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Aims / Learning objectives

1. To recognize and discuss difficulties in ultrasound training
2. To achieve knowledge about competence-based training and educational principles in thoracic ultrasound
3. To achieve knowledge about easily implementable tools and ideas on how to strengthen ultrasound training

Suggested readings

1. Miller GE. The assessment of clinical skills/competence/performance. *Acad Med*. 1990;65(9 Suppl):S63-S67. doi:10.1097/00001888-199009000-00045
2. Witheridge A, Ferns G, Scott-Smith W. Revisiting Miller's pyramid in medical education: the gap between traditional assessment and diagnostic reasoning. *Int J Med Educ*. 2019 Oct 25;10:191-192. doi: 10.5116/ijme.5d9b.0c37. PMID: 31655795; PMCID: PMC7246123.
3. Pietersen PI, Jørgensen R, Graumann O, et al. Training Thoracic Ultrasound Skills: A Randomized Controlled Trial of Simulation-Based Training versus Training on Healthy Volunteers. *Respiration*. 2021;100(1):34-43. doi:10.1159/000509298
4. Laursen CB, Clive A, Hallifax R, et al. European Respiratory Society statement on thoracic ultrasound. *Eur Respir J*. 2021;57(3):2001519. Published 2021 Mar 4. doi:10.1183/13993003.01519-2020

Conflict of interest disclosure



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☒ I have no real or perceived conflicts of interest that relate to this presentation.

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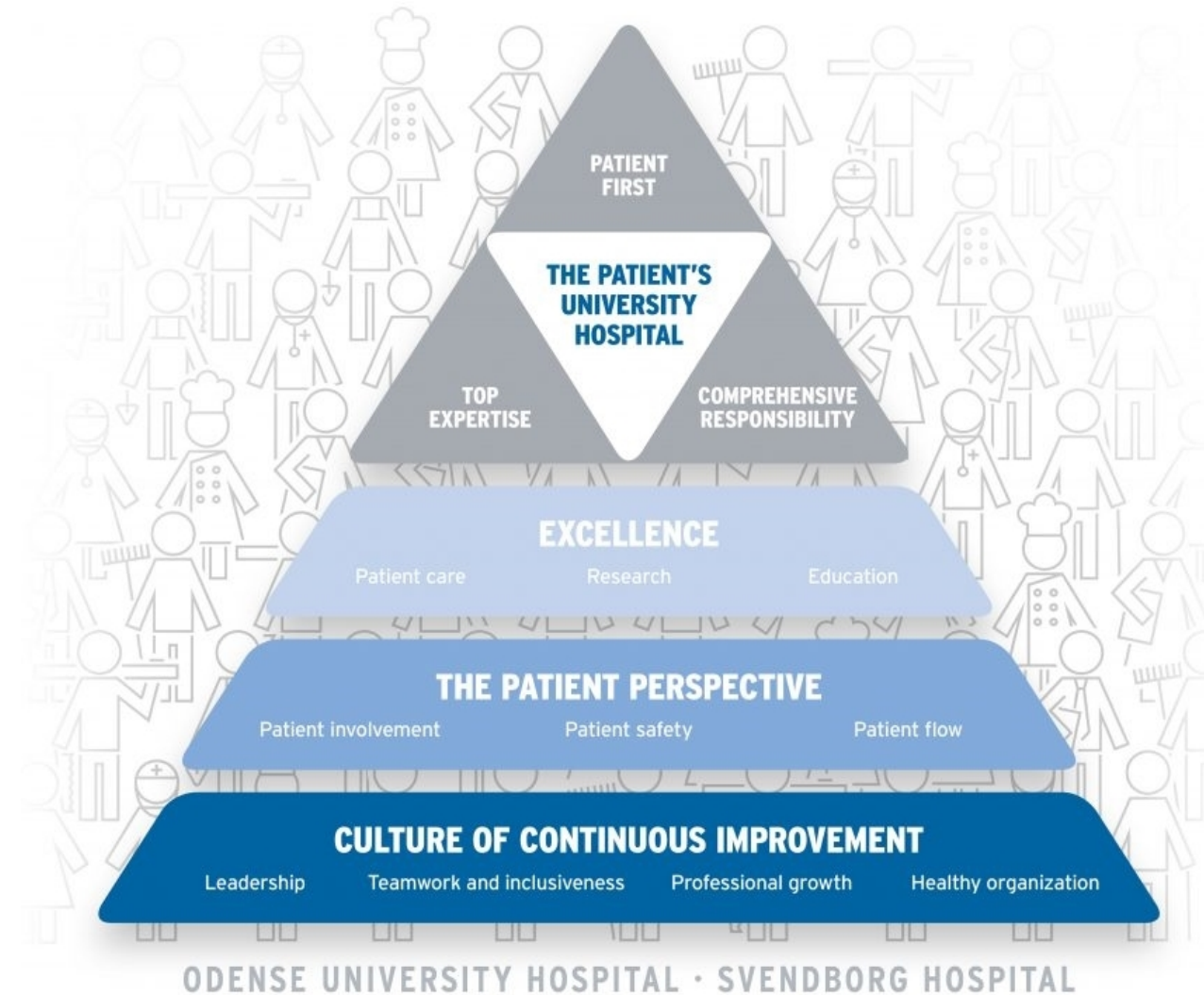
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PATIENT
FIRST

EXCELLENCE

Patient care

Research

Education

THE PATIENT PERSPECTIVE

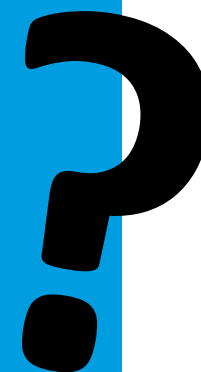
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**never
change a
winning
team...**

