



Surgical Airway Training in the 21st Century: The Case for Replacing Animal Use in the University of Washington Paramedic Program

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1. About the authors

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2. Executive summary

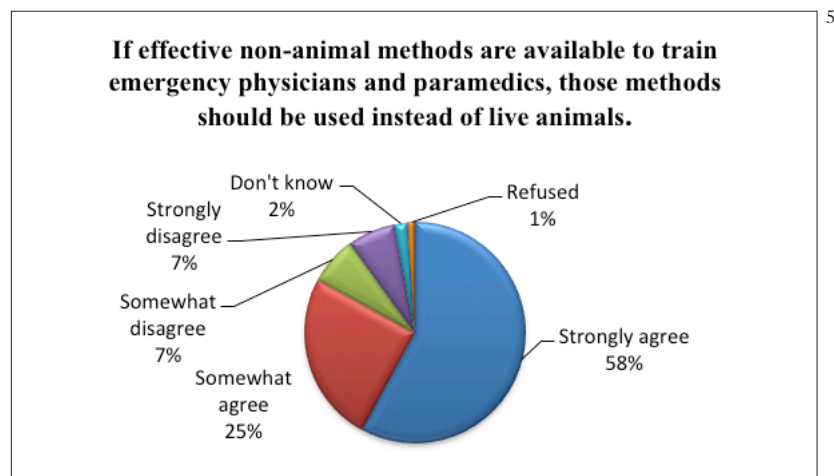
Since the late 1970s, the University of Washington (UW) School of Medicine Paramedic Training Program has used live animals in its curriculum.¹ Currently, 36 pigs are used each year to teach surgical airway to approximately 190 trainees (132 practicing King County paramedics, 40 flight nurses employed by Airlift Northwest, and 18 paramedic students) at Harborview Medical Center.² At the end of each training lab, the animals are killed.³

The use of live animals has continued at UW for about 40 years despite impressive advances over that time in the development of medical training methods modeled on human anatomy (often referred to as “simulators”). Such advances have hastened the replacement of animal use in emergency medical training programs across the United States and Canada. Among the 16 paramedic training programs in Washington, Oregon, and British Columbia that responded to a Physicians Committee survey, 15 (93 percent) exclusively use nonanimal methods. Today, there is no educational or ethical justification for the use of animals for surgical airway training.

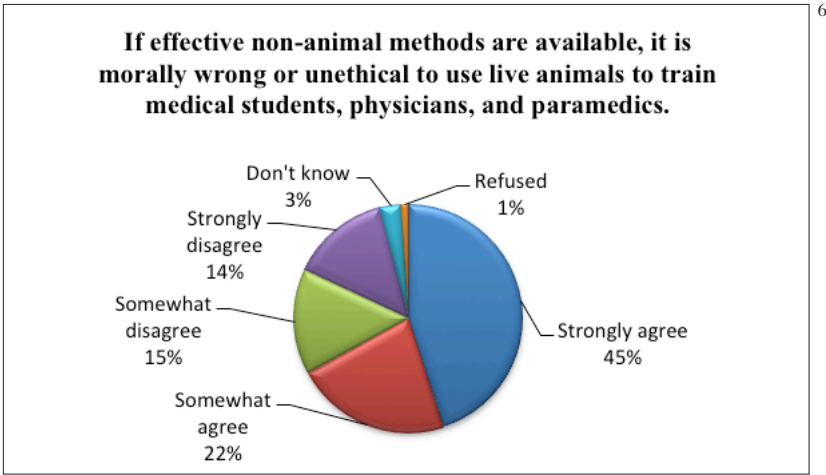
3. Public opinion regarding the use of animals for emergency medical training

A March 2016 nationwide survey conducted by global market research agency ORC International and commissioned by the Physicians Committee asked 1,011 people five questions regarding their views on the use of animals in medical education. The study was conducted using both randomly selected landline telephone numbers and randomly selected mobile telephone numbers.⁴ Two questions specifically asked about medical student and pediatrician training, so we won't discuss those here.

