



Breast Sonography

The purpose of structured education is to provide the opportunity for individuals to develop mastery of discipline-specific knowledge that, when coupled with selected clinical experiences, helps to document qualifications. The *Structured Education Requirements for Breast Sonography* is provided to assist candidates with these requirements.

Candidates for breast sonography certification and registration must document at least 16 hours of structured education¹. The activities must be earned within the 24-month period immediately prior to submission of an application for certification and registration. Structured education activities may be academic courses from an institution accredited by a mechanism recognized by the ARRT², CE opportunities approved by a RCEEM or RCEEM+, or a combination of the two.

Structured education documentation must include at least one CE credit or its equivalent in each content category listed below (i.e., Patient Care, Image Production, and Procedures). The remaining hours may be earned from any one or more of the content areas. Specific topics within each category are addressed in the content outline, which makes up the remaining pages of this document.

Content Category	Minimum Credit Hours
Patient Care (includes) <i>Patient Interactions and Management</i>	1
Image Production (includes) <i>Basic Principles of Ultrasound</i> <i>Image Formation</i> <i>Evaluation and Selection of Representative Images</i>	1
Procedures (includes) <i>Anatomy and Physiology</i> <i>Pathology</i> <i>Breast Interventions</i>	1
Total	16

Acceptable Examples:

Example 1	Example 2	Example 3
Patient Care – 3 hours Image Production – 6 hours Procedures – 7 hours	Patient Care – 1 hour Image Production – 1 hour Procedures – 14 hours	Patient Care – 1 hour Image Production – 10 hours Procedures – 5 hours
TOTAL – 16 hours	TOTAL – 16 hours	TOTAL – 16 hours

1: If there is a structured education requirement document with a newer effective date, you may either use the new document or continue to use this document if you have completed at least one educational activity prior to the effective date of the new version. For more information access the online clinical experience tool, where structured education is also reported.

2: Activities meeting the definition of an approved academic course will be awarded credit at the rate of 12 CE credits for each academic **quarter** credit or 16 CE credits for each academic **semester** credit. See the ARRT *Continuing Education Requirements* document for additional information.



Patient Care

1. Patient Interactions and Management

- A. Patient Communication
 - 1. explanation of procedure
 - a. diagnostic ultrasound
 - b. screening ultrasound
 - 2. patient assessment
 - a. physical observations and symptoms (*e.g., breast changes, palpation findings, scarring)
 - b. medical history and clinical indications
 - 1. previous surgery
 - 2. previous imaging
 - 3. family history
 - 3. review and respond to inquiries regarding benefits and limitations of breast imaging studies
 - a. breast sonography
 - b. automated whole breast ultrasound
 - c. mammography
 - d. breast MRI
 - e. nuclear medicine (e.g., BSGI, PET/CT)
 - f. CT
 - 4. patient positioning
 - 5. explanation of findings and follow-up recommendations (ACR guidelines)
 - a. ACR BI-RADS®
 - b. tissue composition (breast density)
- B. Accreditation of Ultrasound Facilities and Personnel Certification Requirements
- C. Verification of Requested Examination
 - 1. determination of appropriate sequence of imaging studies
 - 2. correlation of imaging request to clinical indications for appropriateness
 - 3. correlation of other imaging with breast ultrasound
 - a. mammography
 - 1. quadrant (triangulation)
 - 2. depth
 - 3. size
 - 4. margin
 - b. breast MR
 - 1. quadrant
 - 2. depth
 - 3. size
 - 4. margin
 - c. CT
 - d. PET/CT

- D. Breast Cancer
 - 1. epidemiology
 - a. incidence
 - b. risk factors
 - 2. signs and symptoms
- E. Communication of Imaging to Supervising Physician (radiologist, surgeon)
 - 1. evaluation of echo patterns (e.g., anechoic, hypoechoic, hyperechoic, isoechoic)
 - 2. review of findings

*e.g., The abbreviation "e.g.," is used to indicate that examples are listed in parenthesis, but that is not a complete list of all possibilities.



Image Production

1. Basic Principles of Ultrasound

- A. Generation of Signal
 - 1. console
 - 2. monitor
 - 3. transducers
 - a. piezoelectric effect
 - b. components
 - c. resonance frequency
 - d. beam characteristics
(e.g., near zone/field, far zone)
 - e. focusing
 - f. types
- B. Ultrasound Wave Characteristics
 - 1. speed of sound (propagation speed)
 - 2. frequency
 - 3. reflection and refraction
 - 4. intensity of signal
 - 5. acoustic impedance
 - 6. attenuation coefficient
 - 7. pulsed
 - 8. Doppler
 - 9. specular reflectors
 - 10. amplitude
- C. Fundamentals
 - 1. relationship between speed of sound, frequency, and wavelength
 - 2. image resolution
 - a. axial
 - b. lateral
 - c. elevational
 - d. temporal
 - e. contrast (soft tissue)
 - 3. range equation
 - 4. dynamic range
 - 5. acoustic transmission media (e.g., gel)

2. Image Formation

- A. Selection and Adjustment of Technical Factors
 - 1. power
 - 2. focal zone
 - 3. field of view (depth)
 - 4. time-gain compensation (TGC)
 - 5. overall gain
 - 6. dynamic range
 - 7. harmonic imaging
 - 8. spatial compounding
- B. Safety
 - 1. sonographer ergonomics¹
 - a. equipment
 - b. work environment
 - c. sonographer body mechanics
 - 2. patient bioeffects
- C. Image Orientation and Transducer Manipulation
 - 1. superior and inferior
 - 2. lateral and medial
- D. Image Documentation (ACR Guidelines)
 - 1. patient identification
 - 2. laterality
 - 3. transducer orientation (e.g., radial or antiradial, transverse or longitudinal)
 - 4. clock position
 - 5. distance from the nipple
 - 6. lesion measurements
- E. Other Imaging Tools
 - 1. Doppler
 - a. color
 - b. power
 - 2. fremitus
 - 3. panoramic imaging
 - 4. stand-off pad
 - 5. cine loop

¹ Operator ergonomics is referenced in the "[Industry Standards for the Prevention of Work Related Musculoskeletal Disorders in Sonography.](#)"

(Image Production continues on the following page.)