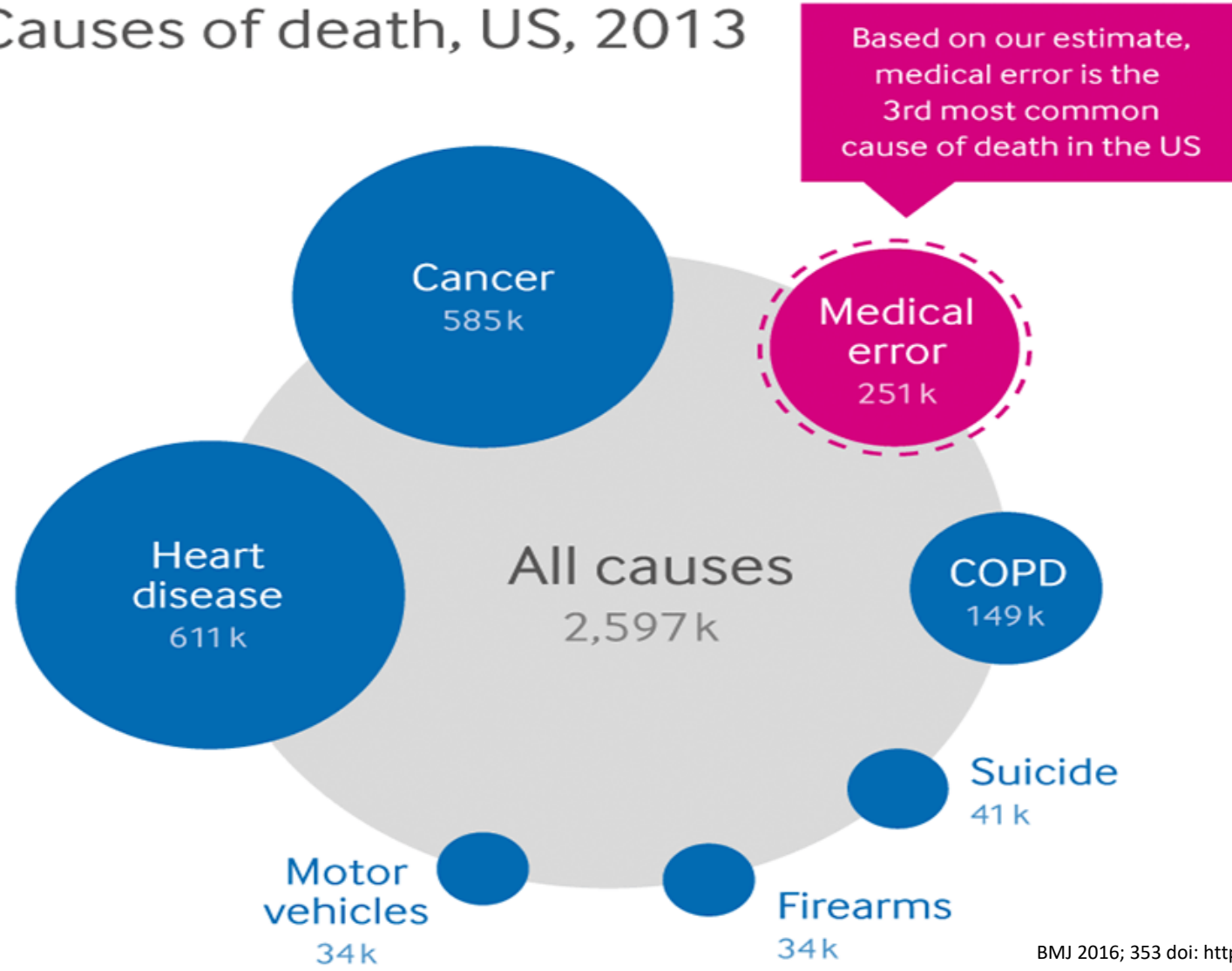




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Causes of death, US, 2013

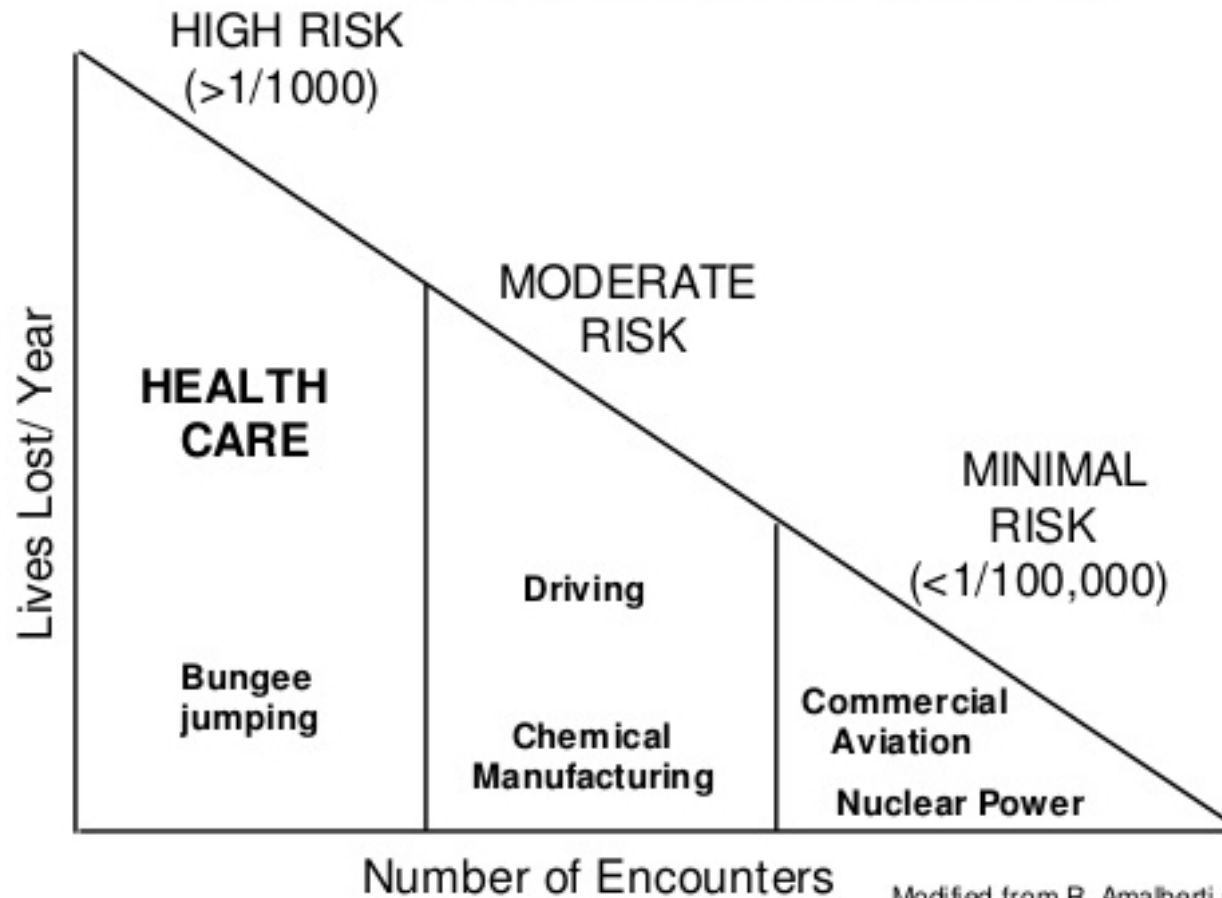




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Comparison of Risk in Health Care With Other Industries



Modified from R. Amalberti and L. Leape

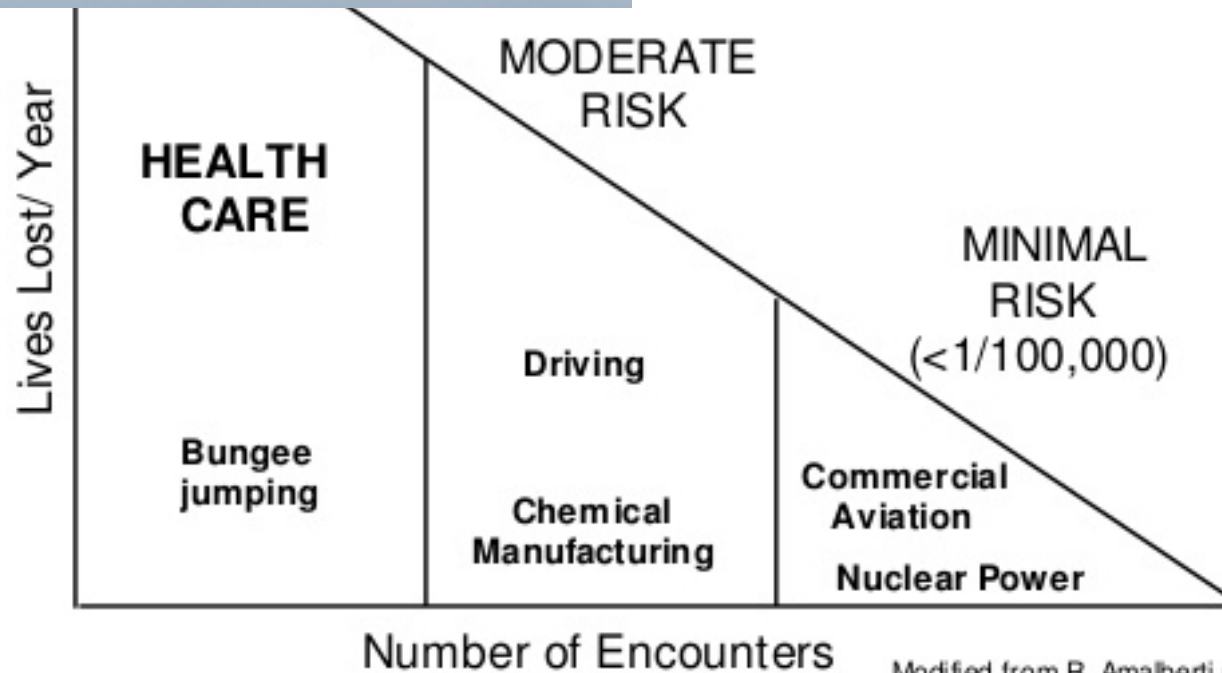


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Risk in Health Care Other Industries



