**Objectives of Training for the Core Emergency Ultrasound Curriculum**

**Physics and Knobology**

1. Describe the basic principles of the piezoelectric effect and the ability of ultrasound probes to both generate and detect sound waves
2. Understand the relationship between frequency, wavelength and resolution and its impact on an ultrasound image
3. Describe the ultrasound appearance of liquid, soft tissue, bone, and air
4. Understand gain and its effect on an ultrasound image
5. Select an appropriate probe for a particular ultrasound application
6. Describe and recognize common ultrasound artifacts (i.e. shadowing, refraction, posterior enhancement, mirroring)
7. Understand the difference between 2D and M-mode imaging
8. Understand color flow Doppler imaging
9. Describe safety and risk associated with ultrasound imaging

**Abdominal Aorta**

1. Describe the indications for performing an aorta scan
2. Select an appropriate probe for this scan
3. Identify key landmarks, including vertebral bodies, aorta, bifurcation into the iliac arteries, and IVC
4. Scan the aorta in short axis from the epigastrium to the bifurcation with visualization throughout
5. Describe methods to optimize visualization of the aorta if obscured by bowel gas
6. Demonstrate appropriate measurement of the maximal AP diameter of the aorta (outside wall to outside wall) and describe upper limit of normal diameter in cms
7. Appropriately and safely integrates findings of a negative, positive, or indeterminate scan into patient management

**Focused Assessment with Sonography in Trauma**

1. Identify free fluid in the abdomen and pelvis
2. Visualize and sweep the hepatorenal interface, splenorenal interface, sub-diaphragmatic space, and recto-uterine/recto-bladder space
3. Use ultrasound to identify ascites

**Focused Cardiac Ultrasound**

1. Generate the following cardiac views: subxiphoid, parasternal long axis, parasternal short axis, and apical 4 chamber
2. Identify cardiac standstill
3. Identify a pericardial effusion
4. Recognize that a plethoric IVC is an echo feature of cardiac tamponade
5. Assess gross left ventricular systolic function using visual estimation and E-point septal separation
6. Assess gross right ventricular function using visual estimation of RV size in relation to LV size
7. Generate images of the IVC

**Thoracic Ultrasound**

1. Generate images of the thorax and pleura
2. Identify pneumothorax
3. Identify pleural effusion and hemothorax
4. Identify pulmonary edema

**Intrauterine Pregnancy**

1. Identify an intrauterine pregnancy using a transabdominal approach in the patient presenting to the emergency department with symptomatic 1st trimester pregnancy
2. Identify a live intrauterine pregnancy
3. Identify an empty uterus
4. Identify an empty gestational sac
5. Identify free fluid/hemorrhage in the setting of ruptured ectopic pregnancy

**Resuscitation**

1. Integrate cardiac, thoracic and IVC ultrasound to assist in determining volume status and fluid tolerance
2. Integrate cardiac, thoracic and IVC ultrasound to differentiate between different types of shock (obstructive, cardiogenic, hypovolemic/distributive) and to guide patient management
3. Perform E-FAST as part of the primary survey

**Central Venous Line Placement**

1. Describe the indications and contraindications for inserting an ultrasound guided central venous catheter
2. Select an appropriate probe for guiding venous access
3. Describe the difference between the ultrasound appearance of an artery and a vein
4. Position the patient appropriately and accurately identify the internal jugular vein and carotid artery
5. Position the patient appropriately and accurately identify the common femoral vein and artery
6. Demonstrate sterile technique including the use of a sterile probe cover and sterile gel
7. Describe and demonstrate central venous catheter insertion using the Seldinger technique
8. Understand the difference between long axis (in plane) vs short axis (out of plane) ultrasound guidance
9. Understand the difference between the ultrasound appearance of the needle tip vs the needle shaft
10. Demonstrate clear visualization of the needle and needle tip on ultrasound at all times
11. Demonstrate clear visualization and guidance of the needle tip to a vascular target on an ultrasound phantom before attempting ultrasound guided central venous catheterization on an actual patient

**Peripheral Intravenous Placement**

1. Describe the indications and contraindications for inserting an ultrasound guided peripheral venous catheter
2. Position the patient appropriately and accurately identify the basilic vein, cephalic vein, and deep brachial veins
3. Select an appropriately sized catheter (i.e. adequate length) for ultrasound guided peripheral venous access