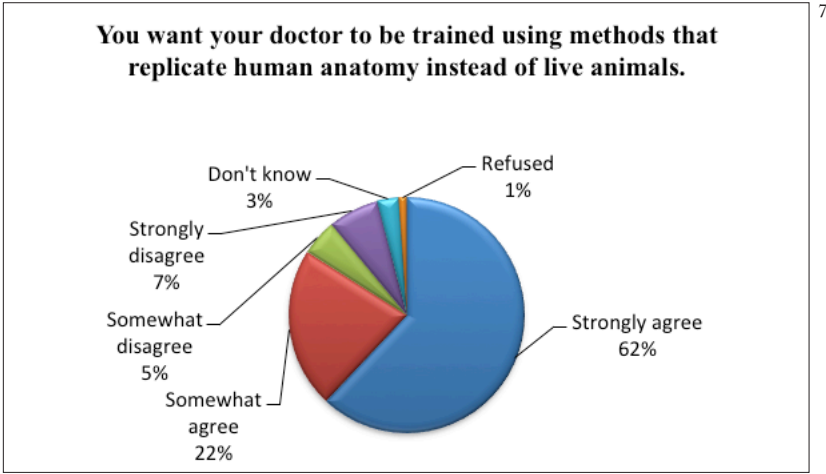
Survey participants were told: "If effective non-animal methods are available to train emergency physicians and paramedics, those methods should be used instead of live animals." A total of 83 percent of respondents agreed with this statement, with 58 percent saying they "strongly agree" and 25 percent saying they "somewhat agree."



Participants were also given the following statement: "If effective non-animal methods are available, it is morally wrong or unethical to use live animals to train medical students, physicians, and paramedics." A total of 67 percent of respondents agreed with this statement, with 45 percent saying they "strongly agree" and 22 percent saying they "somewhat agree."



The last statement provided by ORC was: “You want your doctor to be trained using methods that replicate human anatomy instead of live animals.” While this statement does not explicitly mention paramedics or refer to emergency training, it is relevant because it relates to respondents’ feelings about how their medical providers should be trained. A total of 84 percent of respondents agreed with this statement, with 62 percent saying they “strongly agree” and 22 percent saying they “somewhat agree.”



4. Background on surgical airway training

In emergency situations, a medical professional may need to perform a surgical airway (also called a cricothyrotomy) in order to aid a patient’s breathing. The surgical airway is increasingly uncommon due to the availability of other rescue ventilation techniques.

However, the procedure is still commonly taught to paramedics, flight nurses, emergency physicians, and other medical professionals.

To perform a surgical airway using the traditional method, a medical professional makes an incision in the skin of the neck just below the thyroid cartilage, or Adam's apple, cutting through the cricothyroid membrane before inserting a tube into the opening. The medical professional then attaches a bag or machine to the tube to aid the patient's breathing.

When performing a surgical airway, anatomical landmarks are critical. Time is of the essence when a patient's airway is compromised. In order to accurately teach the procedure, educational programs should employ models based on human anatomy. Locating and accessing the correct section of the trachea is both more difficult and less comparable to human anatomy when using animals, whose necks may be longer, shorter, thicker, and different in skin thickness and resistance. When animals are used to teach surgical airway, most trainees will have to perform the procedure in a way that is not as it would be in a real-life situation. This is explained in a 2006 U.S. Army training video in which surgical airway is performed on an anesthetized goat. In the video, the instructor informs course participants:

*Only one student will be able to actually perform a true surgical [airway]. The rest of the students will have to go down the trachea and go through the cartilaginous rings. It's a little bit tougher to get through the cartilaginous rings.*⁸

Similarly, when pigs are used, the neck is shorter and thicker, and the trachea is deeper than in humans. The first surgical airway is the only "true" procedure. Each subsequent procedure is performed in a slightly different location on the neck than it would be in a real-life situation. This was explained in a 2012 study from members of the Department of Surgery at St. Michael's Hospital and the University of Toronto: "The airway anatomy in the porcine model was not similar to humans and the [surgical airway] procedure could only be performed once on the animal model."⁹

According to documents obtained by the Physicians Committee through the Washington Public Records Act, UW uses each pig to teach five to six trainees, which means that four to five of those trainees will not perform a "true" surgical airway:¹⁰ According to the documents, each pig "will have 5-6 longitudinal incisions several millimeters apart."¹¹

5. Surgical airway within the context of paramedic training and Washington state requirements

For the approximately 18 paramedic students who take part in the UW surgical airway lab each year, this training session represents a minuscule part of the overall curriculum. According to documents obtained from UW, each trainee is given the opportunity to perform only one surgical airway: "A single procedure without explanation takes approximately 30 seconds. With explanation, the procedure can take several minutes."¹²

Yet the entire UW paramedic training program requires 2,500 hours of classroom lectures, training labs, and clinical rotations.¹³

The large majority of participants in the UW surgical airway lab are not students but instead practicing King County paramedics (approximately 132 each year) receiving recertification in surgical airway.¹⁴ As explained in documents obtained from UW, “[t]he state of Washington is the recertification authority for the providers of [Advanced Life Support] service within Seattle/King County,”¹⁵ which includes paramedics. For this reason, it is important to look closely at state requirements. In the official Washington State Department of Health (DOH) Emergency Medical Services Training Program and Instructor Manual, updated in August 2015, the only mention of “surgical airway” is found in the appendix titled “Recommended EMS Course Equipment.”¹⁶ In that appendix, “MANIKIN, SURGICAL AIRWAY” is identified as a “paramedic course item.”¹⁷ “Manikin” is used in medical training to denote a simulator modeled on human anatomy. The 69-page DOH manual makes no mention of the terms “animal,” “pig,” or “porcine.”

