>	<p>Physiology</p> <p>N/A</p>	<p>Physiology</p> <p>N/A</p>	<p>Physiology</p> <p>N/A</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
	<p>respiration on the cardiovascular and nervous systems in pediatric and neonatal patients. The parts of the human body affected by altered, obstructed, inadequate, and cessation of respiration:</p> <p><i>Decreased Oxygenation:</i></p> <ul style="list-style-type: none"> • Results in tissue ischemia. • Leads to anaerobic metabolism • Leads to acidosis • End result is damage to every organ system. • Organs with highest energy requirements/ O2 usage are affected first: <ul style="list-style-type: none"> Brain - mental status changes/coma Kidneys- renal failure Heart - myocardial damage Liver - hypoxic liver damage Gut - ischemic gut <p><i>Decreased Ventilation (not clearing CO2):</i></p> <ul style="list-style-type: none"> • Leads to hypercarbia • Results in altered 	<p>2. Describe how altered, obstructed, inadequate, and cessation of respiration affects the cardiovascular and nervous systems in pediatric and neonatal patients in a written test.</p>	<p>2. Correctly explain how altered, obstructed, inadequate, and cessation of respiration affects the cardiovascular and nervous systems in pediatric and neonatal patients</p>			

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
	<p>mental status/ confusion/ coma (CNS effects)</p> <ul style="list-style-type: none"> • Results in acidosis • Leads to damage to every organ system: • Brain - mental status changes/coma • Kidneys- renal failure • Heart - myocardial damage • Liver - hypoxic liver damage • Gut - ischemic gut <p><i>Mechanical airway protection, due to decreased mental status or other cause of inability to protect airway:</i></p> <ul style="list-style-type: none"> • Leads to aspiration of stomach contents/ acids, blood, tissue, etc. • Leads to pneumonitis (inflammation/damage to lungs) • Leads to possibly infection (aspiration pneumonia) • Aspiration can also lead to airway occlusion • Leads to effects of decreased oxygenation and decrease ventilation. 					

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
Factual	<p>Clinical</p> <p>1. Know how to assess the primary physical and physiological signs to look for during patient assessment to identify the need for airway management:</p> <ul style="list-style-type: none"> • Mouth • Nose; Nasal Flaring • Respiratory effort • Retractions • Apnea • Cyanosis • Pulse <p>2. Knows why to intubate:</p> <p><i>Failure to Ventilate</i> (remove carbon dioxide).</p> <ul style="list-style-type: none"> • Neuromuscular weakness • Obstructive pulmonary disease <p><i>Failure to Oxygenate.</i></p> <ul style="list-style-type: none"> • Pulmonary disease <p><i>Failure to protect airway.</i></p> <ul style="list-style-type: none"> • Altered mental status – neurologic, toxic <p><i>Failure to maintain patent airway.</i></p> <ul style="list-style-type: none"> • Obstruction, secretions, injury, 	<p>Clinical</p> <p>1. Describe the physical and physiological signs to look for during patient assessment in written test.</p> <p>2. Indicate on a written test how to determine if intubation is necessary in a pediatric and neonatal patient.</p>	<p>Clinical</p> <p>1. Correctly describes the primary physical and physiological signs to look for during patient assessment to identify the need for airway management on a written test.</p> <p>2. Correctly indicates on a written test how to determine if intubation is necessary in a pediatric and neonatal patient.</p>	<p>Clinical</p> <p>1. Be able to examine pediatric and neonatal patients to assess indicators of need for airway management:</p> <ul style="list-style-type: none"> • Mouth • Nose; Nasal Flaring • Respiratory effort • Retractions • Apnea • Cyanosis • Pulse <p>2. Be able to examine pediatric and neonatal patients to assess indicators of need for intubation:</p> <p><i>Failure to Ventilate</i> (remove carbon dioxide).</p> <ul style="list-style-type: none"> • Neuromuscular weakness • Obstructive pulmonary disease <p><i>Failure to Oxygenate.</i></p> <ul style="list-style-type: none"> • Pulmonary 	<p>Clinical</p> <p>1. Demonstrate the ability to examine pediatric and neonatal patients to assess the need for airway management in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>2. Demonstrate the ability to examine pediatric and neonatal patients to assess indicators of need for intubation in a simulated context with pediatric and neonatal mannequin simulators.</p>	<p>Clinical</p> <p>1. Correctly demonstrates the ability to examine pediatric and neonatal patients to assess the need for airway management in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>2. Correctly demonstrates the ability to examine pediatric and neonatal patients to assess indicators of need for intubation in a simulated context with pediatric and neonatal mannequin simulators.</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
	<p>blood</p> <p><i>Significant hemodynamic instability.</i></p> <p><i>Operative needs.</i></p>			<p>disease</p> <p><i>Failure to protect airway.</i></p> <ul style="list-style-type: none"> • Altered mental status – neurologic, toxic <p><i>Failure to maintain patent airway.</i></p> <ul style="list-style-type: none"> • Obstruction, secretions, injury, blood <p><i>Significant hemodynamic instability.</i></p> <p><i>Operative needs.</i></p>		
Factual	<p>Medication</p> <p>1. Knows the drugs, dosages, reasons for use, administration routes and time sequences for intubating a neonatal and pediatric patient: <i>Sedative.</i></p> <ul style="list-style-type: none"> • Etomidate (0.3-0.6 mg/kg); IV • Versed (0.05-0.1 mg/kg); IV • Ketamine (1-2mg/kg); IV <p><i>Paralytic.</i></p> <ul style="list-style-type: none"> • Succinylcholine (1-2 mg/kg); IV <p><i>Manage Bradycardia.</i></p> <ul style="list-style-type: none"> • Atropine (0.2 	<p>Medication</p> <p>1. On a written test, identify the drugs, dosages, reasons for use, administration routes and time sequences for intubating a neonatal and pediatric patient.</p> <p>2. Describes how to determine the</p>	<p>Medication</p> <p>1. Correctly identifies the drugs, dosages, reasons for use, administration routes and time sequences for intubating a neonatal and pediatric patient.</p> <p>2. Correctly describes how to determine the correct</p>	<p>Medication</p> <p>1. Be able to place an IV catheter.</p> <p>2. Be able to identify and secure the following medications:</p> <ul style="list-style-type: none"> • Etomidate • Versed • Ketamine • Succinylcholine • Atropine <p>3. Be able to administer the appropriate dosages and</p>	<p>Medication</p> <p>1. Demonstrate the ability to place an IV catheter in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>2. Be able to identify and secure the appropriate medications in a simulated context.</p>	<p>Medication</p> <p>1. Correctly places an IV catheter in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>2. Correctly identifies and secures the appropriate medications in a simulated context.</p> <p>3. Correctly administers the appropriate dosages and drugs through IV catheter in a simulated context</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
	mg/kg); IV 2. Knows how to determine the correct drug dose used for intubating a neonatal and pediatric patients: <ul style="list-style-type: none"> • Broselow Tape • Calculate using dose/weight. • Monitor clinical effect • Adjust dose as needed for clinical effect. 3. Knows ketamine is the best sedative for patients with asthma.	correct drug dose used for intubating a neonatal and pediatric patient on a written test. 3. Identify ketamine as the best sedative for patients with asthma on a written test.	drug dose used for intubating a neonatal and pediatric patient on a written test. 3. Correctly identifies ketamine as the best sedative for patients with asthma on a written test.	drugs through IV catheter.	3. Be able to administer the appropriate dosages and drugs through IV catheter in a simulated context with pediatric and neonatal mannequin simulators.	with pediatric and neonatal mannequin simulators.
Factual	<u>Health Metrics</u> Understand relevant health metrics for assessing pediatric and neonatal patient's physical and physiological status: <ul style="list-style-type: none"> • Respiratory status • Integrity of Airway 	<u>Health Metrics</u> Indicate on a written test which health metrics to assess for a neonatal and pediatric patient who requires intubation.	<u>Health Metrics</u> Correctly indicates the health metrics to assess for a neonatal and pediatric patient who requires intubation.	<u>Health Metrics</u> N/A	<u>Health Metrics</u> N/A	<u>Health Metrics</u> N/A
Factual	<u>Procedural</u> 1. Describe the patient management strategy for pediatric and neonatal patient who require intubation: <ul style="list-style-type: none"> • Drugs • Airway • Breathing 	<u>Procedural</u> 1. Describe the patient management strategy for pediatric and neonatal patient who require intubation on	<u>Procedural</u> 1. Correctly describe the patient management strategy for pediatric and neonatal patient who require	<u>Procedural</u> 1. Be able to assess the need for intubation in pediatric and neonatal patients. 2. Be able to administer	<u>Procedural</u> 1. Be able to assess the need for intubation in pediatric and neonatal patients in a simulated context.	<u>Procedural</u> 1. Correctly assesses the need for intubation in pediatric and neonatal patients in a simulated context. 2. Correctly administers

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
	<ul style="list-style-type: none"> • Monitoring • Stabilizing <p>2. Describe the step-by-step sequence for intubating a pediatric and neonatal patient: <u>Administer medications.</u></p> <p><u>Patient positioning.</u></p> <ul style="list-style-type: none"> • Sniffing position with towel under head & neck • Mild extension further opens / aligns airway • Overextension will hinder <p><u>Apply suction.</u></p> <p><u>Bag-valve-mask.</u></p> <ul style="list-style-type: none"> • Mask selection • Mask position • Use C-E hand configuration • Can use jaw thrust • Have firm seal • Do not block anterior neck <p><u>Insert Laryngoscope Blade.</u></p> <p><u>Place Endotracheal Tube.</u></p> <p>Determine how deep to insert the tube:</p> <ul style="list-style-type: none"> • Use Broselow tape 	<p>a written test.</p> <p>2. Describe the step-by-step sequence for intubating a pediatric and neonatal patient on a written test.</p> <p>3. Describe how to ventilate a pediatric and neonatal patient on a written test.</p> <p>4. Describe how to determine if a pediatric and neonatal patient is clinically stable on a written test.</p>	<p>intubation on a written test.</p> <p>2. Correctly describe the step-by-step sequence for intubating a pediatric and neonatal patient on a written test.</p> <p>3. Correctly describes how to ventilate a pediatric and neonatal patient on a written test.</p> <p>4. Correctly describes how to determine if a pediatric and neonatal patient is clinically stable on a written test.</p>	<p>appropriate dosages of drugs:</p> <ul style="list-style-type: none"> • Sedative • Paralytic • Cardiovascular <p>3. Be able to perform each step of intubating a neonatal and pediatric patient: <u>Administer medications.</u></p> <p><u>Patient positioning.</u></p> <ul style="list-style-type: none"> • Sniffing position with towel under head & neck • Mild extension further opens / aligns airway • Overextension will hinder <p><u>Apply suction.</u></p> <p><u>Bag-valve-mask.</u></p> <ul style="list-style-type: none"> • Mask selection • Mask position • Use C-E hand configuration • Can use jaw thrust • Have firm seal • Do not block anterior neck 	<p>2. Be able to administer appropriate dosages of drugs to a pediatric and neonatal patient mannequin simulator:</p> <ul style="list-style-type: none"> • Sedative • Paralytic • Cardiovascular <p>3. Be able to perform each step of intubating a neonatal and pediatric patient in a simulated context using the correct method on a pediatric and neonatal patient mannequin simulator.</p> <p>4. Be able to ventilate a pediatric and neonatal patient mannequin simulator.</p> <p>5. Be able to assess clinical stability in pediatric and neonatal patient</p>	<p>appropriate dosages of drugs to a pediatric and neonatal patient mannequin simulator</p> <ul style="list-style-type: none"> • Sedative • Paralytic • Cardiovascular <p>3. Be able to perform each step of intubating a neonatal and pediatric patient in a simulated context using the correct method on a pediatric and neonatal patient mannequin simulator.</p> <p>4. Correctly ventilates a pediatric and neonatal patient mannequin simulator.</p> <p>5. Correctly assesses clinical stability in pediatric and neonatal patient mannequin simulators.</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
	<ul style="list-style-type: none"> • 3X Tube size • On end of ETT lines, insert to just past cords • If ETT balloon, balloon just past cords <p><u>Confirm ETT placement.</u></p> <ul style="list-style-type: none"> • Verbalize “see tube pass through cords.” • Auscultation of breath sounds. • CO2 detector. • Post intubation chest x-ray. <p><u>Recognize Misplacement of ETT.</u></p> <ul style="list-style-type: none"> • Identify Esophageal Intubation • Identify Right Main Stem Intubation <p><u>Manage Esophageal Intubation.</u></p> <ul style="list-style-type: none"> • Recognize • Remove ETT \leq 10 sec • Re-start ETT \leq 15 sec Placement <p><u>Manage Right Main Stem Intubation.</u></p> <ul style="list-style-type: none"> • Recognize \leq 10 sec • Pull back ETT \leq 15 sec <p>3. Understands how</p>			<p><u>Insert Laryngoscope Blade.</u></p> <p><u>Place Endotracheal Tube.</u></p> <p>Determine how deep to insert the tube:</p> <ul style="list-style-type: none"> • Use Broselow tape • 3X Tube size • On end of ETT lines, insert to just past cords • If ETT balloon, balloon just past cords <p><u>Confirm ETT placement.</u></p> <ul style="list-style-type: none"> • Verbalize “see tube pass through cords.” • Auscultation of breath sounds. • CO2 detector. • Post intubation chest x-ray. <p><u>Recognize Misplacement of ETT.</u></p> <ul style="list-style-type: none"> • Identify Esophageal Intubation • Identify Right Main Stem 	mannequin simulators.	

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
	<p>to ventilate a pediatric and neonatal patient.</p> <ul style="list-style-type: none"> • Rate • Volume <p>4. Knows how to determine if a pediatric and neonatal patient is clinically stable:</p> <ul style="list-style-type: none"> • Normal vital signs for neonatal patients • Normal vital signs for pediatric patient by age 			<p>Intubation</p> <p><u>Manage Esophageal Intubation.</u></p> <ul style="list-style-type: none"> • Recognize • Remove ETT \leq 10 sec • Re-start ETT \leq 15 sec <p>Placement</p> <p><u>Manage Right Main Stem Intubation.</u></p> <ul style="list-style-type: none"> • Recognize \leq 10 sec • Pull back ETT \leq 15 sec <p>4. Be able to ventilate to support a pediatric and neonatal patient's breathing.</p> <p>5. Be able to assess clinical stability in pediatric and neonatal patients.</p>		
Factual	<p><u>Instruments & Supplies</u></p> <p>1. Identify and describe the function the following medical instruments & supplies:</p>	<p><u>Instruments & Supplies</u></p> <p>1. Identify and describe the function the listed medical</p>	<p><u>Instruments & Supplies</u></p> <p>1. Correctly identify and describe the function the</p>	<p><u>Instruments & Supplies</u></p> <p>1. Be able to identify the location of and select the</p>	<p><u>Instruments & Supplies</u></p> <p>1. Demonstrate the ability to locate and select the listed</p>	<p><u>Instruments & Supplies</u></p> <p>1. Correctly demonstrates the ability to locate and select the listed instruments &</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
	<ul style="list-style-type: none"> • Endotracheal Tube • Stylette • Laryngoscope • Suction • Ambu bag-valve-mask • IV Catheter • IV Fluids • Broselow Tape • pCO2 Detector (litmus paper) • Tape • 10cc syringe <p>2. Determine the size of Endotracheal tube:</p> <ul style="list-style-type: none"> • $(16 + \text{age})/4$ • $(\text{age}/4) + 4$ • Broselow tape • Size of pinky finger after 1y/0 <p>3. Determine size of laryngoscope blade:</p> <ul style="list-style-type: none"> • Use Broselow tape • Measure from tragus to cricoid membrane • Better too long vs. too short <p>4. Determine the best mask for pediatric and neonatal patients:</p> <ul style="list-style-type: none"> • Fits from base of chin to mid-bridge of nose • Cushion helps make better seal • Use best fit • Adjust based on size 	<p>instruments & supplies on a written test.</p> <p>2. Determine the size of Endotracheal tube given information in a case study on a written test.</p> <p>3. Determine size of laryngoscope blade given information in a case study on a written test.</p> <p>4. Indicate the best mask for pediatric and neonatal patients on a written test.</p>	<p>listed medical instruments & supplies on a written test.</p> <p>2. Correctly determines the size of Endotracheal tube given information in a case study on a written test.</p> <p>3. Correctly determines size of laryngoscope blade given information in a case study on a written test.</p> <p>4. Correctly indicates the best mask for pediatric and neonatal patients on a written test.</p>	<p>following instruments & supplies:</p> <ul style="list-style-type: none"> • Endotracheal Tube • Stylette • Laryngoscope • Suction • Ambu bag-valve-mask • IV Catheter • IV Fluids • Broselow Tape • pCO2 Detector (litmus paper) • Tape • 10cc syringe <p>2. Be able to appropriately implement the following medical instruments & supplies:</p> <ul style="list-style-type: none"> • Endotracheal Tube • Stylette • Laryngoscope • Suction • Ambu bag-valve-mask • IV Catheter • IV Fluids • Broselow Tape • pCO2 Detector (litmus paper) • Tape • 10cc syringe 	<p>instruments & supplies in a simulated context.</p> <p>2. Demonstrates ability to appropriately implement the listed medical instruments & supplies in a simulated context.</p>	<p>supplies.</p> <p>2. Correctly demonstrates ability to appropriately implement the listed medical instruments & supplies in a simulated context.</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
	as needed					
Factual	<p>Equipment</p> <p>1. Know how to use suction.</p> <p>2. Know how to use ventilator.</p> <p>3. Know how to use vitals monitor to assess heart rate, respiration rate and SpO2 levels.</p>	<p>Equipment</p> <p>1. Describe how to use suction on a written test.</p> <p>2. Describe how to use ventilator on a written test.</p> <p>3. Describe how to use vitals monitor to assess heart rate, respiration rate and SpO2 levels on a written test.</p>	<p>Equipment</p> <p>1. Correctly describes how to use suction on a written test.</p> <p>2. Correctly describes how to use ventilator on a written test.</p> <p>3. Describes how to use vitals monitor to assess heart rate, respiration rate and SpO2 levels on a written test.</p>	<p>Equipment</p> <p>1. Be able to use suction.</p> <p>2. Be able to use ventilator.</p> <p>3. Be able to use vitals monitor to assess heart rate, respiration rate and SpO2 levels.</p>	<p>Equipment</p> <p>1. Be able to use suction in a simulated context with pediatric and neonatal patient mannequin simulators.</p> <p>2. Be able to use ventilator in a simulated context with pediatric and neonatal patient mannequin simulators.</p> <p>3. Be able to use vitals monitor to assess heart rate, respiration rate and SpO2 levels in a simulated context with pediatric and neonatal patient mannequin simulators.</p>	<p>Equipment</p> <p>1. Correctly uses suction in a simulated context with pediatric and neonatal patient mannequin simulators.</p> <p>2. Correctly uses ventilator in a simulated context with pediatric and neonatal patient mannequin simulators.</p> <p>3. Correctly uses vitals monitor to assess heart rate, respiration rate and SpO2 levels in a simulated context with pediatric and neonatal patient mannequin simulators.</p>
Conceptual	<p>Physiological</p> <p>1. Distinguish between the primary conditions indicating the need for pediatric and neonatal intubation:</p>	<p>Physiology</p> <p>1. Distinguish between the primary conditions indicating the need for</p>	<p>Physiology</p> <p>1. Correctly identify the primary conditions indicating the need for</p>	<p>Physiology</p> <p>N/A</p>	<p>Physiology</p> <p>N/A</p>	<p>Physiology</p> <p>N/A</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
	<ul style="list-style-type: none"> • Decreased Oxygenation. • Decreased ventilation (not clearing CO2). • Decreased mental status causes inability to protect airway. • Other cause of inability to protect airway. 	pediatric and neonatal intubation on a written test.	pediatric and neonatal intubation on a written test.			
Conceptual	<p><u>Clinical</u></p> <p>1. Understand the relevant symptomology for performing a differential diagnosis (DDx) for pediatric and neonatal patients experiencing signs that they require intubation:</p> <ul style="list-style-type: none"> • Identify need for intubation over other airway management interventions. • Identify need for intubation over other respiratory management. <p>2. Distinguish the primary conditions indicating the need for pediatric and neonatal intubation:</p> <ul style="list-style-type: none"> • Decreased Oxygenation. • Decreased ventilation (not 	<p><u>Clinical</u></p> <p>1. Perform Differential Diagnosis (DDx) from case-based information on a written test.</p> <p>2. Identify primary conditions indicating the need for pediatric and neonatal intubation on a written test.</p> <p>3. Distinguish between the clinical indicators for esophageal intubation from case-based information on a written test.</p>	<p><u>Clinical</u></p> <p>1. Correctly identify the need for intubation in pediatric and neonatal patients given clinical conditions from case-based information on a written test.</p> <p>2. Correctly identify primary conditions indicating the need for pediatric and neonatal intubation on a written test.</p> <p>3. Correctly distinguish between the</p>	<p><u>Clinical</u></p> <p>1. Be able to examine a pediatric and neonatal patient to perform DDx:</p> <ul style="list-style-type: none"> • Identify need for intubation over other airway management interventions. • Identify need for intubation over other respiratory management. <p>2. Be able to examine a pediatric and neonatal patient to confirm endotracheal intubation.</p> <p>3. Be able to examine a pediatric and neonatal patient</p>	<p><u>Clinical</u></p> <p>1. Demonstrate the ability to examine a pediatric and neonatal patient and perform DDx in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>2. Be able to examine a pediatric and neonatal patient to confirm endotracheal intubation in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>3. Correctly examines a pediatric and neonatal patient to assess esophageal intubation in a simulated context with pediatric and</p>	<p><u>Clinical</u></p> <p>1. Correctly examines a pediatric and neonatal patient and performs DDx in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>2. Correctly examines a pediatric and neonatal patient to confirm endotracheal intubation in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>3. Correctly examines a pediatric and neonatal patient to assess esophageal intubation in a simulated context with pediatric and</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
	<p>clearing CO2).</p> <ul style="list-style-type: none"> • Decreased mental status causes inability to protect airway. • Other cause of inability to protect airway. <p>3. Distinguish between the clinical indicators for esophageal intubation.</p> <p>4. Distinguish between the clinical indicators for right main stem intubation.</p> <p>5. Understands how to determine clinical stability in pediatric and neonatal patients.</p>	<p>4. Distinguish between the clinical indicators for right main stem intubation from case-based information on a written test.</p> <p>5. Evaluates clinical stability in pediatric and neonatal patients from information given in a case study on a written test.</p>	<p>clinical indicators for esophageal intubation from case-based information on a written test.</p> <p>4. Correctly distinguish between the clinical indicators for right main stem intubation from case-based information on a written test.</p> <p>5. Correctly evaluates clinical stability in pediatric and neonatal patients from information given in a case study on a written test.</p>	<p>to assess esophageal intubation.</p> <p>4. Be able to examine a pediatric and neonatal patient to assess right main stem intubation.</p> <p>5. Be able to evaluate clinical stability in pediatric and neonatal patients.</p>	<p>3. Be able to examine a pediatric and neonatal patient to assess esophageal intubation in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>4. Be able to examine a pediatric and neonatal patient to assess right main stem intubation in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>5. Be able to evaluate clinical stability in a simulated context with pediatric and neonatal mannequin simulators.</p>	<p>neonatal mannequin simulators.</p> <p>4. Correctly examines a pediatric and neonatal patient to assess right main stem intubation in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>5. Correctly evaluates clinical stability in a simulated context with pediatric and neonatal mannequin simulators.</p>
Conceptual	Medication 1. Differentiate dose	Medication 1. Indicate the	Medication 1. Correctly	Medication Be able to adjust	Medication Be able to	Medication Correctly adjusts

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
	<p>requirements by weight for the medications used in pediatric and neonatal intubation:</p> <ul style="list-style-type: none"> • Etomidate (0.3-0.6 mg/kg) • Versed (0.05-0.1 mg/kg) • Ketamine (1-2mg/kg) • Succinylcholine (1-2 mg/kg) • Atropine (0.2 mg/kg) <p>2. Understand the effects of dosing for optimal clinical effect for each medication type.</p>	<p>dose requirements by weight for the medications used in pediatric and neonatal intubation on a written test.</p> <p>2. Indicate how to adjust dosages of medications given information about clinical effects in a case study on a written test.</p>	<p>indicate the dose requirements for the medications used in pediatric and neonatal intubation on a written test.</p> <p>2. Correctly indicates how to adjust dosages of medications given information about clinical effects in a case study on a written test.</p>	<p>medication dosages for optimal clinical effect in a pediatric and neonatal patient requiring intubation.</p>	<p>adjust medication dosages for optimal clinical effect in a simulated context with pediatric and neonatal mannequin simulators.</p>	<p>medication dosages for optimal clinical effect in a simulated context with pediatric and neonatal mannequin simulators.</p>
Practical	<p><u>Clinical</u> N/A</p>	<p><u>Clinical</u> N/A</p>	<p><u>Clinical</u> N/A</p>	<p><u>Clinical</u> 1. Be able to examine pediatric and neonatal patients to assess indicators of need for airway management:</p> <ul style="list-style-type: none"> • Mouth • Nose; Nasal Flaring • Respiratory effort • Retractions • Apnea • Cyanosis • Pulse 	<p><u>Clinical</u> 1. Examine a patient to assess indicators of need for airway management in a simulated context with pediatric and neonatal mannequin simulators. 2. Examine a patient to assess indicators of</p>	<p><u>Clinical</u> 1. Correctly examines a patient to assess indicators of need for airway management in a simulated context with pediatric and neonatal mannequin simulators. 2. Correctly examines a patient to assess indicators of need for intubation in a simulated context with pediatric and neonatal</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
				<p>2. Be able to examine pediatric and neonatal patients to assess indicators of need for intubation:</p> <ul style="list-style-type: none"> • Failure to Ventilate. • Failure to Oxygenate. • Failure to protect airway. • Failure to maintain patent airway. • Significant hemodynamic instability. • Operative needs. <p>3. Be able to examine a pediatric and neonatal patient to perform DDx:</p> <ul style="list-style-type: none"> • Identify need for intubation over other airway management interventions. • Identify need for intubation over other respiratory management. 	<p>need for intubation in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>3. Examine a patient to perform DDx and determine airway management strategy in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>4. Intubate patients in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>5. Examine a patient to confirm endotracheal intubation in a simulated context with pediatric and</p>	<p>mannequin simulators.</p> <p>3. Correctly examines a patient to perform DDx and determine airway management strategy in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>4. Correctly intubates patients in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>5. Correctly examines a patient to confirm endotracheal intubation in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>6. Correctly examines a patient to assess esophageal intubation in a simulated context with pediatric and neonatal mannequin simulators.</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
				<p>4. Be able to intubate pediatric and neonatal patients:</p> <ul style="list-style-type: none"> • Uses appropriate instruments, supplies, equipment • Completes all steps in appropriate sequence <p>5. Be able to examine a pediatric and neonatal patient to confirm endotracheal intubation.</p> <p>6. Be able to examine a pediatric and neonatal patient to assess esophageal intubation.</p> <p>7. Be able to examine a pediatric and neonatal patient to assess right main stem intubation.</p> <p>8. Be able to assess clinical</p>	<p>neonatal mannequin simulators.</p> <p>6. Examine a patient to assess esophageal intubation in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>7. Examine a patient to assess right main stem intubation in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>8. Assess clinical stability in a patient in a simulated context with pediatric and neonatal mannequin simulators.</p>	<p>7. Correctly examines a patient to assess right main stem intubation in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>8. Correctly assesses clinical stability in a patient in a simulated context with pediatric and neonatal mannequin simulators.</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
				stability in a pediatric and neonatal patient.		
Practical	<u>Medication</u> N/A	<u>Medication</u> N/A	<u>Medication</u> N/A	<p><u>Medication</u></p> <p>1. Be able to identify and secure the following medications:</p> <ul style="list-style-type: none"> • Etomidate • Versed • Ketamine • Succinylcholine • Atropine <p>2. Be able to administer the appropriate dosages and drugs through IV catheter in pediatric and neonatal patients.</p> <p>3. Be able to select the appropriate drugs, dosages, administration routes and time sequences for pediatric and neonatal patients.</p> <p>4. Be able to evaluate the clinical effects of selected drugs</p>	<p><u>Medication</u></p> <p>1. Administer drugs through IV catheter in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>2. Administer adjustments to medication doses to gain clinical effect in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>3. Select the appropriate drugs, dosages, administration routes and time sequences for pediatric and neonatal intubation in a simulated context with pediatric and neonatal mannequin</p>	<p><u>Medication</u></p> <p>1. Correctly administers drugs through IV catheter in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>2. Correctly administers adjustments to medication doses to gain clinical effect in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>3. Correctly selects the appropriate drugs, dosages, administration routes and time sequences for pediatric and neonatal intubation in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>4. Correctly evaluates the clinical effects of selected drugs and dosages</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
				<p>and dosages in pediatric and neonatal patients.</p> <p>5. Be able to adjust medication doses and apply appropriate time sequences to gain optimal clinical effect in pediatric and neonatal patients.</p>	<p>simulators.</p> <p>4. Evaluate the clinical effects of selected drugs and dosages in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>5. Adjust medication doses and apply appropriate time sequences to gain optimal clinical effect in a simulated context with pediatric and neonatal mannequin simulators.</p>	<p>in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>5. Correctly adjusts medication doses and apply appropriate time sequences to gain optimal clinical effect in a simulated context with pediatric and neonatal mannequin simulators.</p>
Practical	<p>Health Metrics Knows how to evaluate relevant health metrics for assessing the patient's physical and physiological status:</p> <ul style="list-style-type: none"> • Respiratory status • Integrity of Airway 	<p>Health Metrics Evaluate appropriate health metrics to assess respiratory and/or airway compromise in neonatal and pediatric patients in a</p>	<p>Health Metrics Correctly evaluates appropriate health metrics to assess respiratory and/or airway compromise in neonatal and pediatric</p>	<p>Health Metrics Knows how to examine and indicate patient's physical and physiological status:</p> <ul style="list-style-type: none"> • Respiratory status • Integrity of Airway 	<p>Health Metrics Examines and indicates pediatric and neonatal patients' physical and physiological status in a simulated context with</p>	<p>Health Metrics Correctly examines and indicates pediatric and neonatal patients' physical and physiological status in a simulated context with pediatric and neonatal mannequin</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
		simulated context with pediatric and neonatal mannequin simulators.	patients in a simulated context with pediatric and neonatal mannequin simulators.		pediatric and neonatal mannequin simulators.	simulators.
Analytical	N/A	N/A	N/A	<u>Clinical</u> 1. Identify treatment effects: <ul style="list-style-type: none"> • Decreased retractions • Decreased cyanosis • Decreased respiratory effort • Decreased nasal flaring • Reduced Apnea • Improved respiration 2. Identify effects of clinical mismanagement: <ul style="list-style-type: none"> • Absent positive treatment effects 	<u>Clinical</u> 1. Identify treatment effects in a simulated context with pediatric and neonatal mannequin simulators. 2. Identify effects of clinical mismanagement in a simulated context with pediatric and neonatal mannequin simulators.	<u>Clinical</u> 1. Identify treatment effects in a simulated context with pediatric and neonatal mannequin simulators. 2. Identify effects of clinical mismanagement in a simulated context with pediatric and neonatal mannequin simulators.
Analytical	N/A	N/A	N/A	<u>Procedural</u> 1. Identify challenges of airway management for pediatric and neonatal patients.	<u>Procedural</u> 1. Respond to the challenges of airway management for pediatric and neonatal patients in a simulated	<u>Procedural</u> 1. Respond to the challenges of airway management for pediatric and neonatal patients in a simulated context with pediatric and neonatal mannequin

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
				<p>2. Understand the correct administration of medications.</p> <p>3. Know the step-by-step sequence for intubating pediatric and neonatal patients.</p> <p>4. Know the correct ventilation requirements for pediatric and neonatal patients.</p> <p>5. Understand the stabilization course for intubated pediatric and neonatal patients.</p>	<p>context with pediatric and neonatal mannequin simulators.</p> <p>2. Administer medications as needed for airway management (intubation) in pediatric and neonatal patients in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>3. Intubate as needed for airway management in pediatric and neonatal patients in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>4. Ventilate intubated pediatric and neonatal</p>	<p>simulators.</p> <p>2. Correctly administers medications as needed for airway management (intubation) in pediatric and neonatal patients in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>3. Correctly intubates as needed for airway management in pediatric and neonatal patients in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>4. Correctly ventilates intubated pediatric and neonatal patients in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>5. Adequately stabilizes intubated pediatric and neonatal patients in a simulated context with pediatric and</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
					<p>patients in a simulated context with pediatric and neonatal mannequin simulators.</p> <p>5. Stabilize intubated pediatric and neonatal patients in a simulated context with pediatric and neonatal mannequin simulators.</p>	<p>neonatal mannequin simulators.</p>

Appendix 4: Cholinergic Crisis Task Analysis

TASK STEPS: RECOGNITION AND CLINICAL MANAGEMENT OF CHOLINERGIC CRISIS

Nerve Agent Exposure: Tabun(GA); GB(Sarin); GD(Soman); GF; VX) – liquid/gas

REFERENCES LIST

FMCCQRG: Chemical Casualty Care Division. Field Management of Chemical Casualties Quick Reference Guide, 2nd Edition. USAMRICD, Aberdeen Proving Ground, MD. <http://ccc.apgea.army.mil>.

