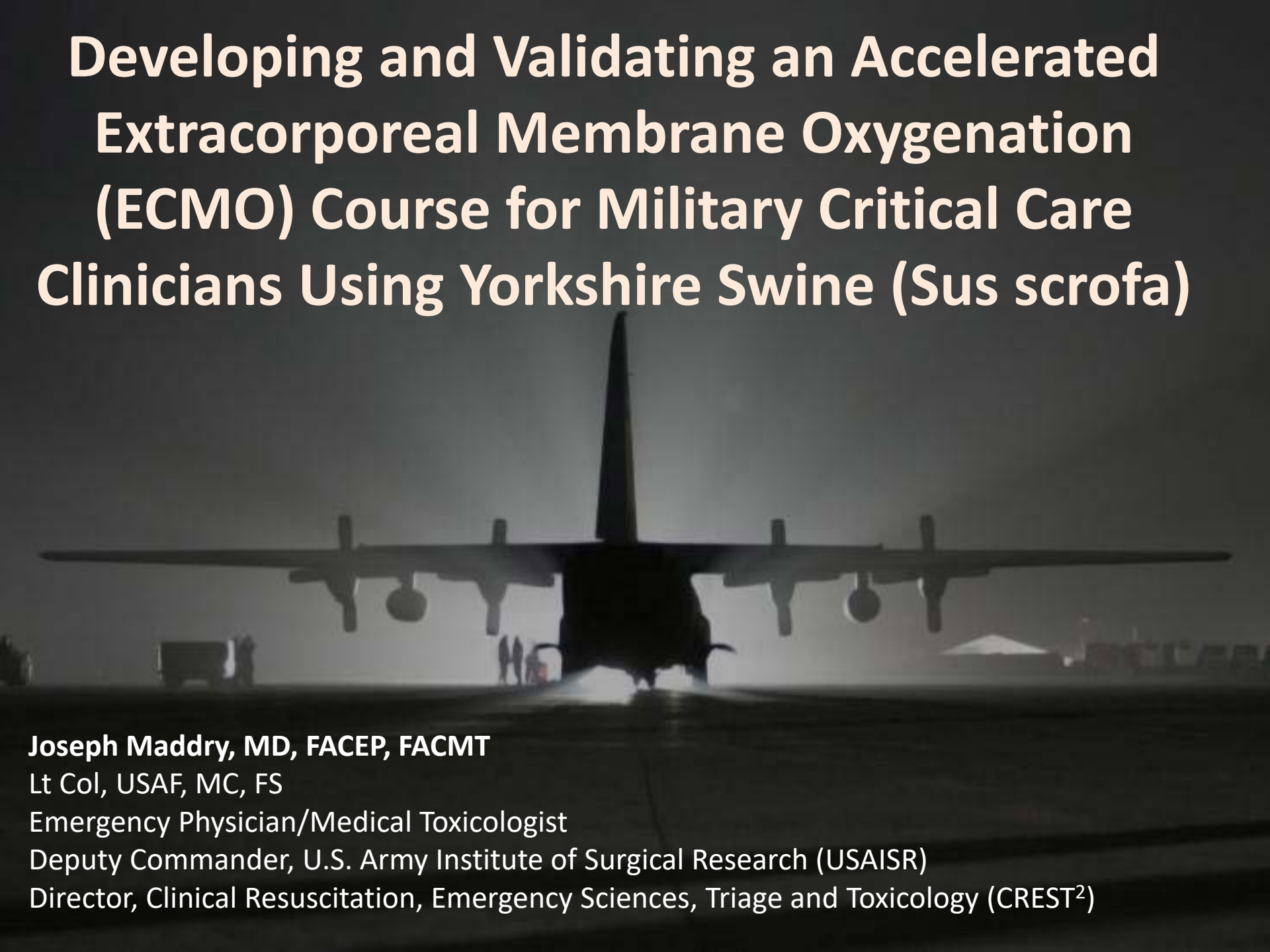


# Developing and Validating an Accelerated Extracorporeal Membrane Oxygenation (ECMO) Course for Military Critical Care Clinicians Using Yorkshire Swine (*Sus scrofa*)

A dark, high-contrast photograph of a military transport aircraft, likely a C-17 Globemaster III, silhouetted against a bright, hazy sky. The aircraft is positioned centrally, with its wings and tail clearly visible. The ground below is dark, and some faint lights or structures are visible in the distance.

