Breast Sonography

The purpose of Continuing Qualifications Requirements (CQR) is to assist Registered Technologists to document their continued qualifications in the disciplines of certification and registration held. To accomplish this purpose, ARRT presents continuing qualifications requirements in three parts: the professional profile, the structured self-assessment (SSA), and continuing education (CE).

The purpose of the CQR Structured Self-Assessment is to assist Registered Technologists identify gaps in the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required for practice within the categories of certification and registration held and help direct their professional development efforts.

The *Structured Self-Assessment Content Specifications for Breast Sonography* is provided to assist breast sonographers during their CQR compliance period. Its purpose is to prepare breast sonographers for the SSA and to help education providers develop coursework for the breast sonographers who need to address specified areas with targeted continuing education. ARRT assigns targeted CE only if a standard is not met in a category on the SSA.

The SSA is composed of sets of questions that are designed to evaluate an individual's knowledge in topics related to current practice. Participants have a maximum of 70 minutes to complete the SSA. Please allow an additional eight minutes for the tutorial, two minutes for the non-disclosure agreement (NDA), and 10 minutes for the survey.

The table below presents the major categories and subcategories covered on the SSA. The number of questions in each category are listed in bold and number of questions in each subcategory in parentheses. The potential number of targeted CE credits that would be prescribed if the standard is not met, are across from each subcategory, with the maximum amount listed at the bottom. Specific topics within each category are addressed in the content outline, which makes up the remaining pages of this document.

Content Category	Number of Questions	Potential CE Credits
Patient Care	**10**	
Patient Interactions and Management (10)		3
Image Production	**30**	
Basic Principles of Ultrasound (10)		6
Image Formation (10)		7
Evaluation and Selection of Representative Images (10)		7
Procedures	**30**	
Anatomical Layers and Breast Tissues (10)		3
Pathology and Sonographic Features (10)		6
Breast Interventions and Other Imaging (10)		2
	Total 70	**Maximum CE 34**

Patient Care

1. Patient Interactions and Management

A. Patient Communication
   1. explanation of procedure
      a. diagnostic ultrasound
      b. screening ultrasound
   2. patient assessment
      a. external appearance
         1. normal findings (e.g.,* hemangioma, skin tags/moles, tattoos, scarring)
         2. abnormal findings (e.g., nipple retraction, skin changes)
      b. patient symptoms/clinical indications
         1. nipple discharge/changes
         2. palpable lump
         3. focal pain
      c. medical history
         1. previous surgery
         2. previous imaging
         3. family history
         4. breast trauma
   3. review and respond to inquiries regarding benefits and limitations of breast imaging studies
      a. breast sonography
      b. automated whole-breast ultrasound
      c. mammography (2D, DBT)
      d. breast MRI
   4. patient positioning
   5. explanation of findings and follow-up recommendations (ACR guidelines)
      a. ACR BI-RADS®
      b. breast density (tissue composition)

B. Facility Requirements
   1. breast imaging center accreditation
   2. ultrasound personnel qualifications (e.g., training, education)

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 MRI
         1. quadrant
         2. depth
         3. size
         4. margin
      c. CT
      d. positron emission tomography (PET/CT)
      e. automated whole-breast ultrasound

D. Breast Cancer
   1. epidemiology
      a. incidence
      b. inherent risk factors
         1. female sex assigned at birth (e.g., menarche, menopause, nulliparity, primiparity)
         2. age
         3. personal history of cancer (e.g., breast, ovarian, lung)
         4. genetic risk (e.g., family history, gene mutations)
         5. previous chest radiation
         6. breast tissue density (tissue composition)
      c. social risk factors
         1. lifestyle (e.g., tobacco use, body weight, excessive alcohol use)
         2. access to care / health disparity
         3. hormone use (e.g., HRT, birth control, gender transition)

E. Communication of Imaging to Supervising Physician (radiologist, surgeon)
   1. description of findings using appropriate terminology (e.g., echo patterns, size/shape, vascularity, location)
   2. review of findings (e.g., in person, remote, teleradiology)

*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. monitors
   3. transducers
      a. piezoelectric effect
      b. components
      c. resonance frequency
      d. beam characteristics (e.g., near zone/field, far zone)
      e. focusing (e.g., electronic, beam)
      f. types (e.g., curved, linear)

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. scatter (specular/nonspecular reflection)
   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)

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

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 ergonomics[1]
      a. equipment (e.g., monitor level, table height)
      b. work environment (e.g., lighting, placement of accessories)
      c. body mechanics (e.g., transducer contact pressure, posture)
   2. patient bioeffects

C. Image Orientation and Transducer Manipulation
   1. superior and inferior
   2. lateral and medial

D. Image Documentation (ACR Practice Parameters)
   1. manual or automated annotation
      a. patient identification
      b. laterality
      c. transducer orientation (e.g., radial or antiradial, transverse or longitudinal)
      d. clock position
      e. distance from the nipple
   2. lesion measurement