FMCCCH: Chemical Casualty Care Division. Nerve Agents. Field Management of Chemical Casualties Handbook 3rd Edition. Hurst CG, Tuorinsky S, et al. Eds. 2007. USAMRICD, Aberdeen Proving Ground, MD. Pages 3-29.

MMCCH: Chemical Casualty Care Division. Nerve Agents. In Medical Management of Chemical Casualties Handbook, 4th Edition. Hurst CG, Tuorinsky S, et al. Eds. 2007. USAMRICD, Aberdeen Proving Ground, MD. Pages 122-156.

MACW: Sidell FR, Newmark J, McDonough JH. Nerve Agents. Medical Aspects of Chemical Warfare. Tuorinsky SD. Ed. 2008. Office of the Surgeon General, Department of the Army, United States of America. Pages 155-205.

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
Factual	<p><u>Anatomy</u> Understand the functions of the Gastrointestinal, Respiratory, Cardiovascular, Neurological, Endocrine, Ophthalmological, and Musculoskeletal Systems.</p>	<p><u>Anatomy</u> Identify the functions of the Gastrointestinal, Respiratory, Cardiovascular, Neurological, Endocrine, Ophthalmological, and Musculoskeletal Systems on a written test.</p>	<p><u>Anatomy</u> Correctly identifies the functions of the Gastrointestinal, Respiratory, Cardiovascular, Neurological, Endocrine, Ophthalmological, and Musculoskeletal Systems.</p>	<p><u>Anatomy</u> N/A</p>	<p><u>Anatomy</u> N/A</p>	<p><u>Anatomy</u> N/A</p>
Factual	<p><u>Physiology</u> 1. The normal action of the enzyme acetylcholinesterase (AChE) to control the transmission of acetylcholine across the synaptic cleft. 2. The effect of blocking AChE on the nervous system.</p>	<p><u>Physiology</u> 1. Identify the normal function of the enzyme acetylcholinesterase is to breakdown (hydrolyze) the chemical messenger (neurotransmitter) acetylcholine (ACh) in the post-synaptic membranes, thereby</p>	<p><u>Physiology</u> 1. Correctly explains the normal function of the enzyme acetylcholinesterase in controlling the neuron signal processing of the nervous system. 2. Correctly explains how nerve agents</p>	<p><u>Physiology</u> N/A</p>	<p><u>Physiology</u> N/A</p>	<p><u>Physiology</u> N/A</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
	The parts of the human body affected by excessive acetylcholine accumulation: Eye, nose (glands), mouth (glands), respiratory tract, gastrointestinal tract, cardiac muscle, sweat glands, skeletal muscle, central nervous system.	controlling the neuron signal processing of the nervous system in a written test. 2. Describe how nerve agents block the enzyme AChE in a written test.	interfere with AChE leading to cholinergic crisis.			
Factual	Clinical Knowledge 1. Know how to assess the patient's physical and physiological status.	Clinical Knowledge 1. Describe the physical and physiological signs to look for during patient assessment in written test. 2. Indicate on a written test the information to request from a conscious patient during clinical assessment. 3. On a written test, list the areas where physical examination will provide indicators of cholinergic crisis.	Clinical Knowledge 1. Correctly describe the primary physical and physiological signs to look for during patient assessment to identify nerve agent exposure: • Miosis • Copious secretions • Generalized muscular fasciculations • Respiratory distress • Cyanosis • Convulsions 2. Correctly indicates the following information to request from a conscious patient	Clinical Skills 1. Be able to examine the patient to assess indicators of cholinergic crisis: • Eyes • Mouth • Nose • Respiratory effort • Muscle control • Pulse	Clinical Skills 1. Demonstrate the ability to examine the patient and assess indicators of cholinergic crisis in a simulated context with a mannequin simulator or a standardized patient: • Eyes • Mouth • Nose • Respiratory effort • Muscle control • Pulse	Clinical Skills 1. Correctly examines the patient to assess indicators of cholinergic crisis in a simulated context with a mannequin simulator or a standardized patient: • Eyes • Mouth • Nose • Respiratory effort • Muscle control

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
			during clinical assessment: <ul style="list-style-type: none"> • Pain • GI/Urinary distress • Difficulty breathing • Fatigue • Muscle control • Other concerns 3. Correctly indicates the areas where physical examination will provide indicators of cholinergic crisis: <ul style="list-style-type: none"> • Eyes • Mouth • Nose • Respiratory effort • Muscle control • Pulse 			<ul style="list-style-type: none"> • Pulse
Factual	<u>Medication Knowledge</u> 1. Know the drugs, dosages, administration routes and time sequences for the management of cholinergic crisis. 2. Understand the purpose of each drug used in the management of cholinergic crisis and their respective expected clinical effects.	<u>Medication Knowledge</u> 1. On a written test, identify the drugs, dosages, administration routes and time sequences for the management of cholinergic crisis. 2. Describe the purpose of each drug used in the management of cholinergic crisis and their respective expected clinical	<u>Medication Knowledge</u> 1. Correctly identifies the drugs, dosages, administration routes and time sequences for the management of cholinergic crisis: Pre-treatment <ul style="list-style-type: none"> • Pyridostigmine Bromide (30mg orally q 8 hours) (pre-treatment) Treatment <ul style="list-style-type: none"> • Mark1 Kit Auto Injector 	<u>Medication Skills</u> 1. Be able to use the following: <ul style="list-style-type: none"> • Mark1 Kit Auto Injector • ATNNA Auto Injector • CANA Auto Injector 2. Be able to place an IV catheter. 3. Be able to administer drugs through IV catheter.	<u>Medication Skills</u> 1. Demonstrate the ability to use the following in a simulated context: <ul style="list-style-type: none"> • Mark1 Kit Auto Injector • ATNNA Auto Injector • CANA Auto Injector 2. Be able to place an IV catheter in a simulated context. 3. Be able to	<u>Medication Skills</u> 1. Correctly uses each of the following in a simulated context: <ul style="list-style-type: none"> • Mark1 Kit Auto Injector • ATNNA Auto Injector • CANA Auto

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
		effects on a written test.	<p>(Atropine, 2mg / 2PAMCL, 300mg) IM 1st injector 2nd injector 10-15 min after 1st injector 3rd injector in rapid succession, 1q 5min as needed, not to exceed 3 in 1 hour</p> <ul style="list-style-type: none"> • ATNAA Auto Injector <p>(Atropine, 2.1mg / 2PAMCL, 600mg) IM 1st injector 2nd injector 10-15 min after 1st injector 3rd injector in rapid succession, 1q 5min as needed, not to exceed 3 in 1 hour</p> <ul style="list-style-type: none"> • CANA) Auto Injector <p>(Diazepam, 10mg) IM 1st injector if patient receives 3 ATNAA/ Mark1 Kits Auto Injectors 2nd/3rd injectors as needed for seizing patient</p> <ul style="list-style-type: none"> • Atropine Ophthalmic Ointment (topical); 0.5" strip in pocket of lower 	4. Be able to administer atropine ophthalmic ointment.	<p>administer drugs through IV catheter in a simulated context.</p> <p>4. Be able to administer atropine ophthalmic ointment (topical); 0.5" strip in pocket of lower eyelid of a patient mannequin simulator.</p>	<p>Injector</p> <p>2. Correctly places an IV catheter in a simulated context.</p> <p>3. Correctly administers drugs through IV catheter in a simulated context.</p> <p>4. Correctly administers atropine ophthalmic ointment (topical); 0.5" strip in pocket of lower eyelid of a patient mannequin simulator.</p>

<i>Level</i>	<i>Knowledge</i>	<i>Assessment</i>	<i>Standard</i>	<i>Skill</i>	<i>Assessment</i>	<i>Standard</i>
			<p>eyelid at Level 2 treatment location</p> <p>2. Correctly describe the purpose of each drug used in the management of cholinergic crisis and their respective expected clinical effects on a written test:</p> <ul style="list-style-type: none"> • Pyridostigmine Bromide – Shields AChE enzyme from full effects of GD to enhance the effectiveness of treatment after GD exposure. • Atropine – Dry secretions, reduce bronchoconstriction, decrease gastrointestinal motility • 2PAMCL – Remove the nerve agent (except GD) from the enzyme acetylcholinesterase. • Diazepam – Control convulsions. • Atropine ophthalmological ointment – Relieve eye symptoms. 			

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
Factual	<p><u>Health Metrics</u> Understand relevant health metrics for assessing the patient's physical and physiological status.</p> <p>Understand relevant time sequence for exposure in assessing the patient's physical and physiological status during cholinergic crisis.</p>	<p><u>Health Metrics</u> Indicate on a written test which health metrics to assess for a patient who may be experiencing cholinergic crisis.</p> <p>Indicate on a written test relevant time sequence for exposure in assessing the patient's physical and physiological status during cholinergic crisis.</p>	<p><u>Health Metrics</u> Indicate the following health metrics:</p> <ul style="list-style-type: none"> • Pupil Size • Respiratory status • Muscle control • Neurological status • Volume of secretions • Heart rate <p>Indicate the time sequences for:</p> <ul style="list-style-type: none"> • Vapor • Liquid 	<p><u>Health Metrics</u> N/A</p>	<p><u>Health Metrics</u> N/A</p>	<p><u>Health Metrics</u> N/A</p>
Factual	<p><u>Situational Knowledge</u> 1. Identify exposure agent by using detection device(s) and situational cues.</p> <p>2. Identify exposure agent by using situational cues.</p> <p>3. Knows the transfer of care sequence for responding to a cholinergic crisis.</p>	<p><u>Situational Knowledge</u> 1. Indicate the meaning of detection results for each of the detection device(s) to assess exposure agent on a written test.</p> <p>2. Identifies other situational cues for assessing exposure agent on a written test.</p> <p>3. Describes the transfer of care sequence for responding to a cholinergic crisis on a written test.</p>	<p><u>Situational Knowledge</u> 1. Correctly indicates the meaning of the detection result for each detection device(s) to identify the exposure agent.</p> <p>2. Identifies other situational cues for assessing exposure agent including: mass casualties, patient symptomology such as the onset of symptoms, localized or general reactions, initial symptoms, and time progression of symptoms.</p>	<p><u>Situational Skills</u> N/A</p>	<p><u>Situational Skills</u> N/A</p>	<p><u>Situational Skills</u> N/A</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
			3. Correctly indicates transfer of care sequence: <ul style="list-style-type: none"> • Self-care • Buddy care • Level 1 Care (Medic, Combat Lifesaver) • Level 2 Care 			
Factual	<p><u>Procedural Knowledge</u></p> <p>1. Describe the patient management strategy for cholinergic crisis:</p> <ul style="list-style-type: none"> • Self-protection • Antidote • Airway • Breathing • Circulation • Drugs • Decontamination <p>2. Describe the decontamination protocol for managing a cholinergic crisis:</p> <ul style="list-style-type: none"> • Remove contaminated clothing and gear • Decontaminate exposed skin 	<p><u>Procedural Knowledge</u></p> <p>1. Describe patient management strategy for cholinergic crisis:</p> <p>Self-protection</p> <ul style="list-style-type: none"> • Pre-treatment w/ Pyridostigmine Bromide • Don Mission-Oriented Protective Posture (MOPP) Level IV <p>Antidote Treatment</p> <ul style="list-style-type: none"> • Mark 1 Kit (atropine and pralidoxime chloride auto-injector) • ATNAA (antidote treatment nerve agent auto-injector; atropine and pralidoxime chloride auto-injector) • CANA (convulsant antidote for nerve 	<p><u>Procedural Knowledge</u></p> <p>1. Correctly describe patient management strategy for cholinergic crisis:</p> <p>Self-protection</p> <ul style="list-style-type: none"> • Pre-treatment w/ Pyridostigmine Bromide • Don Mission-Oriented Protective Posture (MOPP) Level IV <p>Antidote Treatment</p> <ul style="list-style-type: none"> • Mark 1 Kit (atropine and pralidoxime chloride auto-injector) • ATNAA (antidote treatment nerve agent auto-injector; atropine and pralidoxime chloride auto-injector) • CANA (convulsant antidote for nerve 	<p><u>Procedural Skills</u></p> <p>1. Be able to don Mission-Oriented Protective Posture (MOPP) Level IV</p> <p>2. Be able to administer</p> <ul style="list-style-type: none"> • Mark 1 Kit • ATNAA • CANA <p>3. Be able to secure the patient's airway by performing:</p> <ul style="list-style-type: none"> • Suction • Patient positioning • Bag-valve-mask • Intubation <p>4. Be able to ventilate and implement RDIC to support the patient's breathing</p>	<p><u>Procedural Skills</u></p> <p>1. Be able to don Mission-Oriented Protective Posture (MOPP) Level IV in a simulated context</p> <p>2. Be able to administer each of the following to a patient mannequin simulator</p> <ul style="list-style-type: none"> • Mark 1 Kit • ATNAA • CANA <p>3. Be able to perform each of the following skills on a patient mannequin simulator::</p> <ul style="list-style-type: none"> • Suction • Patient positioning • Bag-valve-mask • Intubation 	<p><u>Procedural Skills</u></p> <p>1. Correctly dons Mission-Oriented Protective Posture (MOPP) Level IV in a simulated context</p> <p>2. Correctly administers each of the following to a patient mannequin simulator</p> <ul style="list-style-type: none"> • Mark 1 Kit • ATNAA • CANA <p>3. Correctly performs</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
		agent; diazepam auto-injector) Airway • Suction • Position patient • Bag-valve-mask airway • Intubation Breathing • Assessment • Ventilation • RDIC Circulation • Assessment Drugs • Pyridostigmine Bromide (30mg tablet) (pre-treatment) • Mark1 Kit Auto Injector (Atropine, 2mg / 2PAMCL, 300mg) IM 1 st injector 2 nd injector 10-15 min after 1 st injector 3 rd injector in rapid succession, 1q 5min as needed, not to exceed 3 in 1 hour • ATNAA Auto Injector (Atropine, 2.1mg / 2PAMCL, 600mg) IM 1 st injector	agent; diazepam auto-injector) Airway • Suction • Position patient • Bag-valve-mask airway • Intubation Breathing • Assessment • Ventilation • RDIC Circulation • Assessment Drugs • Pyridostigmine Bromide (30mg tablet) (pre-treatment) • Mark1 Kit Auto Injector (Atropine, 2mg / 2PAMCL, 300mg) IM 1 st injector 2 nd injector 10-15 min after 1 st injector 3 rd injector in rapid succession, 1q 5min as needed, not to exceed 3 in 1 hour • ATNAA Auto Injector (Atropine, 2.1mg / 2PAMCL, 600mg) IM 1 st injector	5. Be able to perform each step of the decontamination protocol: • Remove contaminated clothing and gear • Decontaminate exposed skin • Apply reactive skin decontamination lotion (RSDL) • Irrigate with large amounts of water • Apply M291 SDK • Clean w/ soap & water • Apply M295 • Apply 0.5% hypochlorite solution	4. Be able to ventilate and implement RDIC using a patient mannequin simulator 5. Be able to perform each step of the decontamination protocol in a simulated context using the correct method on a patient mannequin simulator or standardized patient: • Remove and disposition contaminated clothing and gear. • Decontaminate exposed skin in the following order: - Face - Neck area - Chest area - Abdomen - Arms and hands - Other exposed skin areas • Apply reactive skin decontamination lotion (RSDL) • Irrigate with large amounts of water • Apply M291 SDK • Clean w/ soap &	each of the following skills on a patient mannequin simulator: • Suction • Patient positioning • Bag-valve-mask • Intubation 4. Correctly ventilates and implements RDIC using a patient mannequin simulator 5. Be able to perform each step of the decontamination protocol in a simulated context using the correct method on a patient mannequin simulator or

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
		<p>2nd injector 10-15 min after 1st injector 3rd injector in rapid succession, 1q 5min as needed, not to exceed 3 in 1 hour</p> <ul style="list-style-type: none"> • CANA Auto Injector (Diazepam,10mg) IM <p>1st injector if patient receives 3 ATNAA/ Mark1 Kits Auto Injectors 2nd/3rd injectors as needed for seizing patient</p> <ul style="list-style-type: none"> • Atropine <p>Ophthalmic Ointment (topical); 0.5" strip in pocket of lower eyelid at Level 2 treatment location</p> <p>Decontamination</p> <p>Describe decontamination protocol:</p> <ul style="list-style-type: none"> • Remove contaminated clothing and gear (order of removal, how to remove, how to dispose) • Decontaminate exposed skin in the following order: <ul style="list-style-type: none"> - Face - Neck area - Chest area 	<p>2nd injector 10-15 min after 1st injector 3rd injector in rapid succession, 1q 5min as needed, not to exceed 3 in 1 hour</p> <ul style="list-style-type: none"> • CANA Auto Injector (Diazepam,10mg) IM <p>1st injector if patient receives 3 ATNAA/ Mark1 Kits Auto Injectors 2nd/3rd injectors as needed for seizing patient</p> <ul style="list-style-type: none"> • Atropine <p>Ophthalmic Ointment (topical); 0.5" strip in pocket of lower eyelid at Level 2 treatment location</p> <p>Decontamination</p> <p>Describe decontamination protocol:</p> <ul style="list-style-type: none"> • Remove contaminated clothing and gear (order of removal, how to remove, how to dispose) • Decontaminate exposed skin in the following order: <ul style="list-style-type: none"> - Face - Neck area - Chest area 		<p>water</p> <ul style="list-style-type: none"> • Apply M295 • Apply 0.5% hypochlorite solution 	<p>standardize d patient:</p> <ul style="list-style-type: none"> • Remove and disposition contaminate d clothing and gear. • Decontamin ate exposed skin in the following order: <ul style="list-style-type: none"> - Face - Neck area - Chest area - Abdomen - Arms and hands - Other exposed skin areas • Apply reactive skin decontamin ation lotion (RSDL) • Irrigate with large amounts of water • Apply M291 SDK • Clean w/

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
		<ul style="list-style-type: none"> - Abdomen - Arms and hands - Other exposed skin areas • Apply reactive skin decontamination lotion (RSDL) (how much, how applied, sequence) • Irrigate with large amounts of water (how applied, drainage, sequence) • M291 SDK (how much, how applied, sequence) • Soap & water • M295 (how much, how applied, sequence) • 0.5% hypochlorite solution (how much, how applied, sequence) 	<ul style="list-style-type: none"> - Abdomen - Arms and hands - Other exposed skin areas • Apply reactive skin decontamination lotion (RSDL) (how much, how applied, sequence) • Irrigate with large amounts of water (how applied, drainage, sequence) • M291 SDK (how much, how applied, sequence) • Soap & water • M295 (how much, how applied, sequence) • 0.5% hypochlorite solution (how much, how applied, sequence) 			<ul style="list-style-type: none"> soap & water • Apply M295 • Apply 0.5% hypochlorite solution
Factual	<p><u>Instruments & Supplies</u> Identify and describe the function the following medical instruments & supplies:</p> <ul style="list-style-type: none"> • Resuscitation Device, Individual, Chemical (RDIC) • Endotracheal Tube • Stylette • Laryngoscope • Suction 	<p><u>Instruments & Supplies</u> Identify and describe the function the following medical instruments & supplies in a written test:</p> <ul style="list-style-type: none"> • Resuscitation Device, Individual, Chemical (RDIC) • Endotracheal Tube • Stylette • Laryngoscope 	<p><u>Instruments & Supplies</u> Correctly identify and describe the function the following medical instruments & supplies:</p> <ul style="list-style-type: none"> • Resuscitation Device, Individual, Chemical (RDIC) • Endotracheal Tube • Stylette • Laryngoscope • Suction 	<p><u>Instruments & Supplies</u> 1. Be able to identify the location of instruments & supplies.</p> <p>2. Be able to appropriately select and implement the following medical instruments & supplies:</p> <ul style="list-style-type: none"> • Resuscitation 	<p><u>Instruments & Supplies</u> 1. Demonstrate the ability to locate instruments & supplies.</p> <p>2. Demonstrates ability to appropriately select and implement the following medical instruments & supplies in a</p>	<p><u>Instruments & Supplies</u> 1. Correctly demonstrates the ability to locate instruments & supplies.</p> <p>2. Correctly demonstrates ability to</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
	<ul style="list-style-type: none"> • Bag-valve-mask • IV Catheter • IV Fluids • Tape 	<ul style="list-style-type: none"> • Suction • Bag-valve-mask • IV Catheter • IV Fluids • Tape 	<ul style="list-style-type: none"> • Bag-valve-mask • IV Catheter • IV Fluids • Tape 	Device, Individual, Chemical (RDIC) <ul style="list-style-type: none"> • Endotracheal Tube • Stylette • Laryngoscope • Suction • Bag-valve-mask • IV Catheter • IV Fluids • Tape 	simulated context: <ul style="list-style-type: none"> • Resuscitation Device, Individual, Chemical (RDIC) • Endotracheal Tube • Stylette • Laryngoscope • Suction • Bag-valve-mask • IV Catheter • IV Fluids • Tape 	appropriately select and implement the following medical instruments & supplies in a simulated context: <ul style="list-style-type: none"> • Resuscitation Device, Individual, Chemical (RDIC) • Endotracheal Tube • Stylette • Laryngoscope • Suction • Bag-valve-mask • IV Catheter • IV Fluids • Tape
Factual	<u>Equipment</u> 1. Discriminate between positive detection	<u>Equipment</u> 1. Indicate what the alarm indicators or color indicators for	<u>Equipment</u> 1. Correctly indicate what the alarm indicators or	<u>Equipment</u> 1. Be able to use the following detection devices:	<u>Equipment</u> 1. Correctly uses the following detection devices in a	<u>Equipment</u> 1. Correctly uses the following

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
	<p>alarm indicators or color indicators for the following detection devices:</p> <ul style="list-style-type: none"> • M256A1 Chemical Agent Detector Kit • M18A2 Chemical Agent Detector Kit • ICAM (Improved Chemical Agent Alarm) • M8 Chemical Agent Detector Paper • M9 Chemical Agent Detector Paper • M22 (ACADA) Automatic Chemical Agents Detection Alarm • M93A1 FOX NBC RECONNAISSANCE System • M21 (RSCAAL) Remote Sensing Chemical Agent Alarm • M90 Chemical Agent Detector • M272 (in water) <p>2. Know to select and don Mission-Oriented Protective Posture (MOPP) Level IV.</p>	<p>the following detection devices signify:</p> <ul style="list-style-type: none"> • M256A1 Chemical Agent Detector Kit • M18A2 Chemical Agent Detector Kit • ICAM (Improved Chemical Agent Alarm) • M8 Chemical Agent Detector Paper • M9 Chemical Agent Detector Paper • M22 (ACADA) Automatic Chemical Agents Detection Alarm • M93A1 FOX NBC RECONNAISSANCE System • M21 (RSCAAL) Remote Sensing Chemical Agent Alarm • M90 Chemical Agent Detector • M272 (in water) <p>2. Identify protection as Mission-Oriented Protective Posture (MOPP) Level IV on written test.</p>	<p>color indicators for the following detection devices signify:</p> <ul style="list-style-type: none"> • M256A1 Chemical Agent Detector Kit • M18A2 Chemical Agent Detector Kit • ICAM (Improved Chemical Agent Alarm) • M8 Chemical Agent Detector Paper • M9 Chemical Agent Detector Paper • M22 (ACADA) Automatic Chemical Agents Detection Alarm • M93A1 FOX NBC RECONNAISSANCE System • M21 (RSCAAL) Remote Sensing Chemical Agent Alarm • M90 Chemical Agent Detector • M272 (in water) <p>2. Correctly identify protection as Mission-Oriented Protective Posture (MOPP) Level IV.</p>	<ul style="list-style-type: none"> • M256A1 Chemical Agent Detector Kit • M18A2 Chemical Agent Detector Kit • ICAM (Improved Chemical Agent Alarm) • M8 Chemical Agent Detector Paper • M9 Chemical Agent Detector Paper • M22 (ACADA) Automatic Chemical Agents Detection Alarm • M93A1 FOX NBC RECONNAISSANCE System • M21 (RSCAAL) Remote Sensing Chemical Agent Alarm • M90 Chemical Agent Detector • M272 (in water) <p>2. Be able to don Mission-Oriented Protective Posture (MOPP) Level IV.</p>	<p>classroom, lab, or field exercise:</p> <ul style="list-style-type: none"> • M256A1 Chemical Agent Detector Kit • M18A2 Chemical Agent Detector Kit • ICAM (Improved Chemical Agent Alarm) • M8 Chemical Agent Detector Paper • M9 Chemical Agent Detector Paper • M22 (ACADA) Automatic Chemical Agents Detection Alarm • M93A1 FOX NBC RECONNAISSANCE System • M21 (RSCAAL) Remote Sensing Chemical Agent Alarm • M90 Chemical Agent Detector • M272 (in water) <p>2. Demonstrates ability to don Mission-Oriented Protective Posture (MOPP) Level IV.</p>	<p>detection devices in a classroom, lab, or field exercise:</p> <ul style="list-style-type: none"> • M256A1 Chemical Agent Detector Kit • M18A2 Chemical Agent Detector Kit • ICAM (Improved Chemical Agent Alarm) • M8 Chemical Agent Detector Paper • M9 Chemical Agent Detector Paper • M22 (ACADA) Automatic Chemical Agents Detection Alarm • M8 Chemical Agent Detector Paper • M9 Chemical Agent Detector Paper • ICAM (Improved Chemical Agent Alarm) • M8 Chemical Agent Detector Paper • M9 Chemical Agent Detector Paper • M22 (ACADA) Automatic Chemical Agents Detection Alarm • M93A1 FOX NBC RECONNAISSANCE System • M21 (RSCAAL) Remote Sensing Chemical Agent Detector Paper • M9 Chemical Agent Detector Paper • M22 (ACADA) Automatic Chemical Agents Detection Alarm • M93A1 FOX NBC

