

# Faculty Feedback Using Remote Images to Assess Point-of-Care Ultrasound Skills in Trainees

Kate Steinberg MD

Pierre Kory MD

University of Wisconsin-Madison

Department of Medicine



# Background

- Increasing use of point-of-care ultrasound
- Skill sets for competence defined by consensus and evidence-based guidelines<sup>1,2</sup>
- Growth has been limited by number of expert faculty available within programs<sup>3,4</sup>
- Remote supervision with feedback as one solution<sup>5</sup>

1. *Chest*, 2009 2. *Crit Care Med*, 2016 3. *Ann Am Thoracic Soc*, 2014

4. *Crit Care Med*, 2010 5. *J Crit Care*, 2015

# Aims

- To assess feasibility of using remote supervision and feedback to teach ultrasound skills in our ICU
- To describe the quality of images obtained, accuracy of image interpretation, and clinical application of ultrasound findings

# Basic Critical Care Echocardiography (BCCE)

# Basic Critical Care Echocardiography (BCCE)

Shock State	Ultrasound Findings	Treatment
Acute Cor Pulmonale	<ul style="list-style-type: none"> <li>• Dilated RV</li> <li>• Impaired RV Function</li> <li>• Dilated IVC</li> </ul>	<ul style="list-style-type: none"> <li>• Anti-coagulation</li> <li>• Lytics</li> <li>• Thrombectomy</li> </ul>
Left Ventricular Failure	<ul style="list-style-type: none"> <li>• Dilated LV</li> <li>• Impaired LV Function</li> <li>• Dilated IVC</li> </ul>	<ul style="list-style-type: none"> <li>• Inotropes</li> <li>• Afterload Reduction</li> </ul>
Tamponade	<ul style="list-style-type: none"> <li>• Pericardial Effusion</li> <li>• Atrial/RV Collapse</li> <li>• Dilated IVC</li> </ul>	<ul style="list-style-type: none"> <li>• Pericardiocentesis</li> </ul>
Distributive	<ul style="list-style-type: none"> <li>• Essentially Normal Echo</li> <li>• Hyperdynamic Heart</li> <li>• Variable IVC Size</li> </ul>	<ul style="list-style-type: none"> <li>• Fluids</li> <li>• Vasopressors</li> </ul>
Hypovolemic	<ul style="list-style-type: none"> <li>• Essentially Normal Echo</li> <li>• Hyperdynamic Heart</li> <li>• Small IVC</li> </ul>	<ul style="list-style-type: none"> <li>• Fluids</li> <li>• Blood Products</li> <li>• Hemostasis</li> </ul>



# Methods

- Focused two-day training course teaching:
  - Four domains of critical care ultrasonography (lung/heart/abdomen/lower extremity DVT exam)
  - Defined image sets to be achieved for each domain
- Exams performed in the ICU, images saved and uploaded to feedback software
- Trainee filled out findings/interpretation/clinical application form
- Software sent form and all images to faculty expert
- Written feedback given based on quality of images, interpretation, and clinical application



# Basic Critical Care Echo Views

- Five Views
  - Parasternal Long Axis
  - Parasternal Short Axis
  - Apical 4-Chamber
  - Subcostal
  - IVC Assessment

# Basic Critical Care Echo Assessments

- LV and RV size and function
- Regional wall motion abnormalities
- Major valvular abnormalities
- Presence/absence of pericardial effusion
- IVC Size and Variation




# Methods

**TLC Image Acquisition Quality**

GOOD(16-20)

**COMMENT ON IMAGE QUALITY**

 [REDACTED] excellent A4C, IVC - too MUCH depth on SCLA (would have been a 5!). PSLA AND PSSA were ...2's - I really could barely make an assessment except for maybe that the RV was not dilated (in some cases this alone is a lot of information to glean, like in this case - however, these poor quality views were not your fault, you were on axis - nice job!