Image Production (continued)

3. Evaluation and Selection of Representative Images

- A. Criteria for Diagnostic Quality
 - 1. demonstration of anatomic structure
 - 2. demonstration of pathologic conditions
 - 3. use of calipers
 - 4. improvement of suboptimal images
- B. Artifact Recognition
 - 1. posterior shadowing
 - 2. edge shadowing
 - 3. posterior enhancement
 - 4. reverberation
 - 5. color Doppler flash
 - 6. speed propagation
 - 7. ring-down
- C. Image Display and Storage
 - 1. post-processing
 - a. dynamic range
 - b. cine loop
 - c. gain
 - d. annotations and measurements
 - 2. PACS
- D. Evaluation of Sonographic Equipment and Accessories
 - 1. equipment quality control
 - a. sensitivity (e.g., contrast resolution, detection of lesion, dead zone)
 - b. vertical and horizontal distance accuracy
 - c. focal zone
 - d. resolution (e.g., lateral, axial)
 - e. TGC characteristics
 - f. overall gain
 - g. dynamic range
 - 2. recognition of equipment malfunctions
 - 3. clean, disinfect, and maintain equipment (e.g., transducers², keyboard, monitor, filters)

²Transducer infection control is referenced in the ["Guidelines for Infection Prevention and Control in Sonography: Reprocessing the Ultrasound Transducer."](#)



Procedures

1. Anatomy and Physiology

- A. Ducts
- B. Lobules
- C. Fibroglandular Tissue
- D. Fat
- E. Skin
- F. Cooper Ligament
- G. Fascia
- H. Pectoralis Muscle
- I. Ribs
- J. Pregnancy Induced Changes
- K. Nipple
 - 1. areola
 - 2. Montgomery glands
- L. Vascular System
- M. Lymphatic System
 - 1. axilla
 - 2. regional lymph nodes

2. Pathology

- A. Benign Conditions and Sonographic Features (e.g., echogenicity, posterior acoustic features)
 - 1. cyst
 - 2. galactocele
 - 3. sebaceous cyst
 - 4. fibroadenoma
 - 5. papilloma
 - 6. lipoma
 - 7. hamartoma
 - 8. abscess and inflammation
 - 9. traumatic changes
 - 10. fat necrosis
 - 11. ductal ectasia
 - 12. edema
 - 13. diabetic mastopathy
 - 14. pseudoangiomatous stromal hyperplasia (PASH)
 - 15. phyllodes tumor
 - 16. gynecomastia
 - 17. lymph nodes

- B. High Risk Conditions and Sonographic Features (e.g., echogenicity, posterior acoustic features)
 - 1. lobular carcinoma in situ (LCIS)
 - 2. atypical ductal hyperplasia (ADH)
 - 3. atypical lobular hyperplasia (ALH)
 - 4. papilloma with atypia
 - 5. radial scar
- C. Malignant Conditions and Sonographic Features (e.g., echogenicity, posterior acoustic features)
 - 1. ductal carcinoma in situ (DCIS)
 - 2. invasive ductal carcinoma
 - a. medullary carcinoma
 - b. mucinous (colloid) carcinoma
 - c. papillary carcinoma
 - d. tubular carcinoma
 - 3. invasive lobular carcinoma
 - 4. inflammatory carcinoma
 - 5. Paget disease
 - 6. phyllodes
 - 7. lymphoma
 - 8. metastasis
 - 9. metastatic lymph nodes

3. Breast Interventions

- A. Surgical Procedures*
 - 1. lumpectomy
 - 2. axillary dissection
 - 3. mastectomy
 - 4. augmentation
 - 5. reduction
 - 6. reconstruction
- B. Postoperative Breast Changes
 - 1. hematoma
 - 2. seroma
 - 3. surgical scarring
- C. Therapeutic Treatment Changes*
 - 1. chemotherapy
 - 2. hormonal therapy (e.g., antiestrogen therapy)
 - 3. post-radiation changes

*The breast sonographer is expected to have basic knowledge of these procedures and treatment changes.

(Procedures continues on the following page.)



Procedures (continued)

D. Image-Guided Breast Procedures

1. Fluid Aspiration (e.g., abscess, seroma, cyst)
2. Fine Needle Aspiration Biopsy
3. Needle Core Biopsy (e.g., spring-loaded)
4. Vacuum-Assisted Core Biopsy
5. Clip Placement
6. Needle/Wire Localization

FOCUS OF QUESTIONS

Questions about each of the procedures listed on the left may focus on any of the following factors:

- A. Explain Procedure, Risks, and Benefits
- B. Consent (e.g., informed, oral, implied)
- C. Select and Prepare Equipment
- D. Perform Time Out Procedure
- E. Position Patient
- F. Practice Infection Control and Prevention
 1. aseptic technique
 2. sharps disposal
 3. biohazard disposal (OSHA Guidelines)
- G. Assist with Procedure
- H. Communicate with Performing Physician
- I. Provide Post-Procedural Care and Instructions
- J. Hemostasis