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
						RECONNAISSANCE System • M21 (RSCAAL) Remote Sensing Chemical Agent Alarm • M90 Chemical Agent Detector • M272 (in water) 2. Correctly dons Mission-Oriented Protective Posture (MOPP) Level IV.
Conceptual	<u>Physiological</u> 1. Distinguish other possible exposures leading to similar patient symptomology. 2. Distinguish other possible medical conditions leading to similar patient	<u>Physiology</u> 1. Indicate other possible exposures leading to similar patient symptomology on a written test: 2. Indicate other possible medical conditions leading to	<u>Physiology</u> 1. Correctly identify other possible exposures: • Vesicants: cough, erythema, blisters, conjunctivitis • Pulmonary Agents: airway irritation, shortness of breath (delayed	<u>Physiology</u> N/A	<u>Physiology</u> N/A	<u>Physiology</u> N/A

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
	symptomology.	similar patient symptomology in a written test.	<p>onset), eye irritation, chest tightness</p> <ul style="list-style-type: none"> • Cyanide: pulmonary edema (secretions, cough difficulty breathing), seizures, respiratory arrest, cardiac arrest • Riot: respiratory discomfort (coughing, difficulty breathing, shortness of breath), burning pain on mucous membranes, skin and eyes • Respiratory Irritants: respiratory discomfort (coughing, wheezing, shortness of breath, chest tightness), irritation to eyes, nose, upper airway. <p>2. Correctly identify other possible medical conditions leading to similar patient symptomology:</p> <ul style="list-style-type: none"> • Upper respiratory infections • Viral infection (GI) • Medication toxicities - opiates 			

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
Conceptual	<p>Clinical Knowledge</p> <p>1. Understand the relevant symptomology for performing a differential diagnosis (DDx) for patient experiencing signs of a cholinergic crisis.</p> <ul style="list-style-type: none"> • Identify other possible exposures. • Identify other possible medical conditions <p>2. Distinguish the primary combination of nerve agent exposure indicators.</p> <p>3. Distinguish between the clinical indicators for vapor or liquid exposure.</p> <p>4. Distinguish between the clinical indicators for the extent of poisoning</p>	<p>Clinical Knowledge</p> <p>1. Perform Differential Diagnosis (DDx) from case-based information on a written test.</p> <ul style="list-style-type: none"> • Identify other possible exposures. • Identify other possible medical conditions <p>2. Identify primary combination of nerve agent exposure indicators on a written test.</p> <p>3. Distinguish between the clinical indicators for vapor or liquid exposure from case-based information on a written test.</p> <p>4. Distinguish between the clinical indicators for the extent of poisoning from case-based information on a written test.</p>	<p>Clinical Knowledge</p> <p>1. Correctly identify the following clinical conditions from case-based information on a written test:</p> <ul style="list-style-type: none"> • Nerve agent • Vesicant • Pulmonary Agents • Riot • Cyanide • Respiratory Irritant • Upper respiratory infections • Viral infection (GI) • Medication toxicities - opiates <p>2. Correctly identify primary combination of nerve agent exposure indicators:</p> <ul style="list-style-type: none"> • Miosis • Copious secretions • Generalized muscular fasciculations • Respiratory distress • Cyanosis • Convulsions <p>3. Correctly determines vapor or liquid exposure: Vapor –</p>	<p>Clinical Skills</p> <p>1. Be able to examine the patient to perform DDx:</p> <ul style="list-style-type: none"> • Eyes • Mouth • Nose • Respiratory effort • Muscle control • Pulse • Skin • Pain level/location • Fever 	<p>Clinical Skills</p> <p>1. Demonstrate the ability to examine the patient and perform DDx in a simulated context with a mannequin simulator or a standardized patient:</p> <ul style="list-style-type: none"> • Eyes • Mouth • Nose • Respiratory effort • Muscle control • Pulse • Skin • Pain level/location • Fever 	<p>Clinical Skills</p> <p>1. Correctly examines the patient to assess indicators of cholinergic crisis in a simulated context with a mannequin simulator or a standardized patient:</p> <ul style="list-style-type: none"> • Eyes • Mouth • Nose • Respiratory effort • Muscle control • Pulse • Skin • Pain level/location • Fever

<i>Level</i>	<i>Knowledge</i>	<i>Assessment</i>	<i>Standard</i>	<i>Skill</i>	<i>Assessment</i>	<i>Standard</i>
			<p>Symptomatic onset within seconds to minutes; Eye, Respiratory, Secretory, Neuromuscular, Gastrointestinal</p> <p>Liquid – Symptomatic onset within 10 minutes to 18 hours; Muscle twitching and sweating at site of exposure, Nausea/Vomiting, Weakness, Respiratory, Gastrointestinal, Neurological</p> <p>Both – Convulsions, Apnea</p> <p>4. Correctly determines the extent of poisoning</p> <ul style="list-style-type: none"> • Mild – Miosis, Headache, Rhinorrhea, Salivation, Dyspnea, Bronchoconstriction • Severe – Symptoms progress to more than one organ system. Respiratory 			

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
			Cessation, Neuromuscular Symptoms			
Conceptual	<u>Medication Knowledge</u> 1. Differentiate dose requirements by age for the medications used in the management of cholinergic crisis.	<u>Medication Knowledge</u> 1. Indicate the dose requirements by age for the medications used in the management of cholinergic crisis on a written test.	<u>Medication Knowledge</u> 1. Correctly indicate the dose requirements by age for the medications used in the management of cholinergic crisis on a written test. • Atropine: 2mg/dose (>12 years); 1mg/dose (6-12 years); 0.5mg/dose (age 1-5 years); 0.25mg/dose (<1 years) • Praladoxime Chloride (25/50mg/kg; 2000mg max for all): 3 injectors (>12 years); 2 injectors (6-12 years); 1 injector (age 1-5 years); NA (<1 years) • Diazepam: 10mg/dose (>12 years); 0.3mg/kg (6-12 years); 0.5mg/kg (age <6 years)	<u>Medication Knowledge</u> N/A	<u>Medication Knowledge</u> N/A	<u>Medication Knowledge</u> N/A

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
Practical	<p>Clinical Knowledge</p> <p>1. Know how to examine and assess the patient's physical and physiological status.</p> <p>2. Perform a differential diagnosis (DDx) for patient experiencing signs of a cholinergic crisis in a simulated context with a mannequin simulator or a standardized patient.</p> <ul style="list-style-type: none"> • Identify other possible exposures. • Identify other possible medical conditions <p>3. Distinguish the primary combination of nerve agent exposure indicators.</p> <p>4. Distinguish between the clinical indicators for vapor or liquid exposure.</p> <p>5. Distinguish between the clinical indicators for the extent of poisoning</p>	<p>Clinical Knowledge</p> <p>1. Request information from a conscious patient, and assess the physical and physiological signs of a patient in a simulated context with a mannequin simulator or a standardized patient.</p> <p>2. Perform Differential Diagnosis (DDx) for a patient in a simulated context with a mannequin simulator or a standardized patient.</p> <ul style="list-style-type: none"> • Identify other possible exposures. • Identify other possible medical conditions <p>3. Identify primary combination of nerve agent exposure indicators in a simulated context with a mannequin simulator or a standardized patient.</p> <p>4. Distinguish</p>	<p>Clinical Knowledge</p> <p>1. Correctly examines and assesses physical and physiological signs to identify nerve agent exposure of a patient in a simulated context with a mannequin simulator or a standardized patient:</p> <ul style="list-style-type: none"> • Miosis • Copious secretions • Generalized muscular fasciculations • Respiratory distress • Cyanosis • Convulsions • Pain • GI/Urinary distress • Difficulty breathing • Fatigue • Muscle control <p>2. Correctly performs Differential Diagnosis (DDx) for a patient in a simulated context with a mannequin simulator or a standardized patient.</p> <ul style="list-style-type: none"> • Nerve agent 	<p>Clinical Skills</p> <p>1. Be able to examine the patient to assess indicators of cholinergic crisis:</p> <ul style="list-style-type: none"> • Eyes • Mouth • Nose • Respiratory effort • Muscle control • Pulse 	<p>Clinical Skills</p> <p>1. Demonstrate the ability to examine the patient and assess indicators of cholinergic crisis in a simulated context with a mannequin simulator or a standardized patient:</p> <ul style="list-style-type: none"> • Eyes • Mouth • Nose • Respiratory effort • Muscle control • Pulse 	<p>Clinical Skills</p> <p>1. Correctly examines the patient to assess indicators of cholinergic crisis in a simulated context with a mannequin simulator or a standardized patient:</p> <ul style="list-style-type: none"> • Eyes • Mouth • Nose • Respiratory effort • Muscle control • Pulse

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
		<p>between the clinical indicators for vapor or liquid exposure in a simulated context with a mannequin simulator or a standardized patient.</p> <p>5. Distinguish between the clinical indicators for the extent of poisoning in a simulated context with a mannequin simulator or a standardized patient.</p>	<ul style="list-style-type: none"> • Vesicant • Pulmonary Agents • Riot • Cyanide • Respiratory Irritant • Upper respiratory infections • Viral infection (GI) • Medication toxicities - opiates <p>3. Correctly identify primary combination of nerve agent exposure indicators in a simulated context with a mannequin simulator or a standardized patient:</p> <ul style="list-style-type: none"> • Miosis • Copious secretions • Generalized muscular fasciculations • Respiratory distress • Cyanosis • Convulsions <p>4. Correctly determines vapor or liquid exposure in a simulated context with a mannequin simulator or a standardized patient:</p>			

<i>Level</i>	<i>Knowledge</i>	<i>Assessment</i>	<i>Standard</i>	<i>Skill</i>	<i>Assessment</i>	<i>Standard</i>
			<p>Vapor – Symptomatic onset within seconds to minutes; Eye, Respiratory, Secretory, Neuromuscular, Gastrointestinal</p> <p>Liquid – Symptomatic onset within 10 minutes to 18 hours; Muscle twitching and sweating at site of exposure, Nausea/Vomiting, Weakness, Respiratory, Gastrointestinal, Neurological</p> <p>Both – Convulsions, Apnea</p> <p>4. Correctly determines the extent of poisoning in a simulated context with a mannequin simulator or a standardized patient.</p> <p>• Mild – Miosis, Headache, Rhinorrhea, Salivation, Dyspnea,</p>			

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
			Bronchoconstriction • Severe – Symptoms progress to more than one organ system. Respiratory Cessation, Neuromuscular Symptoms			
Practical	<p>Medication Knowledge</p> <p>1. Know the drugs, dosages, administration routes and time sequences for the management of cholinergic crisis.</p> <p>2. Understand the purpose of each drug used in the management of cholinergic crisis and their respective expected clinical effects.</p>	<p>Medication Knowledge</p> <p>1. Select the drugs, dosages, administration routes and time sequences for the management of cholinergic crisis in a simulated context with a mannequin simulator or a standardized patient.</p> <p>2. Evaluate the clinical effects of the drugs in a simulated context with a mannequin simulator or a standardized patient.</p>	<p>Medication Knowledge</p> <p>1. Correctly selects the drugs, dosages, administration routes and time sequences for the management of cholinergic crisis in a simulated context with a mannequin simulator or a standardized patient:</p> <p>Pre-treatment</p> <ul style="list-style-type: none"> • Pyridostigmine Bromide (30mg tablet orally q 8 hours) (pre-treatment) <p>Treatment</p> <ul style="list-style-type: none"> • Mark1 Kit Auto Injector (Atropine, 2mg / 2PAMCL, 300mg) IM 1st injector 2nd injector 10-15 min after 1st injector 3rd injector in rapid 	<p>Medication Skills</p> <p>1. Be able to use the following:</p> <ul style="list-style-type: none"> • Mark1 Kit Auto Injector • ATNNA Auto Injector • CANA Auto Injector <p>2. Be able to place an IV catheter.</p> <p>3. Be able to administer drugs through IV catheter.</p> <p>4. Be able to administer atropine ophthalmic ointment.</p>	<p>Medication Skills</p> <p>1. Demonstrate the ability to use the following in a simulated context:</p> <ul style="list-style-type: none"> • Mark1 Kit Auto Injector • ATNNA Auto Injector • CANA Auto Injector <p>2. Be able to place an IV catheter in a simulated context.</p> <p>3. Be able to administer drugs through IV catheter in a simulated context.</p> <p>4. Be able to administer atropine ophthalmic ointment (topical); 0.5" strip in pocket of lower eyelid of a patient mannequin</p>	<p>Medication Skills</p> <p>1. Correctly uses each of the following in a simulated context:</p> <ul style="list-style-type: none"> • Mark1 Kit Auto Injector • ATNNA Auto Injector • CANA Auto Injector <p>2. Correctly places an IV catheter in a simulated context.</p> <p>3. Correctly administers drugs</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
			<p>succession, 1q 5min as needed, not to exceed 3 in 1 hour</p> <ul style="list-style-type: none"> • ATNAA Auto Injector (Atropine, 2.1mg / 2PAMCL, 600mg) IM 1st injector 2nd injector 10-15 min after 1st injector 3rd injector in rapid succession, 1q 5min as needed, not to exceed 3 in 1 hour • CANA) Auto Injector (Diazepam, 10mg) IM 1st injector if patient receives 3 ATNAA/ Mark1 Kits Auto Injectors 2nd/3rd injectors as needed for seizing patient • Atropine Ophthalmic Ointment (topical); 0.5" strip in pocket of lower eyelid at Level 2 treatment location <p>2. Correctly evaluates the clinical effects of the drugs in a simulated</p>		simulator.	<p>through IV catheter in a simulated context.</p> <p>4. Correctly administers atropine ophthalmic ointment (topical); 0.5" strip in pocket of lower eyelid of a patient mannequin simulator.</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
			context with a mannequin simulator or a standardized patient: <ul style="list-style-type: none"> • Pyridostigmine Bromide – Shields AChE enzyme from full effects of GD to enhance the effectiveness of treatment after GD exposure. • Atropine – Dry secretions, reduce bronchoconstriction, decrease gastrointestinal motility • 2PAMCL – Remove the nerve agent (except GD) from the enzyme acetylcholinesterase. • Diazepam – Control convulsions. • Atropine ophthalmological ointment – Relieve eye symptoms. 			
	<u>Health Metrics</u> 1. Understand relevant health metrics for assessing the patient’s physical and physiological status.	<u>Health Metrics</u> 1. Evaluates appropriate health metrics to assess a patient who may be experiencing cholinergic crisis in a simulated context	<u>Health Metrics</u> 1. Assesses the following health metrics in a simulated context with a mannequin simulator or a standardized patient:	<u>Health Metrics</u> N/A	<u>Health Metrics</u> N/A	<u>Health Metrics</u> N/A

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
	2. Understand relevant time sequence for exposure in assessing the patient's physical and physiological status during cholinergic crisis.	with a mannequin simulator or a standardized patient. 2. Evaluate the relevant time sequence for exposure in assessing the patient's physical and physiological status during cholinergic crisis in a simulated context with a mannequin simulator or a standardized patient.	<ul style="list-style-type: none"> • Pupil Size • Respiratory status • Muscle control • Neurological status • Volume of secretions • Heart rate 2. Correctly evaluates the time sequences in a simulated context with a mannequin simulator or a standardized patient for: <ul style="list-style-type: none"> • Vapor • Liquid 			
	<u>Situational Knowledge</u> Identify exposure agent by using detection device(s) and situational cues.	<u>Situational Knowledge</u> 1. Assess exposure agent in a simulated context with a mannequin simulator or a standardized patient. 2. Identify other situational cues for assessing exposure agent in a simulated context with a mannequin simulator or a standardized patient.	<u>Situational Knowledge</u> 1. Correctly assesses the exposure agent in a simulated context with a mannequin simulator or a standardized patient. 2. Correctly identifies other situational cues for assessing exposure agent in a simulated context with a mannequin simulator or a standardized patient, including: mass casualties, patient	<u>Situational Skills</u> N/A	<u>Situational Skills</u> N/A	<u>Situational Skills</u> N/A

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
			symptomology such as the onset of symptoms, localized or general reactions, initial symptoms, and time progression of symptoms.			
	<p><u>Procedural Knowledge</u></p> <p>1. Implements the patient management strategy for cholinergic crisis:</p> <ul style="list-style-type: none"> • Self-protection • Antidote • Airway • Breathing • Circulation • Drugs • Decontamination <p>2. Implements the de-contamination protocol for managing a cholinergic crisis:</p> <ul style="list-style-type: none"> • Remove contaminated clothing and gear • Decontaminate exposed skin 	<p><u>Procedural Knowledge</u></p> <p>1. Implements patient management strategy for cholinergic crisis in a simulated context with a mannequin simulator or a standardized patient:</p> <p>Self-protection Antidote Treatment Airway Breathing Circulation Drugs Decontamination</p>	<p><u>Procedural Knowledge</u></p> <p>1. Correctly implements patient management strategy for cholinergic crisis in a simulated context with a mannequin simulator or a standardized patient:</p> <p>Self-protection</p> <ul style="list-style-type: none"> • Pre-treatment w/ Pyridostigmine Bromide • Don Mission-Oriented Protective Posture (MOPP) Level IV <p>Antidote Treatment</p> <ul style="list-style-type: none"> • Mark 1 Kit (atropine and pralidoxime chloride auto-injector) • ATNAA (antidote treatment nerve agent auto-injector; atropine and pralidoxime chloride auto-injector) 	<p><u>Procedural Skills</u></p> <p>1. Be able to don Mission-Oriented Protective Posture (MOPP) Level IV</p> <p>2. Be able to administer</p> <ul style="list-style-type: none"> • Mark 1 Kit • ATNAA • CANA <p>3. Be able to secure the patient's airway by performing:</p> <ul style="list-style-type: none"> • Suction • Patient positioning • Bag-valve-mask • Intubation <p>4. Be able to ventilate and implement RDIC to support the patient's breathing</p> <p>5. Be able to perform each step of the decontamination protocol:</p>	<p><u>Procedural Skills</u></p> <p>1. Be able to don Mission-Oriented Protective Posture (MOPP) Level IV in a simulated context</p> <p>2. Be able to administer each of the following to a patient mannequin simulator</p> <ul style="list-style-type: none"> • Mark 1 Kit • ATNAA • CANA <p>3. Be able to perform each of the following skills on a patient mannequin simulator::</p> <ul style="list-style-type: none"> • Suction • Patient positioning • Bag-valve-mask • Intubation <p>4. Be able to ventilate and implement RDIC using a patient</p>	<p><u>Procedural Skills</u></p> <p>1. Correctly dons Mission-Oriented Protective Posture (MOPP) Level IV in a simulated context</p> <p>2. Correctly administers each of the following to a patient mannequin simulator</p> <ul style="list-style-type: none"> • Mark 1 Kit • ATNAA • CANA <p>3. Correctly performs each of the following skills on a patient</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
			<ul style="list-style-type: none"> • CANA (convulsant antidote for nerve agent; diazepam auto-injector) <p>Airway</p> <ul style="list-style-type: none"> • Suction • Position patient • Bag-valve-mask airway • Intubation <p>Breathing</p> <ul style="list-style-type: none"> • Assessment • Ventilation • RDIC <p>Circulation</p> <ul style="list-style-type: none"> • Assessment <p>Drugs</p> <ul style="list-style-type: none"> • Pyridostigmine Bromide (30mg tablet) (pre-treatment) • Mark1 Kit Auto Injector (Atropine, 2mg / 2PAMCL, 300mg) IM 1st injector 2nd injector 10-15 min after 1st injector 3rd injector in rapid succession, 1q 5min as needed, not to exceed 3 in 1 hour 	<ul style="list-style-type: none"> • Remove contaminated clothing and gear • Decontaminate exposed skin • Apply reactive skin decontamination lotion (RSDL) • Irrigate with large amounts of water • Apply M291 SDK • Clean w/ soap & water • Apply M295 • Apply 0.5% hypochlorite solution 	<p>mannequin simulator</p> <p>5. Be able to perform each step of the decontamination protocol in a simulated context using the correct method on a patient mannequin simulator or standardized patient:</p> <ul style="list-style-type: none"> • Remove and disposition contaminated clothing and gear. • Decontaminate exposed skin in the following order: <ul style="list-style-type: none"> - Face - Neck area - Chest area - Abdomen - Arms and hands - Other exposed skin areas • Apply reactive skin decontamination lotion (RSDL) • Irrigate with large amounts of water • Apply M291 SDK • Clean w/ soap & water • Apply M295 • Apply 0.5% hypochlorite solution 	<p>mannequin simulator:</p> <ul style="list-style-type: none"> • Suction • Patient positioning • Bag-valve-mask • Intubation <p>4. Correctly ventilates and implements RDIC using a patient mannequin simulator</p> <p>5. Be able to perform each step of the decontamination protocol in a simulated context using the correct method on a patient mannequin simulator or standardized patient:</p> <ul style="list-style-type: none"> • Remove and

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
			<ul style="list-style-type: none"> • ATNAA Auto Injector (Atropine, 2.1mg / 2PAMCL, 600mg) IM <ul style="list-style-type: none"> 1st injector 2nd injector 10-15 min after 1st injector 3rd injector in rapid succession, 1q 5min as needed, not to exceed 3 in 1 hour • CANA Auto Injector (Diazepam, 10mg) IM <ul style="list-style-type: none"> 1st injector if patient receives 3 ATNAA/ Mark1 Kits Auto Injectors 2nd/3rd injectors as needed for seizing patient • Atropine Ophthalmic Ointment (topical); 0.5" strip in pocket of lower eyelid at Level 2 treatment location <p>Decontamination Performs decontamination protocol:</p> <ul style="list-style-type: none"> • Removes contaminated clothing and gear • Decontaminates exposed skin in the 			<p>disposition contaminate d clothing and gear.</p> <ul style="list-style-type: none"> • Decontaminate exposed skin in the following order: <ul style="list-style-type: none"> - Face - Neck area - Chest area - Abdomen - Arms and hands - Other exposed skin areas • Apply reactive skin decontamination lotion (RSDL) • Irrigate with large amounts of water • Apply M291 SDK • Clean w/ soap & water • Apply M295

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
			following order: - Face - Neck area - Chest area - Abdomen - Arms and hands - Other exposed skin areas • Applies reactive skin decontamination lotion (RSDL) • Irrigates with large amounts of water • Applies M291 SDK • Soap & water • Applies M295 • Applies 0.5% hypochlorite solution			<ul style="list-style-type: none"> • Apply 0.5% hypochlorite solution
	<u>Instruments & Supplies</u> 1. Be able to identify the location of instruments & supplies.	<u>Instruments & Supplies</u> 1. Demonstrate the ability to locate instruments & supplies in a simulated context: • Resuscitation Device, Individual, Chemical (RDIC) • Endotracheal Tube • Stylette • Laryngoscope • Suction • Bag-valve-mask • IV Catheter • IV Fluids • Tape	<u>Instruments & Supplies</u> 1. Correctly demonstrates the ability to locate instruments & supplies in a simulated context: • Resuscitation Device, Individual, Chemical (RDIC) • Endotracheal Tube • Stylette • Laryngoscope • Suction • Bag-valve-mask • IV Catheter • IV Fluids • Tape	<u>Instruments & Supplies</u> 1. Be able to appropriately select and implement the following medical instruments & supplies: • Resuscitation Device, Individual, Chemical (RDIC) • Endotracheal Tube • Stylette • Laryngoscope • Suction • Bag-valve-mask • IV Catheter • IV Fluids • Tape	<u>Instruments & Supplies</u> 1. Demonstrates ability to appropriately select and implement the following medical instruments & supplies in a simulated context: • Resuscitation Device, Individual, Chemical (RDIC) • Endotracheal Tube • Stylette • Laryngoscope • Suction • Bag-valve-mask • IV Catheter • IV Fluids	<u>Instruments & Supplies</u> 1. Correctly demonstrates ability to appropriately select and implement the following medical instruments & supplies in a simulated context: <ul style="list-style-type: none"> • Resuscitation Device,

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
					<ul style="list-style-type: none"> • Tape 	Individual, Chemical (RDIC) <ul style="list-style-type: none"> • Endotracheal Tube • Stylette • Laryngoscope • Suction • Bag-valve-mask • IV Catheter • IV Fluids • Tape
	<u>Equipment</u> 1. Discriminate between positive detection alarm indicators or color indicators for the following detection devices: <ul style="list-style-type: none"> • M256A1 Chemical Agent Detector Kit • M18A2 Chemical Agent Detector Kit • ICAM (Improved Chemical Agent Alarm) • M8 Chemical Agent Detector Paper • M9 Chemical Agent 	<u>Equipment</u> 1. Indicate what the alarm indicators or color indicators for the following detection devices signify in a simulated context: <ul style="list-style-type: none"> • M256A1 Chemical Agent Detector Kit • M18A2 Chemical Agent Detector Kit • ICAM (Improved Chemical Agent Alarm) • M8 Chemical Agent Detector Paper • M9 Chemical Agent 	<u>Equipment</u> 1. Correctly indicate what the alarm indicators or color indicators for the following detection devices signify in a simulated context: <ul style="list-style-type: none"> • M256A1 Chemical Agent Detector Kit • M18A2 Chemical Agent Detector Kit • ICAM (Improved Chemical Agent Alarm) • M8 Chemical Agent Detector Paper 	<u>Equipment</u> 1. Be able to use the following detection devices: <ul style="list-style-type: none"> • M256A1 Chemical Agent Detector Kit • M18A2 Chemical Agent Detector Kit • ICAM (Improved Chemical Agent Alarm) • M8 Chemical Agent Detector Paper • M9 Chemical Agent Detector Paper • M22 (ACADA) Automatic Chemical Agents Detection 	<u>Equipment</u> 1. Correctly uses the following detection devices in a classroom, lab, or field exercise: <ul style="list-style-type: none"> • M256A1 Chemical Agent Detector Kit • M18A2 Chemical Agent Detector Kit • ICAM (Improved Chemical Agent Alarm) • M8 Chemical Agent Detector Paper • M9 Chemical Agent Detector Paper • M22 (ACADA) 	<u>Equipment</u> 1. Correctly uses the following detection devices in a classroom, lab, or field exercise: <ul style="list-style-type: none"> • M256A1 Chemical Agent Detector Kit • M18A2 Chemical Agent Detector Kit • ICAM

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
	<p>Detector Paper</p> <ul style="list-style-type: none"> • M22 (ACADA) <p>Automatic Chemical Agents Detection Alarm</p> <ul style="list-style-type: none"> • M93A1 FOX NBC RECONNAISSANCE System • M21 (RSCAAL) <p>Remote Sensing Chemical Agent Alarm</p> <ul style="list-style-type: none"> • M90 Chemical Agent Detector • M272 (in water) <p>2. Know to select and don Mission-Oriented Protective Posture (MOPP) Level IV.</p>	<p>Detector Paper</p> <ul style="list-style-type: none"> • M22 (ACADA) <p>Automatic Chemical Agents Detection Alarm</p> <ul style="list-style-type: none"> • M93A1 FOX NBC RECONNAISSANCE System • M21 (RSCAAL) <p>Remote Sensing Chemical Agent Alarm</p> <ul style="list-style-type: none"> • M90 Chemical Agent Detector • M272 (in water) <p>2. Identify protection as Mission-Oriented Protective Posture (MOPP) Level IV in a simulated context.</p>	<ul style="list-style-type: none"> • M9 Chemical Agent Detector Paper • M22 (ACADA) <p>Automatic Chemical Agents Detection Alarm</p> <ul style="list-style-type: none"> • M93A1 FOX NBC RECONNAISSANCE System • M21 (RSCAAL) <p>Remote Sensing Chemical Agent Alarm</p> <ul style="list-style-type: none"> • M90 Chemical Agent Detector • M272 (in water) <p>2. Correctly identify protection as Mission-Oriented Protective Posture (MOPP) Level IV in a simulated context.</p>	<p>Alarm</p> <ul style="list-style-type: none"> • M93A1 FOX NBC RECONNAISSANCE System • M21 (RSCAAL) <p>Remote Sensing Chemical Agent Alarm</p> <ul style="list-style-type: none"> • M90 Chemical Agent Detector • M272 (in water) <p>2. Be able to don Mission-Oriented Protective Posture (MOPP) Level IV.</p>	<p>Automatic Chemical Agents Detection Alarm</p> <ul style="list-style-type: none"> • M93A1 FOX NBC RECONNAISSANCE System • M21 (RSCAAL) <p>Remote Sensing Chemical Agent Alarm</p> <ul style="list-style-type: none"> • M90 Chemical Agent Detector • M272 (in water) <p>2. Demonstrates ability to don Mission-Oriented Protective Posture (MOPP) Level IV in a simulated context.</p>	<p>(Improved Chemical Agent Alarm)</p> <ul style="list-style-type: none"> • M8 <p>Chemical Agent Detector Paper</p> <ul style="list-style-type: none"> • M9 <p>Chemical Agent Detector Paper</p> <ul style="list-style-type: none"> • M22 (ACADA) <p>Automatic Chemical Agents Detection Alarm</p> <ul style="list-style-type: none"> • M93A1 FOX NBC RECONNAISSANCE System • M21 (RSCAAL) <p>Remote Sensing Chemical Agent Alarm</p> <ul style="list-style-type: none"> • M90 Chemical Agent Detector

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
						<ul style="list-style-type: none"> • M272 (in water) <p>2. Correctly dons Mission-Oriented Protective Posture (MOPP) Level IV in a simulated context.</p>
Analytical	<p>Clinical Knowledge</p> <p>1. Identify treatment effects.</p> <p>2. Identify effects of clinical mismanagement.</p>	<p>Clinical Knowledge</p> <p>1. Identify treatment effects in a simulated context.</p> <p>2. Identify effects of clinical mismanagement in a simulated context.</p>	<p>Clinical Knowledge</p> <p>1. Identify treatment effects in a simulated context:</p> <ul style="list-style-type: none"> • Decreased secretions • Improved respiration • Improved muscle control • Reduced GI symptoms <p>Identify effects of clinical mismanagement in a simulated context:</p> <ul style="list-style-type: none"> • Absent positive treatment effects 			
	<p>Procedural Knowledge</p> <p>1. Identify challenges of airway</p>	<p>Procedural Knowledge</p> <p>1. Respond to the challenges of airway</p>	<p>Procedural Knowledge</p> <p>1. Respond to the challenges of airway</p>	<p>Procedural Skills</p> <p>1. Be able to evaluate and adjust</p>	<p>Procedural Skills</p> <p>1. Demonstrate the ability to evaluate</p>	<p>Procedural Skills</p> <p>1. Correctly demonstrat</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
	<p>management for a patient during a cholinergic crisis</p> <p>2. Understands the administration of Diazepam.</p> <p>3. Evaluates and provides supportive treatment to patient as needed.</p> <p>4. Determines stabilization course for patient.</p>	<p>management for a patient during a cholinergic crisis in a simulated context.</p> <p>2. Administers Diazepam as needed for severe effects in a simulated context.</p> <p>3. Evaluates and provides supportive treatment to patient as needed in a simulated context.</p> <p>4. Determines stabilization course for patient in a simulated context.</p>	<p>management for a patient during a cholinergic crisis in a simulated context:</p> <ul style="list-style-type: none"> • Initial ventilation is difficult due to high airway resistance (50-70 cm of water). • Resistance decreases after atropine administration. • Requires frequent suctioning. • Ventilate 0.5-3 hours. <p>2. Correctly administers Diazepam as needed for severe effects in a simulated context.</p> <p>3. Provides supportive treatment to patient in a simulated context:</p> <ul style="list-style-type: none"> • Intravenous fluids • Respiratory support <p>4. Stabilizes patient in a simulated context:</p> <ul style="list-style-type: none"> • Continue atropine, pralidoxime chloride, diazepam as needed 	<p>Instruments, supplies and equipment as needed.</p>	<p>and adjust Instruments, supplies and equipment as needed in a simulated context.</p>	<p>e the ability to evaluate and adjust Instruments , supplies and equipment as needed in a simulated context.</p>

Level	Knowledge	Assessment	Standard	Skill	Assessment	Standard
			for persistent severe symptoms			
	<p><u>Situational Knowledge</u> 1. Implement field-based care protocol.</p> <p>2. Assess Level 1 Care options.</p> <p>3. Assess transport to Level 2 Care facilities.</p>	<p><u>Situational Knowledge</u> 1. Follow field-based care protocol in a simulated context.</p> <p>2. Assess Level 1 Care options in a simulated context.</p> <p>3. Assess transport to Level 2 Care facilities in a simulated context.</p>	<p><u>Situational Knowledge</u> 1. Correctly follows field-based care protocol in a simulated context: • Self-care • Buddy care</p> <p>2. Correctly assesses Level 1 Care options in a simulated context: • Medic • Combat Lifesaver</p> <p>3. Correctly assesses transport to Level 2 Care facilities in a simulated context: • Immediate • Delayed</p>			

Appendix 5: Critical Steps and Error Sources

Pediatric and Neonatal Intubation

Critical Step: Examine patient to assess indicators of need for airway management.

