

# Delivering an Ultrasound Curriculum in Pre-Clinical Medical Education: Implementation and Evaluation



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# Session Outline and Learning Objectives

- Delivery of Course Content
  - Balance between didactic and hands-on learning
  - Setting up a hands-on lab
  
- Evaluation
  - Individual Student Performance and Learning
  - Impact on Overall Learning

# Delivery of Course Content

- Adult Learning Theory:
  - Adults are internally motivated and self-directed
  - Adults bring life experiences and knowledge to learning experiences
  - Adults are goal oriented
  - Adults are relevancy oriented
  - Adults are practical
  - Adult learners like to be respected

Knowles, 1970

# Delivery of Course Content: Didactic Learning

- Brief didactics, primarily hands-on labs
  - Brief (<30 minutes) pre-lab lecture/demonstration
    - Most efficient if delivered to entire group at once
  - Longer classroom lecture for complex topics (usually no more than 1 per semester)
  - Utilize self-directed learning resources to fill knowledge gaps

# Web-based Modules

- Cover a wide range of topics from ultrasound physics to specific clinical indications
- Demonstrate relevant technique plus discuss evidence based guidelines for use of ultrasound in the clinical setting
- Include ultrasound images and loops
- Generally 5-15 minutes in length
  - [http://media.med.sc.edu/ultrasound\\_institute/M2/11B/player.html](http://media.med.sc.edu/ultrasound_institute/M2/11B/player.html)

# Delivery of Course Content: Hands-On Learning

- Issues to consider
  - Group size
    - 20-25 students
  - Faculty to Student Ratio
    - 4-6 faculty preceptors
  - Equipment (US and models) to student ratio
    - 5-8 standardized patients and US units
  - Time
    - Somewhat dependent on other factors as listed above
    - 40-60 minutes

# Ultrasound Models

- Simulated models
  - “Still” models (phantoms)
  - Ultrasound Simulators
  - Higher initial investment
  - Technological support
- Live patient models
  - Best for clinical skill building
  - Allows for demonstration of variability (“normal variants”), true physiologic principles
  - Recurring cost
  - Minimal safety issues

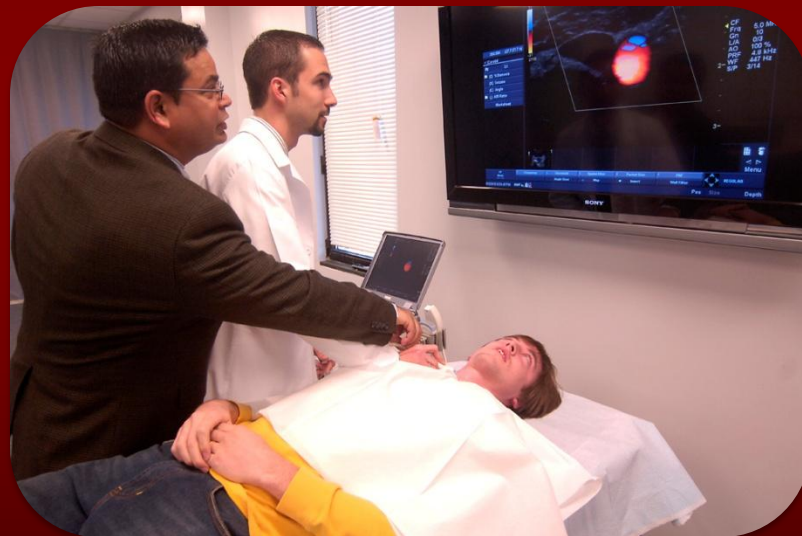






# Live Patient Models: “Standardized Patients”

- Balance between success and realism for early learners should be in the direction of “success”
  - Models should be
    - Normal
    - Easy to image
- Issues to consider
  - Body habitus
  - Gender
  - Age



# Live Patient Models: “Standardized Patients”

- What is the “true risk”?
  - **AIUM Official Statement: Prudent Use and Clinical Safety**
  - *Approved 4/1/2012*
  - Diagnostic ultrasound has been in use since the late 1950s. Given its known benefits and recognized efficacy for medical diagnosis, including use during human pregnancy, the American Institute of Ultrasound in Medicine herein addresses the clinical safety of such use: **No independently confirmed adverse effects caused by exposure from present diagnostic ultrasound instruments have been reported in human patients in the absence of contrast agents. Biological effects (such as localized pulmonary bleeding) have been reported in mammalian systems at diagnostically relevant exposures but the clinical significance of such effects is not yet known.** Ultrasound should be used by qualified health professionals to provide medical benefit to the patient. Ultrasound exposures during examinations should be as low as reasonably achievable (ALARA). <http://www.aium.org/resources/viewStatement.aspx?id=34>
- What we are really concerned about
  - “ADCP”