Modified from R. Amalberti and L. Leape



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Risk in Health Care Other Industries



Bungee
jumping

Chemical
Manufacturing

Commercial
Aviation
Nuclear Power

Number of Encounters

Modified from R. Amalberti and L. Leape



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Risk in Health Care Other Industries



Bungee
jumping

Chemical
Manufacturing

Number of Encounter





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EFSUMB

EUROPEAN FEDERATION OF SOCIETIES FOR ULTRASOUND IN MEDICINE AND BIOLOGY

'Building a European Ultrasound Community'

MINIMUM TRAINING REQUIREMENTS FOR THE PRACTICE OF MEDICAL ULTRASOUND IN EUROPE

Appendix 5: Gastroenterological Ultrasound

This curriculum is intended for clinicians who perform gastroenterological ultrasound scans. It includes standards for theoretical knowledge and practical skills. At least Level 1 competence should be obtained by anyone performing gastroenterological ultrasound unsupervised

Level 1

- It is recommended that at least 5–10 examinations are performed by the trainee (under supervision) per week and that a minimum of 300 examinations in total are undertaken. However different trainees will acquire the necessary skills at different rates and the end point of the training programme should be judged by an assessment of competencies
- Examinations should encompass the full range of pathological conditions listed below
- A log book listing the types of examinations undertaken should be kept
- Training should usually be supervised by a level 2 practitioner.
- In certain circumstances it may be appropriate to delegate some of this supervision to an experienced level 1 practitioner with at least two years of regular practical experience.
- Trainees should attend an appropriate theoretical course and should read appropriate textbooks and literature
- It is recommended that a medical practitioner performing level 1 ultrasound should continue to perform at least 300 examinations each year on a regular basis and attend regular ultrasound meetings
- During the course of training the competency assessment sheet should be completed as this will

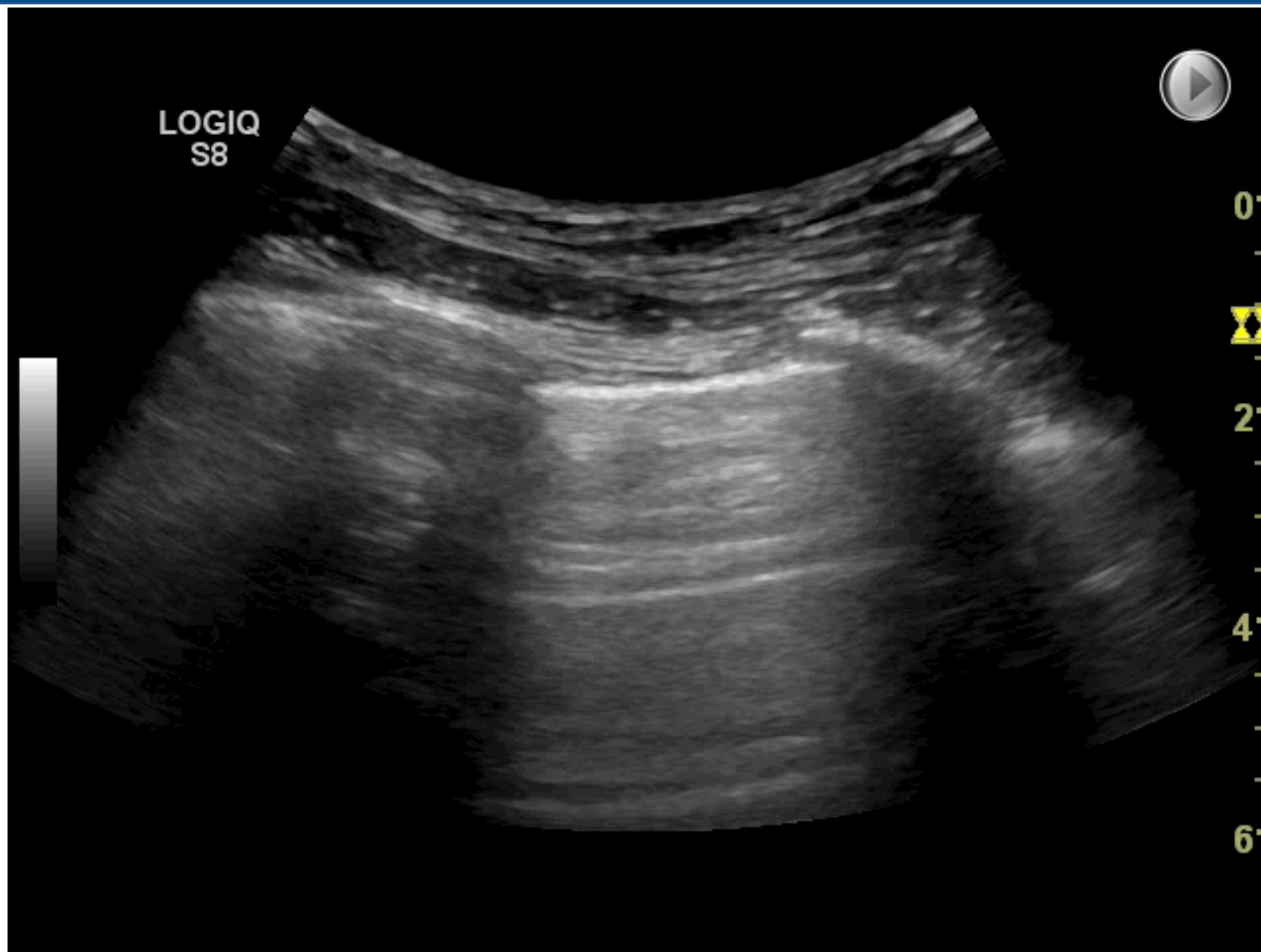


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Question to you:

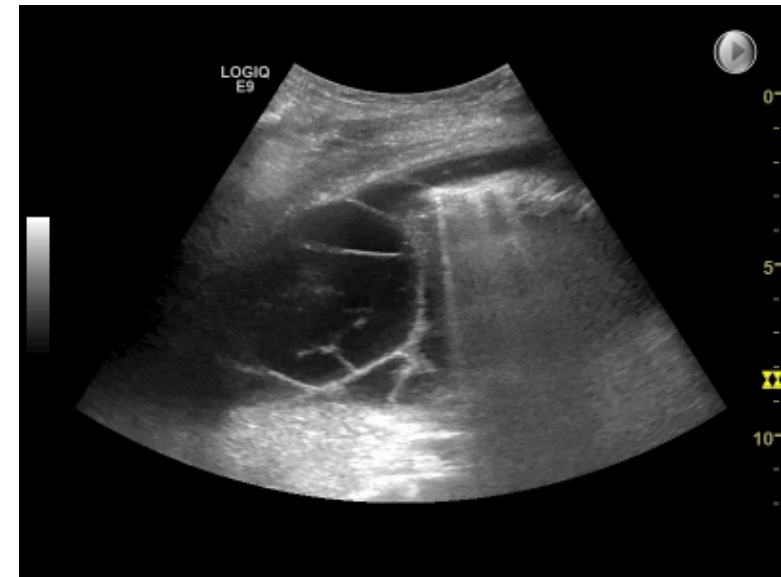
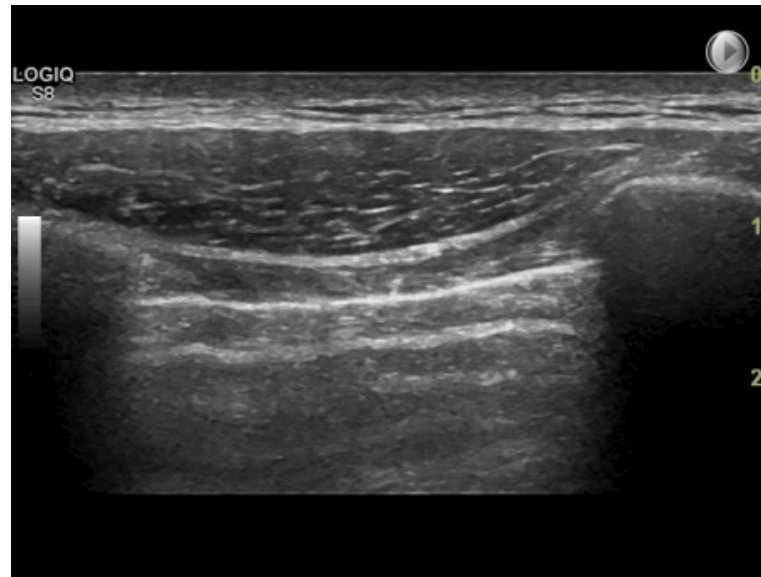
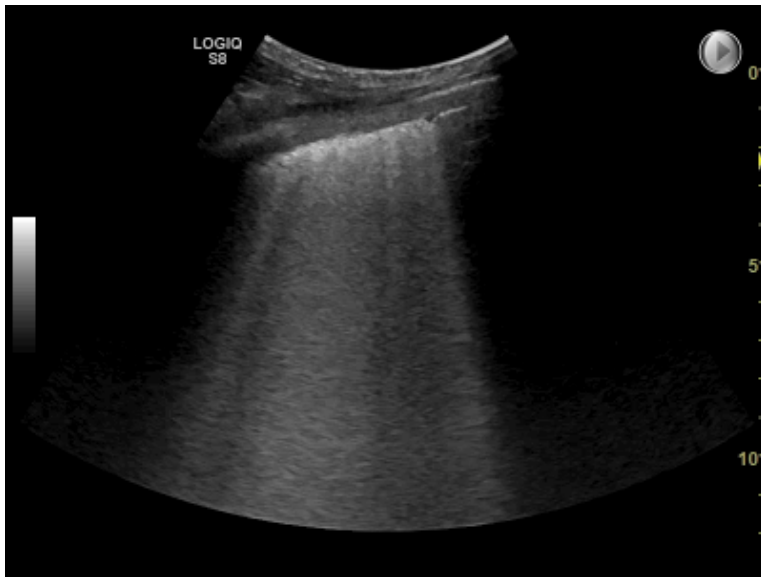
- How did you learn thoracic ultrasound?
- What was the advantage/disadvantages of this method?