Potential Sources of Error:

- Incorrect examination
- Incorrect assessment

Critical Step: Perform DDx to determine airway management strategy.

Potential Sources of Error:

- Incorrect DDx
- Incorrect airway management strategy
- Incomplete knowledge/skills to perform strategy

Critical Step: Adjust medication doses by weight and apply appropriate time sequences to gain optimal clinical effect in pediatric and neonatal patients.

Potential Sources of Error:

- Incorrect medication
- Incorrect dosage
- Incorrect time sequence
- Incorrect weight estimation
- Incorrect administration route
- Incorrect evaluation of clinical/treatment effects

Critical Step: Intubate patient.

Potential Sources of Error:

- Incorrect equipment
- Incorrect medications
- Incomplete procedural knowledge/skills
- Incorrect strategy
- Incorrect confirmation of endotracheal intubation
- Esophageal intubation
- Right main stem intubation

Critical Step: Ventilate intubated patient.

Potential Sources of Error:

- Incorrect equipment
- Incorrect pressure
- Incorrect rate
- Incorrect connection to O2 source

Critical Step: Assesses clinical stability of patient.

Potential Sources of Error:

- Incorrect examination
- Incorrect assessment
- Failure to identify effects of clinical mismanagement

Cholinergic Crisis

Critical Step: Examine patient to assess indicators of cholinergic crisis.

Potential Sources of Error:

- Incorrect examination
- Incorrect assessment
- Incorrect DDx
- Incorrect exposure level
- Incorrect exposure type

Critical Step: Don Mission-Oriented Protective Posture (MOPP) Level IV.

Potential Sources of Error:

- Incorrect treatment strategy
- Omits self-protection
- Misjudges time constraints of exposure
- Incomplete MOPP Level IV
- Incorrect equipment, supplies, resources.

Critical Step: Administers the following for treatment: Mark1 Kit Auto Injector, ATNNA Auto Injector, CANA Auto Injector.

Potential Sources of Error:

- Incorrect medication
- Incorrect dosage
- Incorrect time sequence
- Incorrect administration route
- Incorrect evaluation of clinical/treatment effects

Critical Step: Provide suction support for patient:

Potential Sources of Error:

- Incorrect equipment
- Incorrect pressure
- Incorrect rate
- Incorrect patient positioning
- Equipment failure

Critical Step: Provide breathing support for patient:

Potential Sources of Error:

- Incorrect equipment
- Incorrect strategy selection
- Incomplete procedural knowledge/skills

Critical Step: Be able to intubate patient.

Potential Sources of Error:

- Incorrect equipment
- Incorrect medications
- Incomplete procedural knowledge/skills
- Incorrect strategy
- Incorrect confirmation of endotracheal intubation
- Esophageal intubation
- Right main stem intubation

Critical Step: Ventilate and implement RDIC.

Potential Sources of Error:

- Incorrect equipment
- Incorrect pressure

- Incorrect rate
- Incorrect connection to O2 source

Critical Step: Perform each step of the decontamination protocol.

Potential Sources of Error:

- Incorrect sequence
- Incorrect disposition
- Incorrect materials (e.g. M291 SDK, M295, etc.)
- Incomplete sequence

Esophageal intubation

- Right main stem intubation

Critical Step: Ventilate and implement RDIC.

Potential Sources of Error:

- Incorrect equipment
- Incorrect pressure
- Incorrect rate
- Incorrect connection to O2 source

Critical Step: Perform each step of the decontamination protocol.

Potential Sources of Error:

- Incorrect sequence
- Incorrect disposition
- Incorrect materials (e.g. M291 SDK, M295, etc.)
- Incomplete sequence

Appendix 6: Instructional Gaps

SUMMARY RESULTS FROM PRISMA ANALYSES

Clinical Training Mechanisms, Outcomes, Curricula and Technological Alternatives.

Pediatric & Neonatal Intubation Training – Curriculum Gaps

Literature review confirms the need for definition of performance standards, assessment metrics, and formalization of training methods.

- Training Gaps
- Imprecise assessment mechanisms
- Absent specific and measurable performance standards
- Absent evidence-based training methods

Pediatric & Neonatal Intubation Training – Technology Gaps

We evaluated the most advanced computer programmable infant and neonatal simulators with real time monitoring of vital signs available through commercial vendors. The following advanced technology simulators were evaluated for adequacy of training conditions identified in the task analyses for pediatric (infant) and neonatal intubation:

Gaumard: PremieHAL, Newborn HAL,

METI: BabySIM

Laerdal: SimBaby, SimNewB

Technology review confirms gaps in necessary clinical manifestations for adequate training conditions.

- Simulator Technology Gaps
- More copious secretions including saliva (frothy, bubbles, slobber), runny nose, tears, vomit
- Improved muscle fasciculation, twitching, seizures
- Airway variability –Mallampati variability, Pierre Robin airway (short mandible)
- Lung auscultation – more realistic and localized breath sounds
- Unrealistic, can hear breath sounds from one side all over chest wall, pump noise often drown out lung sounds.
- Changes in airway: Airway material is easily punctured at vallecula and should be modified.
- More anterior airway
- Fat tongue, better tongue tissue fidelity (slippery, wet)
- More redundant airway tissues, slippery tissues, friable/bleeding,
- Large and floppy epiglottis
- True preemie (28-30 weeks, <3kg)
- Nasal flaring
- True perioral cyanosis (1cm around the mouth turning blue)

Cholinergic Crisis Training – Curriculum Gaps

Literature review confirms the need for definition of performance standards and assessment metrics.

- Training Gaps
- Imprecise assessment mechanisms
- Absent specific and measurable performance standards
- Absent evidence-based training methods

Cholinergic Crisis Training – Technology Gaps

We evaluated the most advanced computer programmable adult and pediatric simulators with real time monitoring of vital signs available through commercial vendors. The following advanced technology simulators were evaluated for adequacy of training conditions identified in the task analyses for the identification and management of a cholinergic crisis:

Gaumard: PremieHAL, Newborn HAL, NOELLE, HAL

METI: BabySIM, iStan, HPS, METIMan

Laerdal: SimBaby, SimNewB, SimMan, SimMan3G, SimMom

Technology review confirms gaps in necessary clinical manifestations for adequate training conditions.

- Simulator Technology Gaps
- More copious secretions including saliva (frothy, bubbles, slobber), sweat, runny nose, tears, vomit, urine. Frothing cannot occur simultaneously with other secretions.
- Vocalizations – garbled, confused, slurring, nonsensical
- Realistic progressive occurrence of rashes, erythemas, burns, other skin conditions associated with chemical, vesicant, etc. exposure.
- Improved muscle fasciculation, twitching, seizures (no fasciculation or lower limb options)
- Airway variability –Mallampati variability, Pierre Robin airway (short mandible)
- Lung auscultation – more realistic and localized breath sounds
- Unrealistic, can hear breath sounds from one side all over chest wall, pump noise often drown out lung sounds.
- Changes in airway: Airway material is easily punctured at vallecula and should be modified.
- For pediatric/neonatal Airways:
 - More anterior airway
 - Fat tongue, better tongue tissue fidelity (slippery, wet)
 - More redundant airway tissues, slippery tissues, friable/bleeding,
 - Large and floppy epiglottis
 - True preemie (28-30 weeks, <3kg)
 - Nasal flaring
 - True perioral cyanosis (1cm around the mouth turning blue

Appendix 8: Assessment Instruments

PEDIATRIC/NEONATAL INTUBATION
COGNITIVE ASSESSMENT

1. What methods can be used to determine endotracheal tube size? Circle all that apply. (*Count this as 5 questions – 1 for each possible answer.*)

Patient's Age/4 + 4

Size (diameter) of the patient's fifth finger

(Patient's age + 4)/16

Broselow tape

(Patient's Age + 16)/4

2. How does an infant's airway differ from an adult's? Circle all that apply. (*Count this as 5 questions – 1 for each possible answer.*)

An infant's tongue is proportionally smaller than an adult's.

An infant's epiglottis is proportionally larger and floppier than an adult's.

An infant's airway is more anterior than an adult's.

An infant's head is proportionally larger than an adult's.

The narrowest part of an infant's airway is supraglottic while the narrowest part of an adult's is subglottic.

3. What is an appropriate dose of succinylcholine for intubating a 7kg infant? (*2X weight*)

1-2 mg/kg or 7-14 mg

4. What is the sedative of choice and an appropriate dose for intubating a 3-year-old child who is experiencing a severe asthma exacerbation? (*Count this as 2 questions, 1.5X weight*)

a. Ketamine, b. 1-2 mg/kg – we didn't give them a weight or specify that we wanted a per kg dosing so accept any dose that would work for a 10-25kg child (or the per kg dose)

5. What medication could be used to prevent bradycardia (decreased heart rate) that may be associated with intubation in an infant? (*2X weight*)

Atropine

6. Describe how you would position an infant for intubation. (*1 point for each*)

Prone (on back)

Head-tilt chin lift (neck extended, head tipped backwards)

Towel roll under shoulders

7. Describe at least 3 methods for determining correct endotracheal tube placement. (*score 1 point for each*)

CO2 detector

Visualize tube pass through cords (*going in is ½ point*)

Chest x-ray

Fogging of tube

Auscultation

8. What size and type laryngoscope blade would you use to intubate a newborn (3-4kg infant)? (*Count this as 2 questions*)

Size 1

Miller (straight blade)

9. What is the dose of etomidate for intubating an infant? (*weighted 2x*)

0.3-0.6 mg/kg

10. How do you determine appropriate depth of endotracheal tube placement? (*1 point each*)

Broselow tape

3 X tube size

See double lines (or cuff) on tube go just beyond the vocal cords

PEDIATRIC INTUBATION COMPETENCY EVALUATION

Date: _____ Unique ID: _____ Level: (circle) *None* *Novice* *Intermed* *Advanced*

Evaluator: _____ Training: *Animal* _____ *Simulator* _____

RSIs before today: Assisted _____ Performed _____

Instructions: Please mark the box that best corresponds to your assessment of the item

Item	Rating Scale			
PREPARATION				
<input type="radio"/> ET Tube w/ stylette	<input type="radio"/> Ambu bag w/ mask	<input type="radio"/> Attach Ambu bag to wall	<input type="radio"/> Laryngoscope	
<input type="radio"/> 10cc syringe	<input type="radio"/> Suction	<input type="radio"/> Establish IV Access	<input type="radio"/> Meds	
PREOXYGENATION				
Mask Selection/Application	Correct Selection	Incorrect Selection	Correct Application	Incorrect Application
Bag to Maintain O2 Sat	< 90	90 - 93	94 - 96	≥ 97
SEDATION				
Appropriate Med/Dose	Correct Med: Etomidate____ Versed____ Ketamine____	Incorrect Med	Correct Dose: Etomidate (1.8-4.2 mg) Versed (0.3-0.7 mg) Ketamine (6-14 mg)	Incorrect Dose
Appropriate Med/Dose	Correct Med: Succinocholine____ Vecuronium____ Rocuronium____	Incorrect Med	Correct Dose: Succinocholine (6-14 mg) Vecuronium (1.2-1.4 mg) Rocuronium (6-14 mg)	Incorrect Dose
INTUBATION				
Time for placement from 1 st approach	> 2 min	≤ 2 min	≤ 1 min	≤ 30 sec
CONFIRMATION				
Method Selected	None	CO2 Monitor	Chest Xray	Listen to lungs + ABD
ESOPHAGEAL INTUBATION	N/A			
Recognition Time	> 60 sec	≤ 31 - 60 sec	≤ 11 - 30 sec	≤ 10 sec
Identify Treatment: Remove/Start Over	> 60 sec	≤ 31 - 60 sec	≤ 16 - 30 sec	≤ 15 sec
RT MAIN STEM INTUBATION	N/A			
Recognition Time	> 60 sec	≤ 31 - 60 sec	≤ 11 - 30 sec	≤ 10 sec
Identify Treatment: Pull Back Tube	> 60 sec	≤ 31 - 60 sec	≤ 16 - 30 sec	≤ 15 sec
Comments:				

NEONATAL INTUBATION COMPETENCY EVALUATION

Date: _____ Unique ID: _____ Level: (circle) *None* *Novice* *Intermed* *Advanced*

Evaluator: _____ Training: *Animal* _____ *Simulator* _____

RSIs before today: Assisted _____ Performed _____

Instructions: Please mark the box that best corresponds to your assessment of the item

Item	Rating Scale			
PREPARATION				
<input type="radio"/> ET Tube w/ stylette	<input type="radio"/> Ambu bag w/ mask	<input type="radio"/> Attach Ambu bag to wall	<input type="radio"/> Laryngoscope	
<input type="radio"/> 10cc syringe	<input type="radio"/> Suction	<input type="radio"/> Establish IV Access	<input type="radio"/> Meds	
PREOXYGENATION				
Mask Selection/Application	Correct Selection	Incorrect Selection	Correct Application	Incorrect Application
Bag to Maintain O2 Sat	< 90	90 - 93	94 - 96	≥ 97
SEDATION				
Appropriate Med/Dose	Correct Med: Etomidate____ Versed_____ Ketamine____	Incorrect Med	Correct Dose: Etomidate (0.9-3.0 mg) Versed (0.15-0.5 mg) Ketamine (3-10 mg)	Incorrect Dose
PARALYSIS				
Appropriate Med/Dose	Correct Med: Succinicholine____ Vecuronium_____ Rocuronium_____	Incorrect Med	Correct Dose: Succinicholine (3-10 mg) Vecuronium (0.6-1.0 mg) Rocuronium (3-5 mg)	Incorrect Dose
INTUBATION				
Time for placement from 1 st approach	> 2 min	≤ 2 min	≤ 1 min	≤ 30 sec
CONFIRMATION				
Method Selected	None	CO2 Monitor	Chest Xray	Listen to lungs + ABD
ESOPHAGEAL INTUBATION N/A				
Recognition Time	> 60 sec	≤ 31 - 60 sec	≤ 11 - 30 sec	≤ 10 sec
Identify Treatment: Remove/Start Over	> 60 sec	≤ 31 - 60 sec	≤ 16 - 30 sec	≤ 15 sec
RT MAIN STEM INTUBATION N/A				
Recognition Time	> 60 sec	≤ 31 - 60 sec	≤ 11 - 30 sec	≤ 10 sec
Identify Treatment: Pull Back Tube	> 60 sec	≤ 31 - 60 sec	≤ 16 - 30 sec	≤ 15 sec
Comments:				

SELF-EVALUATION QUESTIONNAIRE

Name _____ Date _____

Please use the scale associated with each item to indicate the degree to which you agree or disagree with the item. For example, if you strongly agree with the item, mark the scale corresponding to column for “strongly agree.” When you have completed the survey, please give it to one of the researchers before leaving the assessment area.

	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
I am familiar with the equipment used for pediatric/neonatal intubation						
I am able to correctly use the tools associated with performing pediatric/neonatal intubation						
I know the procedural steps required to perform pediatric/neonatal intubation						
I am able to correctly identify the principal anatomy associated with intubation						
I am able to accurately identify the need for pediatric/neonatal intubation						
I am able to successfully perform pediatric/neonatal intubation						
I feel calm						
I feel secure						
I am tense						
I feel at ease						
I feel upset						
I am presently worrying over possible mistakes						
I feel rested						
I feel anxious						
I feel comfortable						
I feel self-confident						
I feel nervous						
I am jittery						
I feel “high strung”						
I am relaxed						
I feel content						
I am worried						
I feel over-excited and “rattled”						
I feel joyful						
I feel pleasant						

CHOLINERGIC CRISIS RECOGNITION AND RESPONSE
COGNITIVE ASSESSMENT

ID Number :

Date :

Group :

1. Match names to the functions of the systems listed below (1 point each). For example, Urinary: C

Organ System	Match Letter	Function
Urinary:	C	A. Exchanges oxygen and carbon dioxide as a means of oxygenating blood.
Gastrointestinal:	B	B. Converts food into energy the body requires to survive and eliminates residue waste.
Respiratory:	A	C. Eliminates toxins and fluid waste excreted by the kidneys.
Cardiovascular:	H	D. Facilitates visual perception.
Neurological:	G	E. Supports the weight of the body, maintains body position and produces controlled, precise movements.
Endocrine:	F	F. Secretes different types of hormones that regulate bodily functions.
Ophthalmological:	D	G. Transmits signals between different parts of the body to coordinate voluntary and involuntary actions.
Musculoskeletal:	E	H. Transports blood bourn elements throughout the body, eliminates metabolic wastes, circulates lymph to counter microbes and toxins, and maintains homeostasis.

2. Explain the normal function of the enzyme acetylcholinesterase in controlling the neuron signal processing of the nervous system:

A. Breaks down acetylcholine after transmission

B. Acts as the receptor for transmitted acetylcholine

C. Terminates the transfer of acetylcholine

D. Initiates signal transmission via acetylcholine

3. Explain how nerve agents interfere with AChE leading to cholinergic crisis:

A. Inhibits acetylcholinesterase production

B. Inhibits acetylcholinesterase function

C. Inhibits acetylcholine production

D. Inhibits acetylcholine transmission

4. Describe the primary signs to look for during patient assessment to identify nerve agent exposure:

A. Pain, GI/Urinary distress, Respiratory distress, Erythema, Muscular fasciculations, Convulsions

B. Fever, Respiratory distress, Tachycardia, Convulsions, Diaphoresis, Peripheral Numbness

C. Fever, Pain, GI distress, Respiratory distress, Rhinorrhea, Lacrimation, Diaphoresis

D. Copious secretions, Muscular fasciculations, Respiratory distress, Miosis, Convulsions

5. Indicate the information to request from a conscious patient during clinical assessment:

A. Pain, GI/Urinary distress, Difficulty breathing, Sight changes, Muscle control

B. Pain, GI/Urinary distress, Difficulty breathing, Fatigue, Muscle control

C. Pain, GI/Urinary distress, Difficulty breathing, Sight changes, Peripheral Numbness

D. Pain, GI/Urinary distress, Difficulty breathing, Muscle control, Peripheral Numbness

6. Indicate the correct dosages, administration routes and time sequences (up to three doses in 1-hour) for ATNAA autoinjector treatment of cholinergic crisis in an adult:

A. One ATNAA autoinjector, IM, dose1 @ 5-10 minutes, dose 2@10-15 minutes, dose 3@15-20 minutes.

B. One ATNAA autoinjector, IM, dose1 @ 5-10 minutes, dose 2@15-20 minutes, dose 3@25-30 minutes.

C. One ATNAA autoinjector, IM, dose1 @ 0 minutes, dose 2@15-20 minutes, dose 3@25-30 minutes.

D. One ATNAA autoinjector, IM, dose1 @ 0 minutes, dose 2@10-15 minutes, dose 3@15-20 minutes.

7. From the list below, select three other possible medical conditions that lead to similar patient symptomology as a cholinergic crisis.

Response options:

Vesicant Exposure

Radiation Exposure

Anaphylaxis

- 1.
- 2.
- 3.
- 4.

8. Match the expected clinical effects to the drugs used in the management of cholinergic crisis:

Drug	Match Letter	Function
2PAMCL:	B	A. Control convulsions.
Atropine:	C	B. Remove the nerve agent from the enzyme acetylcholinesterase.
Diazepam:	A	C. Dry secretions, reduce bronchoconstriction, decrease gastrointestinal motility.
Pyridostigmine Bromide:	E	D. Relieve eye symptoms.
Atropine Ophthalmological Ointment:	D	E. Shields AChE enzyme from full effects of GD nerve agent to enhance the effectiveness of treatment after GD exposure.

9. The ATNAA autoinjector includes which of the following:

- A. Atropine, 2mg / 2PAMCL, 600mg
- B. Atropine, 2mg / 2PAMCL, 300mg
- C. Atropine, 2.1mg / 2PAMCL, 600mg**
- D. Atropine, 2.1mg / 2PAMCL, 300mg

10. Indicate the time sequences for vapor exposure to nerve agents:

- A. onset within seconds to minutes**
- B. onset within minutes to hours
- C. onset within minutes to days
- D. onset within hours to days

11. Indicate the time sequences for liquid exposure to nerve agents:

- A. onset within seconds to minutes
- B. onset within minutes to hours**
- C. onset within minutes to days
- D. onset within hours to days

12. A positive indicator for M9 Chemical Agent Detector Paper is:

- A. Orange
- B. Blue
- C. Green
- D. Yellow**

13. Identify other situational cues used for assessing nerve agent exposure including:

- A. Multiple casualties
- B. Burn injuries
- C. Odor
- D. All of the above**

14. Indicate the correct transfer of care sequence by placing a "1" for the first, "2" for the second, etc.:

Level 1 Care 3 Buddy care 2 Self-care 1 Level 2 Care 4

15. If patient is symptomatic, describe the treatment sequence for managing cholinergic crisis:

- A. Self-protection, ATNAA Injection, Airway Management, Respiratory Support, CANA injection**
- B. Self-protection, Airway Management, ATNAA Injection, Respiratory Support, CANA injection

D. Self-protection, ATNAA Injection, CANA injection, Airway Management, Respiratory Support

16. Which of the following is NOT part of the decontamination protocol for cholinergic crisis patient management:

- A. Remove contaminated clothing and gear
- B. Decontaminate exposed skin
- C. Apply reactive skin decontamination lotion (RSDL)
- D. Irrigate with large amounts of water
- E. Apply M291 SDK
- F. Clean w/ soap & water
- G. Apply M295
- H. Apply 0.5% hypochlorite solution

I. Incinerate contaminated clothing and gear

17. What Mission-Oriented Protective Posture (MOPP) level of protection is required for responding to a cholinergic event?

- A. Level III
- B. Level IV**
- C. Level V
- D. Level VI

18. Match the likely cause (exposure) to the listed symptomology:

- A. Vesicant
- B. Pulmonary Agent
- C. Cyanide
- D. Riot Gas
- E. Respiratory Irritant
- F. Upper Respiratory Infection
- G. Viral Infection (GI)
- H. Medication Toxicity (Opiates)

18.1: Respiratory discomfort (coughing, wheezing, shortness of breath, chest tightness), irritation to eyes, nose, upper airway. Likely Cause/Exposure(s): _____ **E** _____

18.2: Pulmonary edema (secretions, cough difficulty breathing), seizures, respiratory arrest, cardiac arrest. Likely Cause/Exposure(s): _____ **C** _____

18.3: Cough, erythema, blisters, conjunctivitis. Likely Cause/Exposure(s): _____ **A** _____

18.4: Respiratory discomfort (coughing, difficulty breathing, shortness of breath), burning pain on mucous membranes, skin and eyes. Likely Cause/Exposure(s): _____ **D** _____

18.5: Airway irritation, shortness of breath (delayed onset), eye irritation, chest tightness. Likely Cause/Exposure(s): _____ **B** _____

19. Given the following information, is the nerve agent exposure vapor or liquid?

Symptomatic onset within 10 minutes to 18 hours; Muscle twitching and sweating at site of exposure, Nausea/Vomiting, Weakness, Respiratory, Gastrointestinal, Neurological.

Vapor: _____ **Liquid:** _____

20. Given the following information, is the nerve agent exposure mild or severe?

Miosis, Headache, Rhinorrhea, Salivation, Dyspnea, Bronchoconstriction.

Mild: _____ **Severe:** _____

21. Indicate the ATNAA autoinjector time sequence for management of cholinergic crisis in an adult:

- a. 1st dose after 5 minutes; 2nd – 6th doses at 5-minute intervals thereafter.

b. 1st dose after 5 minutes; 2nd dose 5 minutes after 1st dose, 3rd – 6th dose at 10-minute intervals after 2nd dose.

c. 1st dose immediately; 2nd dose 10 minutes after 1st dose, 3rd – 6th dose at 5-minute intervals after 2nd dose.

d. 1st dose immediately; 2nd – 6th doses at 10-minute intervals thereafter.

22. If seizure activity is present, indicate the CANA dose requirements for management of cholinergic crisis in an adult:

a. 1st dose given immediately.

b. 1st dose given after 1st ATNAA injection.

c. 1st dose given after 2nd ATNAA injection.

d. 1st dose given after 3rd ATNAA injection.

CHOLINERGIC CRISIS RECOGNITION AND RESPONSE
PERFORMANCE ASSESSMENT

		No	Partial	Yes
1.0	Correctly dons Mission- Oriented Protective Posture (MOPP) Level IV.			
2.0	Correctly assesses patient for signs of nerve agent exposure (verbalizes & examines).			
	2.1	Miosis		
	2.2	Copious secretions		
	2.3	Generalized muscular fasciculations		
	2.4	Difficulty breathing		
	2.5	Cyanosis		
	2.6	Convulsions		
	2.7	Pain		
	2.8	GI/Urinary distress		
	2.9	Respiratory distress		
	2.10	Fatigue		
	2.11	Muscle control		
3.0	Correctly performs Differential Diagnosis (DDx).			
	3.1	Identifies alternate diagnoses (verbalizes 3 alternates). Correct responses: Vesicant, Pulmonary Agents, Riot Gas, Cyanide, Respiratory Irritant, Upper respiratory infections, Viral infection (GI), Medication toxicities (Opiates).		
	3.2	Identifies distinguishing symptoms for nerve agent exposure (verbalizes). Correct responses: Copious secretions, Generalized muscular fasciculations, Respiratory distress, Cyanosis, Convulsions.		
4.0	Correctly uses the M9 Chemical Agent Detector Paper.			
5.0	Correctly identifies other situational cues for assessing exposure agent (verbalizes at least 3). Correct responses: mass casualties, onset of symptoms, localized or general reactions, initial symptoms, time progression of symptoms, M9 indicator.			
6.0	Correctly determines vapor exposure.			
7.0	Correctly determines moderate poisoning			
8.0	Correctly locates instruments & supplies in supply kit.			
9.0	Correctly implements ATNAA Auto Injector, dosages, administration routes, time sequences.			
	9.1	1 injector/dose		
	9.2	IM injection		
	9.3	0 min, +10-15min, +15-20 min, +20-25min, +25-30min		
10.0	Correctly evaluates the clinical effects of ATNAA Auto Injector (verbalizes at least 2). Correct responses: Remove the nerve agent, dry secretions, reduce bronchoconstriction, decrease gastrointestinal motility.			
11.0	Correctly demonstrates ability to appropriately implement the following interventions:			
	11.1	Suction		
	11.2	Bag-valve-mask		
	11.3	IV Catheter		
	11.4	Resuscitation Device, Individual, Chemical (RDIC)		
	11.5	Endotracheal Intubation		
12.0	Correctly implements CANA Auto Injector, dosages, administration routes, time sequences.			
	12.1	1 injector/dose		
	12.2	IM injection		
	12.3	After 3 rd ATNAA injection, +5min, +10min		
13.0	Correctly evaluates the clinical effects of Diazepam (verbalizes). Correct response: Control convulsions.			
14.0	Evaluates treatment effects during patient management:			
	14.1	Decreased secretions.		
	14.2	Improved respiration.		
	14.3	Improved muscle control.		
	14.4	Reduced GI symptoms.		

