Mammography

The purpose of Continuing Qualifications Requirements (CQR) is to assist Registered Technologists to document their continued qualifications in the categories of certification and registration held. To accomplish this purpose, ARRT presents the 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 Mammography* is provided to assist mammographers during their CQR compliance period. Its purpose is to prepare mammographers for the SSA and to help education providers develop coursework for the mammographers 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 40 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 a follow-up 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	**10**	
Image Acquisition and Quality Assurance (10)		5
Procedures	**20**	
Anatomy, Physiology, and Pathology (10)		5
Mammographic Positioning and Procedures (10)		7
	Total 40	**Maximum CE 20**

Patient Care

1. Patient Interactions and Management

A. Patient Communication
   1. pre-exam instructions (*e.g., removal of deodorant, clothing)
   2. explanation of mammographic imaging
      a. establish patient rapport
      b. provide psychological and emotional support (e.g., anxiety, modesty)
      c. address physical and mental needs
      d. explain need for repeat imaging (e.g., motion, artifact)
   3. patient education
      a. American Cancer Society (ACS) and American College of Radiology (ACR) guidelines for mammography screening
      b. ACS recommendations for breast self-examination (BSE)
      c. ACS recommendations for clinical breast examination (CBE)
      d. typical patient dose
      e. breast imaging modalities (e.g., DBT/3D, 2D, ultrasound)
   4. patient results
      a. process for receiving results (e.g., telephone, mail, electronic chart access)
      b. reason(s) for additional imaging
      c. clinician's role in explaining results and findings (e.g., breast density reporting, diagnostic mammogram)

B. Patient Assessment (risks for breast cancer; implication for imaging)
   1. epidemiology of breast cancer
      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)
   2. signs and symptoms
      a. pain
      b. lump
      c. nipple discharge
      d. skin changes
         1. thickening
         2. erythema
         3. dimpling
      e. nipple and areolar changes
      f. edema
   3. review and documentation of medical history and physical findings
      a. imaging request (e.g., physician orders)
      b. previous breast surgery (e.g., lumpectomy, augmentation)
      c. clinical findings (e.g., lumps, scars, moles, tattoos, abnormalities)
      d. gender affirmation (e.g., surgery, hormonal therapy)
   4. previous mammograms
      a. importance of having prior images available
      b. review prior to exam

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

(Patient Care continues on the following page.)

Patient Care (continued)

C. Breast Cancer Treatment Options[1]
   1. surgical options
      a. lumpectomy / breast-conserving surgery
      b. sentinel axillary node biopsy
      c. simple (total) mastectomy
      d. modified radical mastectomy
      e. prophylactic mastectomy
   2. nonsurgical options
      a. radiation therapy
      b. chemotherapy
      c. hormone therapy (antiestrogen therapy)
         1. hormone receptor status (ER+/-)
         2. hormone receptor status (PR+/-)
         3. anti-HER2/neu therapy
   3. implant reconstruction

[1] The mammographer is expected to understand the definitions and basic descriptions of these terms.

Image Production

1. Image Acquisition and Quality Assurance

A. Design Characteristics of Mammography Units
   1. kVp range
   2. mammography tube (e.g., anode, filtration, window, focal spot)
   3. compression paddles (e.g., fixed, flexed, curved, spot, implant)
   4. grids
   5. system geometry (e.g., SID, OID, magnification)

B. Digital Acquisition, Display, and Informatics
   1. acquisition type
      a. full-field digital mammography-direct radiography (FFDM-DR/2D)
      b. digital breast tomosynthesis (DBT/3D)
      c. synthesized imaging
   2. image receptors
   3. monitors
      a. acquisition workstation
      b. radiologist interpretation workstation
   4. digital image display and informatics
      a. medical record
         1. HIS/RIS
         2. EMR
      b. PACS
         1. storage and retrieval of data
         2. backup and archive
         3. troubleshooting
   5. computer-aided detection (CAD)