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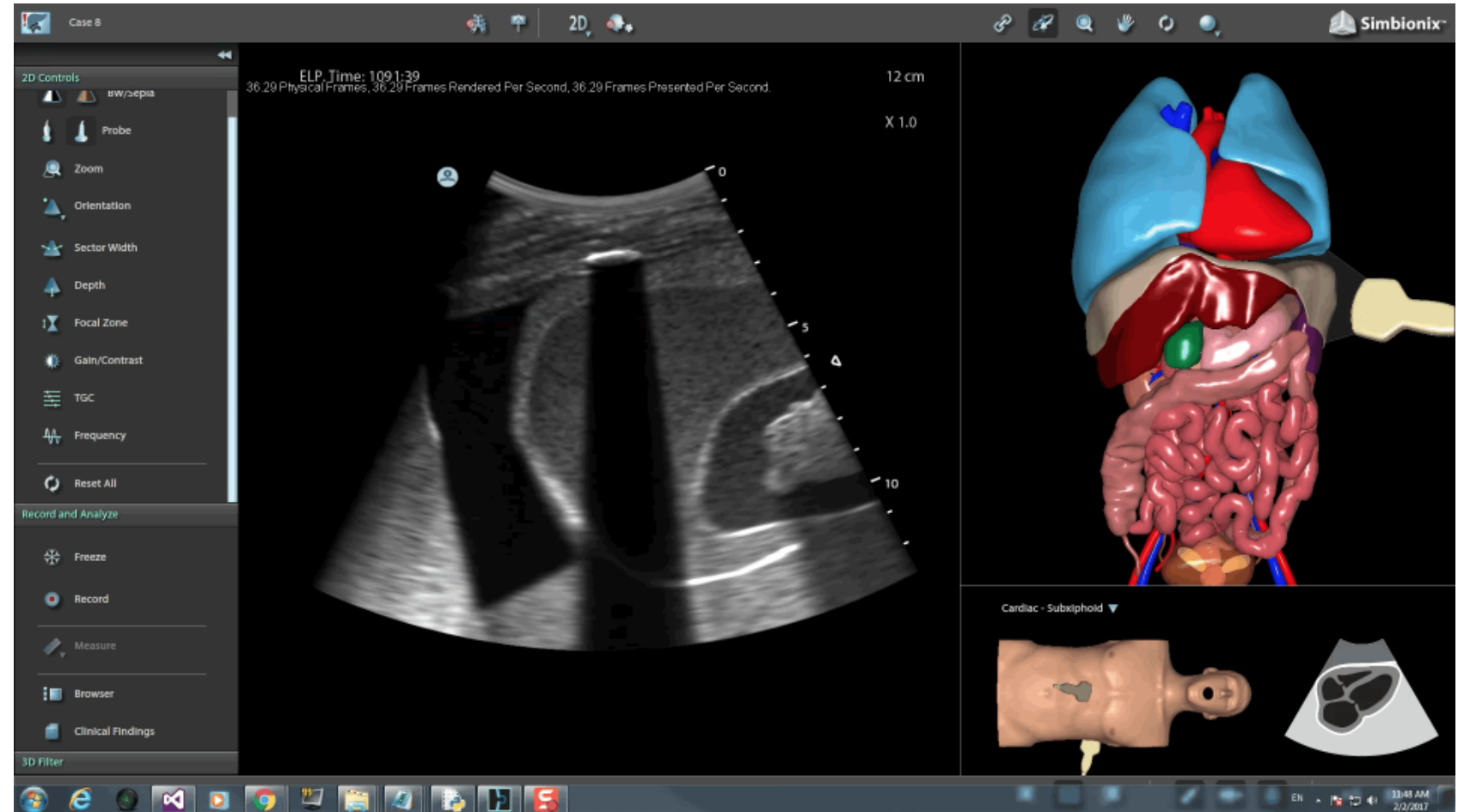


What about all the pathologies?