6. Human-relevant methods available for teaching surgical airway

The number of medical training methods modeled on human anatomy for teaching surgical airway continues to increase. This trend has yielded numerous lifelike models that allow trainees (whether they are paramedics, flight nurses, physicians, or Army medics) to improve their lifesaving skills through repetition without having to translate anatomical differences between species. In this section, we examine four specific human-relevant methods, but there are numerous others.

The TraumaMan System, made by Seattle-based Simulab, is the most widely used surgical simulator in the world and has lifelike skin, subcutaneous fat, and muscle.¹⁸ The TraumaMan System allows trainees to practice a variety of surgical procedures, including surgical airway. Replaceable tissues provide each trainee with a first cut experience and make this simulator ideal for team-training scenarios. This simulator was approved in 2001 by the American College of Surgeons for teaching the surgical skills component (including surgical airway) of the Advanced Trauma Life Support course,¹⁹ and today it is the overwhelmingly preferred choice for such courses (see section 8). The TraumaMan System is currently part of the extensive suite of devices utilized by the WWAMI Institute for Simulation in Healthcare (WISH),²⁰ which has facilities at UW Medical Center and Harborview Medical Center.²¹



TraumaMan System

The SimMan 3G, made by Laerdal (Stavanger, Norway), is another widely used training device and is currently owned by WISH.²² The simulator is a high-fidelity, full-body patient model that displays human physiology. It can be used to teach surgical airway and many other procedures. The SimMan 3G can be programmed to simulate a multitude of emergency scenarios.



SimMan used in paramedic training

The Human Worn Partial Task Surgical Simulator, which is referred to as the “Cut Suit,” is made by Strategic Operations (San Diego, Calif.)²³ and is increasingly used in military first responder training. This device is worn by a course participant or actor, allowing the trainee the realism of performing a surgical airway on a live “patient.” The skin is repairable, allowing for multiple uses and team-training opportunities.



Cut Suit used in demonstration of trauma procedures

Unlike the devices above, the Life/form Cricothyrotomy Simulator, made by Simulaids (Saugerties, N.Y.), is specific to teaching surgical airway. This simulator, which is part of WISH, has replaceable skin and a replaceable trachea, which ensure that each trainee can perform a “true” surgical airway. As Simulaids explains: “Paramedics, EMTs, other emergency personnel...all now have the opportunity to perfect this technique.”²⁴

7. A review of scientific literature and expert opinions supporting the use of human-relevant training methods for surgical airway

There has been much information published on teaching surgical airway using various methods, including live animals, human cadavers, and medical simulators. While the widespread use of human-relevant methods (see section 8) provides ample evidence that replacing animal use for teaching surgical airway is validated and trusted by the medical community at large, it is important to look at evidence published in peer-reviewed scientific journals as well. In this section, we examine some of the literature on this issue. Much of the recent literature has been funded and conducted by military agencies, which have a strong interest in ensuring that lifesaving procedures like surgical airway are carried out quickly and accurately.

The capabilities of human-relevant simulators have been well documented. As explained by Wright State University professor Raymond P. Ten Eyck, M.D., M.P.H., in his 2011 review of simulation for emergency medicine training: “Available simulators enable students to rehearse procedures or recreate life-threatening emergencies characterized by physiological extremes and the need for invasive interventions.”²⁵

U.S. Air Force Maj. Andrew Hall, M.D., has extensively explored comparisons between using animals and simulators for emergency medical procedures, including surgical airway. Following years of work, in his July 2014 letter to the journal *Military Medicine*, Maj. Hall declared: “We have entered into an age where artificial simulator models are at least equivalent to, if not superior to, animal models.”²⁶

Maj. Hall and others led a U.S. Air Force study comparing pigs with the TraumaMan System for learning surgical airway. According to the 2015 study: “There was no statistically significant, objective difference in any metric between animal- and simulator-trained groups after [surgical airway] training. For initial training, there is no objective benefit of animal training.”²⁷

In another study conducted by Maj. Hall and others, airmen practiced three emergency procedures, including surgical airway, on either pigs or the TraumaMan System. The study was published in 2014 and stated: “Post-training self-efficacy scores were not statistically different between live animal and artificial simulator training for [any procedures]. We conclude that artificial simulator and live animal training produce equivalent levels of self-efficacy after initial training.”²⁸

A 2012 study from St. Michael’s Hospital and the University of Toronto asked participants (instructors and trainees) to rate the “educational effectiveness” of the TraumaMan System simulator compared to live pigs for learning four emergency procedures. For surgical airway, 27 of the 32 participants rated the simulator as either “very good” or “excellent,” while only 16 rated pigs as “very good” or “excellent.”²⁹

“We have entered into an age where artificial simulator models are at least equivalent to, if not superior to, animal models.”