C. Quality Assurance and Evaluation
   1. accreditation bodies and certifying agencies (e.g., ACR, FDA)
      a. purpose
      b. process
      c. frequency
   2. MQSA regulations
      a. personnel requirements
      b. recordkeeping (e.g., assessment categories, image ID and labeling, maintenance of images and reports, communication of results to providers and patient)
      c. medical outcomes audit
      d. required policies (e.g., infection control, consumer complaint)
      e. Enhancing Quality Using the Inspection Program (EQUIP)
         1. quality assurance (clinical image corrective action)
         2. clinical image quality
         3. quality control oversight
      f. breast density reporting requirements

(Image Production continues on the following page.)

Image Production (continued)

D. Quality Control[2]
   1. mammographer tests
      a. phantom image
         1. quality
         2. artifact
      b. compression thickness
      c. visual checklist
      d. acquisition and radiologist workstation monitors
         1. monitor cleanliness
         2. monitor calibration and test pattern (e.g., SMPTE, TG18)
      e. repeat analysis
      f. viewing conditions
      g. compression force
      h. manufacturer detector calibration

FOCUS OF QUESTIONS

- Purpose
- Frequency
- Equipment and Procedure
- Performance Criteria
- Evaluation and Documentation
- Corrective Action

   2. medical physicist tests
      a. mammographic equipment evaluation
      b. collimation assessment
      c. system resolution tests
         1. spatial resolution
         2. modulation transfer function (MTF)
      d. low-contrast performance tests
         1. signal-to-noise (SNR)
         2. contrast-to-noise (CNR)
      e. automatic exposure control system performance
      f. artifact evaluation
      g. phantom image quality evaluation
      h. kVp accuracy and reproducibility
      i. beam quality assessment (half-value layer)
      j. average glandular dose
      k. room illuminance
      l. evaluation of technologists' quality control program
      m. application of compression
      n. compression paddle alignment
      o. acquisition and radiologist interpretation workstation QC

FOCUS OF QUESTIONS

- Purpose
- Frequency

[2] The Quality Control (QC) tests for the mammographer and the medical physicist tests listed are referenced in the 2018 ACR Digital Mammography Quality Control Manual. The mammographer is expected to have a detailed understanding of all the mammographer QC tests and a basic understanding of the medical physicist QC tests.

(Image Production continues on the following page.)

Image Production (continued)

E. Mammographic Technique and Image Evaluation

1. technical factors
   a. kVp
   b mAs
   c. automatic exposure
   d. manual exposure
   e. compression thickness
   f. target/filter
   g. focal spot
   h. grids
   i. magnification
   j. labeling

2. evaluation of image quality
   a. EQUIP
      1. positioning
      2. compression
      3. exposure
      4. contrast
      5. sharpness
      6. noise artifacts
      7. exam ID
   b. patient-related artifacts (e.g. motion, clothing, anatomy, implanted devices)

Procedures

1. Anatomy, Physiology, and Pathology

A. Localization Terminology
   1. clock position
   2. quadrants
   3. triangulation

B. External Anatomy
   1. breast margins
   2. nipple
   3. areola
      a. Morgagni tubercles
      b. Montgomery glands
   4. angle of pectoral muscle
   5. skin
      a. sebaceous glands
      b. sweat glands
      c. hair follicles
   6. axillary tail
   7. inframammary fold

C. Internal Anatomy
   1. fascial layers
   2. retroglandular space
   3. fibrous tissues
   4. glandular tissues
      a. lobules
      b. terminal ductal lobular unit (TDLU)
         1. extralobular terminal duct
         2. intralobular terminal duct
         3. acinus (ductal sinus)
   5. adipose tissues
   6. Cooper ligaments
   7. pectoral muscle
   8. vascular system
   9. lymphatic system