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# Disclaimer

The opinions expressed on this document are solely those of the authors and do not represent an endorsement by or the views of the United States Air Force, United States Army, the Department of Defense, or the United States Government.

This study was conducted under a protocol reviewed and exempt by the 59<sup>th</sup> Medical Wing IRB, approved by the IACUC, and in accordance with the approved protocol.

# Introduction

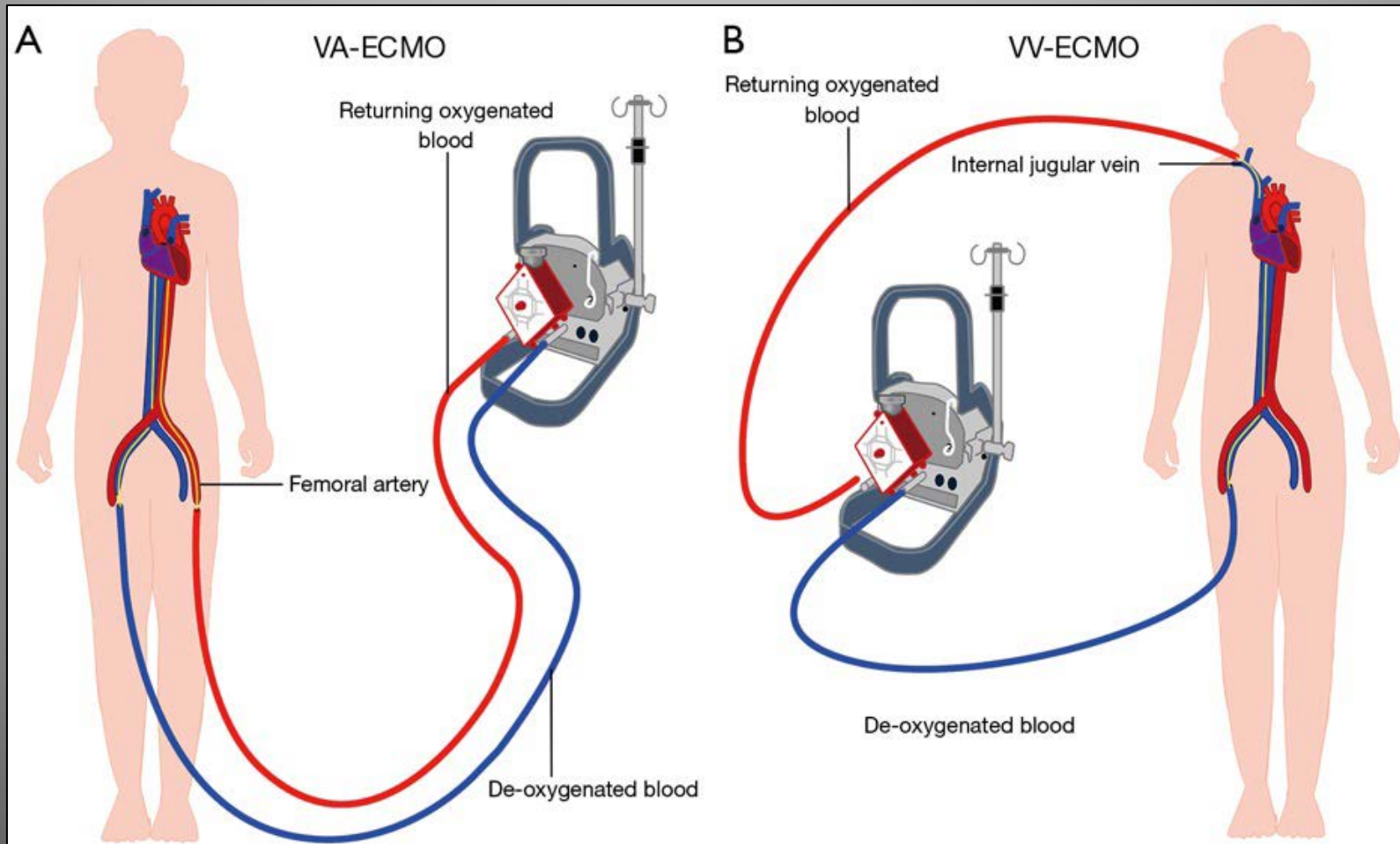
- Extracorporeal membrane oxygenation (ECMO) is a modification of cardiopulmonary bypass that allows prolonged support of patients with severe respiratory or cardiac failure
- The primary Department of Defense (DoD) ECMO Team is based at San Antonio Military Medical Center (SAMMC) and may take  $\geq 30$  hours-reach patients in need of this life saving intervention