**- Maj. Andrew Hall, M.D., Department of Surgery
Keesler Medical Center, Keesler Air Force Base**

Yet another recent military study—this one conducted by the Canadian Armed Forces—evaluated randomized groups of military medical technicians (medics) on their performance of five critical skills, including surgical airway. One group of medics practiced on the Caesar Trauma Patient Simulator, while the other group practiced on live pigs. The study author concluded: “We found no difference in performance between medics trained on simulators versus live tissue models.” Yet the author did find an important difference when it came to the teaching of surgical airway. He stated: “Medics who were tested on [surgical airway] on simulators during the battlefield scenario were more likely to pass the assessment because they were more likely to be able to insert the tracheotomy tube into the trachea, compared with those medics tested on the animal model.”³⁰

While pure skill acquisition is critical to performing a surgical airway, so is being able to handle the stress of performing this lifesaving procedure. Studies have shown that when immersive simulation environments are created trainees perform as if they are in a life-and-death scenario. In one such study, a group of emergency medicine residents took part in a scenario in which the “patient” (a simulator) deteriorated and the treatment of lethal cardiac and airway emergencies was necessary. The authors concluded that their findings “suggest that treating a patient simulator can indeed be similar to treating a real critically ill patient.” Measuring the heart rate and blood pressure of the study participants at regular intervals, the authors further stated: “Physiological arousal suggests that the residents developed a sense of urgency and responsibility for managing the simulated patient... We were able to demonstrate that residents adequately ‘suspended disbelief’ and performed ‘as if’ it were real.”³¹

8. Programs teaching surgical airway without animals

While UW continues to use animals in its training of surgical airway, the procedure is taught regularly by hundreds of programs that exclusively use human-relevant methods such as simulators.

A Physicians Committee survey has identified 15 paramedic programs in the Pacific Northwest (Washington, Oregon, and British Columbia) that do not use animals. The survey identified no other regional programs in which animals are used.

The use of simulators for surgical airway training is supported by paramedic programs elsewhere as well. Dwight A. Polk, director of the highly rated University of Maryland, Baltimore County (UMBC) Paramedic Program, stated that “we have not participated in any live animal training sessions in my 26-year tenure.” Mr. Polk explained that surgical airway training at UMBC involves “initial manikin simulation practice” followed by “patient training” using human cadavers. According to Mr. Polk, the UMBC Paramedic Program “does not support live animal training.”³²

Surgical airway is also a core procedure in the surgical skills component of Advanced Trauma Life Support (ATLS) courses, which are overseen by the American College of Surgeons. As of March 2016, 275 of the 277 accredited ATLS programs in the United States and Canada (99 percent) exclusively use human-relevant methods for the surgical skills component.³³

Further, the Department of Defense removed the use of animals from its ATLS courses as of January 2015. When he announced the decision, Assistant Secretary of Defense for Health Affairs Jonathan Woodson, M.D., explained: “I concluded that there are sufficient simulation models available to meet medical education and training needs in the following programs.” He then went on to list ATLS among six areas of medical training.³⁴

Similarly, emergency medicine residency programs across the United States have increasingly embraced human-relevant training methods instead of animals. In these residency programs, physicians learn numerous lifesaving procedures, including surgical airway. As of March 2016, 119 of the 135 surveyed U.S. emergency medicine residency programs (88 percent) reported that they do not use animals, including the program at UW.³⁵

9. Conclusion

Considering the evidence presented above, there is no educational or ethical justification for the University of Washington's continued use of live pigs for surgical airway training of paramedic students, practicing paramedics, or practicing flight nurses. The evidence includes public opinion opposing the use of animals for emergency medical training, the availability of validated human-relevant methods, the scientific evidence in favor of using those methods, the overwhelming preference for nonanimal methods by the medical education community, and the ethics of using and killing animals in the service of substandard emergency medical training. UW operates two state-of-the-art medical simulation facilities currently equipped with numerous devices for teaching surgical airway. In order to improve training and eliminate the unnecessary use of animals, university faculty and leadership should move UW's paramedic program into the 21st century by replacing the live animal lab portion of the curriculum.

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