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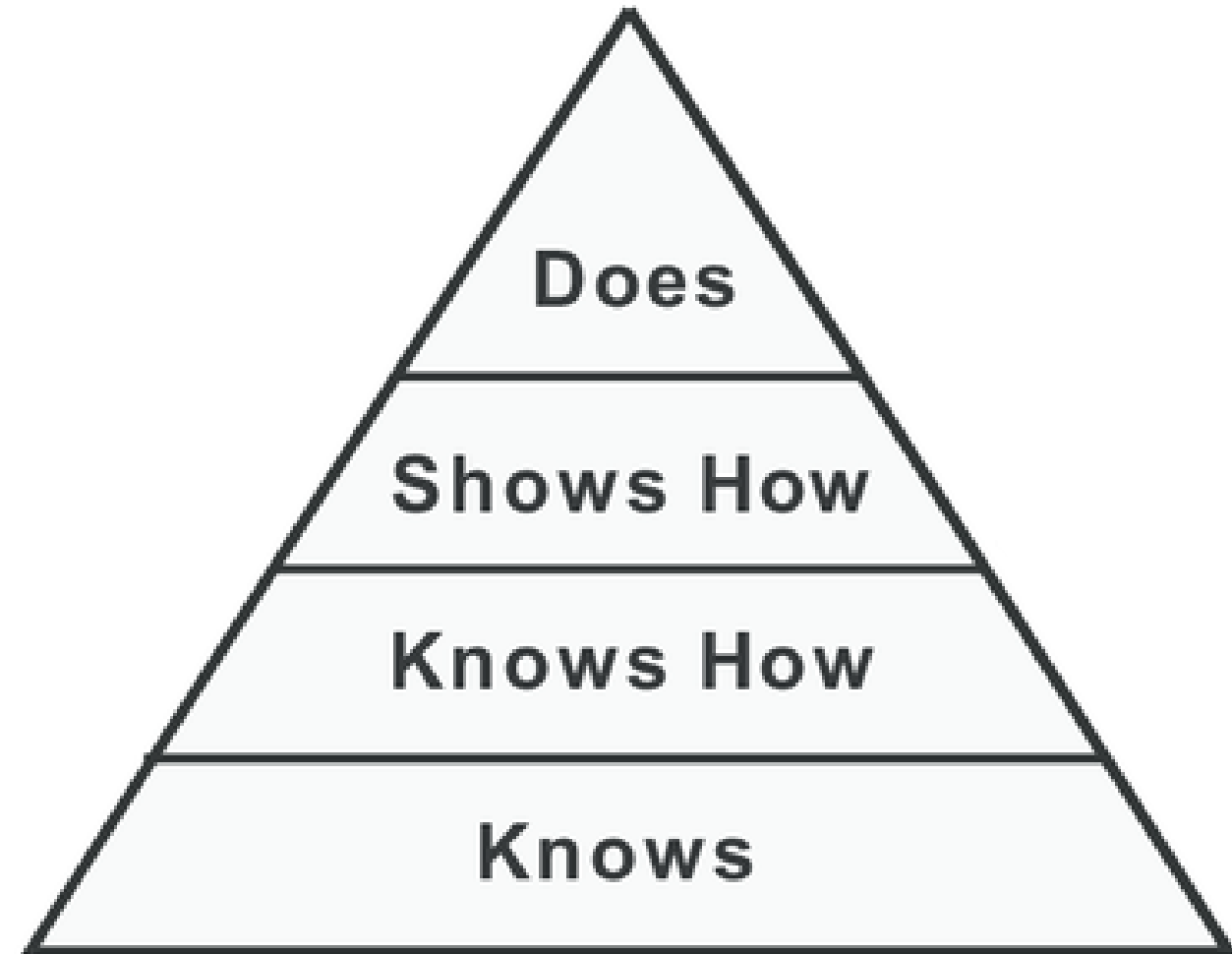
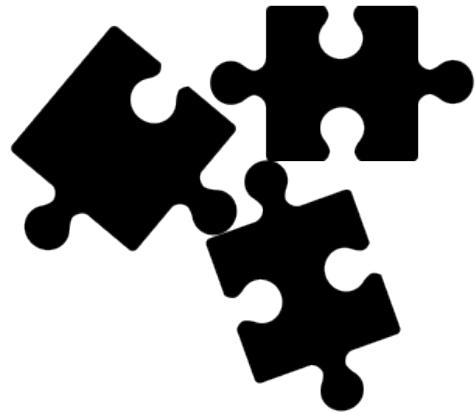
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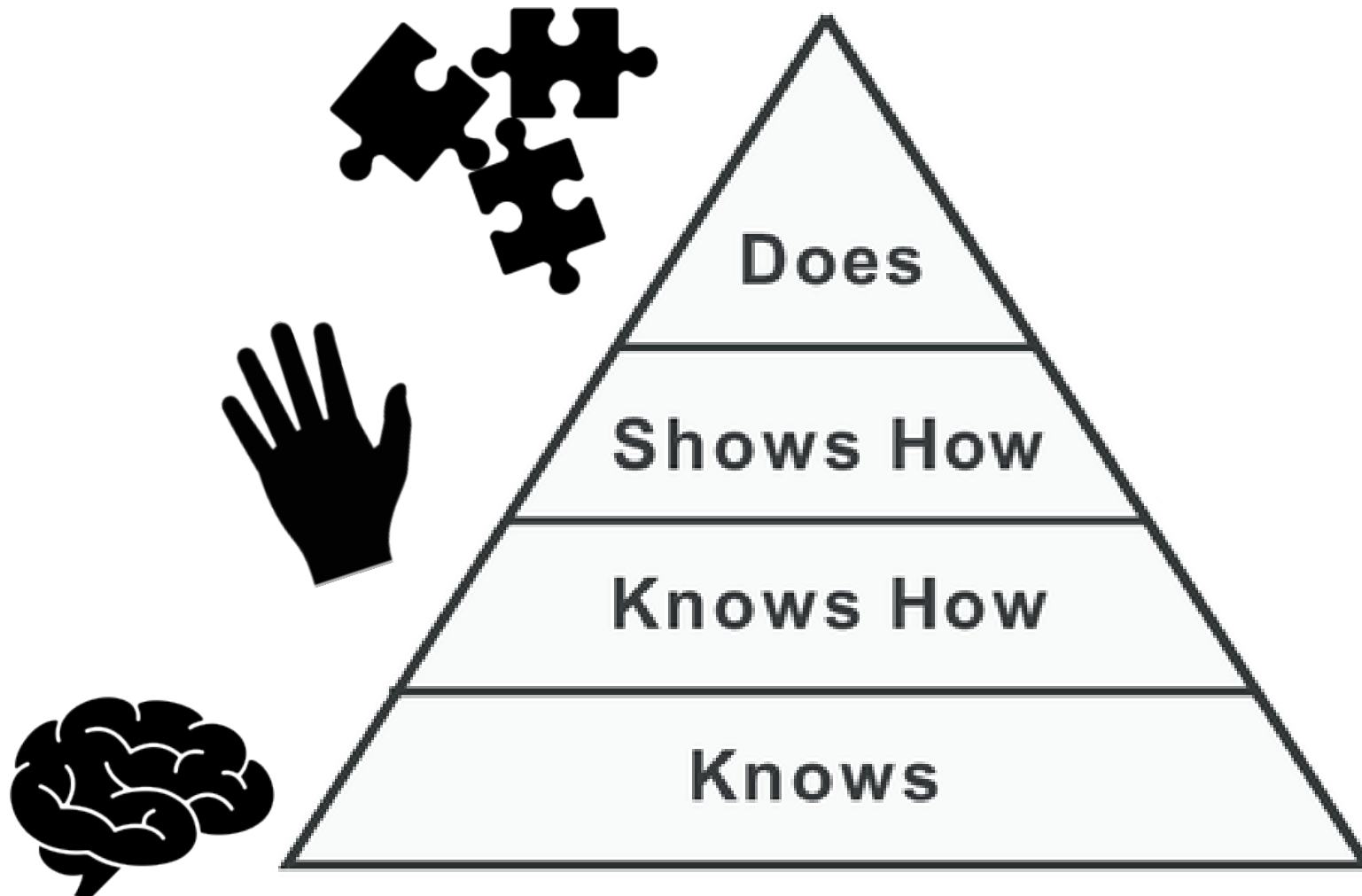
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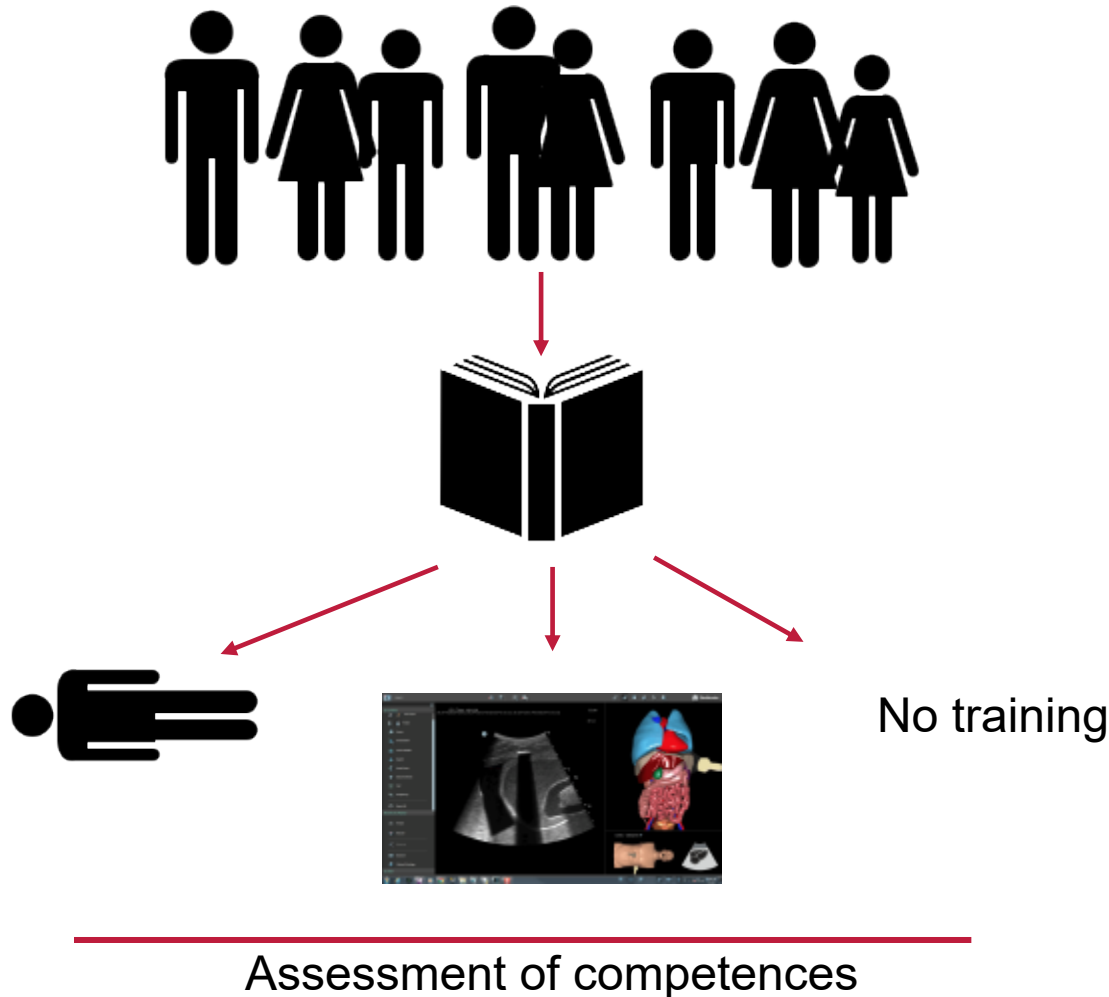
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Respiration