# Introduction

- Critically ill patients are at high risk for clinically decompensating or dying during this crucial period
- Current CCATTs lack the training and skills to initiate ECMO or provide en route care for the ECMO patient



# Introduction



# Objective

The objective of our study was to develop and evaluate an abbreviated (less than 8 hour) ECMO course that can be taught to emergency and critical care physicians and nurses.



# Methods

- An abbreviated ECMO course was provided to participants using an IRB and IACUC approved protocol
- Participants were assigned into teams of two (one physician and one nurse)
- Teams were provided a "Teach, Train, Test" model to reinforce learning

# Methods

## Teach

Teams independently viewed a condensed version of the SAMMC ECMO training program and were provided with step by step guides with directions to set up and prime the ECMO circuit, cannulate, and troubleshoot common ECMO complications

## Train

Qualified ECMO specialists trained teams using Yorkshire swine (*Sus scrofa*)

## Test

Teams were evaluated by ECMO specialists on their ability to place the patient on ECMO using a validation checklist containing key aspects of the ECMO procedure.

Confidence and knowledge assessment completed prior to and after participation in the study.

# Team Assessment

## Performance Tasks:

1. Set up and prime circuit
2. Place wires, dilate, and cannulate
3. Place patient on ECMO
  - VA
  - Convert to VAV
4. Troubleshoot:
  - Power failure
  - Loss of circuit integrity
  - Venous Air
  - Arterial Air
  - Chatter



# Checklist and assessments

- Validation checklist: 92% interrater agreement across all items and teams
  - Came to 100% consensus following review
- Confidence assessment: 10 items; each on a scale from 0 (no experience) to 5 (expert)
  - Good reliability (Cronbach's  $\alpha=0.90$ )
- Knowledge assessment: 20 items; multiple-choice and true/false

# Statistical Analysis

Primary outcomes:

- Successful ECMO initiation (yes/no)
- Successful priming of circuit (yes/no)
- Preparation time (minutes)
- Procedure time (minutes)
- Total lab time (minutes)

Reported as percentages or means with 95% CI



# Statistical Analysis

Secondary outcomes:

- Knowledge assessment (pre/post)
- Confidence assessment (pre/post)

Compared pre- and post-training scores using paired t-tests and McNemar tests



# Results

## Clinician characteristics (17 physicians, 17 nurses)

- 59% had  $\leq 5$  years of experience in their position
- 59% from ED, 41% from ICU
- 59% had no experience caring for ECMO patients
- None had any formal ECMO training experience

# Results

- **All 17 teams successfully primed and prepared the ECMO circuit**
- **15 teams successfully initiated ECMO (88%, 95% CI 64-99%)**
  - 2 teams could not initiate ECMO due to fatal arterial laceration
  - 1 team successfully initiated VA ECMO but could not convert to VAV ECMO