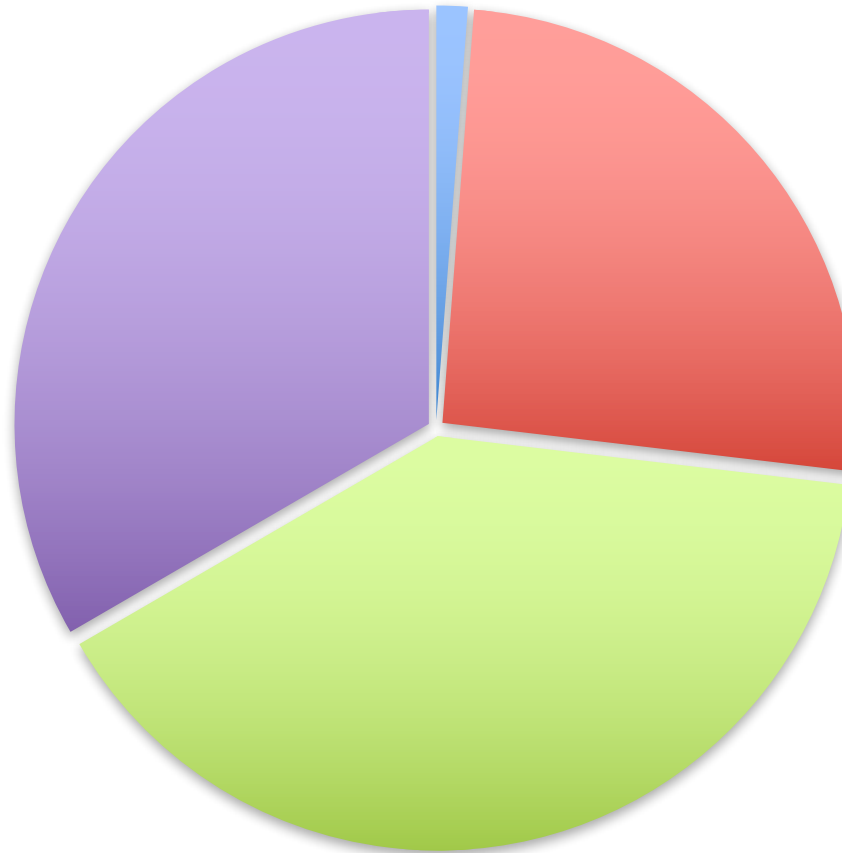
# Results

- 123 basic critical care echos performed by 9 ICU trainees over 9 months (Sept 2015-June 2016)
- 81 studies submitted for review and feedback
- Number of studies submitted by each trainee ranged from 3 to 23

# Quality of Images (N=79)

## Grading Scale

- Each view graded 1-5
- 5 views added to get total score
- 0-10: Poor
- 11-15: Fair
- 16-20: Good
- 21-25: Excellent



- Poor 1.2% (2 studies)
- Fair 25.3% (20 studies)
- Good 39.2% (31 studies)
- Excellent 32.9% (26 studies)

2 studies were not evaluated for image quality and are not included in this chart.