Interventional Pulmonology

Respiration 2021;100:34–43
DOI: 10.1159/000509298

Received: April 24, 2020
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Training Thoracic Ultrasound Skills: A Randomized Controlled Trial of Simulation- Based Training versus Training on Healthy Volunteers

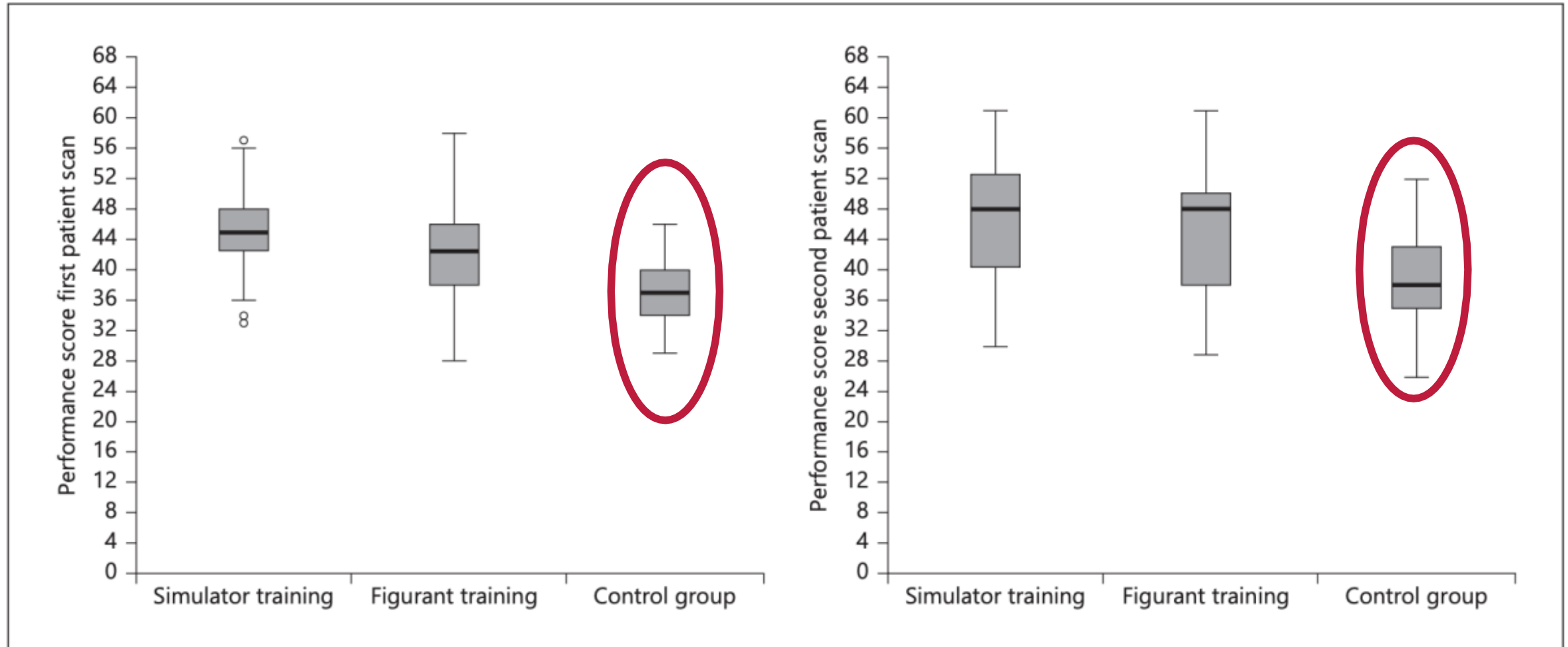
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ABSTRACT

Background: Lung ultrasound is increasingly used in critically ill patients as an alternative to bedside chest radiography, but the best training method remains uncertain. This study describes a training curriculum allowing trainees to acquire basic competence.

Methods: This multicenter, prospective, and educational study was conducted in 10 Intensive Care Units in Brazil, China, France and Uruguay. One hundred residents, respiratory therapists, and critical care physicians without expertise in transthoracic ultrasound (trainees) were trained by 18 experts. The main study objective was to determine the number of supervised exams required to get the basic competence, defined as the trainees' ability to adequately classify lung regions with normal aeration, interstitial-alveolar syndrome, and lung consolidation. An initial 2-h video lecture provided the rationale for image formation and described the ultrasound patterns commonly observed in critically ill and emergency patients. Each trainee performed 25 bedside ultrasound examinations supervised by an expert. The progression in competence was assessed every five supervised examinations. In a new patient, 12 pulmonary regions were independently classified by the trainee and the expert.

Results: Progression in competence was derived from the analysis of 7,330 lung regions in 2,562 critically ill and emergency patients. After 25 supervised examinations, 80% of lung regions were adequately classified by trainees. The ultrasound examination mean duration was 8 to 10 min in experts and decreased from 19 to 12 min in trainees (after 5 vs. 25 supervised examinations). The median training duration was 52 (42, 82) days.

Conclusions: A training curriculum including 25 transthoracic ultrasound examinations supervised by an expert provides the basic skills for diagnosing normal lung aeration, interstitial-alveolar syndrome, and consolidation in emergency and critically ill patients.