# Results

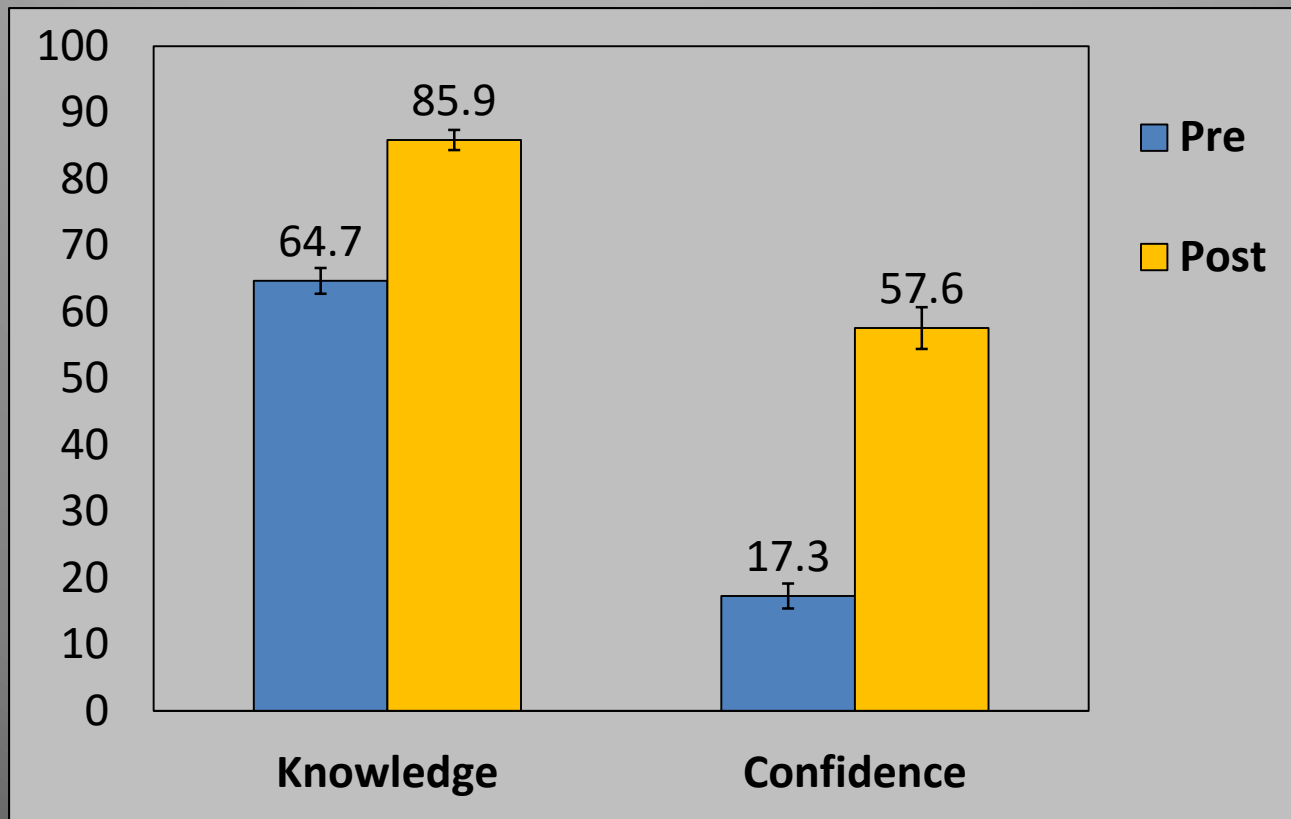
Mean time-completion:

- Preparation: 31 minutes (95% CI 28-35)
- Procedure: 59 minutes (95% CI 45-74)
- Total lab: 145 minutes (95% CI 121-163)



# Results

Knowledge and confidence assessment scores significantly improved after course completion



# Results

Percent of clinicians rating themselves as “competent” or better significantly improved after course completion

Item on confidence assessment	Pre-test	Post-test	% increase (95% CI)
1. Determining which patients would benefit from ECMO	18%	<b>62%</b>	44% (27-62%)
2. Initiation of IV anticoagulation	53%	<b>85%</b>	32% (16-49%)
3. Placement of cannula using Seldinger technique	38%	<b>62%</b>	24% (9-39%)
4. Preparing cannulas for connection-ECMO circuit	0%	<b>68%</b>	68% (51-84%)
5. Connecting patient-ECMO circuit	0%	<b>62%</b>	62% (45-79%)
6. Securing cannulas	15%	<b>71%</b>	56% (36-75%)
7. Achieving respiratory and hemodynamic goals	35%	<b>79%</b>	44% (25-64%)
8. Maintaining ECMO during patient transport	0%	<b>50%</b>	50% (32-68%)
9. Troubleshooting and managing issues with equipment	0%	<b>56%</b>	56% (38-73%)
10. Initiating ECMO in a critical patient in deployed setting	0%	<b>47%</b>	47% (29-65%)

# Limitations

Animal model

Live tissue labs not available at all institutions

Testing occurred immediately following hands-on training

Course focused on initiating ECMO therapy - not maintenance and weaning



# Conclusions

We developed reliable survey materials along with an accelerated 8-hour ECMO course.

Clinicians improved in their confidence and knowledge assessments after taking the course.

With accelerated training, 88% of military critical care clinicians were able to successfully initiate ECMO therapy.

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# Questions