15.0	Correctly provides supportive treatment to stabilize patient.				
	15.1	Correctly continues drug therapy as needed.			
	15.2	Correctly provides respiratory support as needed.			
	15.3	Correctly provides Intravenous fluids as needed.			
16.0	Correctly identifies next steps (verbalizes). Correct responses: Decontamination, Transport to Level 2 care facility.				

CHOLINERGIC CRISIS RECOGNITION AND RESPONSE
SELF-ASSESSMENT SURVEY

Name _____ Date _____

Please use the scale associated with each item to indicate the degree to which you agree or disagree with the item. For example, if you strongly agree with the item, mark the scale corresponding to column for “strongly agree.” When you have completed the survey, please give it to one of the researchers before leaving the assessment area.

	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
I am familiar with the equipment used for cholinergic crisis management.						
I am able to correctly use the tools associated with cholinergic crisis management.						
I know the procedural steps required for cholinergic crisis management.						
I am able to correctly identify the principal anatomical and physiological reactions associated with cholinergic crisis management.						
I am able to accurately identify the need for cholinergic crisis management.						
I am able to successfully perform the procedures associated with cholinergic crisis management.						
I believe the antidote for nerve agent exposure is effective in resolving cholinergic crisis.						
I feel calm						
I feel secure						
I am tense						
I feel at ease						
I feel upset						
I am presently worrying over possible mistakes						
I feel rested						
I feel anxious						
I feel comfortable						
I feel self-confident						
I feel nervous						
I am jittery						
I feel “high strung”						
I am relaxed						
I feel content						
I am worried						
I feel over-excited and “rattled”						
I feel joyful						
I feel pleasant						

Appendix 8: Instructional Components

PEDIATRIC AND NEONATAL INTUBATION INSTRUCTION

Training Sequence

- Didactic Instruction
- Introduction to feline models
- Introduction to laboratory facilities
- Cognitive assessment and feedback
- Clinical preparation
- Self-preparation
- Clinical assessment of patient – simulated context
- Patient preparation – simulated context
- Master procedural tasks – simulated context
 - Intubation practice
 - Performance assessment
 - Feedback
 - Repeat 9a-9c until standards of performance are achieved.

Didactic Presentation

Pediatric Intubation

Joseph B. House, MD
Suzanne Dooley-Hash, MD
Pamela Andreatta PhD



Objectives

- Reasons to Intubate
- Anatomy
 - Neonatal
 - Cat
- Medication
- The Procedure
 - Post-procedure confirmation



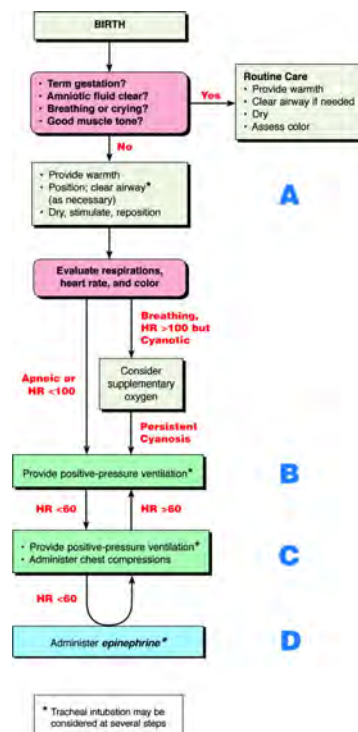
What is intubation

- Placing a plastic tube into the airway of your patient



Why to intubate

- Failure to Ventilate (remove carbon dioxide)
 - Neuromuscular weakness
 - Obstructive pulmonary disease
- Failure to Oxygenate
 - Pulmonary disease
- Failure to protect airway
 - Altered mental status – neurologic, toxic
- Failure to maintain patent airway
 - Obstruction, secretions, injury, blood
- Significant hemodynamic instability
- Operative needs

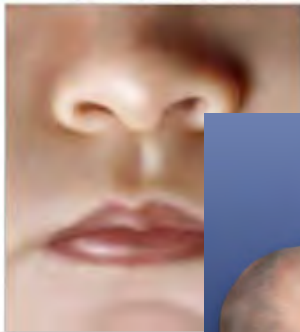


Signs of Distress

- Retractions
- Nasal Flaring
- Apnea
- Cyanosis

Signs of Distress

Normal nostrils



Flared nostrils



Figure 27: Adult Airway
Anatomy of adult airway

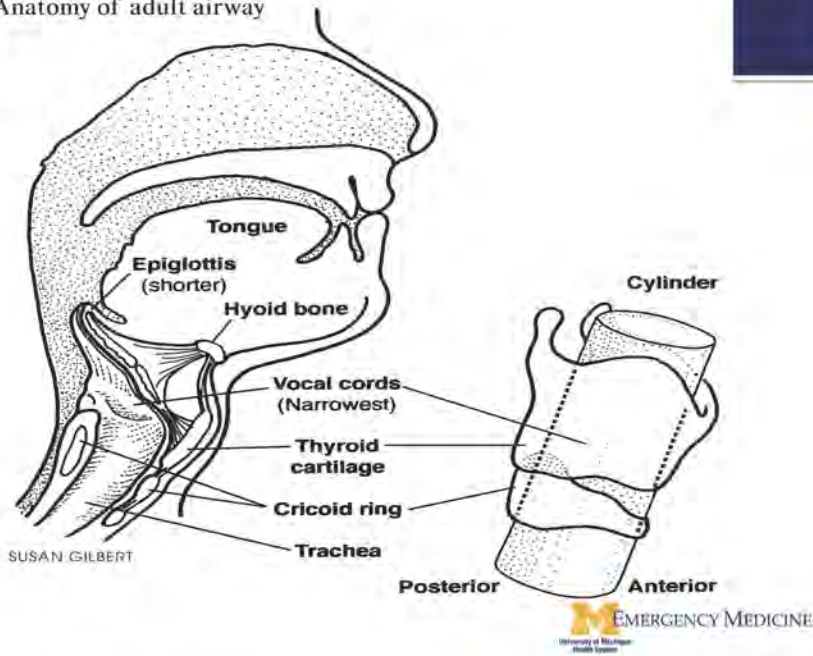
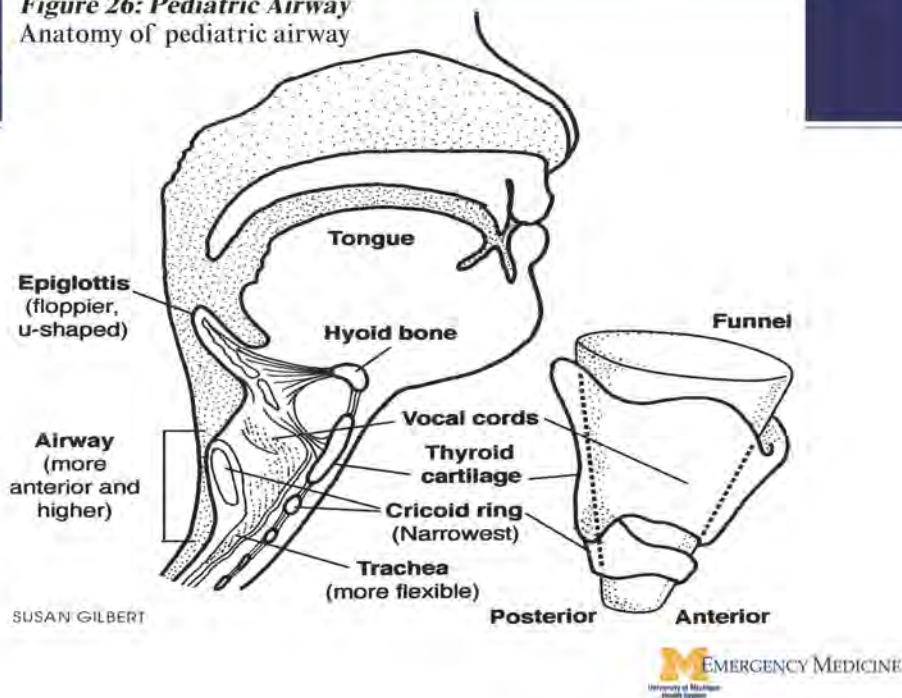


Figure 26: Pediatric Airway
Anatomy of pediatric airway

A



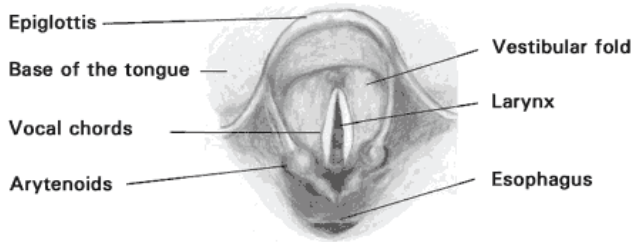
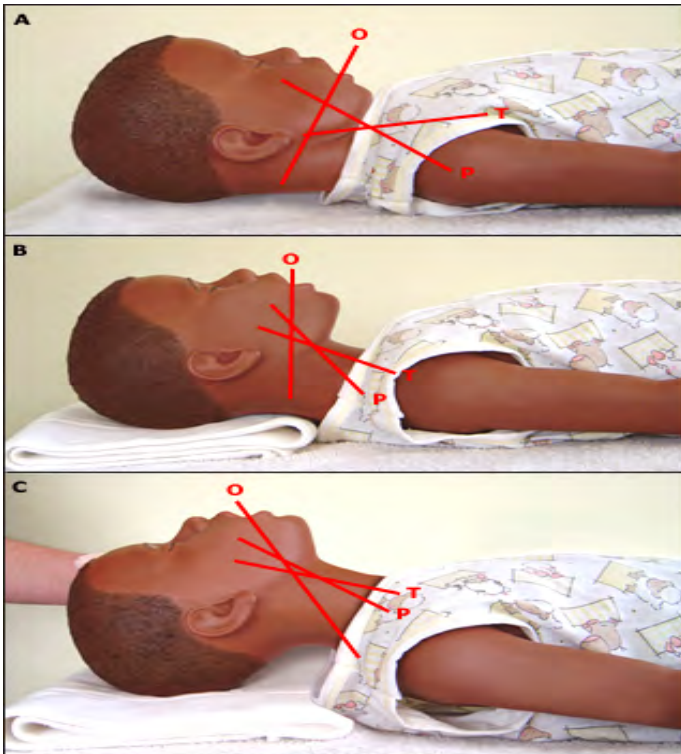


Figure 1 - View of the glottic area via direct laryngoscopy



Normal position with obstruction

Sniffing position with towel under helps with support of airway

Mild extension further opens/aligns airway. Overextension will hinder



Endotracheal Intubation



Endotracheal Size

- Determining Size
 - $(16 + \text{age}) / 4$
 - $(\text{age}/4) + 4$
 - Broselow tape
 - Tape measure utilizing median weight for length
 - Size of pinky finger after 1y/0



How deep to insert tube

- Use Broslow Tape
- 3 x tube size
- On end of ETT lines, insert to just past cords, if using ett with balloon, balloon just past cords



Laryngoscope Blades



- Size:
- Broselow tape
- Measure from tragus to cricoid membrane
- Better too long vs too short



Other needed equipment

- Stylet : maintains firmness of ET Tube
- pCO2 detector:
 - Litmus paper: “yellow is a go
- Tape
- Suction
- Bag/mask



Masks



- Should fit from base of chin to mid-bridge of nose
- Cushion helps make better seal
- Use best fit
- Will need to adjust based on size



Correct positioning



Bag-mask Ventilation

- Use C-E hand configuration
- Can use jaw thrust
- Should have a firm seal
- Do not block anterior neck



M EMERGENCY MEDICINE
University of Michigan
Health System

Medication

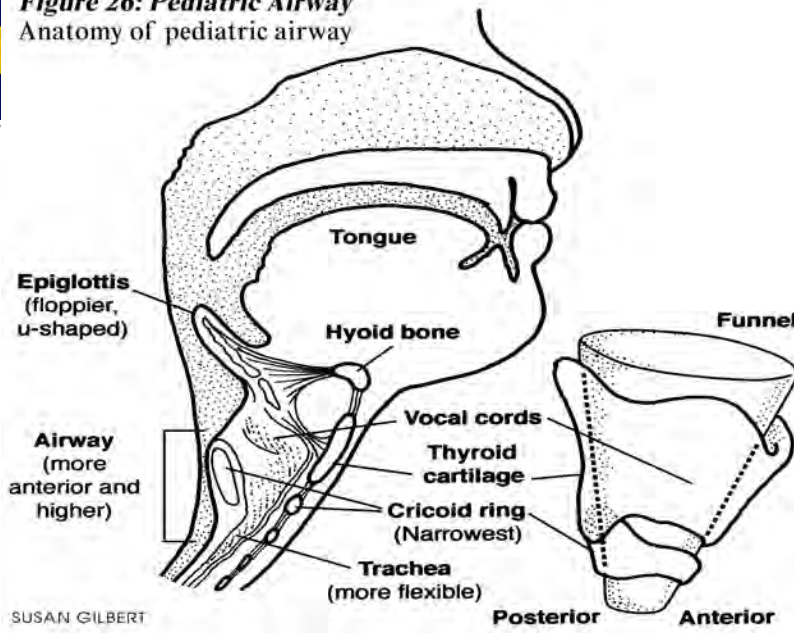
- Sedative
 - Etomidate (0.3 -0.6 mg/kg)
 - Versed (0.05-0.1 mg/kg)
 - Ketamine (1-2mg/kg) [may choose for patient with asthma]
- Paralytic
 - Succinylcholine (1-2mg/kg)
- Atropine: (0.2 mg/kg) [prevent bradycardia]
- Use Broselow Tape

M EMERGENCY MEDICINE
University of Michigan
Health System

How to Intubate



Figure 26: Pediatric Airway
Anatomy of pediatric airway



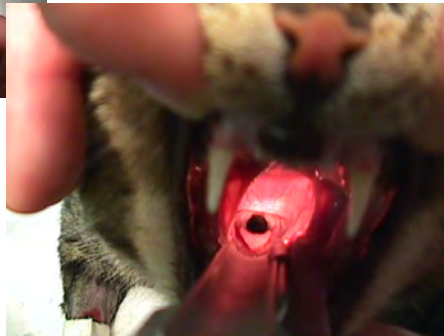
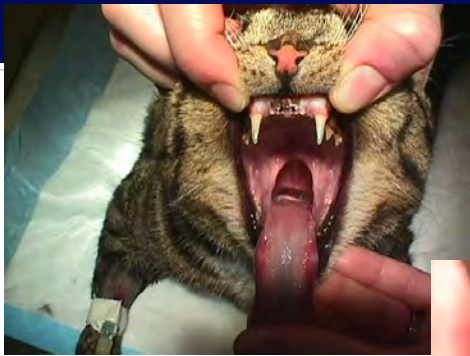
Straight Blade Placement





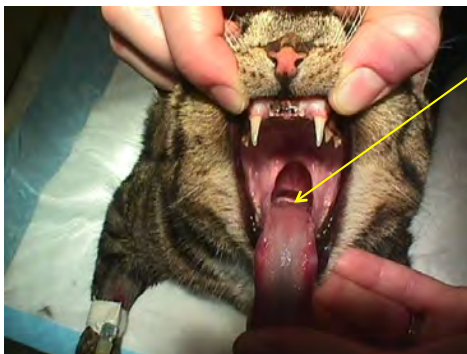
Confirmation

- Verbalize “see tube pass through cords”
- Auscultation of breath sounds
- CO2 detector
- Post intubation chest x-ray



EMERGENCY MEDICINE
University of Michigan
Health System

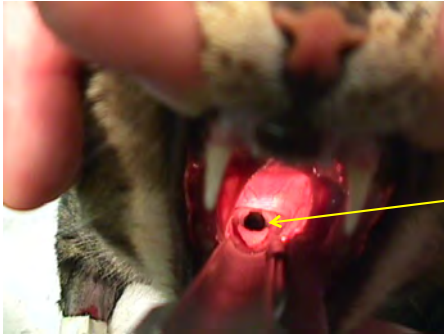
CAT1



Epiglottis

Can just barely
See the dorsal
arytenoids

EMERGENCY MEDICINE
University of Michigan
Health System



Much better
Epiglottis easily
seen, the
arytenoid
cartilages are
abducted (have
been given local
anesthetic to
stop
laryngospasm



Endotracheal Intubation Of The Cat –(in dorsal recumbency)

-
- Cat will have previously received injection of sedative combined with pain medication and have an intravenous catheter in place
- Cat will be induced with anesthetic drug
- Lidocaine will be dripped on arytenoid cartilage (1-2 drops per side)
- Cat will be placed in dorsal recumbency (on their back)
- Endotracheal tube (size 3.0-4.5mm) and laryngoscope with size 0-1 Miller blade will be made ready
** NOTE- laryngoscope light must not be turned on prior to use to avoid burning mucosal tissue with hot bulb
- Laryngoscope is held upside down with non-dominant hand (shape of L) and endotracheal tube is held in dominant hand
- Tip of laryngoscope blade is advanced into mouth and placed rostral to epiglottis
- To help open arytenoids, upward pressure is applied to tongue base (lift handle of scope slightly toward ceiling and rotate wrist to bring top end of scope handle towards your body)
- It is extremely important to avoid touching the epiglottis or arytenoid cartilages since the cat larynx is very prone to spasm
- Once the arytenoid cartilages are visualized on both sides of larynx the endotracheal tube is positioned, in the mouth alongside the laryngoscope, **ready** to be placed
- If the arytenoid cartilages are closed, **DO NOT** attempt to push through them or bump up against them. The cartilages must be open before you attempt to pass the tube.
- Wait for the arytenoids to open and quickly (**but gently**) advance through the space in between. Sometimes many seconds will pass before the cat takes another breath.
- If spasms are occurring, additional drops of lidocaine can be applied (1 drop each side)
- Once the endotracheal tube has passed between the arytenoids, remove the laryngoscope (ensure endotracheal tube is not coughed out or pulled out while removing scope).
- Endotracheal tube is gently advanced further into the trachea so the inflatable cuff is positioned caudal to the larynx but rostral to the thoracic inlet.

CHOLINERGIC CRISIS CLINICAL MANAGEMENT INSTRUCTION

Training Sequence

- Didactic Instruction
- Introduction to laboratory facilities
- Practice procedural tasks – simulated context (SimMan3G)
- Multimedia application – simulated context (animal video or physiological animation)
- Cognitive assessment and feedback
- Clinical preparation
- Self-preparation
- Clinical assessment of patient – simulated context
- Patient preparation – simulated context
- Master procedural tasks – simulated context
 - Clinical practice
 - Performance assessment
 - Feedback
 - Repeat 9a-9c until standards of performance are achieved.

Course Content & Materials.

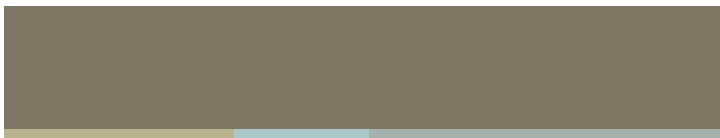
Course materials were completed in 2013-Q3.

Didactic Presentation

Presentation materials from USAMRICD courses titled *Medical Management of Chemical and Biological Casualties* and *Field Management of Chemical and Biological Casualties* will be used for the following content areas:

- Introduction to Chemical Agents
- Nerve Agents
- Anatomy
- Physiology

Lecture and discussions will take place over 20-minutes.



CRITICAL COMPETENCY IN CHOLINERGIC CRISIS (C4)

Recognition & clinical management of cholinergic crisis

University of Minnesota Medical School
SimPORTAL/CREST
PI: Pamela Andreatta, EdD, PhD



IDENTIFY SIGNS OF POTENTIAL NERVE AGENT EXPOSURE

- **LIQUID/GAS AGENTS: TABUN(GA); GB(SARIN); GD(SOMAN); GF; VX)**
- Identify situational cues for exposure to a chemical agent:
 - Mass casualties
 - Chemical residue
 - Odor (not all agents)
 - Initial patient symptoms
 - Onset of patient symptoms
 - Localized or general patient reactions
 - Time progression of symptoms.



IDENTIFY SIGNS OF POTENTIAL NERVE AGENT EXPOSURE

- **LIQUID/GAS AGENTS: TABUN(GA); GB(SARIN); GD(SOMAN); GF; VX)**
- Identify situational cues for exposure to a chemical agent:
 - Mass casualties
 - Chemical residue
 - Odor (not all agents)
 - Initial patient symptoms
 - Onset of patient symptoms
 - Localized or general patient reactions
 - Time progression of symptoms.



TRANSFER OF CARE

1. Self-Care
2. Buddy Care
3. Level 1 Care (Medic, Combat Lifesaver)
4. Medical transport to appropriate Level 2 receiving facility if possible
5. Field stabilization and monitoring if transport not available



PHYSICAL SIGNS & SYMPTOMS OF CHOLINERGIC CRISIS

Eye Symptoms

- Miosis
- Vision changes (blurred, dim)
- Eye pain
- Dull ache in frontal part of head
- Conjunctival injection

Gastrointestinal Symptoms

- Nausea
- Vomiting
- Abdominal Pain / Heartburn
- Diarrhea
- Involuntary Defecation/Urination

Respiratory Symptoms

- Respiratory distress – mild to severe
- Increased secretions
- Dyspnea
- Chest tightness
- Bronchospasm
- Bronchoconstriction
- Apnea / Respiratory cessation



PHYSICAL SIGNS & SYMPTOMS OF CHOLINERGIC CRISIS

Neuro-muscular Symptoms

- Feeling of weakness
- Flacid Paralysis
- Muscle fasciculations / twitching
- Seizures
- Convulsions
- Loss of Consciousness
- Mental status changes

Secretory Symptoms

- Sweating – local or generalized
- Salivation – copious
- Rhinorrhea – copious
- Lacrimation – copious
- Bronchial – copious

Cardiovascular Symptoms

- Low, High or Normal Heart Rate
- Change in Heart Rate
- Bradyarrhythmias first (1st, 2nd, 3rd degree heart block)



PERFORM DIFFERENTIAL DIAGNOSIS (DDX)

Identify primary combination of nerve agent exposure indicators

- Miosis
- Copious secretions
- Generalized muscular fasciculations
- Respiratory distress
- Cyanosis
- Convulsions

Identify other possible medical conditions

- Upper respiratory infections
- Viral infection (GI)
- Medication toxicities - opiates



PERFORM DIFFERENTIAL DIAGNOSIS (DDX)

Identify other possible exposures

- **Vesicants**
 - Cough, erythema, blisters, conjunctivitis
- **Pulmonary Agents**
 - Airway irritation, shortness of breath (delayed onset), eye irritation, chest tightness
- **Cyanide**
 - Pulmonary edema (secretions, cough difficulty breathing), seizures, respiratory arrest, cardiac arrest
- **Riot Agent**
 - Respiratory discomfort (coughing, difficulty breathing, shortness of breath), burning pain on mucous membranes, skin and eyes
- **Respiratory Irritants**
 - Respiratory discomfort (coughing, wheezing, shortness of breath, chest tightness), irritation to eyes, nose, upper airway.



IDENTIFY EXPOSURE AGENT

Use available detection options

- **M9 Chemical Agent Detector Paper**
 - Yellow-Brown for vapor; Pink, red, reddish brown, purple for liquid nerve agents or vesicants
 - Discriminate between positive detection indicators



Determine Vapor or Liquid Exposure

- **Vapor** – Symptomatic onset within seconds to minutes;
 - Eye, Respiratory, Secretory, Neuromuscular, Gastrointestinal
- **Liquid** – Symptomatic onset within 10 minutes to 18 hours
 - Muscle twitching and sweating at site of exposure, Nausea/Vomiting, Weakness, Respiratory, Gastrointestinal, Neurological
- **Both** – Convulsions, Apnea

Determine Extent of Poisoning

- **Mild** – Miosis, Headache, Rhinorrhea, Salivation, Dyspnea, Bronchoconstriction
- **Severe** – Symptoms progress to more than one organ system. Respiratory Cessation, Neuromuscular Symptoms



MANAGEMENT STRATEGY 1

Self Protection

- Pretreatment with **Pyridostigmine Bromide**: (one 30mg tablet orally q 8 hours pre-treatment). Shields AChE enzyme from full effects of GD to enhance the effectiveness of treatment after GD exposure.
- Don Mission-Oriented Protective Posture (MOPP) Level IV
- Protective mask
- Chemical protective over-garment
- Gloves
- Protective footwear/over-boots

Patient Management

Secure Patient

- Move patient as needed to safety



MANAGEMENT STRATEGY 2

Identify Location of Medical Supplies

- Suction
- Bag-valve/laryngeal mask
- Resuscitation Device, Individual, Chemical (RDIC)
- Endotracheal Tube / Stylette
- Laryngoscope
- Needles
- IV Catheter
- IV Fluids
- Tape
- Scalpels



MANAGEMENT STRATEGY 3

Perform Medical Management (ABCD Treatment)

1. **Airway** – Suction; Position patient; Secure airway; Resuscitation Device, Individual, Chemical (RDIC); Intubation if needed. Requires frequent suctioning.
2. **Breathing** – Assessment; drugs; bag-valve-mask ventilation - Initial ventilation is difficult due to high airway resistance (50-70 cm of water). Resistance decreases after atropine administration. Ventilate 0.5-3 hours.
3. **Circulation** – Assessment, drugs.



MANAGEMENT STRATEGY 4

Perform Medical Management (ABCD Treatment)- Continued

4. Administer Drugs – Antidote, Symptom Management

Atropine: Dry secretions, reduce bronchoconstriction, decrease gastrointestinal motility. 2mg/dose (>12 years); 1mg/dose (6-12 years); 0.5mg/dose (age 1-5 years); 0.25mg/dose (<1 years).

ATNAA/ Atropine Auto Injector

- 1st injector (2.1mg) IM
- 2nd injector (2.1mg) IM 10-15 min after 1st injector
- 3rd injector (2.1mg) IM in rapid succession, 1q 5min as needed

Pralidoxime Chloride (2PAM CL): Remove the nerve agent (except GD) from the enzyme acetylcholinesterase. (25/50mg/kg; 2000mg max for all).

ATNAA Auto Injector: 3 injectors (>12 years); 2 injectors (6-12 years); 1 injector (age 1-5 years); NA (<1 years)

- 1st injector (600mg) IM
- 2nd injector (600mg) IM 10-15 min after 1st injector
- 3rd injector (600mg) IM in rapid succession, not to exceed 3 in 1 hour



MANAGEMENT STRATEGY 5

Perform Medical Management (ABCD Treatment)- Continued...

4. Administer Drugs – Antidote, Symptom Management Continued...

Diazepam (CANA): Control convulsions .

CANA Auto Injector

- 1 injector (10mg) IM IF patient receives 3 2PAMCL or Atropine doses
- 2-3 injectors (10-20mg) IM for seizing patient as needed

Atropine Ophthalmological Ointment: At Battalion Aid Station (BAS) apply Atropine Ophthalmic Ointment (topical); 0.5” strip in pocket of lower eyelid. Relieve eye symptoms.



MANAGEMENT STRATEGY 6

Perform Medical Management (ABCD Treatment) Continued...

- **Re-assess & Monitor Patient**
 - **Supportive Treatment** – intravenous fluids, respiratory support.
 - **Stabilize Patient** – continue drug therapy as needed for persistent symptoms.
 - **Identify Treatment Effects.**
 - **Identify Clinical Mismanagement Effects.**



DECONTAMINATION

Decontamination

- Remove contaminated clothing and gear. Decontaminate exposed skin in the following order:
- Face
- Neck area
- Chest area
- Abdomen
- Arms and hands
- Other exposed skin areas



DECONTAMINATION

Decontamination

- Remove contaminated clothing and gear. Decontaminate exposed skin in the following order:
- Face
- Neck area
- Chest area
- Abdomen
- Arms and hands
- Other exposed skin areas



DISPOSITION PATIENT

Disposition Patient

- Medical transport to appropriate Level 2 receiving facility (if possible)
- Field stabilization and monitoring if transport not available.