# Live Patient Models: “Standardized Patients”

- Dealing with discovery of abnormalities
  - Pre-screen
  - Standard procedures for routing SP’s to care
  - Inform of this possibility (and the standard procedure) in *consent document*
  - Stress that incidental discovery of asymptomatic disease is associated with better outcomes
    - Opportunity for early intervention, planning for management
  - Other issues to include in consent document
    - Responsibility to keep commitments (on both sides)
    - Consent to be photographed/have images saved

# Live Patient Models: “Standardized Patients”

- Recruitment
  - Healthy young adults with flexible schedules
  - Some investment in/interest in medical education
    - Undergraduate Pre-Med/Healthcare Interest Groups
    - Spouses/SO’s, friends of medical students
    - Helpful to develop a pool of regular participants
- Reimbursement
  - Unskilled, no training, low risk
  - No standard
  - Enough to be willing to give their time reliably
  - May be different for different demographics
    - » College student vs young professional

# Ultrasound – Assessment of skills

- Objective Structured Clinical Examination (OSCE) is our standard testing format for all levels of student learners
- Must demonstrate
  - Understanding of technology (M1-M4)
  - Ability to acquire images (M1-M4)
  - Ability to interpret findings in context of patient history and physical exam (M3-M4)
  - Ability to use findings appropriately in planning patient care (M3-M4)

# Ultrasound OSCE for Pre-Clinical Students

- “Clinical Interaction”
  - Expectation for:
    - » Demonstration of appropriate attention to the patient’s privacy and comfort
    - » Professionalism
- Demonstration of practical understanding of anatomic/physiologic concepts
  - Choose images obtained based on the ability to demonstrate that understanding

# Ultrasound OSCE for Pre-Clinical Students

- Assessment of acquired skills
- Focus on associated concepts pertinent to the course
- Must demonstrate
  - Knowledge of anatomy/physiology
  - Proper ultrasound technique





# Ultrasound OSCE for Pre-Clinical Students

Write down your name, ID number and date in the designated space

UNIVERSITY OF SOUTH CAROLINA SCHOOL OF MEDICINE

Student Name \_\_\_\_\_ Date \_\_\_\_\_

Student ID Number \_\_\_\_\_ Start time \_\_\_\_\_

Observer \_\_\_\_\_ End Time \_\_\_\_\_

Maximum time allowed is 15 minutes

## M1 ULTRASOUND OSCE CHECKLIST (Fall Semester- Nov 23, 2011)

Only 6 views to be completed in any order in 15 minutes

Structure identification allowed in only one frame per required view

#7 is just general observation by the examiner

Focused ultrasound exam	Adequate image obtained?		Structure Identified?	
	YES	NO	YES	NO
<b>1. Right Upper Quadrant (Morison's Pouch view)</b>				
a. Right kidney-longitudinal view				
b. Right costophrenic angle				
c. Morison's pouch/Hepatorenal fossa				
<b>2. Transverse view (liver) showing hepatic veins draining into IVC</b>				
a. Liver- Hepatic veins draining into IVC				
<b>3. Pelvic Ultrasound</b>				
a. Urinary bladder-mid longitudinal view				
<b>4. Echocardiography-Parasternal Long axis (PLAX) view</b>				
a. Left atrium				
b. Left ventricle				
c. Anterior mitral valve leaflet				
d. Interventricular septum (IVS)				
e. Right ventricular outflow tract/RV				
f. Aortic valve				
<b>5. Neck Ultrasound (mid neck - right side)</b>				
a. Right internal jugular vein (transverse)				
<b>6. Knee Ultrasound (mid longitudinal-suprapatellar) - view should be without anisotropy</b>				
a. Femur				
b. Quadriceps tendon				
<b>7. Miscellaneous Observations</b>			<b>YES</b>	<b>NO</b>
a. Did student introduce herself/himself to the patient?				
b. Attentiveness to patient comfort and modesty?				
c. Able to select and change probes for specific exams?				
d. Was probe marker pointing in correct direction?				
e. Was proper preset selected?				
f. Was focus position and depth acceptable?				