E. Image Optimization
   1. manual image optimization
      a. Doppler
         1. color
         2. power
      b. fremitus
      c. panoramic imaging (extended field of view)
      d. stand-off pad
      e. cine loop
      f. beam steering
      g. static elastography (mechanical compression)
   2. automated imaging optimization (e.g., automated technical factor selection)

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 (diagnostic versus nondiagnostic value)
   1. posterior shadowing
   2. edge shadowing
   3. posterior enhancement
   4. reverberation
   5. color Doppler flash
   6. speed propagation
   7. mirror artifact
   8. implant rupture artifacts (e.g., snowstorm, stepladder)

C. Image Display and Storage
   1. postprocessing
      a. cine loop
      b. overall gain
   2. PACS (MIMPS)

D. Maintenance of Sonographic Equipment and Accessories
   1. sonographer quality assurance tasks
      a. clean filters
      b. visual check (e.g., cords, transducer)
      c. infection control (e.g., exam table, transducer disinfection[2])
      d. console cleanliness (e.g., gel buildup, dust)
   2. recognition of equipment malfunctions (e.g., transducer dropout, trackball)

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

Procedures

1. Anatomical Layers and Breast Tissues

A. Breast Anatomy
   1. skin
   2. fat
   3. fibroglandular tissue
   4. pectoralis muscle
   5. ribs

B. Fascia
   1. superficial fascia
   2. deep fascia

C. Nipple
   1. areola
      a. Montgomery glands
      b. Morgagni tubercles
      c. lactiferous sinus

D. Blood Flow
   1. normal blood flow
   2. artery versus vein

E. Lymph Nodes
   1. axillary
   2. internal mammary
   3. intramammary
   4. supraclavicular

F. Other Breast Components
   1. ducts
   2. lobules
   3. Cooper ligaments

2. Pathology and Sonographic Features[3]

A. Benign Conditions
   1. cyst (e.g., simple, complex, complicated)
   2. sebaceous cyst
   3. fibroadenoma
   4. papilloma
   5. lipoma
   6. hamartoma
   7. abscess and inflammation
   8. hematoma
   9. oil cyst
   10. fat necrosis
   11. duct ectasia
   12. edema
   13. diabetic mastopathy
   14. pseudoangiomatous stromal hyperplasia (PASH)
   15. gynecomastia
   16. lymph nodes
   17. pregnancy-induced changes (e.g., galactocele, prominent ducts, lactating adenoma)
   18. pseudoaneurysm

B. Benign with Upgrade Potential
   1. lobular carcinoma in situ (LCIS)
   2. atypical ductal hyperplasia (ADH)
   3. atypical lobular hyperplasia (ALH)
   4. papilloma with atypia
   5. radial scar
   6. phyllodes tumor

C. Malignant Conditions
   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. lymphoma
   7. metastasis
   8. metastatic lymph nodes

[3] The breast sonographer is expected to describe sonographic and pathologic features according to the ACR BI-RADS® lexicon manual including shape, orientation, margin, echo pattern, and posterior features.

Procedures (continued)

3. Breast Interventions and Other Imaging

A. Surgical Procedures*
   1. lumpectomy (e.g., benign surgical excision, breast conservation surgery)
   2. axillary dissection
   3. mastectomy (with/without reconstruction)
   4. augmentation
   5. reduction

B. Postoperative Breast Changes
   1. hematoma
   2. seroma
   3. surgical changes (e.g., fat necrosis, oil cysts, lumpectomy scarring)

C. Therapeutic Treatment Changes*
   1. chemotherapy (neoadjuvant and adjuvant)
   2. hormonal therapy (e.g., antiestrogen therapy)
   3. postradiation changes

D. Other Breast Ultrasound Imaging
   1. whole-breast ultrasound (implant integrity)
   2. supplemental screening for dense tissue
   3. identification of multifocal/multicentric disease (post breast cancer diagnosis)
   4. second look following MRI

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

Procedures (continued)

E. Image-Guided Breast Procedures

1. fluid aspiration (e.g., abscess, seroma, cyst)
2. fine needle aspiration
3. needle core biopsy (e.g., spring-loaded)
4. vacuum-assisted core biopsy
5. clip placement
6. needle localization
   a. wire
   b. non-wire (radar/radiofrequency, magnetic, radioactive seed)

FOCUS OF QUESTIONS

Questions about a specific study or procedure may address any of the following factors:

- Explain Procedure, Risks, and Benefits
- Consent (e.g., informed, oral, implied)
- Select and Prepare Equipment
- Perform Time-Out Procedure
- Position Patient
- Practice Infection Control and Prevention
  - aseptic technique
  - sharps disposal
  - biohazard disposal (OSHA Guidelines)
- Assist with Procedure
- Communicate with Performing Physician
- Provide Postprocedural Care and Instructions
- Hemostasis