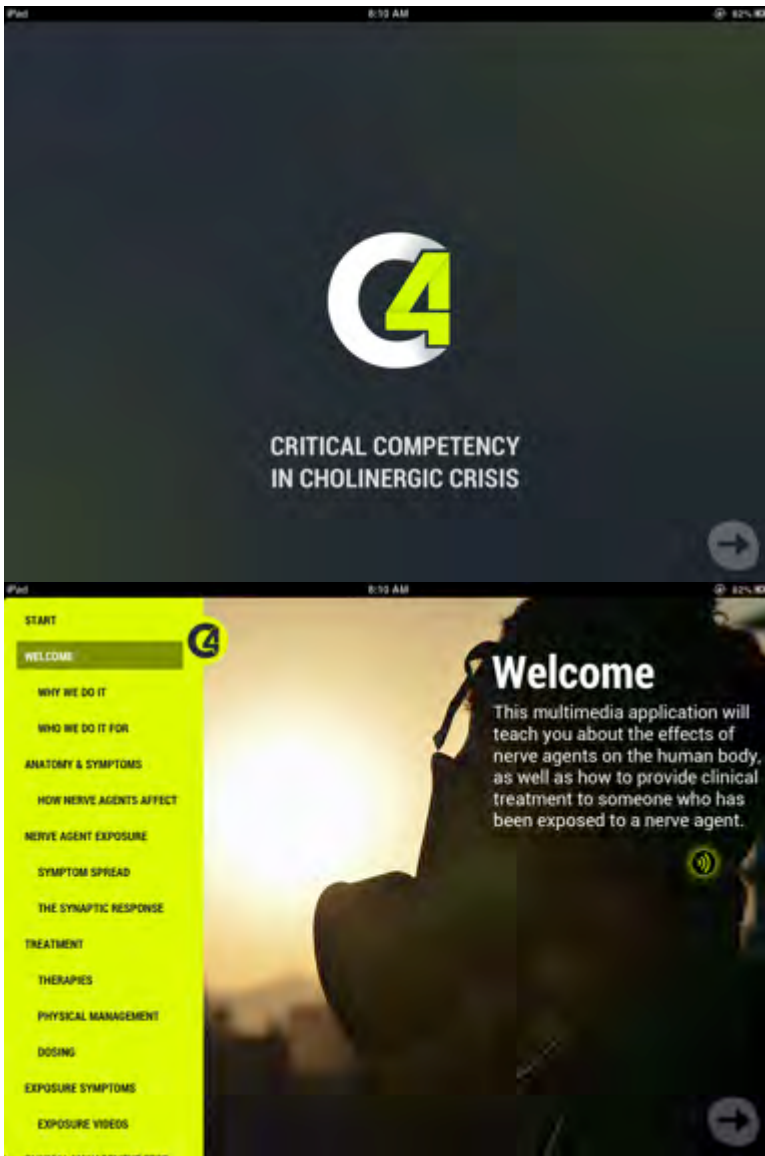


Multimedia Exercises

Multimedia training about how chemical and nerve agents effect physiological functioning, and how the antidotes modify the physiological outcomes will include one of the following conditions:

- Live animal response and recovery from a cholinergic event
- Animated human response and recovery from a cholinergic event

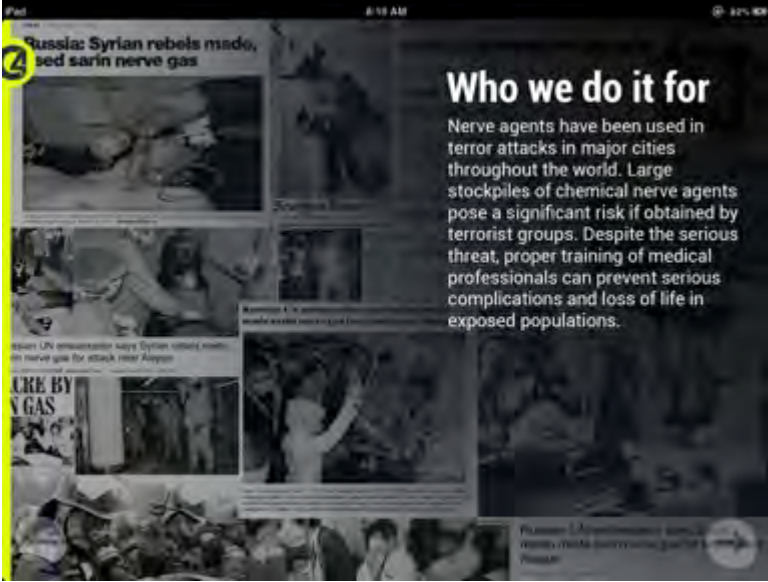
Multimedia training will take place over 30-45 minutes. The full multimedia application can be downloaded and viewed on an iPad using Testflight (username: c4study@gmail.com; password: cholinergic). To download the application, navigate to testflightapp.com and log in using the information above. Click the "Install Apps" tab and tap the C4 app to install. The C4 application can be interchanged between animal and human, using the C4 "Application Mode" toggle in the "Settings" menu of the iPad. Animal mode is activated when the Monkey toggle is "On" in the C4 section of the "Settings" menu. Human/simulator mode is activated when the Monkey toggle is "Off" in the C4 section of the "Settings" menu.





Why we do it

Nerve agents can affect all members of a population. Training is essential to enable first-responders to correctly recognize and manage nerve agent exposure in affected individuals.



Who we do it for



Nerve agents have been used in terror attacks in major cities throughout the world. Large stockpiles of chemical nerve agents pose a significant risk if obtained by terrorist groups. Despite the serious threat, proper training of medical professionals can prevent serious complications and loss of life in exposed populations.

ANATOMY & SYMPTOMS

Pad 8:19 AM 82% KB

4

How nerve agents affect the **NEUROLOGICAL** system





Seizure Exposure to nerve agents can cause the exposed individual's body to shake rapidly and uncontrollably. The symptoms can also be identified as convulsions.

Next **Optical**

Pad 8:19 AM 82% KB

4

How nerve agents affect the **OPTICAL** system





Exposure to nerve agents can cause **Miosis**: pupil constriction and **Lacrimation**: excessive secretion of tears in the affected individual.

Next **Nasal**

Pad 8:19 AM 82% KB

4

How nerve agents affect **NASAL** secretions



Rhinorrhea Exposure to nerve agents can cause excessive discharge of nasal fluid in an exposed individual.

Next **Oral**

Pad 8:19 AM 82% KB

4

How nerve agents affect **ORAL** secretions



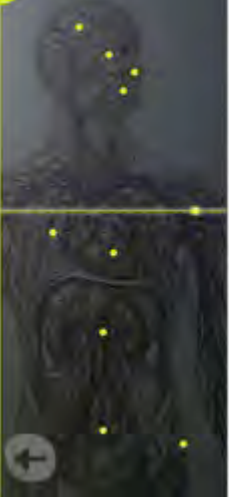


Salivation Nerve agent exposure may cause profuse salivation.

Next: Muscular

Pad 8:19 AM 82% KB

4

How nerve agents affect the **MUSCULAR** system

Muscular Fasciculation Nerve agent exposure can cause what is known as generalized muscular fasciculation. Muscular fasciculations are uncontrollable minor contractions or twitching of a muscle group.

Next: Respiratory

Pad 8:19 AM 82% KB

4

How nerve agents affect the **RESPIRATORY** system




Respiratory Distress Exposure to nerve agents can cause bronchoconstriction, and excessive mucous in the lungs that lead to difficulty breathing and possible cessation of respiration. Apnea can also occur after extensive exposure.

Next: Cardiovascular

Pad 8:19 AM 82% KB

4

How nerve agents affect the **CARDIOVASCULAR** system



Bradycardia Exposure can cause a decrease in heart rate.

Next: **Gastrointestinal**

Pad 8:19 AM 82% KB

4

How nerve agents affect the **GASTROINTESTINAL** system




Nerve agent exposure can lead to an increase in gastrointestinal motility leading to **Gastrointestinal Distress**: smooth muscle tone changes causing gastrointestinal problems, **Emesis**: vomiting, and **Bowel Incontinence**: relaxation of the internal sphincter.

Next: **Urinary**

Pad 8:19 AM 82% KB

4

How nerve agents affect the **URINARY** system




Urinary Incontinence Exposure to nerve agent can cause relaxation of the internal sphincter muscle of the urethra, and contraction of the detrusor muscles.


Next: **Endocrine**

Pad 8:10 AM 82% KB

4

How nerve agents affect the **ENDOCRINE** system





0:00 0:07

Nerve agent exposure can cause symptoms evident in examination of the skin. These include **Perspiration**: excessive sweating and **Cyanosis**: blueish coloring of the skin around the mouth and fingers, due to lack of oxygen to the tissue.

Next

Pad 8:11 AM 82% KB

4

NERVE AGENT EXPOSURE


0:00

Pad 8:11 AM 82% KB

4

Symptom Spread

Mid-Liquor Outer-Liquor Mid-Vasor Outer-Vasor



Onset Seconds Minutes Hours

8:11 AM 42% KB

The Synaptic Response

Acetylcholine is essential for signal processing. Acetylcholinesterase hydrolyzes acetylcholine, enabling receptor neurons to continue transmission. Nerve agents block acetylcholinesterase and impede neurotransmission, causing malfunction in organ systems that rely on those signals.

8:11 AM 42% KB

pre-treatment

ATNAA
Atropine Treatment Nerve Agent Antidote

pyridostigmine bromide

- Protects Acetylcholinesterase from the nerve agent, Sarin. It enhances treatment effectiveness after exposure to Sarin.
- Administered as a pre-treatment. Taken as an 30mg tablet every 8 hours.

Atropine

- Used to dry secretions, reduce bronchoconstriction and reduce gastrointestinal distress.
- Dose requirements vary by age.
- It is administered using Mark I kit (2mg/dose) or ATNAA auto-injector (2.1mg/dose) by intramuscular injection.
- A second dose is administered after 10-15 minutes, and additional doses may be necessary.

Pralidoxime Chloride (2PAMCL)

- Removes the nerve agent from acetylcholinesterase.
- Dose requirements vary by weight (max dose = 2000mg).
- 2PAMCL is also administered using a Mark I kit (300mg/dose) or ATNAA auto-injector (600mg/dose) by intramuscular injection.
- A second dose is administered after 10-15 minutes, and additional doses may be necessary.

Diazepam

- Used to control convulsions.
- Dose requirements weight/age.
- Administered using auto-injector (10 mg intramuscular injection) if patient has received Mark I or ATNAA kit.
- Additional doses may be necessary.

8:11 AM 42% KB

DOSING

Atropine

Baby 0.25 mg/dose

- Dose 1
- 10-15 min
- Dose 2
- 5 min
- Dose 3
- 5 min
- Dose 4
- 5 min
- Dose 5

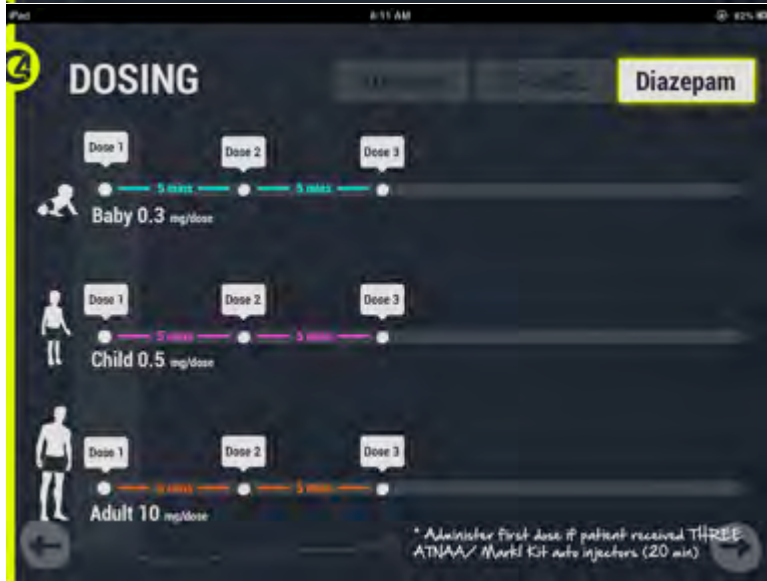
Child 1 mg/dose

- Dose 1
- 10-15 min
- Dose 2
- 5 min
- Dose 3
- 5 min
- Dose 4
- 5 min
- Dose 5

Adult 2 mg/dose

- Dose 1
- 10-15 min
- Dose 2
- 5 min
- Dose 3
- 5 min
- Dose 4
- 5 min
- Dose 5

* Additional doses every 5min
No more than three additional doses in one hour.



4 **EXPOSURE SYMPTOMS**

8:12 AM 82% KB

4 Symptoms

A grid of six video thumbnails, each with a play button icon. The thumbnails show a human patient with various symptoms: Lacrimation (tears in eyes), Vomiting, Gastrointestinal Upset, & Urinary Incontinence (vomiting), Perspiration & Rhinorrhea (sweating and runny nose), Respiratory Distress (breathing into a mask), Seizure & Muscular Fasciculation (convulsions), and Salivation (drooling).

Lacrimation

Vomiting, Gastrointestinal Upset, & Urinary Incontinence

Perspiration & Rhinorrhea

Respiratory Distress

Seizure & Muscular Fasciculation

Salivation

8:47 AM 94% KB

4 Symptoms

A grid of six video thumbnails, each with a play button icon. The thumbnails show a dog patient with various symptoms: Lacrimation (tears in eyes), Vomiting, Gastrointestinal Upset, & Urinary Incontinence (vomiting), Perspiration & Rhinorrhea (sweating and runny nose), Respiratory Distress (breathing into a mask), Seizure & Muscular Fasciculation (convulsions), and Salivation (drooling).

Lacrimation

Vomiting, Gastrointestinal Upset, & Urinary Incontinence

Perspiration & Rhinorrhea

Respiratory Distress

Seizure & Muscular Fasciculation

Salivation

8:12 AM 82% KB

A video player showing a soldier in a field. The video has a progress bar at the bottom with a play button on the left and a stop button on the right. The time 0:00 is shown on the left and 4:39 on the right.

Clinical Management Test

Instructions: Watch the video above, then move to the next page to complete a series of questions testing your knowledge.

8:12 AM 82% 4

Select the appropriate treatment from your pack below:

100mg/250mcg Atropine
 ATRAA
 Resusc
 Stetho
 Resuscitator (Ambu)
 IV Flask
 Nebulizer
 AED Ready To Use

You were met with resistance when using the bag-valve-mask to assist patient respiration. Administer the RDIC resuscitation device, which is appropriate for use in toxic atmospheres, to ventilate the patient.

Hint Start Over

8:12 AM 82% 4

CONGRATS!

You're done.

This completes the multimedia, you are encouraged to seek additional training on protective measures and device procedures in cholinergic crisis management.

restart

Simulation Exercises with SimMan3G

Programmed case scenarios will be presented for training and practice with the SimMan3G mannequin simulator:

- Moderate exposure, Vapor

Hands-on simulation training will include 30-45 minutes.

SimMan3G Scenario Progression

Initial State

Vitals: BP 85/45, HR 60, RR 28, O2 88%

Cough, Vomit sounds
Nasal, eye secretions
Lung Resistance
Coarse breath and Lung sounds
Seizure

Trend 0-5min
Vitals: BP 78/40, HR 40, RR 36, O2 82%

Trend 5-15min
Vitals: BP 62/40, HR 34, RR 8, O2 68%,

Trend 15-17min
Vitals: BP -, HR 0, RR 0, O2 -

ATNAA (Round 1)
No change in vitals

BVM
No change in vitals

IV Fluid Given
Trend - 7 minutes
Vitals: BP 90/64

ATNAA (Round 2)
No change in vitals

Ambu Military III
No change in vitals

ATNAA (Round 3)
Trend - 2 minutes
Vitals: RR 20, BP 100/60,
HR 80, O2 95%
Stop nasal/eye secretions
stop vomiting

Intubation
Trend - 2 min
Vitals - O2 98%

Diazepam Given
Trend: 5 minutes
Vitals: RR 16, O2 92%,
Seizures stop.

SimMan3g TEACHING PROTOCOL

Notes:

- Use terminology as indicated.
- Do NOT vary the protocol from below.
- Do NOT ad-lib content or add content that differs or departs from that indicated below.
- Refer all content related questions to Dr. Andreatta.
- Do NOT assume correct responses to questions or base responses off your knowledge. Following the protocol EXACTLY is essential.

TEACHING SEQUENCE

1. Orient the subjects to the SimMan3G
2. Tell the subjects they will learn to
 - Recognize the symptoms of cholinergic crisis
 - Perform the clinical tasks associated with medical management of cholinergic crisis
3. Tell subjects to request the following information from the conscious patient:
 - Do they have any PAIN?
 - Any GASTROINTESTINAL or URINARY DISTRESS?
 - DIFFICULTY BREATHING?
 - Assess the patient's MUSCLE CONTROL by having them squeeze your hand.
 - Determine patient's MENTAL STATUS by asking them where they are.
 - Ask if ANYTHING ELSE IS BOTHERING them.
4. Instruct subjects to perform a full body patient assessment by checking for the following indicators:
 - Eyes - Miosis
 - Mouth - copious secretions
 - Nose - copious secretions
 - Respiratory Effort - respiratory distress, Cyanosis
 - Muscle control - yes/no, muscular fasciculations
 - Pulse – bradycardia, variable rhythm
 - Neurological – mental status, convulsions/seizure
 - Other physical symptoms
 - Incontinence
 - Fatigue
 - Paralysis

*******SUBJECTS PRACTICE Items 3 & 4 *******

5. Teach subjects how to provide Clinical Management of the patient through the following:
 - Suction – demonstrate how to suction
 - Position patient on side
– demonstrate how to position patient on the side using subjects
 - Bag-valve-mask ventilation
- demonstrate how to use BVM

- ATNAA auto-injector administration (includes 1 dose of 2PAMCL & Atropine)
- demonstrate how to use ATNAA auto-injector
- IV placement - demonstrate how to place IV.
Indicate that training for IV access is not part of this course for safety purposes.

******* SUBJECTS PRACTICE Item 5 *******

6. Instruct subjects to continue providing Clinical Management of the patient through the following:
- Suction as needed
 - Second ATNAA auto-injector administration (2nd dose of 2PAMCL & Atropine)
 - RDIC – demonstrate how to use RDIC
 - Reassess patient

******* SUBJECTS PRACTICE Item 6 *******

7. Instruct subjects to continue providing Clinical Management of the patient through the following:
- Suction as needed
 - Third ATNAA auto-injector administration (3rd dose of 2PAMCL & Atropine)
 - CANA auto-injector (includes 1 dose of Diazepam) for seizures/convulsions
- demonstrate how to use CANA auto-injector.
 - Reassess patient

******* SUBJECTS PRACTICE Item 7 *******

8. Teach subjects that if the patient loses consciousness, they should intubate the patient to secure the airway.
- Demonstrate how to use Intubate.
 - Remind subjects that IF PATIENT IS CONSCIOUS DO NOT INTUBATE.
9. Teach subjects to call for patient transport to a Level 2 facility and maintain supportive treatment until patient is either stable or handed-off to transport team.

Simulation Exercises with Standardized Patients

Five case scenarios will be presented for training and practice in the recognition and response to a cholinergic event using simulated patients representing five similar symptomologies, only one of which is a cholinergic event:

- Nerve agent exposure
- Vesicant exposure

Hands-on simulation training will include 30 minutes.

Appendix 9: Training Event Images

IMAGES FROM PEDIATRIC/NEONATAL INTUBATION TRAINING



Figure 1. Subjects don protective gear prior to entering the surgical area to practice intubation on an anesthetized cat.



Figure 2. Veterinary students observe and assist subjects performing intubation.



Figure 3. Licensed veterinary technicians supervise participants during intubation procedures.



Figure 4. After being intubated by study subjects cats are spayed or neutered by veterinary students as part of Michigan State University College of Veterinary Medicine's spay/neuter program.



Figure 5. Prior to and after training, subjects are assessed on their ability to perform the procedural steps associated with intubation on pediatric and neonatal simulators.



Figure 6. Subjects are provided with standard equipment and instruments to perform intubation.



Figure 7. Raters use the performance assessment instrument to mark competencies subjects perform during assessment activities.

IMAGES FROM CHOLINERGIC CRISIS RECOGNITION AND RESPONSE TRAINING



Figure 1. Raters greet subjects and enter administrative data, prior to the initiation performance assessment activities.



Figure 2. Subjects, raters and standardized patient actors during performance assessment activities.



Figure 3. Subject assesses distractor patient actor.



Figure 4. Subject reassesses nerve agent exposure patient after performing airway management on an airway manikin with RDIC.



Figure 5. Subject administers airway management to airway manikin in order to provide to the standardized patient.



Figure 6. Rater marks completed competency points as subject administers ANTAA to nerve agent exposure patient.



Figure 7. Video production for the animal component of the cholinergic crisis multimedia application was conducted in a surgical suite at the University of Missouri.



Figure 8. The African Green monkey was carefully monitored by licensed veterinary medical professionals from onset of cholinergic crisis to resolution.



Figure 9. Dr. Andreatta and Project Manager, Laszlo Alberti present a certificate of appreciation to the City of Plymouth Fire Station and Chief Klein.

Appendix 10: Preliminary Data

Recognition and Management of Cholinergic Crisis

Assessment Instrument Psychometric Evidence

- Construct validity was supported by statistically significant differences between subjects with and without prior training in the clinical management of a cholinergic event.
- Scores for greater levels of experience exceeded those of lower experience levels for:
- Knowledge ($F(1, 122) = 8.89, p = .003$)
- Performance ($F(1, 122) = 170.34, p = .000$)

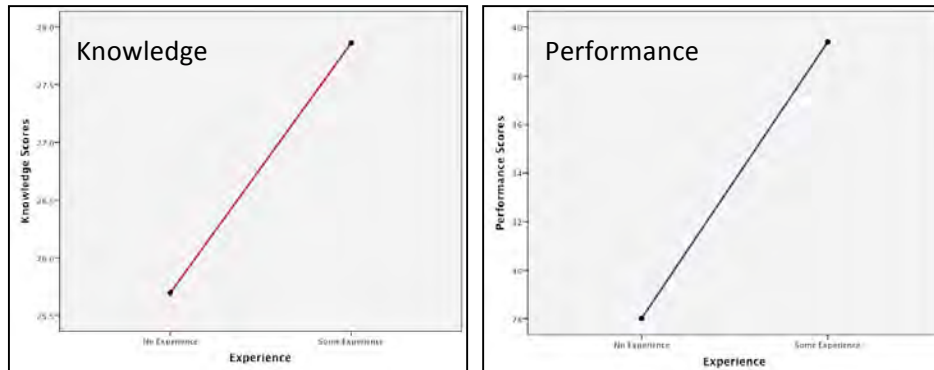


Figure 1. Construct validity for cholinergic crisis knowledge and performance assessments.

- Significant correlations between test-retest outcomes for both assessment instruments indicated measurement reliability ($p < .01$).
- Test-retest (Pearson "r") correlations were:
- Knowledge (.97)
- Performance (.98)
- The assessment instruments demonstrated internal consistency (Cronbach's alpha):
- Knowledge (.70)
- Performance (.90)

Evaluation of Training Modalities

- Both groups had significant performance improvement across all assessment dimensions:
- Knowledge ($F(1,203) = 1046.47, p = .000$). >20% increase in knowledge scores
- Performance ($F(1,203) = 1805.23, p = .000$). >50% increase in performance

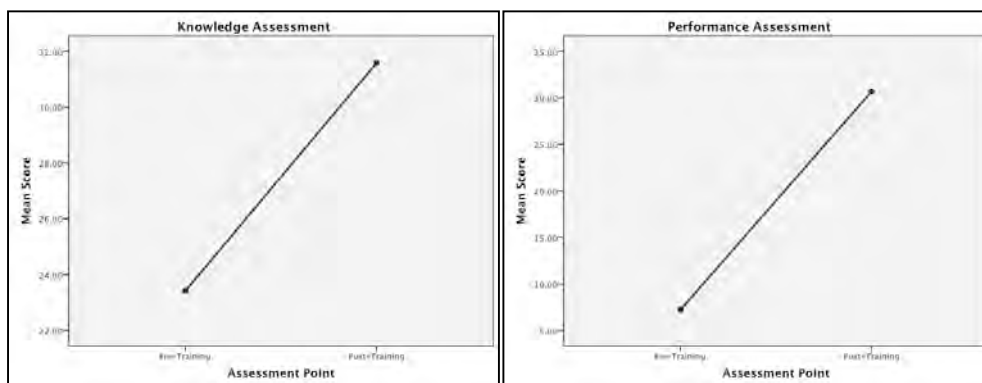


Figure 2. Knowledge and performance outcomes over time (pre-test and post-test).

- Self-efficacy ($F(1,203) = 933.22, p = .000$). >34% increase in self-efficacy scores
- Affect ($F(1,203) = 78.97, p = .000$) >15% increase in affect scores

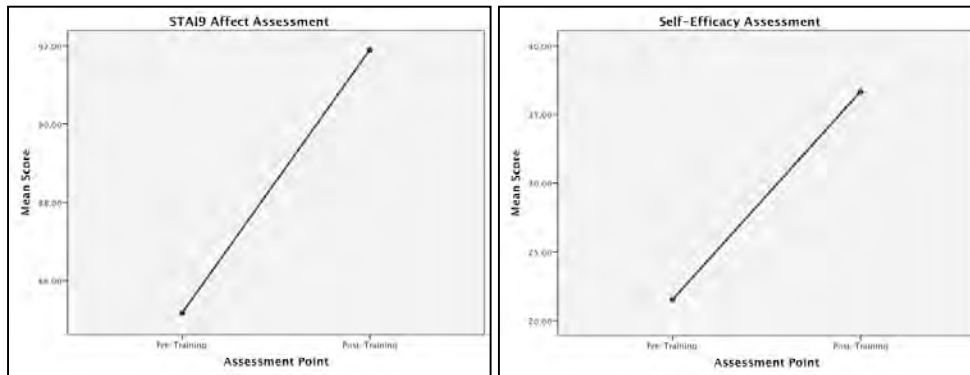


Figure 3. Affect and self-efficacy outcomes over time (pre-test and post-test).

- There were no significant differences in any of the post-training outcomes for the two groups.

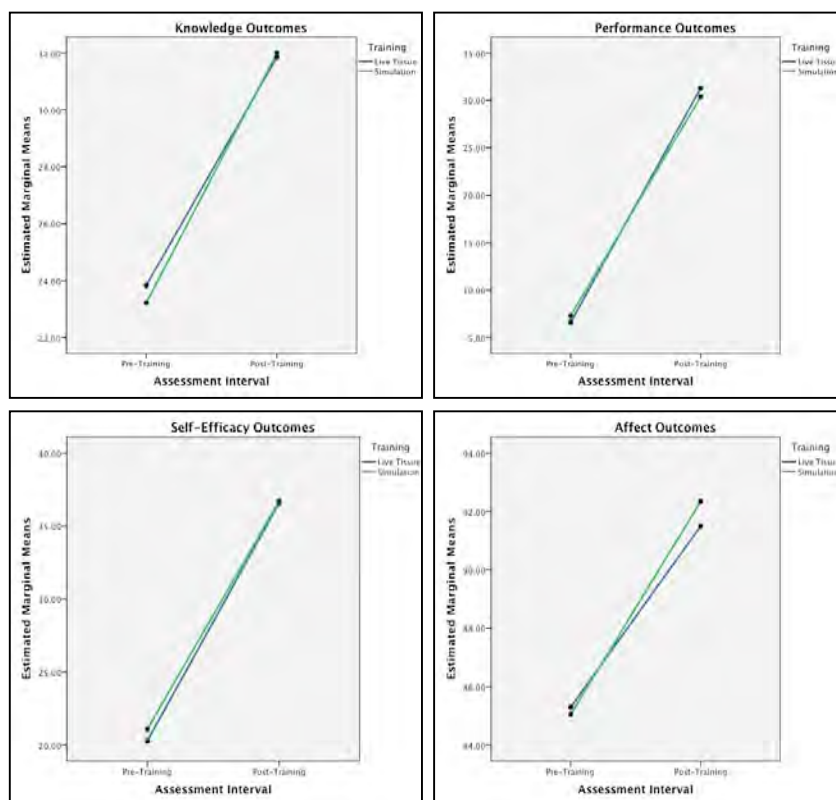


Figure 4. Pre-post instruction assessment scores by training model.

- There were significant correlations between the post-training self-efficacy scores and those for performance and affect, as well as between knowledge and performance scores ($p < .05$) for the live animal trained group.
- The post-training scores for the patient actor trained group had significant correlations between self-efficacy scores and those for knowledge, performance and affect ($p < .05$).
- Retention assessment scores decreased significantly from post training scores:
 - Cognitive outcomes at all retention intervals ($F(1,161) = 316.83, p = .000$)
 - Performance at 6 weeks ($F(1,161) = 44.87, p = .000$), 18 weeks ($F(1,54) = 363.11, p = .000$) and 52 weeks ($F(1,46) = 97.06, p = .000$)
 - Self-efficacy at 6 weeks ($F(1,59) = 19.89, p = .000$), 18 weeks ($F(1,54) = 131.68, p = .000$) and 52 weeks ($F(1,46) = 92.05, p = .000$)
 - Performance retention scores were significantly higher at 6 weeks than those at 52 weeks ($p = .000$).

- There were no significant retention differences between subjects with and without prior training in the clinical management of a cholinergic event in any domain.
- There were no significant retention differences between training groups for knowledge and performance.

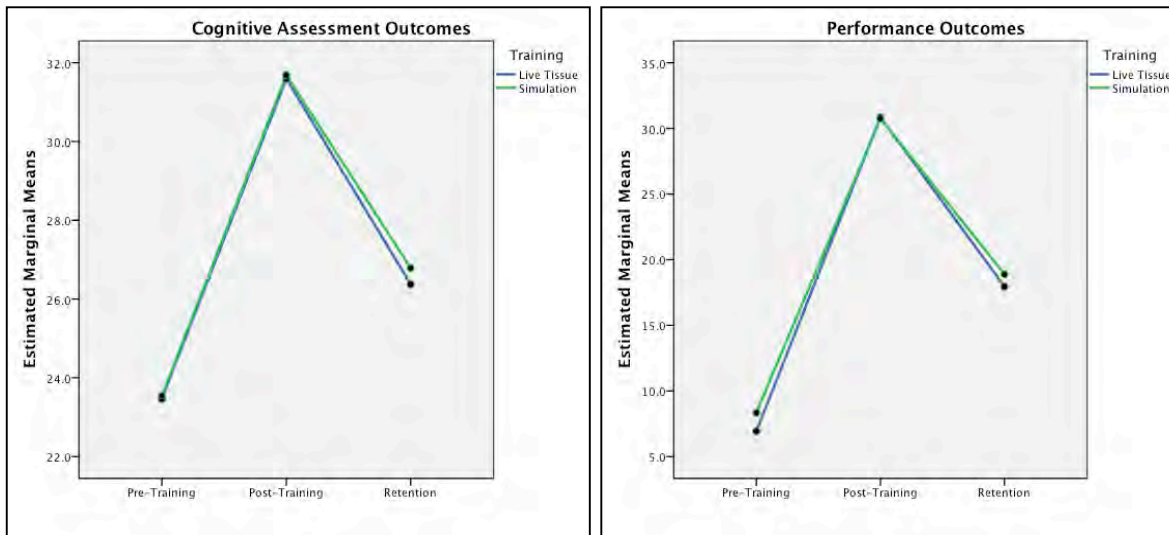


Figure 5. Pre-post instruction assessment scores by training model.