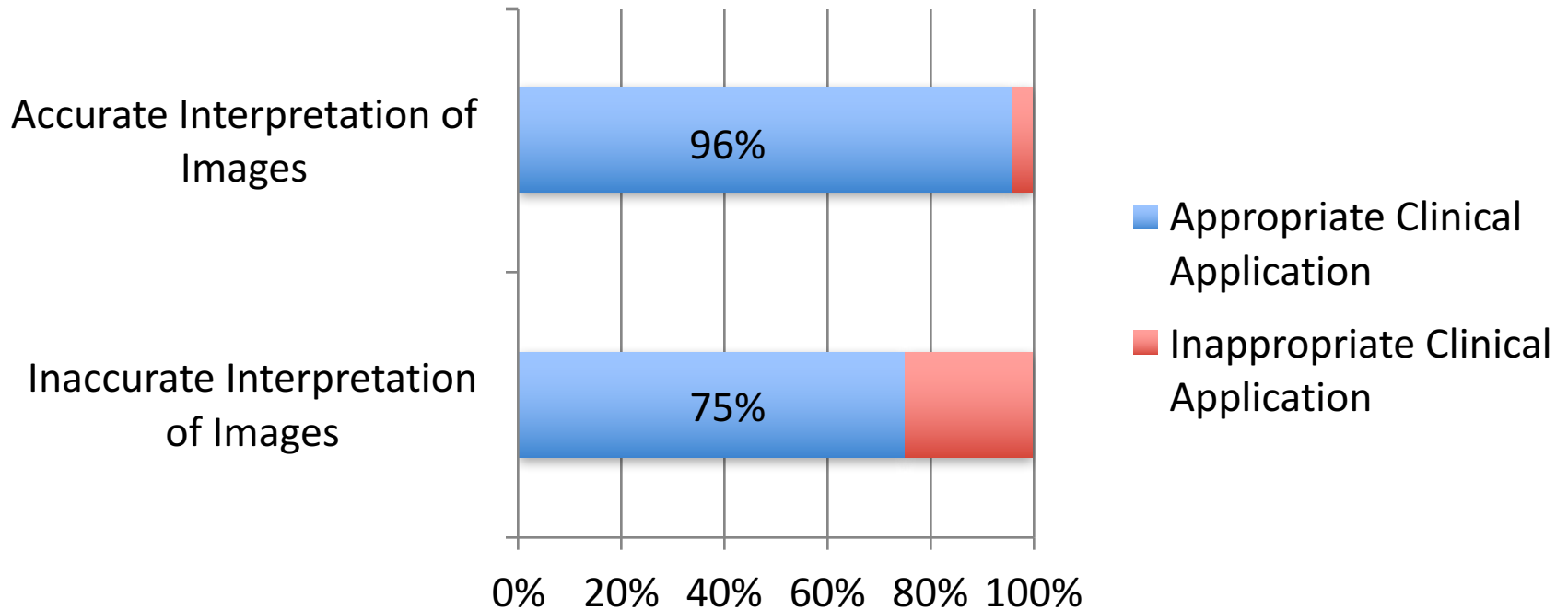
# Accuracy of Interpretation

	Finding Present on Expert Review	Finding Absent on Expert Review
Trainee reported positive finding	27	11
Training reported negative finding	7	32

- Positive predictive value = 79%
- Negative predictive value = 74%
- Overall diagnostic accuracy of 77%
  - Based on all cardiac findings

4 studies were not evaluated for accuracy and are not included in this table.

# Clinical Application of Findings



Inappropriate clinical applications included incorrect fluid management and use of inotropes.

# Conclusions and Next Steps

- Conclusions
  - Use of a remote feedback software system is feasible and enables a single faculty expert to give feedback to multiple trainees
  - Trainees were able to capture high quality images and had high diagnostic accuracy with appropriate clinical applications
- Address Limitations
  - Many ultrasounds that were performed were not saved or not submitted for review
  - Feedback was limited by information available to faculty (especially in assessment of clinical application)
  - Requires a large time commitment from faculty giving feedback
- Database involved review and feedback on other types of ultrasound exams (lung, abdominal, DVT)

# References

1. Mayo PH, Beaulieu Y, Doelken P, et al. American College of Chest Physicians/La Société de Réanimation de Langue Française statement on competence in critical care ultrasonography. *Chest*. 2009 Apr; 135(4): 1050-60.
2. Levitov A, Frankel HL, Blaivas M, et al. Guidelines for the Appropriate Use of Bedside General and Cardiac Ultrasonography in the Evaluation of Critically Ill Patients. *Crit Care Med*. 2016 Jun; 44(6):1206-27.
3. Hulett C, Pathak V, Katz J, et al. Development and Preliminary Assessment of a Critical Care Ultrasound Course in an Adult Pulmonary and Critical Care Fellowship. *Ann Am Thoracic Soc*. 2014 Jun; 11(5); 784-8.
4. Eisen LA, Leung S, Gallagher AE, Kvetan V. Barriers to ultrasound training in critical care medicine fellowships: a survey of program directors. *Crit Care Med*. 2010 Oct; 38(10): 1978-83.
5. Arntfield RT. The utility of remote supervision with feedback as a method to deliver high-volume critical care ultrasound training. *J Crit Care*. 2015 Apr; 30(2):441.

# Acknowledgments

- Dr. Pierre Kory
- Dr. Sean O'Neill
- Dr. Bennett Vogelman
- University of Wisconsin, Department of Medicine Housestaff