(ANESTHESIOLOGY 2020; 132:899–907)

Lung ultrasound training: curriculum implementation and learning trajectory among respiratory therapists

Intensive Care Med (2016) 42:63–71
DOI 10.1007/s00134-015-4102-9

Abstract Purpose: Guidelines recommend teaching of lung ultrasound for critical care, though little information exists on how much training is required for independent practice, especially for non-physician trainees. We thus aimed to elucidate a threshold number of cases above which competency for independent practice may be attained for respiratory therapists (RTs). **Methods:** We conducted a prospective audit of lung ultrasound training between July 2014 and April 2015 in our 20-bed medical intensive care unit. Following theoretical instruction and self-learning, trainees acquired images from 12 lung zones under direct supervision and classified images into six patterns. Assistance during image acquisition and correct interpretation of ultrasound images were recorded. **Results:** Eleven ultrasound-naïve

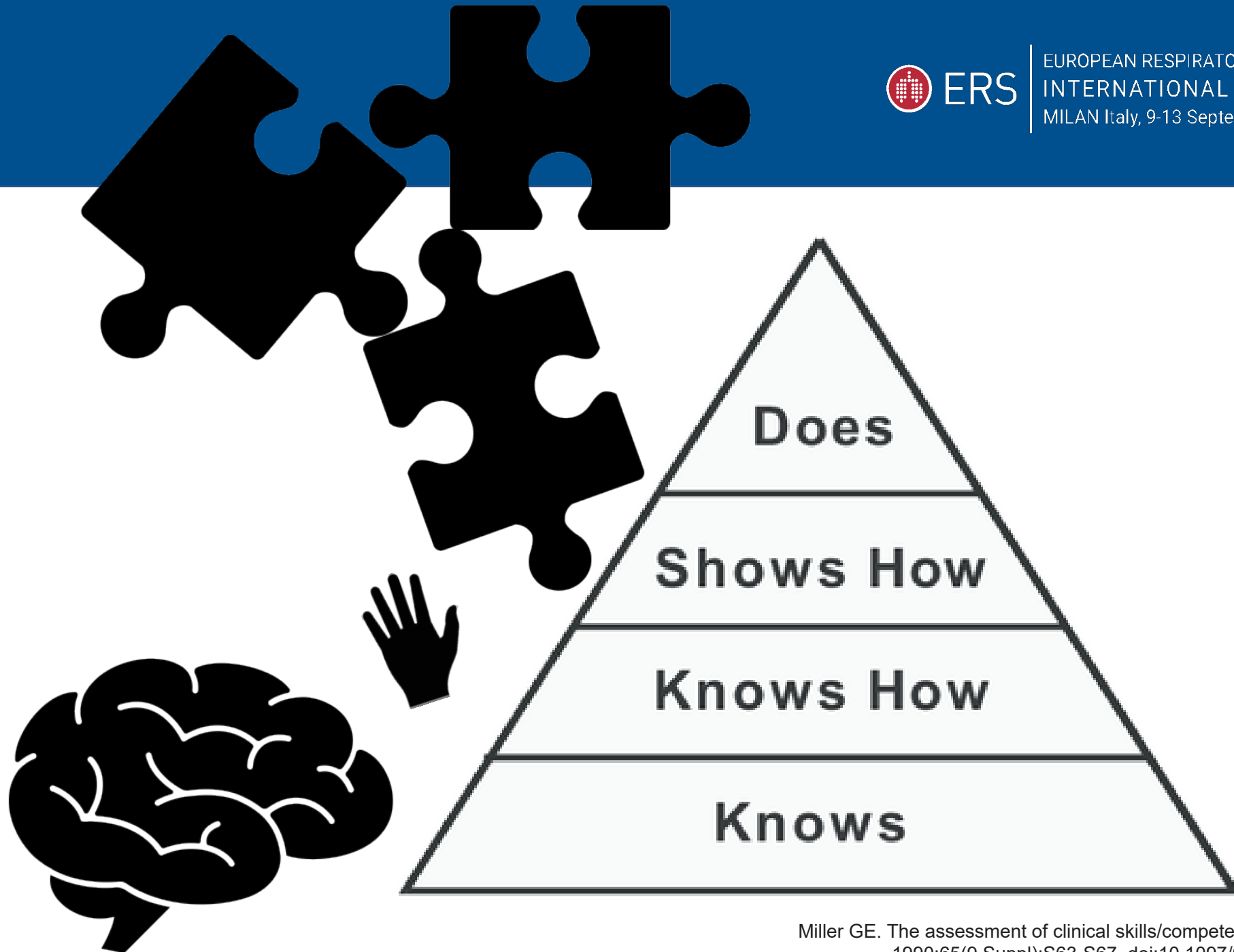
RTs scanned an average of 15 patients each (170 patients in total). Among supervisor-adjudicated lung ultrasound findings, 35.5 % were abnormal. Blinded verification of the adjudicated findings was done for the first 92 patients (1104 images), with an agreement of 95.4 %. As RTs scanned more patients, there was a significant decrease in the proportion of images requiring supervisor assistance (Cuzick's $P < 0.001$), and a significant increase in the proportion of correctly identified images (Cuzick's $P = 0.008$). After trainees performed at least ten scans, less than 2 % of images required assistance with acquisition and less than 5 % were wrongly interpreted. **Conclusions:** Our training method allowed RTs to independently perform lung ultrasound after at least ten directly supervised scans. Given that RTs are likely to have less ultrasound knowledge and less clinical know-how compared to physicians, we believe that the same threshold number of scans may be also safely applied to the latter.

Keywords Lung · Thorax · Ultrasonography · Curriculum · Education · Learning



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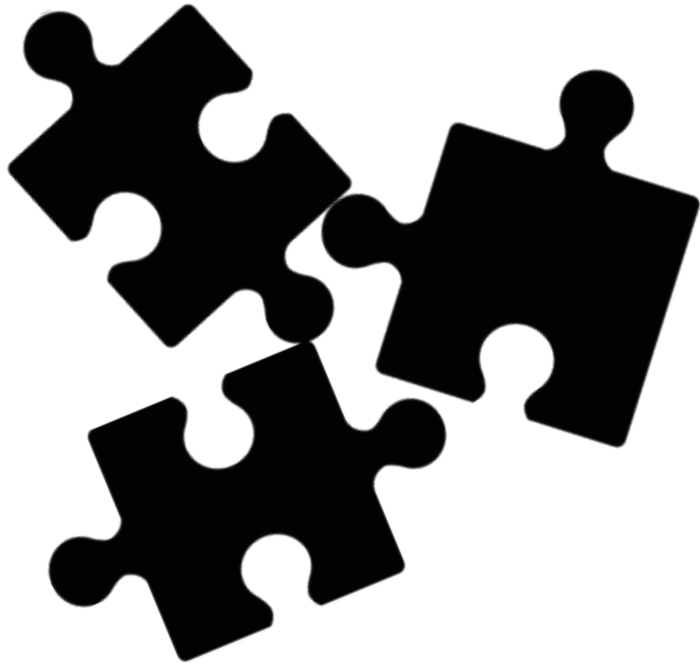
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- Time for reflection
- Morning meetings
- Access to supervision from more experienced colleagues
-
-
- Experience...



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Question to you:

- What are the difficulties in training ultrasound?
- How can we overcome these challenges?



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Suggestions... (Not at all evidence-based...)



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If you are the noob:

- **Other colleagues also learning TUS:**
 - Dual learning
 - Store images/clips and discuss cases
- **Have a supervisor/mentor/experienced operators:**
 - Ask for supervision
 - Focus of the week
- **Alone:**
 - ...

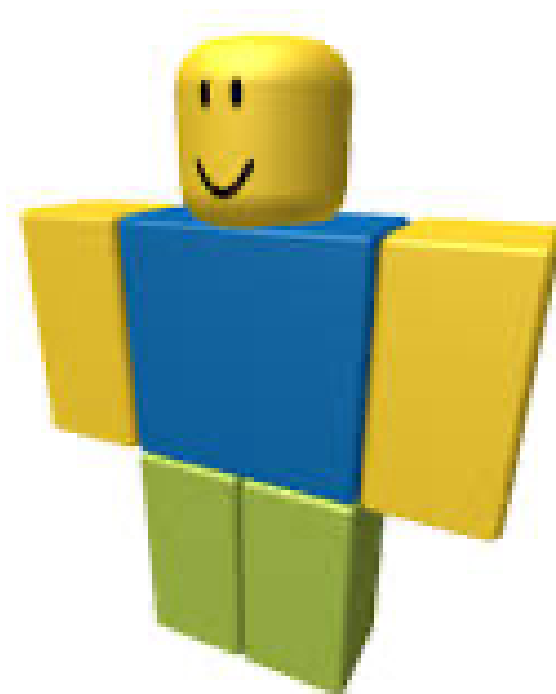


Table 2. Lung ultrasound objective structured assessment of technical skills tool in its final form*