Pediatric and Neonatal Intubation

Assessment Instrument Psychometric Evidence

- For pediatric and neonatal intubation, construct validity was supported by statistically significant differences between subjects with varying levels of experience, such that the scores for greater levels of experience exceeded those of lower experience levels.
- Between group ANOVA outcomes for experience levels were as follows:
 - Cognitive ($F(2,212) = 107.45, p = .000$)
 - Pediatric Performance ($F(2,212) = 115.18, p = .000$)
 - Neonatal Performance ($F(2,212) = 111.89, p = .000$)
- Bonferroni post-hoc analyses confirmed statistical significance between all experience levels for each assessment instrument ($p < .001$).



Figure 1. Construct validity for pediatric-neonatal cognitive and performance assessments.

- Significant correlations between test-retest outcomes for all assessment instruments indicated measurement reliability ($p < .01$).
- Test-retest (Pearson "r") correlations were:
 - Knowledge (.99)
 - Pediatric performance (.96)
 - Neonatal Performance (.96)
- The assessment instruments demonstrated excellent internal consistency (Cronbach's alpha):

- Knowledge (.92)
- Pediatric performance (.84)
- Neonatal performance (.85)

Evaluation of Training Modalities

- Overall, subjects performed significantly better across all assessment domains after training:
- Knowledge ($F(1,293) = 913.96, p = .000$)
- Pediatric performance ($F(1,293) = 197.11, p = .000$)
- Neonatal performance ($F(1,293) = 111.64, p = .000$)
- Self-efficacy ($F(1,293) = 359.64, p = .000$)
- There were no significant differences between the live animal and simulator groups on post-training assessment outcomes by experience level.

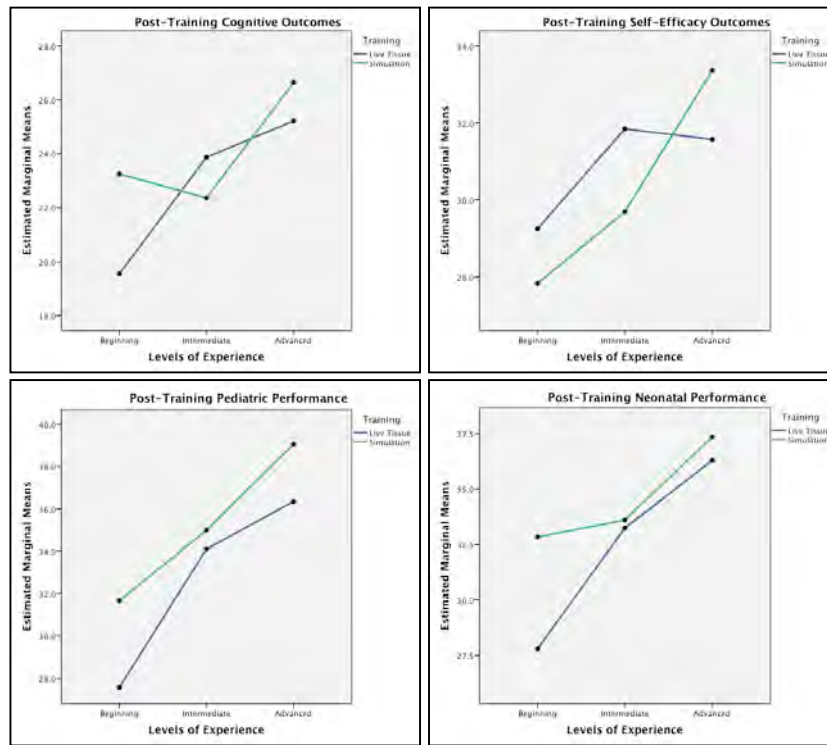


Figure 2. Post-training assessment outcomes by training model and experience level.

- Retention differences at 18 and 52 weeks post-training favored those who trained using the simulator, likely due to deliberate practice opportunity.
- Knowledge outcomes at 52 weeks ($F(1,26) = 9.38, p = .005$)

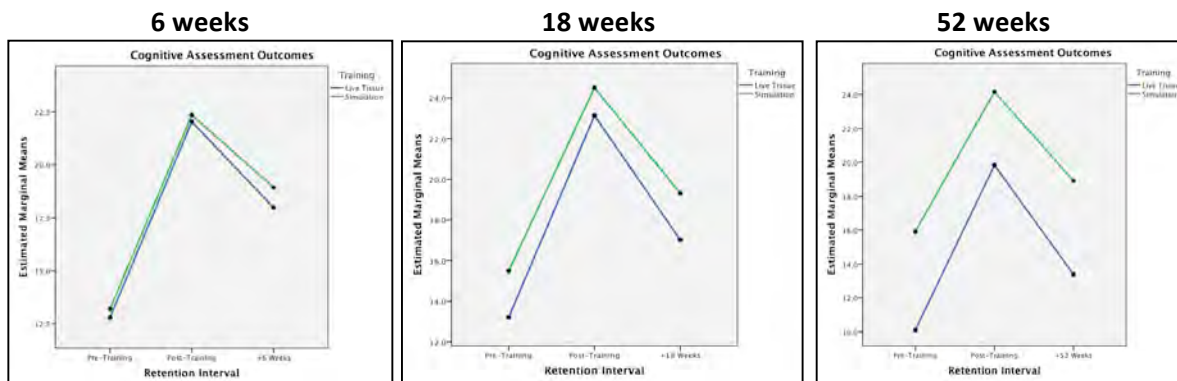


Figure 3. Knowledge outcomes between subject groups over time (pre-test; post-test; retention-test).

- Pediatric performance outcomes at 18 weeks ($F(1,51) = 13.42, p = .001$) and 52 weeks ($F(1,26) = 13.74, p = .001$)

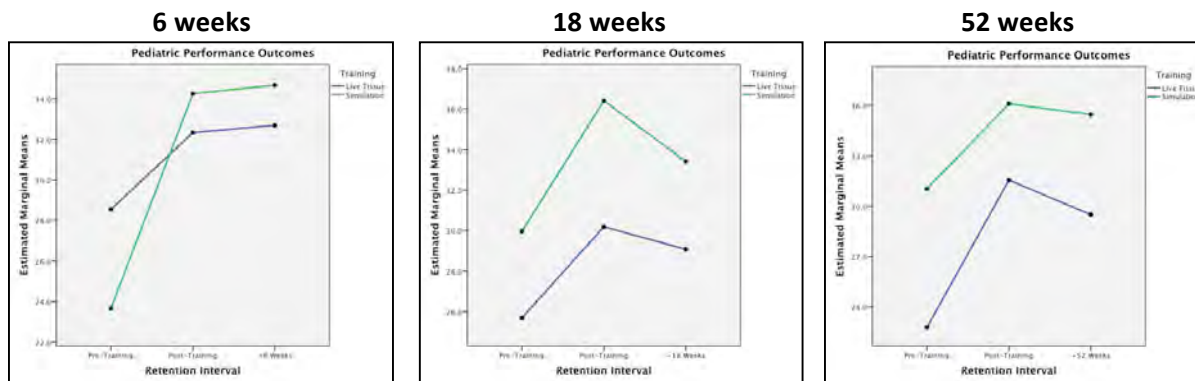


Figure 4. Pediatric performance assessment outcomes between subject groups over time (pre-test; post-test; retention-test).

- Neonatal performance outcomes at 18 weeks ($F(1,51) = 7.22, p = .01$) and 52 weeks ($F(1,26) = 13.47, p = .001$)



Figure 5. Neonatal performance assessment outcomes between subject groups over time (pre-test; post-test; retention-test).

- Retention assessment scores decreased significantly from post-training scores:
- Knowledge outcomes at all retention intervals ($F(1,170) = 209.28, p = .000$)
- Self-efficacy outcomes at 18 weeks ($F(1,51) = 16.88, p = .000$) and 52 weeks ($F(1,45) = 8.99, p = .004$)
- There were significant differences between retention scores for subjects with varying amounts of experience performing pediatric and neonatal intubation across the following domains:
- Cognitive ($F(3,168) = 64.13, p = .000$)
- Pediatric performance ($F(3,168) = 42.81, p = .000$)
- Neonatal performance ($F(3,168) = 48.21, p = .000$)
- Self-efficacy ($F(3,168) = 31.50, p = .000$)

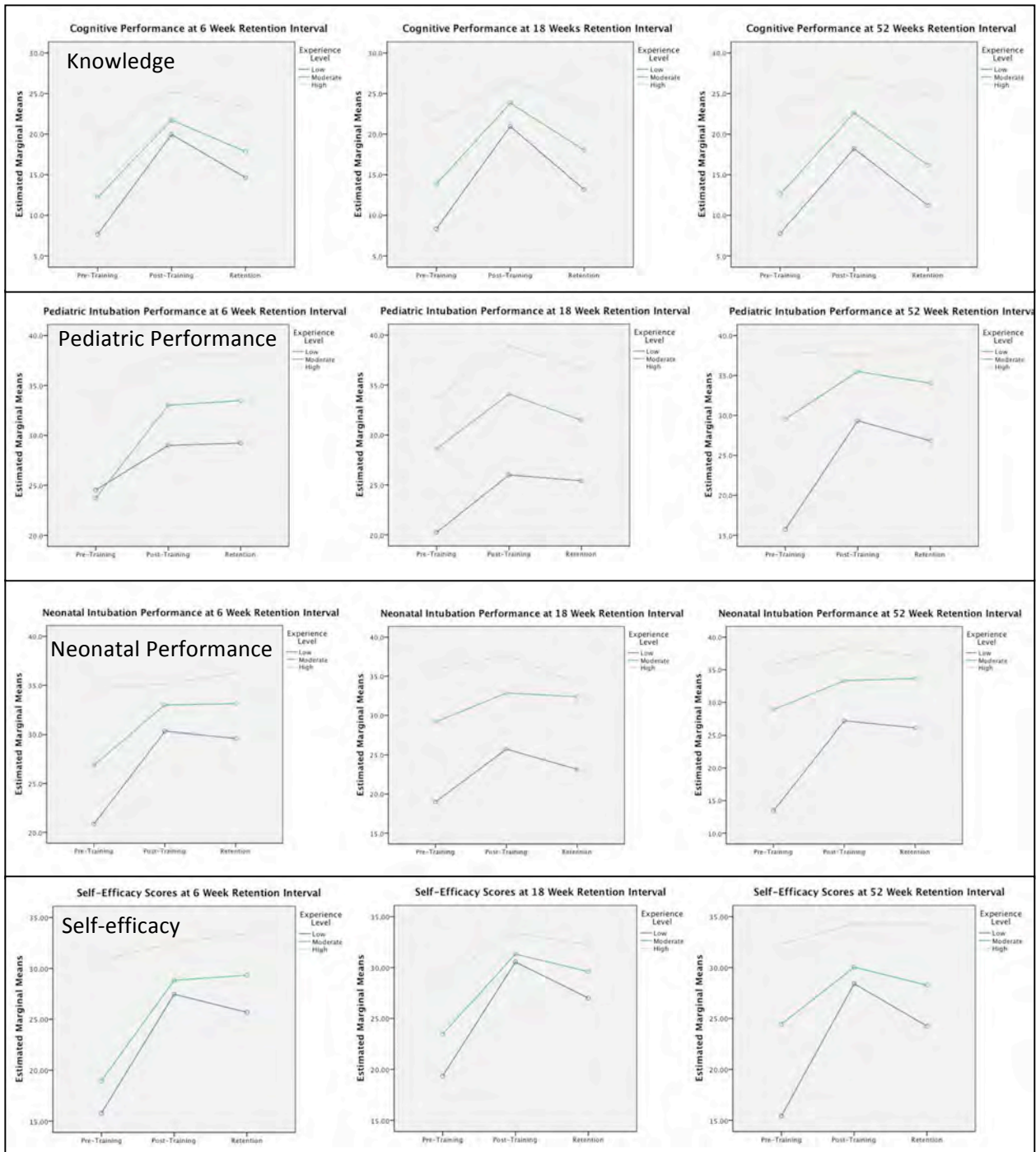


Figure 6. Pediatric and neonatal intubation competency assessment outcomes by experience level at each retention interval.

Appendix 11: Publication and Presentation Lists

Publications

1. Klotz JJ, Dooley-Hash SL, House JB, Andreatta PB. (2014). Evaluation of a precise and measurable model for learning laparoscopic tissue handling. *Simulation in Healthcare*, 9(6), 283-287. doi: 10.1097/SIH.0000000000000036.
2. Andreatta PB, Klotz JJ, Madsen JM, Hurst CG, Talbot TB. (2014). Assessment instrument validation for critical clinical competencies: pediatric-neonatal intubation and cholinergic crisis management. *Proceedings of the Interservice/Industry Training, Simulation & Education Conference (IITSEC) 2014*.
3. Andreatta PB, Klotz JJ, Dooley-Hash SL, House JB. (2014). Outcomes from two forms of pediatric and neonatal intubation training. *Proceedings of the Interservice/Industry Training, Simulation & Education Conference (IITSEC) 2014*.
4. Andreatta PB, Klotz JJ, Madsen JM, Hurst CG, Talbot TB. (2014). Training effects for first-responder competency in cholinergic crisis management. *Proceedings of the Interservice/Industry Training, Simulation & Education Conference (IITSEC) 2014*.
5. Andreatta PB, Klotz JJ, Dooley-Hash SL, Hauptman JG, Biddinger B, House JB. Performance-based comparison of neonatal intubation training outcomes: simulator and live animal. *Advances in Neonatal Care* (in press).
6. Andreatta PB, Klotz JJ, Madsen JM, Hurst CG, Talbot TB. Training effects for first-responder competency in cholinergic crisis management. *Transactions from the Interservice/Industry Training, Simulation & Education Conference (IITSEC)* (in press).
7. Andreatta PB, Klotz JJ, Madsen JM, Hurst CG, Talbot TB. Outcomes from two forms of training for first-responder competency in cholinergic crisis management. *Military Medicine* (in review).
8. Andreatta PB, Klotz JJ, Madsen JM, Hurst CG, Talbot TB. Retention of training for first-responder competency in cholinergic crisis management. *Military Medicine* (in process).
9. Andreatta PB, Klotz JJ, Madsen JM, Hurst CG, Talbot TB. Mixed methods training for first-responder training in cholinergic crisis management. *Simulation in Healthcare* (in process).

Presentations

1. Andreatta P. *Emergency medicine skills: Pediatric & neonatal intubation; Cholinergic crisis management*. Medicine Meets Virtual Reality (MMVR). Manhattan Beach, CA. February 2014.
2. Andreatta P, Klotz J, Dooley-Hash S, House J. *Outcomes from two forms of pediatric and neonatal intubation training*. SimHealth. Adelaide, South Australia, AU. August 2014.
3. Andreatta P, Klotz J, Dooley-Hash S, House J. *Validation of assessment instruments to evaluate pediatric/neonatal intubation competency*. SimHealth. Adelaide, South Australia, AU. August 2014.
4. Andreatta P, Klotz J, Dooley-Hash S, House J. *Post-training retention curves associated with pediatric and neonatal intubation skills*. SimHealth. Adelaide, South Australia, AU. August 2014.
5. Andreatta P, Klotz J, Madsen JM, Hurst CG, Talbot TB. *Training and retention outcomes from two forms of pediatric and neonatal intubation training*. Military Health System Research Symposium (MHSRS). Fort Lauderdale, FL. August 2014.
6. Andreatta P, Klotz J, Dooley-Hash S, House J. *Training and retention outcomes from two forms of pediatric and neonatal intubation training*. Military Health System Research Symposium (MHSRS). Fort Lauderdale, FL. August 2014.
7. Andreatta PB, Klotz JJ, Dooley-Hash SL, House JB. *Outcomes from two forms of pediatric and neonatal intubation training*. The Interservice/Industry Training, Simulation & Education Conference (I/ITSEC). Orlando, FL. December 2014.
8. Andreatta PB, Klotz JJ, Madsen JM, Hurst CG, Talbot TB. *Assessment instrument validation for critical clinical competencies: pediatric-neonatal intubation and cholinergic crisis management*. The Interservice/Industry Training, Simulation & Education Conference (I/ITSEC). Orlando, FL. December 2014.
9. Andreatta PB, Klotz JJ, Madsen JM, Hurst CG, Talbot TB. *Training effects for first-responder competency in cholinergic crisis management*. The Interservice/Industry Training, Simulation & Education Conference (I/ITSEC). Orlando, FL. December 2014.

Appendix 12: Program Review/Summary Report
(Report Date: 24 JUNE 2014)

PROGRAM PROGRESS REPORT PRESENTATION - 24 JUNE 2014



University of Minnesota

Critical Analyses and Development of Training Mechanisms: Cholinergic Crisis and Pediatric/Neonatal Intubation

PI: Pamela Andreatta, PhD
Associate Professor
Award # W81XWH-12-2-0001

UAGSAMRPP0000 0000 0000 0000

0000 0000



Project Information



- Organization: University of Minnesota
 - University of Michigan
 - Michigan State University
 - University of Missouri
- Award #: W81XWH-12-2-0001
- Principal Investigator: Pamela Andreatta, PhD
- Amount: \$3.38 Million
- Period of Performance: 4 Nov 11 – 3 Dec 14
- Grants Officer Representative: Mr. Tony Story, CDMRP
- Grants Specialist: Ms. Gay Hayden, USAMRAA

UAGSAMRPP0000 0000 0000 0000

0000 0000



Consortium



- **University of Minnesota (Medical School)**
 - Pamela Andreatta, PhD/EdD
 - Jessica Klotz, BSc
- **University of Michigan (Medical School, Emergency Medicine)**
 - Suzanne Dooley-Hash, MD
 - Joseph House, MD
- **Michigan State University (College Veterinary Medicine)**
 - Joseph Hauptman, DVM
- **University of Missouri (Medical School/College Veterinary Medicine)**
 - Stephen Barnes, MD
 - Alex Bukoski, DVM
- **USAMRICD**
 - Col. (Ret) Charles G. Hurst, MD
 - Col. James Madsen, MD
- **TATRC/ University of Southern California**
 - Thomas B. Talbot, MD, MS

UAGSAMRPP0000 0000 0000 0000

0000 0000



Hypotheses & High Level Objectives



- **HYPOTHESES:** Cognitive dissonance from affective overload can interfere with application of knowledge & skills in a mass casualty environment.
 - Contextually relevant factors improves training transfer to applied performance.
 - Live animals provide contextually relevant factors; Ethical considerations using live animals for these purposes.
 - Current training methods lack contextually-based performance assessment; Performance assessment will facilitate comparison of training methods.
- **HIGH LEVEL OBJECTIVE:** Evaluate relative impact of live animals and high-fidelity mannequin simulators for training in the recognition of medical need and consequential clinical management of 1) Cholinergic Crisis and 2) Pediatric & Neonatal Intubation

USAMRIID/2019-001

1/1/2019



Specific Objectives



OBJECTIVE 1: Comprehensive Literature Review & Competency Measurement

- Create a defensible framework for facilitating, determining and evaluating competency (performance standards, assessment, training methods).

OBJECTIVE 2: Evaluation of Training Methods (Live Animal vs. Simulation)

- **Management of Cholinergic Crisis:** Training interventions follow a modified version of the content offered by USAMRICD.
- **Pediatric & Neonatal Intubation:** Training interventions follow American Heart Association (AHA) PALS/NRP content.
- **Compare Training Outcomes:** (Cognitive, Psychomotor, Affective).
 - Pre/Post Performance
 - Performance Retention (6 weeks, 18 weeks, 52 weeks).

OBJECTIVE 3: Develop of Evidence-based Curricula

- Design comprehensive, data-driven, evidence-based training program: learning objectives; performance standards; instructional methods; assessment metrics; material and human resources.

USAMRIID/2019-001

1/1/2019



Tasks & Milestone Update



Calendar Quarter (rounded) ->			11				12				13				14			
			4	3	2	1	4	3	2	1	4	3	2	1	4	3	2	1
OBJECTIVE 1: Comprehensive Literature Review and Competency Measurement																		
Task Analysis (Completed)	Jan-12	Apr-12																
Critical Steps Identified for Respective Skills (Completed)	Feb-12	Apr-12																
Potential Sources of Errors Identified during Critical Steps																		
Systematic review of the literature, professional practice guidelines, and training pedagogies	Nov-11	Jul-12																
Performance Standards	Mar-12	Apr-12																
Instructional Needs	Mar-12	Aug-12																
Develop Performance Assessment Instruments	Apr-12	May-12																
Verify Assessment Materials	Aug-12	Aug-12																
Assemble Data-driven, defensible / comprehensible Assessment Program	Oct-12	Nov-12																
Assemble Data-driven, defensible training program	Aug-12	Aug-12																

UNCLASSIFIED//FOUO Slide 6 of 46

7/10/14 09:38



Tasks & Milestone Update



Calendar Quarter (rounded) ->			11				12				13				14			
			4	3	2	1	4	3	2	1	4	3	2	1	4	3	2	1
OBJECTIVE 2: Evaluation of Training Methods (Live Animal vs. Simulation)																		
Pre-assessment	Dec-12	Mar-13																
Training	Dec-12	Mar-13																
Post-Assessment 1 (Learning)	Dec-12	Mar-13																
Post-Assessment 2 (Retention)	Jan-13	Jun-13																
Data Analysis	Dec-12	Apr-13																
OBJECTIVE 3: Develop on Evidenced-based Curricula																		
Write training objectives	Oct-12	Apr-13																
Document standards of performance	Oct-12	Apr-13																
Define instructional methods	Jul-12	Jun-14																
Authenticate methods of assessment	Mar-14	Jun-14																
Prepare Evaluation Plan: Curriculum	Mar-14	Oct-14																

UNCLASSIFIED//FOUO Slide 7 of 46

7/10/14 09:38



Tasks Completed: Objective 1



- Comprehensive Meta-analyses
 - Imprecise assessment mechanisms; partially assessed performance domain
 - Absent specific and measurable performance standards
 - No statistically validated assessment instruments
 - Absent evidence-based training methods
 - Reported training methods are inadequate to develop and maintain proficiency in pediatric and neonatal intubation.
 - Comprehensive task analyses across each performance domain.
 - Simulation models compared to performance requirements.

UNCLASSIFIED//FOUO Slide 8 of 46

7/10/14 09:38



Tasks Completed: Objective 1



- Develop Assessment Instruments
 - Expert review confirmed content validity.
 - Construct validity established by using the instruments to differentiate between performance of a purposively selected sample of novice through expert practitioners, stratified by level of experience performing pediatric-neonatal intubation (N=214) and cholinergic crisis management (N=123).
 - Reliability was established using test-retest (Pearson "r" correlation) and internal consistency (Cronbach's "α" alpha) for assessment instruments.



Tasks Completed: Objective 2 Cholinergic Crisis



Evaluation of Cholinergic Crisis Training Methods

Training interventions followed a modified version of the content from USAMRICD "Medical Management of Chemical and Biological Casualties, and Field Management of Chemical and Biological Casualties" courses.

- Pre-training assessment (cognitive, psychomotor, affective) of performance abilities.
- Equivalent training opportunities and course content.
- Heart rate variability (baseline, peak, mean) measured throughout all study activities.
- Post-training assessment (cognitive, psychomotor, affective) of performance abilities.
- Retention assessment (cognitive, psychomotor, affective) of performance abilities after 6 weeks, 18 weeks, or 52 weeks*.



Tasks Completed: Objective 2 Cholinergic Crisis



Variable of Interest

- Group 1: Non-human Primate Model (Live Animal Model)
- Group 2: Standardized Patient Actor Model (Simulation Model)



UNCLASSIFIED//FOUO Slide 11 of 46

7/15/14 09:40



Tasks Completed: Objective 2 Pediatric/Neonatal Intubation



Evaluation of Pediatric & Neonatal Intubation Training Methods

Training interventions follow a modified version of the American Heart Association (AHA) *Pediatric Advanced Life Support (PALS)* course.

- Pre-training assessment (cognitive, psychomotor, affective) of performance abilities.
- Equivalent training opportunities and course content.
- Heart rate variability (baseline, peak, mean) measured throughout all study activities.
- Post-training assessment (cognitive, psychomotor, affective) of performance abilities.
- Retention assessment (cognitive, psychomotor, affective) of performance abilities after 6 weeks, 18 weeks, or 52 weeks.



UNCLASSIFIED//FOUO Slide 13 of 46



7/15/14 08:41

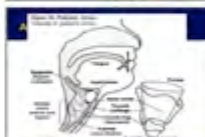


Tasks Completed: Objective 2 Pediatric/Neonatal Intubation



Variable of Interest

- Group 1: Live Cat Model
- Group 2: Simulated Cat Model



7/15/14 08:41



Tasks Completed: Objective 3



Development of Evidence-based Curricula

- Design comprehensive curricula for the management of cholinergic crisis and pediatric/neonatal intubation.
- Derive evidenced-based curricular elements from Objectives 1 & 2 data describing cognitive, psychomotor and affective dimensions of performance.
- Assemble and document all curricular elements, including but not limited to:
 - Training Objectives (Completed)
 - Standards Of Performance (Completed)
 - Assessment Methods (Completed)
 - Instructional Methods (In Process)
 - Material Resources (In Process)
 - Human Resources (Completed)

UNCLASSIFIED//FOUO Slide 14 of 46

7/15/14 08:41



Results: Competency Assessment



Assessment Solutions

- Developed 2 Cognitive, 3 Performance, 2 Self-Efficacy Instruments. Chose STAI validated instrument for measuring affect.
- Established validity & reliability evidence and performance standards for all instruments (statistical significance, $p < 0.5$; Pearson's $r > .80$; Cronbach's $\alpha > 0.72$)

Psychometric Evidence

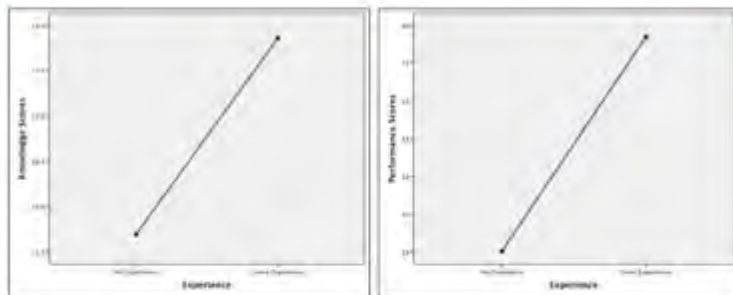
	Cognitive	Performance	Affective (STAI)	Self-Efficacy
Cholinergic Crisis (N = 123)	$p < .01$	$p < .001$	$p < .05$	$p = .001$
	$r = .97$	$r = .98$	n/a	n/a
	$\alpha = .69$	$\alpha = .90$	$\alpha = .95$	$\alpha = .91$
Pediatric & Neonatal Airway (N = 212)	$p < .001$	Pediatric $p < .001$ Neonatal $p < .001$	$p < .05$	$p < .001$
	$r = .99$	Pediatric $r = .96$ Neonatal $r = .96$	n/a	n/a
	$\alpha = .92$	Pediatric $\alpha = .84$ Neonatal $\alpha = .85$	$\alpha = .96$	$\alpha = .95$

UNCLASSIFIED//FOUO Slide 15 of 46

7/19/14 08:42



Results: Construct Validity Cholinergic Crisis Management



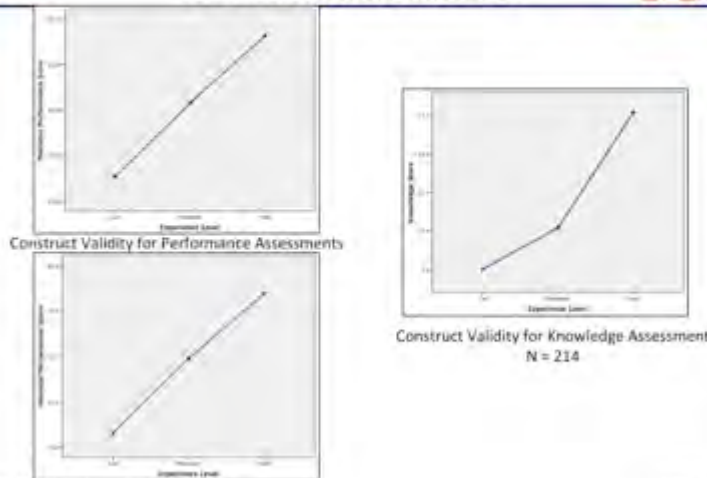
Construct Validity for Knowledge and Performance Assessments
N = 123

UNCLASSIFIED//FOUO Slide 16 of 46

7/19/14 08:41



Results: Construct Validity Pediatric & Neonatal Intubation



Construct Validity for Knowledge Assessment
N = 214

UNCLASSIFIED//FOUO Slide 17 of 46

7/19/14 08:41



Results: Technology Gaps



Adult Mannequin Simulators

- **Secretions** – Requires copious and simultaneous secretions including sweat, runny nose, tears, vomit, urine, and saliva (frothy, bubbles, slobber).
- **Vocalizations** – Requires alternatives for garbled, confused, slurring, nonsensical expression.
- **Skin** – Requires realistic, progressive occurrences of rashes, erythemas, burns, and other skin conditions associated with chemical, vesicant, and other types of exposure.
- **Nervous System** – Requires improved, simultaneous muscle fasciculations, twitching, seizures.
- **Airway** – Requires Mallampati variability, Pierre Robin airway (short mandible), improved material at vallecula (easily punctured).
- **Lung Auscultation** – Requires more realistic and localized breath sounds.