D. Cytology
   1. epithelial cells
   2. myoepithelial cells
   3. basement membrane

E. Pathology
   1. mammographic appearance and reporting terminology (BI-RADS®)
      a. architectural distortion
      b. asymmetry and focal asymmetry
      c. characteristics of masses
         1. shape
            (e.g., round, irregular)
         2. margin
            (e.g., circumscribed, indistinct, spiculated)
         3. density
      d. characteristics of calcifications
         1. typically benign
            (e.g., skin, vascular, coarse, milk of calcium, dystrophic)
         2. suspicious morphology
            (e.g., amorphous, heterogeneous, fine pleomorphic)
         3. distribution
            (e.g., diffuse, grouped, linear)
      e. BI-RADS® categories
         1. mammographic assessment
         2. breast density
            (e.g., entirely fatty, heterogeneously dense)
      f. recommendations
   2. benign pathology and mammographic appearance
      a. cyst
      b. galactocele
      c. fibroadenoma
      d. lipoma
      e. hamartoma
      f. papilloma
      g. duct ectasia
      h. hematoma
      i. abscess and inflammation
      j. fat necrosis
      k. lymph nodes
      l. gynecomastia
      m. edema
      n. seroma
   3. benign with upgrade potential pathology and mammographic appearance
      a. lobular carcinoma in situ (LCIS)
      b. atypical ductal hyperplasia (ADH)
      c. atypical lobular hyperplasia (ALH)
      d. papilloma with atypia
      e. flat epithelial atypia
      f. radial scar
      g. phyllodes tumor
   4. malignant pathology and mammographic appearance
      a. ductal carcinoma in situ (DCIS)
      b. invasive/infiltrating ductal carcinoma (IDC)
      c. invasive lobular carcinoma
      d. inflammatory carcinoma
      e. Paget disease of the breast
      f. sarcoma
      g. lymphoma
      h. metastatic lesions

Procedures (continued)

2. Mammographic Positioning[3] and Procedures

A. Views
   1. craniocaudal (CC)
   2. mediolateral oblique (MLO)
   3. mediolateral (ML)
   4. lateromedial (LM)
   5. exaggerated craniocaudal (XCCL, XCCM)
   6. cleavage (CV)
   7. axillary tail (AT)
   8. tangential (TAN)
   9. rolled (RL, RM, RS, RI)
   10. implant displaced (ID)
   11. nipple in profile
   12. anterior compression
   13. spot compression
   14. magnification

B. Patient Variance
   1. chest wall variations (e.g., pectus excavatum, pectus carinatum)
   2. irradiated breast
   3. reduction mammoplasty
   4. postsurgical breast
   5. male sex assigned at birth
   6. kyphotic/lordotic patients
   7. protruding abdomen
   8. implanted devices (e.g., pacemaker, port)
   9. breast augmentation (e.g., implants, injections)
   10. lactating breast
   11. extremely large/small breast (e.g., mosaic, tiling, paddle selection)

C. Imaging Examinations
   1. mammography
      a. screening
      b. diagnostic
   2. breast ultrasound[4]
   3. breast MRI[4]

D. Interventional Procedures[4]
   1. patient preparation
      a. pertinent history (e.g., anticoagulation, allergies)
      b. informed consent
      c. time-out procedure
      d. procedure setup
      e. postprocedure instructions
   2. procedures
      a. biopsy
         1. stereotactic (upright or prone)
         2. ultrasound
      b. needle localization (wire)
   3. procedure-associated imaging
      a. surgical specimen
      b. stereotactic specimen
         1. intraprocedural (real-time)
         2. post core needle biopsy
      c. localization
      d. clip placement
   4. handling and disposing of biohazardous materials
      a. biopsy specimens
      b. body fluids
      c. sharps and biopsy supplies

[3] The mammographer is expected to know positioning as presented in the ACR *Mammography Quality Control Manual-Clinical Image Quality* (1999). Approximately six items in this section will cover the standard views (CC and MLO).

[4] The mammographer is expected to have the basic knowledge of these examinations and procedures.