	1	2	3	4	5
Indication					
Evaluates the indication for lung ultrasound	None		Some		Sufficient
Suggests focused questions that can be examined by lung ultrasound	None		Some		Sufficient
Systematic lung ultrasound examination					
Performs lung ultrasound systematically	No systematic approach		Some systematic approach		Sufficient systematic approach
Performs lung ultrasound on the basis of focused questions	No correlation between focused questions and scanning		Some correlation between focused questions and scanning		Sufficient correlation between focused questions and scanning
Technical skills					
Correct placement of patient (e.g., supine when scanning for pneumothorax)	Wrong placement (e.g., evaluating pleural effusion with patient in Trendelenburg position)				Optimal placement (e.g., evaluating pleural effusion with patient in seated position)
Correct choice of transducer	Wrong choice of transducer				Optimal choice of transducer
Correct depth	Wrong depth setting				Optimal depth setting
Correct gain	Wrong setting of gain				Optimal setting of gain
Correct handling of transducer	Poor transducer handling				Optimal transducer handling
Findings					
Correct assessment of pleura	Not able to assess correctly		Properly assessed sometimes		Properly assessed every time
Correct assessment of B-lines	Not able to assess correctly		Properly assessed sometimes		Properly assessed every time
Correct assessment of consolidations	Not able to assess correctly		Properly assessed sometimes		Properly assessed every time
Correct assessment of pleural effusion	Not able to assess correctly		Properly assessed sometime		Properly assessed every time
Correct assessment of whether ultrasound-guided thoracentesis is safe	Not able to assess correctly		Proper assessed sometimes		Properly assessed every time
Documentation					
Documents findings in patient's chart	None		Main findings are described		Described sufficiently
Conclusion					
Able to make a diagnosis on the basis of lung ultrasound findings	No diagnosis		Some diagnosis		Correct diagnosis
Able to integrate lung ultrasound findings with patient's history	No integration		Some integration		Optimal integration



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	1	2	3	4	5
Indication					
Evaluates the indication for lung ultrasound	None		Some		Sufficient
Suggests focused questions that can be examined by lung ultrasound	None		Some		Sufficient
Systematic lung ultrasound examination					
Performs lung ultrasound systematically	No systematic approach		Some systematic approach		Sufficient systematic approach
Correlates lung ultrasound on focused questions	No correlation between focused questions and scanning		Some correlation between focused questions and scanning		Sufficient correlation between focused questions and scanning
Optimal patient positioning	Wrong placement (e.g., evaluating pleural effusion with patient in Trendelenburg position)				Optimal placement (e.g., evaluating pleural effusion with patient in seated position)
Optimal transducer choice	Wrong choice of transducer				Optimal choice of transducer
Optimal depth setting	Wrong depth setting				Optimal depth setting
Optimal setting of gain	Wrong setting of gain				Optimal setting of gain
Optimal transducer handling	Poor transducer handling				Optimal transducer handling
Correct assessment of pleura	Not able to assess correctly		Properly assessed sometimes		Properly assessed every time
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Documentation					
Documents findings in patient's chart	None		Main findings are described		Described sufficiently
Conclusion					
Able to make a diagnosis on the basis of lung ultrasound findings	No diagnosis		Some diagnosis		Correct diagnosis
Able to integrate lung ultrasound findings with patient's history	No integration		Some integration		Optimal integration

Focus of the week:

- Image optimization
- Patient communication
- Pleura
- Integration of findings
- ...



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If you are experienced TUS operator:

- Be kind!
- Create time for reflection
- Identify gaps or points of improvement and communicate in a constructive way (types of feedback)
- Keep your hands behind your back!



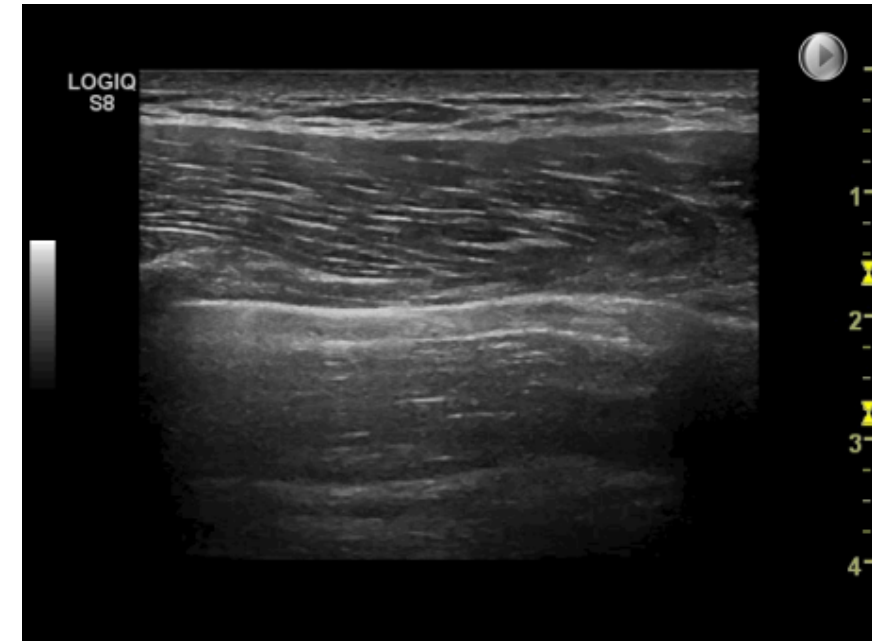


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Summarized:

- We discussed competence-based training and how a TUS is structured as a competence (Millers pyramid)
- We discussed difficulties in training TUS
- We discussed easily implementable tools (not evidence-based) tools and ideas how to strengthen ultrasound training





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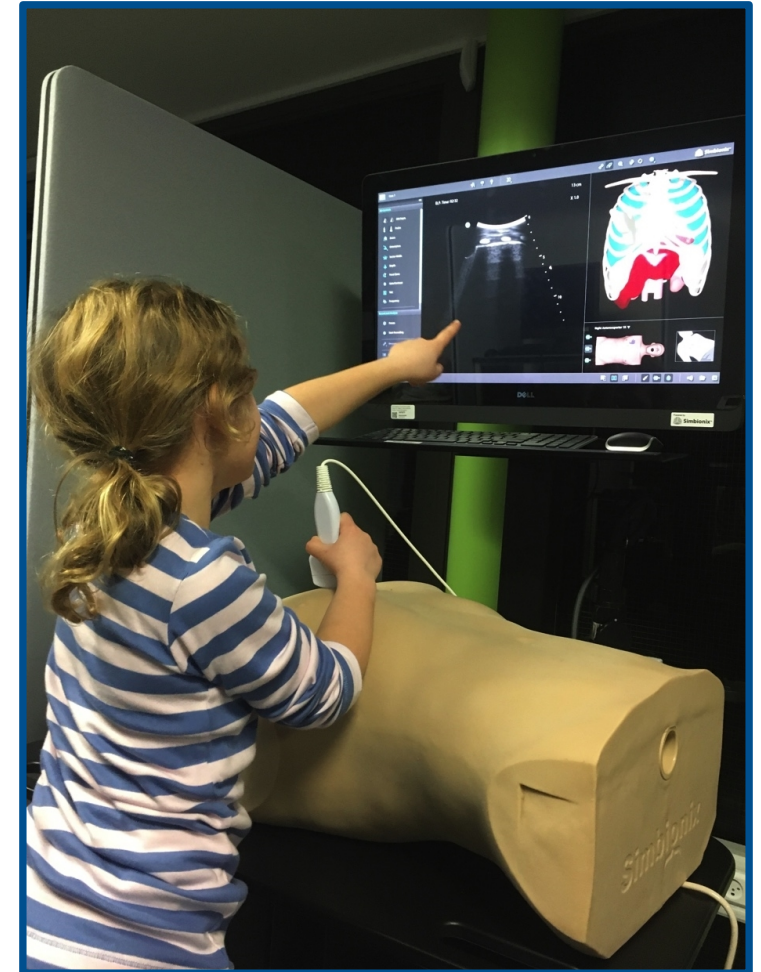
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Thank you for the attention

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