UNCLASSIFIED//FOUO Slide 18 of 46



7/15/14 08:43



Results: Technology Gaps



Pediatric / Neonatal Simulators

- **Secretions** – Requires copious and simultaneous secretions including sweat, runny nose, tears, vomit, urine, and saliva (frothy, bubbles, slobber).
- **Vocalizations** – Requires alternatives for garbled, confused, slurring, nonsensical expression.
- **Skin** – Requires realistic, progressive occurrences of rashes, erythemas, burns, and other skin conditions associated with chemical, vesicant, and other types of exposure.
- **Nervous System** – Requires improved muscle fasciculations, twitching, seizures.
- **Lung Auscultation** – Requires more realistic and localized breath sounds.
- **Cyanosis** – True Perioral Cyanosis (1cm around the mouth turning blue).
- **Size** – True Preemie (28-30 weeks, <3kg).
- **Airway** – Requires the following:
 - Fat tongue, improved tongue tissue fidelity (slippery, wet)
 - More redundant airway tissues, slippery tissues, friable/bleeding
 - Large, floppy epiglottis
 - Nasal flaring
 - More anterior airway

UNCLASSIFIED//FOUO Slide 19 of 46

7/15/14 08:43



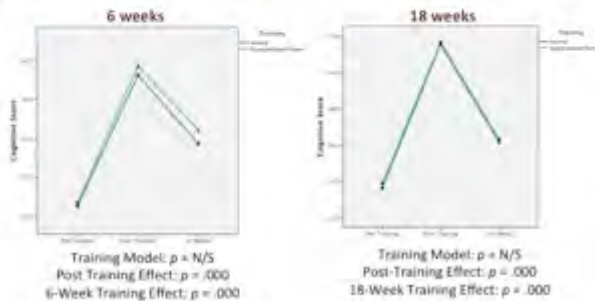
Results: Cholinergic Crisis Training Methods Comparison



COGNITIVE OUTCOMES	Pre-Training N = 204	Post-Training N = 204	6 Weeks N = 60	18 Weeks N = 55
Group 1 (Animal)	23.58 ± 3.68	31.39 ± 3.18	27.16 ± 3.93	26.14 ± 4.45
Group 2 (Simulator)	23.25 ± 3.33	31.78 ± 3.05	28.04 ± 3.73	26.31 ± 4.14

Total Possible: 39

PRELIMINARY



UNCLASSIFIED//FOUO Slide 20 of 46

7/15/14 08:45



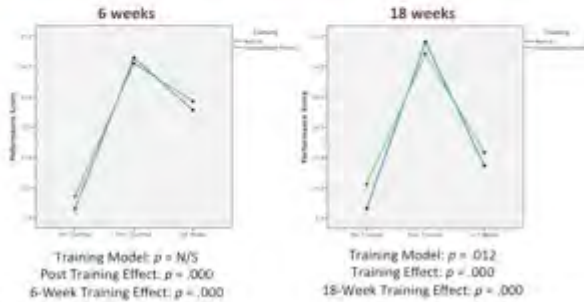
Results: Cholinergic Crisis Training Methods Comparison



PERFORMANCE OUTCOMES	Pre-Training N = 204	Post-Training N = 204	6 Weeks N = 60	18 Weeks N = 55
Group 1 (Animal)	6.78 ± 5.62	30.94 ± 7.36	22.78 ± 9.31	13.66 ± 5.98
Group 2 (Simulator)	7.71 ± 5.52	30.37 ± 5.73	24.23 ± 9.20	15.81 ± 7.50

Total Possible: 45

PRELIMINARY



UNCLASSIFIED//FOUO

Slide 21 of 46

7/15/14 08:45



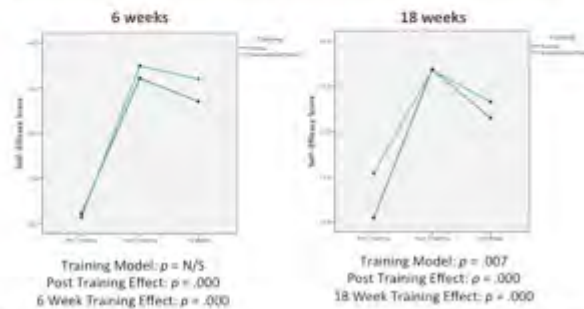
Results: Cholinergic Crisis Training Methods Comparison



SELF-EFFICACY OUTCOMES	Pre-Training N = 204	Post-Training N = 204	6 Weeks N = 60	18 Weeks N = 55
Group 1 (Animal)	20.96 ± 7.76	36.60 ± 3.46	33.50 ± 4.47	31.45 ± 3.39
Group 2 (Simulator)	22.14 ± 7.36	36.71 ± 3.16	36.00 ± 4.33	33.31 ± 3.83

Total Possible: 42

PRELIMINARY



UNCLASSIFIED//FOUO

Slide 22 of 46

7/15/14 08:45



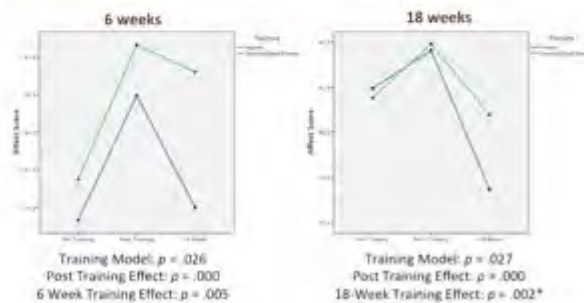
Results: Cholinergic Crisis Training Methods Comparison



AFFECTIVE (STAI) OUTCOMES	Pre-Training N = 204	Post-Training N = 204	6 Weeks N = 60	18 Weeks N = 55
Group 1 (Animal)	85.29 ± 12.49	91.50 ± 11.32	85.03 ± 10.50	73.69 ± 12.65
Group 2 (Simulator)	85.27 ± 11.74	92.34 ± 10.74	94.00 ± 11.85	81.81 ± 11.44

Total Possible: 114

PRELIMINARY



UNCLASSIFIED//FOUO

Slide 23 of 46

7/15/14 08:45



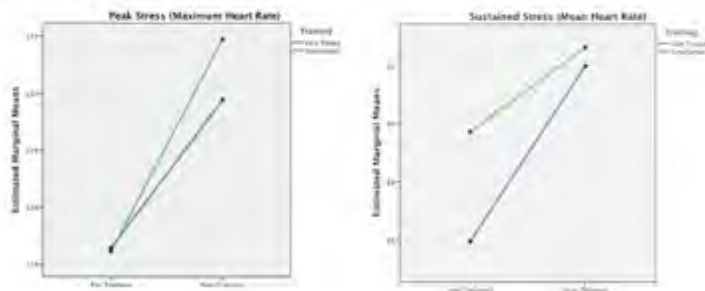
Results: Cholinergic Crisis Training Methods Comparison



Peak & Sustained Stress Outcomes (Heart Rate)

There were significant increases in peak ($p = .002$) and sustained stress ($p = .000$) after training for both groups. There were no significant differences between the peak and sustained stress outcomes by training model ($N = 204$).

PRELIMINARY



UNCLASSIFIED//FOUO Slide 24 of 46

7/15/14 08:40

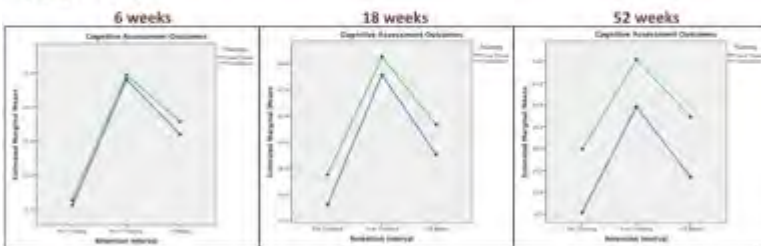


Results: Pediatric/Neonatal Intubation Training Methods Comparison



COGNITIVE OUTCOMES	Pre-Training N = 171	Post-Training N = 171	6 Weeks N = 72	18 Weeks N = 53	52 Weeks N = 46
Group 1 (Animal)	12.90 ± 6.38	21.81 ± 4.58	17.99 ± 5.25	17.02 ± 5.91	13.39 ± 5.02
Group 2 (Simulator)	15.27 ± 6.72	23.75 ± 4.25	18.94 ± 5.23	19.32 ± 5.75	18.91 ± 6.43

Total Possible: 31



Training Model: $p = N/S$
Post Training Effect: $p = .000$
6-Week Training Effect: $p = .000$

Training Model: $p = N/S$
Post Training Effect: $p = .000$
18-Week Training Effect: $p = .000$

Training Models: $p = .001$
Post Training Effect: $p = .000$
52-Week Training Effect: $p = .000$

UNCLASSIFIED//FOUO Slide 25 of 46

7/15/14 08:40

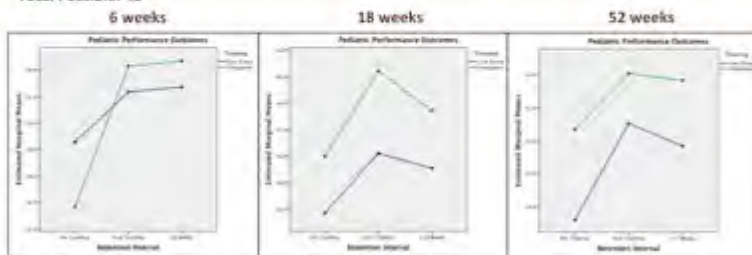


Results: Pediatric/Neonatal Intubation Training Methods Comparison



PEDIATRIC PERFORMANCE OUTCOMES	Pre-Training N = 171	Post-Training N = 171	6 Weeks N = 72	18 Weeks N = 53	52 Weeks N = 46
Group 1 (Animal)	26.23 ± 8.73	31.05 ± 6.41	32.82 ± 6.66	29.08 ± 7.29	29.50 ± 5.72
Group 2 (Simulator)	29.32 ± 10.55	36.17 ± 5.32	34.67 ± 5.60	33.41 ± 5.36	35.46 ± 4.51

Total Possible: 48



Training Model: $p = N/S$
Post Training Effect: $p = .000$
6-Week Training Effect: $p = .000$

Training Models: $p = .001$
Post Training Effect: $p = .000$
18-Week Training Effect: $p = .000$

Training Models: $p = .001$
Post Training Effect: $p = .000$
52-Week Training Effect: $p = .000$

UNCLASSIFIED//FOUO Slide 26 of 46

7/15/14 08:40

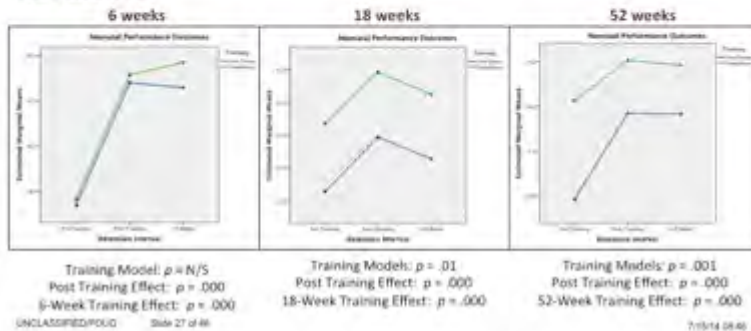


Results: Pediatric/Neonatal Intubation Training Methods Comparison



NEONATAL PERFORMANCE OUTCOMES	Pre-Training N = 171	Post-Training N = 171	6 Weeks N = 72	18 Weeks N = 53	52 Weeks N = 46
Group 1 (Animal)	25.51 ± 9.83	30.86 ± 6.76	32.58 ± 5.65	28.19 ± 9.09	29.17 ± 7.21
Group 2 (Simulation)	29.99 ± 10.60	34.76 ± 5.18	33.69 ± 6.34	33.11 ± 6.03	34.57 ± 6.21

Total Possible: 48



UNCLASSIFIED PAGE Slide 27 of 46

7/15/14 08:40

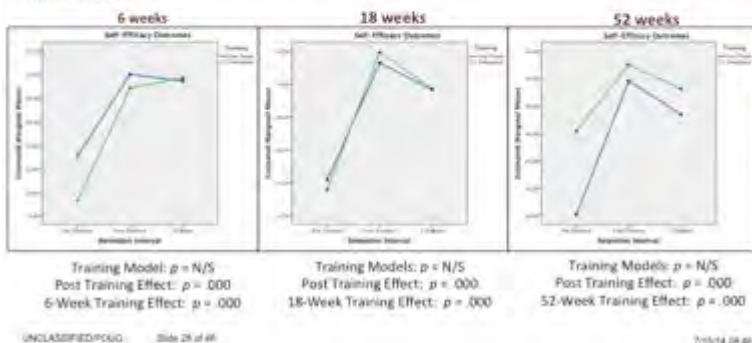


Results: Pediatric/Neonatal Intubation Training Methods Comparison



SELF-EFFICACY OUTCOMES	Pre-Training N = 171	Post-Training N = 171	6 Weeks N = 72	18 Weeks N = 53	52 Weeks N = 46
Group 1 (Animal)	22.64 ± 8.13	30.47 ± 3.67	29.46 ± 5.36	29.65 ± 4.69	27.39 ± 5.08
Group 2 (Simulation)	24.19 ± 8.75	30.79 ± 4.66	29.72 ± 4.92	29.70 ± 4.73	29.23 ± 7.25

Total Possible: 36



UNCLASSIFIED PAGE Slide 28 of 46

7/15/14 08:40

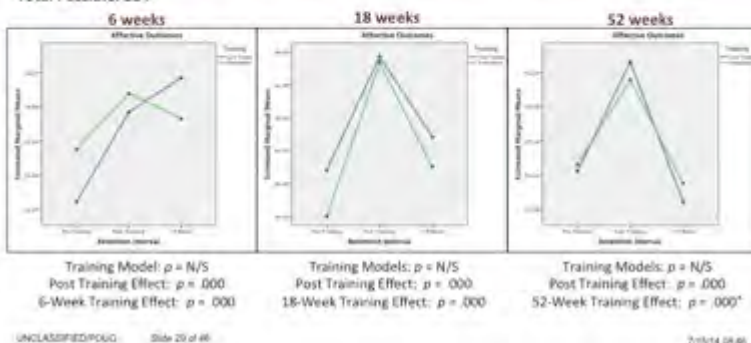


Results: Pediatric/Neonatal Intubation Training Methods Comparison



AFFECTIVE OUTCOMES	Pre-Training N = 171	Post-Training N = 171	6 Weeks N = 72	18 Weeks N = 53	52 Weeks N = 46
Group 1 (Animal)	84.14 ± 14.29	91.68 ± 12.60	92.12 ± 15.04	88.84 ± 12.67	83.06 ± 13.13
Group 2 (Simulation)	86.15 ± 12.68	91.85 ± 11.38	89.13 ± 14.77	87.04 ± 13.43	84.25 ± 19.53

Total Possible: 114



UNCLASSIFIED PAGE Slide 29 of 46

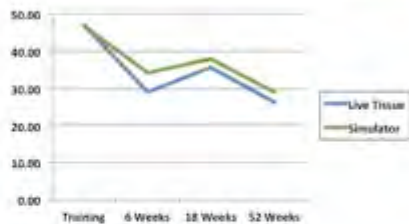
7/15/14 08:40



Results: Pediatric/Neonatal Intubation Training Methods Comparison



Stress Outcomes (Δ Heart Rate)



Δ Heart Rate	Training N = 171	6 Weeks N = 72	18 Weeks N = 53	52 Weeks N = 46
Group 1 (Animal)	47.24 ± 23.32	28.97 ± 17.41	35.62 ± 17.64	26.28 ± 15.45
Group 2 (Simulator)	46.78 ± 24.94	34.31 ± 17.27	38.00 ± 23.09	29.00 ± 16.26

UNCLASSIFIED//FOUO Page 35 of 46

7/2014 08:40

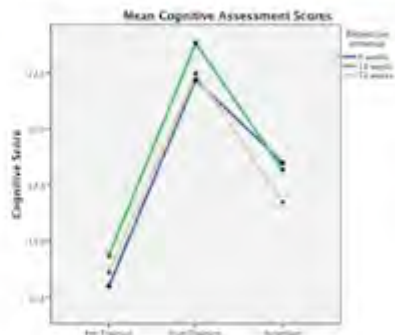


Results: Pediatric/Neonatal Intubation Post-training Cognitive Retention



Cognitive Retention Outcomes

There were no significant differences between retention intervals for cognitive scores. Retention scores remained significantly greater than pre-training scores (N = 171; $p = .000$).



UNCLASSIFIED//FOUO Page 37 of 46

7/2014 08:40

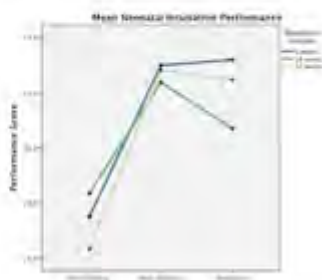
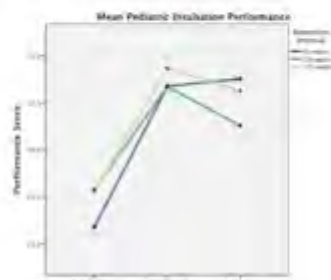


Results: Pediatric/Neonatal Intubation Post-training Performance Retention



Performance Retention Outcomes

There were no significant differences between retention intervals for pediatric or neonatal intubation performance. Retention scores remained significantly greater than pre-training scores for pediatric (N = 171; $p = .000$) and neonatal (N = 171; $p = .000$) performance.



UNCLASSIFIED//FOUO Page 38 of 46

7/2014 08:40



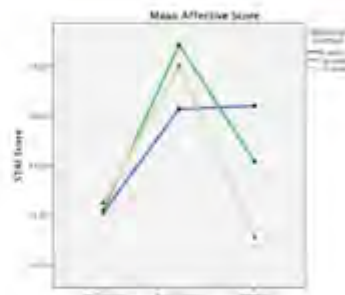
Results: Pediatric/Neonatal Intubation Post-training Affect Retention



Affect Retention Outcomes

There were significant differences between retention intervals for affective scores (N = 171; $p = .001$)

- 6-week retention interval affective scores remained significantly above pre-training scores (N = 72; $p = .001$)
- 18-week retention scores were significantly below post-training scores (N = 53; $p = .001$)
- 52-week retention scores were significantly below post-training scores (N = 46; $p = .001$)



UNCLASSIFIED//FOR OFFICIAL USE ONLY

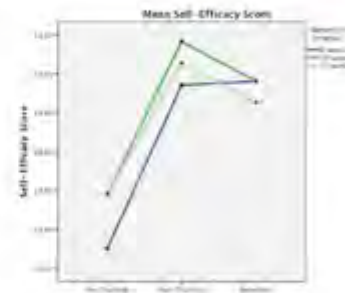
Results: Pediatric/Neonatal Intubation Post-training Self-Efficacy Retention



Self-Efficacy Retention Outcomes

There were significant differences between retention intervals for self-efficacy scores (N = 171; $p = .003$)

- 6-week retention interval scores remained at post-training level.
- 18-week retention scores were significantly below post-training scores (N = 53; $p = .000$), but above pre-training scores ($p = .000$).
- 52-week retention scores were significantly below post-training scores (N = 46; $p = .004$), but above pre-training scores ($p = .000$).



UNCLASSIFIED//FOR OFFICIAL USE ONLY

Results: Pediatric/Neonatal Intubation Post-training Cognitive Retention by Experience Level



Cognitive Outcomes by Experience Level

Cognitive retention scores for subjects with more experience outperformed those with less at every retention point ($p = .000$).

Pediatric and Neonatal Performance Outcomes by Experience Level

Pediatric and neonatal performance retention scores for subjects with more experience outperformed those with less at every retention point ($p = .000$).

Self-Efficacy Outcomes by Experience Level

Self-efficacy retention scores for subjects with more experience had higher scores at every retention point ($p = .002$).

Affect Outcomes by Experience Level

Subjects with more experience scored lower (less anxiety) than those with less experience ($p = .003$). There were no significant differences between subjects with moderate experience and the other two experience levels.

UNCLASSIFIED//FOR OFFICIAL USE ONLY



Deliverables (Completed)



- Summary of findings of systematic review of literature & professional practice guidelines critical competencies (associated performance standards/metrics, methods of assessment, current training methods) that could provide a credible and defensible framework to determine & evaluate competency in clinical management of cholinergic crisis and pediatric & neonatal intubation.
- Technology gap analyses of adult, pediatric, and neonatal mannequin simulators used for training in cholinergic crisis management, and pediatric and neonatal intubation.
- Report relative benefits of using live animal and simulator models for training subjects to clinically performing pediatric/ neonatal intubation using competency assessment for cognitive, psychomotor, & affective performance dimensions.



Deliverables (Near Completed)



- Report relative benefits of using example of live animal and simulated patient (actor) models for training subjects to clinically manage a cholinergic crisis using competency assessment for cognitive, psychomotor, & affective performance dimensions.
- Instructional (multimedia) resources for cholinergic crisis management.
- Instructional (multimedia) resources for pediatric/neonatal intubation.
- Comprehensive evidence-based curricula using the ADDIE model for management of cholinergic crisis and pediatric/neonatal intubation, inclusive of all curricular components, and formal evaluation and transition plans.



What Remains



- Collect & analyze 52-week retention outcomes for cholinergic crisis arm.
- Assemble curriculum documents with implementation guidelines.
- Produce pediatric/neonatal intubation multimedia app.
- Draft evaluation and implementation plans.
- Write and publish 4 additional manuscripts.





Publications



Publications

1. Klotz JJ, Dooley-Hash SL, House JB, Andreatta PB. Pediatric and neonatal intubation training gap analysis: instruction, assessment, and technology. *Simulation in Healthcare* (in press).
2. Andreatta PB, Klotz JJ, Dooley-Hash SL, House JB. Outcomes from two forms of pediatric and neonatal intubation training. *Transactions from the Interservice/Industry Training, Simulation & Education Conference (I/ITSEC)* (in press).
3. Andreatta PB, Klotz JJ, Madsen JM, Hurst CG, Talbot TB. Assessment instrument validation for critical clinical competencies: pediatric-neonatal intubation and cholinergic crisis management. *Transactions from the Interservice/Industry Training, Simulation & Education Conference (I/ITSEC)* (in press).
4. Andreatta PB, Klotz JJ, Madsen JM, Hurst CG, Talbot TB. Training effects for first-responder competency in cholinergic crisis management. *Transactions from the Interservice/Industry Training, Simulation & Education Conference (I/ITSEC)* (in press).
5. Andreatta PB, Klotz JJ, Dooley-Hash SL, Hauptman JG, Biddinger B, House JB. Performance-based comparison of neonatal intubation training outcomes: simulator and live animal. *Advances in Neonatal Care* (in review).
6. Andreatta PB, Dooley-Hash SL, Klotz JJ, Hauptman J, Biddinger B, House JB. Retention curves for pediatric and neonatal intubation skills after simulation-based training. *Pediatric Emergency Care* (in review).
7. Andreatta PB, Klotz JJ, Madsen JM, Hurst CG, Talbot TB. Outcomes from two forms of training for first-responder competency in cholinergic crisis management. *Military Medicine* (in review).
8. Andreatta PB, Klotz JJ, Madsen JM, Hurst CG, Talbot TB. Retention of training for first-responder competency in cholinergic crisis management. *Military Medicine* (in process).
9. Andreatta PB, Klotz JJ, Madsen JM, Hurst CG, Talbot TB. Mixed methods training for first-responder training in cholinergic crisis management. *Simulation in Healthcare* (in process).

USAMRIID/PR000

2014-10-16

7/10/14 (8/1)



Presentations



Presentations

1. Andreatta P. Emergency medicine skills. Pediatric & neonatal intubation; Cholinergic crisis management. Medicine Meets Virtual Reality (MMVR). Manhattan Beach, CA. February 2014.
2. Andreatta P, Klotz J, Dooley-Hash S, House J. Outcomes from two forms of pediatric and neonatal intubation training. SimHealth. Adelaide, South Australia, AU. August 2014.
3. Andreatta P, Klotz J, Dooley-Hash S, House J. Validation of assessment instruments to evaluate pediatric/neonatal intubation competency. SimHealth. Adelaide, South Australia, AU. August 2014.
4. Andreatta P, Klotz J, Dooley-Hash S, House J. Post-training retention curves associated with pediatric and neonatal intubation skills. Adelaide, South Australia, AU. August 2014.
5. Andreatta PB, Klotz JJ, Dooley-Hash SL, House JB. Outcomes from two forms of pediatric and neonatal intubation training. The Interservice/Industry Training, Simulation & Education Conference (I/ITSEC). Orlando, FL, December 2014.
6. Andreatta PB, Klotz JJ, Madsen JM, Hurst CG, Talbot TB. Assessment instrument validation for critical clinical competencies: pediatric-neonatal intubation and cholinergic crisis management. The Interservice/Industry Training, Simulation & Education Conference (I/ITSEC). Orlando, FL, December 2014.
7. Andreatta PB, Klotz JJ, Madsen JM, Hurst CG, Talbot TB. Training effects for first-responder competency in cholinergic crisis management. The Interservice/Industry Training, Simulation & Education Conference (I/ITSEC). Orlando, FL, December 2014.

USAMRIID/PR000

2014-10-16

7/10/14 (8/1)



Lessons Learned



- Cooperative and routine communication with Program and Grant Officers is essential for resolving inevitable challenges. They are phenomenal resources and a PI's best partners.
 - Post-award moratorium placed on use of non-human primate colony at USAMRIID led to scope change for cholinergic crisis arm; 1 year delay recovered during years 2-3.
 - Change in research priorities at University of Michigan Medical School led to transfer of award from University of Michigan to University of Minnesota. One year delay in transfer with costs covered by University of Minnesota; no project delays.
- Multi-institutional coordination requires proactive planning, flexibility in implementation, attention to detail, patience, diligence, and a lot of open communication. The advantages far exceed any challenges.
- A communication plan is essential for multi-institutional collaboration and is ideally developed collaboratively by all involved. This should be done early - even at the proposal stage - and modified only if absolutely necessary in order to maintain consistent protocols for decision making.

USAMRIID/PR000

2014-10-16

7/10/14 (8/1)



Key Next Steps



- Prescribe training, review, and maintenance schedules to assure provider performance of critical competencies at every experience level.
- Assess transfer of pediatric & neonatal intubation training outcomes to clinical performance.
- Further study required to characterize affective influences over time.
- Develop off-the-shelf training resources. The combination of multimedia and simulation-based methods creates an experiential learning environment that yields significant performance improvements.
 - Easily distributed programs.
 - Facilitates on-demand, just-in-time training, review and maintenance.
 - Opportunity for repetitive engagement that supports mastery learning.
 - Performance standards and validated assessment assures competency.
 - Supports military, civilian, and academic environments.



Key Next Steps



- Develop library of interactive resources for rare events where performance mastery is essential.
 - On-demand prompts for just-in-time training or refreshment.
 - Multimedia applications for knowledge acquisition or refreshment.
 - Embedded assessment with individual performance records.
 - Connected to simulators to integrate full performance domain.
- Improve mannequin simulators to improve initial training and maintenance outcomes.
 - Oral & Skin Secretions (adult, pediatric, neonatal)
 - Anatomical Fidelity (pediatric & neonatal airway)
 - Cyanosis (adult, pediatric, neonatal)
 - Muscle Fasciculation (adult, pediatric, neonatal)
 - Embedded, sensor-based assessment with individual performance records.
 - Connected to interactive resources to integrate full performance domain.
- Calibrate sensor-based assessment metrics from simulators; create predictive performance models.
- Develop sensor-based "smart" instruments from predictive modeling.



UNCLASSIFIED//~~FOUO~~

Slide 43 of 46

7/19/14 08:51



Summary / Key Results



- Valid/Reliable performance assessment supports competency-based mastery-learning.
- **(PRELIMINARY)** outcomes suggest there is no significant difference between effectiveness of live animal and simulated model (actor) for the recognition and clinical management of cholinergic crisis. 52-Week retention data in process.
- Outcomes suggest there is no significant difference between effectiveness of live animal and simulated models for training in the clinical performance of pediatric and neonatal intubation.
- Outcomes suggest a significant ($p < .01$) retention difference for pediatric and neonatal intubation knowledge and performance skills favoring those who train with the simulation model over those who train with the animal model at 18 weeks and 52 weeks post training intervals. Likely due to opportunity for repetitive practice.
- Experience level correlated to performance, regardless of training model.
- All experience levels improved performance above baseline; sustained up to 52-weeks for cognitive, performance and self-efficacy.
- Affect outcomes (STAI) appear to decrease after 18 weeks; require further study.

UNCLASSIFIED//~~FOUO~~

Slide 44 of 46

7/19/14 08:51



Budgetary Update



- Total award amount of \$3,377,701,
- Amount awarded to the University of Michigan was \$1,848,643.04
- Amount transferred to the University of Minnesota \$1,529,057.96

University of Minnesota Expenditures 5/1/2013 – 6/09/2014:

Total Direct	\$626,480
Indirect Costs	\$317,239
Total Expenditure	\$943,719
BALANCE:	\$585,339

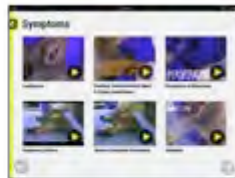
UNCLASSIFIED//FOUO



Regulatory Update



- IRB Approvals Secured
 - University of Michigan
 - University of Minnesota
 - Michigan State University
 - HRPO
- Animal Use Approvals Secured
 - Michigan State University IACUC
 - ACURO



UNCLASSIFIED//FOUO Slide 46 of 46

7/15/14 08:34



Questions?



Contact Information:
 Dr. Pamela Andreatta
pandreat@umn.edu
 Mobile: 650.575.4023



UNCLASSIFIED//FOUO Slide 47 of 46

7/15/14 08:54