Each row is worth 5 points— This row has 2 green boxes so each green box is worth 2.5 points

Each row is worth 5 points— This one has 1 green boxes so each green box is worth 5.0 points

# Ultrasound OSCE



# Other Methods of Assessment:

## Standard Multiple Choice Questions

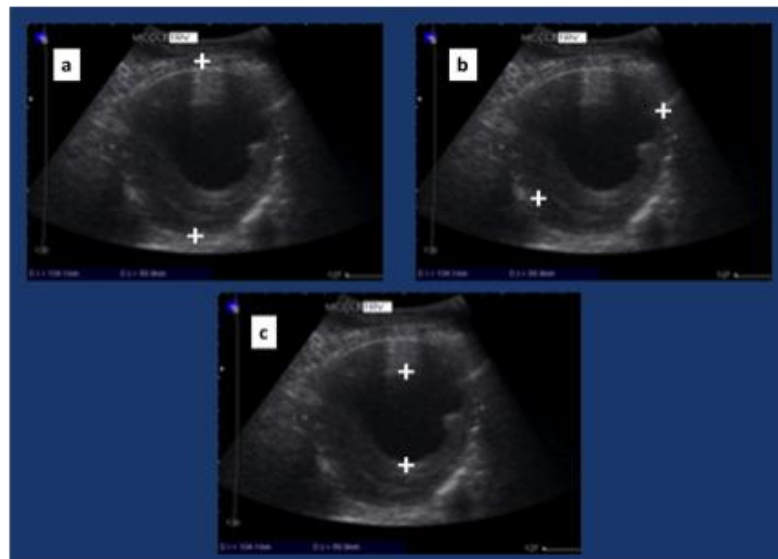
- May be incorporated into quizzes and tests for the course with which the curriculum is paired
- Can create “stand-alone” quizzes
- Can incorporate questions with other learning materials (web-based modules)
- Questions usually include cases and/or images

Questions for AAA module

1. The appropriate way to measure an abdominal aortic aneurysm is:
  - a. Inner wall to inner wall
  - b. Outer wall to outer wall
  - c. Anterior inner wall to posterior outer wall

OR

1. The appropriate cardiac view for assessing LVH is depicted in image:



# Evaluating the Contribution of Ultrasound to Overall Student Learning

- Key element to widespread acceptance of ultrasound in medical curricula
- More challenging than assessing individual student learning with ultrasound alone
- Ideally would involve comparing learning by traditional means to learning with ultrasound
- Similar to the issues that initially faced the incorporation of simulation into medical education

# Evaluating the Contribution of Ultrasound to Overall Student Learning

## Controlled Study of Comparative Performance on Gross Anatomy Multiple Choice Quiz

- 3 predefined dissection groups:
  - Group A: Anterior wall
  - Group B: Viscera
  - Group C: Posterior wall
- Half of each group randomly assigned to additional abdominal ultrasound exposure during abdominal dissection

# Controlled Study of Comparative Performance on Gross Anatomy Multiple Choice Quiz

- Performance on 25 question quiz compared
  - Questions from pre-existing test bank utilized in the usual fashion
  - Prior to test administration, Ultrasound and Gross Anatomy faculty reviewed quiz and identified 6 questions thought to be related to Ultrasound Concepts

# Controlled Study of Comparative Performance on Gross Anatomy Multiple Choice Quiz: Results

- Intervention group (n=53)
- Control group (n=50)

	Mean difference (+/- SD)	Significance
All 25 questions	0.786(+/-1.597)	ns
19 “non US” questions	0.397(+/- 0.96)	ns
6 “US” questions	0.355(+/-1.79)	P<0.1

- Multiple comparisons explored (US vs no US within and across dissection groups) without a clear pattern of significant differences (though in most comparisons US scores slightly higher)
- Additional comparisons planned controlling for overall Gross Anatomy grade



# Learning Objectives - *revisited*

- You should now
  - Understand the role of ultrasound as an adult learner centered, hands-on learning modality in pre-clinical medical education
  - Recognize the practical issues associated with implementing an ultrasound curriculum
  - Understand the role of the OSCE in assessing learning
  - Recognize the importance of ongoing work to demonstrate a contribution of ultrasound to overall learning