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| **Rotation:** Breast imaging | **Duration:** 4 weeks | **Month(s): 3** |
| **Institution: Stanford** | **Call Responsibility: night float covers specimens after 6 pm** | **Night(s): none** |
| **Responsible Faculty Member(s):**Debra Ikeda, MDSunita Pal, M.D.Jafi Lipson, MDJennifer Kao, MD | **Location:** Cancer Center Reading Room #1220Reading Room #1206  |
| **Phone Numbers:**Room #1220: 6-7678 or 6-7214Room #1206: 6-0797 or 6-1702 |
| **Technologists/Technical Staff:**Charlotte Foster R.T. | **Training Level:** Years 1, 2, 3 |
| **Goals & Objectives****T**he Breast Imaging rotations provide you with an introduction to full field digital mammography, screening mammography, diagnostic mammography, computer-aided detection, breast ultrasound and interventional procedures, including needle localization prior to surgical biopsy, stereotactic core biopsy, ultrasound guided biopsies, breast MRI and MRI-guided biopsies. An extensive set up documents has been prepared by our service covering how to do specific procedures, what protocols are used, JCAHO expectations, VR Radwhere, and other detailed instructions. These materials also include a resident test with answers. The complete Breast imaging resident manual is available from the Breast Imaging section Administrative Assistant, T.J. Mims (tmims@stanford.edu phone 3-8462).Mammography is governed by the Mammography Quality Standards Act (MQSA), passed by Congress in 1992 and enforced since October, 1994. Most of our daily procedures and all of our outcome tracking are based on this FDA-enforced Act. We are inspected yearly by the FDA and State of California. |

**WHAT TO DO DURING THE BREAST IMAGING ROTATION**

* The Resident completes the tasks that are outlined in the Resident Monthly Overview Checklist (see Breast imaging resident manual).
* The Resident previews screening mammograms, goes over the cases, and dictates them. He or she does not take down films off of any alternator unless asked to do so.
* The Resident reviews outside mammograms and ultrasounds, and dictates them.
* The Resident reviews diagnostic mammograms, directs work-up with additional views, and performs breast ultrasound. If the Resident is a male, a woman must accompany him into the ultrasound examining room.
* The Resident participates in breast biopsy procedures and dictates them.
* Friday morning the Resident may help prepare cases for Breast Tumor Board. The Resident may accompany the Fellow to the Oncology day Care Center from 10:00-12:00, if time and staffing permits.

Dictation of all scheduled examinations **and** completion of all work left in the mammography reading room must be finished before the end of each working day.

All **abnormal screening** examinations require that an Abnormal Fax Sheet be sent to the referring physician **on the day the mammogram** is read. These FAX forms should be placed on the Mammography Reading Room door in a HIPAA-compliant fashion.

All **abnormal diagnostic** examinations recommending a biopsy require a communication to the referring physician (or his/her nurse or medical assistant) the day of the mammogram.

Specific goals and objectives for EACH rotation are listed below.

**Rotation 1: First Year**

**Patient Care**

***Knowledge-Based Objectives***

* Develop imaging interpretation skills and demonstrate progress during subsequent rotations.
* Correlate and manage clinical and imaging findings on patients with breast problems, report significant or unexpected findings to referring physicians.
* Develop appropriate diagnostic treatment plan based on the clinical presentation, imaging findings, and prior imaging.
* Demonstrate sufficient knowledge of breast disease and its application to imaging findings to generate meaningful differential diagnoses and patient management plan.
* Oversee customized breast imaging workups.
* Counsel patients concerning imaging findings.
* Perform exams responsibly and safely, assuring that the correct exam is performed.
* Develop percutaneous breast biopsy skills.
* Help prepare cases for multidisciplinary tumor board.

***Skills***

* Learn to perform a simple cyst aspiration
* Learn to perform a simple x-ray-guided needle localization
* Learn US biopsy techniques using a phantom
* How to perform a simple breast ultrasound
* How to pull up and review breast MRI
* How to manage a diagnostic workup
* RAD/PATH correlation

***Behavior and Attitude Objectives:***

* Work with the health care team in a professional manner to provide patient centered care, and
* Notify referring clinician for urgent, emergent, or unexpected findings, and document in dictation.

**Medical Knowledge**

***Knowledge-Based Objectives***

* Epidemiology
* Breast anatomy, pathology, and physiology
* Screening mammography
* Mammographic equipment and technique
* Mammographic interpretation
* Problem solving mammography
* How to correlate mammograms, ultrasound, and MRI
* **Required reading First Rotation:**
	+ - BIRADS Lexicon book
		- Ikeda, *Breast Imaging: The Requisites* (chapters 1-5)
		- Tabar’s Atlas of Calcifications

***Skills and Assessment***

* Written test for Breast Imaging Section – to be done at beginning and end of rotation.
* Take graduated responsibility in performing radiologic procedures.
* Attend didactic resident lectures and case conferences.
* Create teaching file cases.
* Prepare 10-15 minute presentation on a breast imaging topic during each rotation.

***Behavior and Attitudes***

* Recognize limitations of personal competency and ask for guidance when appropriate

**Interpersonal and Communication**

***Knowledge-Based Objectives***

* Provide a clear report based on BIRADS lexicon
* Provide direct communication to referring physicians, and documenting communication in report.
* Demonstrate skills in obtaining informed consent, including effective communication to patients of the risks, benefits, complications, and alternatives to the procedure.
* Demonstrate the verbal and non-verbal skills necessary for face-to-face listening and speaking to patients, physicians, families, and support personnel.

***Skills***

* Participation as an active member for the Radiology team by communicating with clinicians face-to-face, providing consults, answering phones, problem solving and decision-making.
* Act as a contact person for technologists and nurses in managing patient and imaging issues.
* Practice experience in dictating radiological reports.

***Behavior and Attitudes***

* Work with the health care team in a professional manner to provide patient centered care, and
* Notify referring clinician for urgent, emergent, or unexpected findings, and document in dictation.

**Professionalism**

***Knowledge-Based Objectives*:**

* Discussion of issues stated under Professionalism Skills during daily clinical work.
* Training programs on harassment and discrimination.
* Participation in hospital-based educational activities.

***Skills***

* Demonstrate compassion (be understanding and respectful of patients, their families, and medical colleagues).
* Demonstrate excellence in performing responsibilities in a professional manner.
* .
* Demonstrate knowledge of issues of impairment.
* Demonstrate positive work habits, including punctuality and professional appearance.
* Demonstrate the broad principles of biomedical ethics.
* Demonstrate principles of confidentiality with all information transmitted during a patient encounter (HIPAA compliance).

***Behavior and Attitudes***

* Demonstrate honesty with patients and staff.
* Demonstrate sensitivity without prejudice on the basis of religious, ethnic, sexual or educational differences, and without employing sexual or other types of harassment
* Respect, compassion, integrity, and responsiveness to patient care needs that supersede self-interest.

**Practice-based Learning and Improvement**

***Knowledge-Based Objectives***

* Participate in Journal Club, clinical conferences, and independent learning.
* Learn about MQSA-directed mammographic audit and Quality Control.

***Skills***

* Analyze and develop improvement plans in the clinical practice, including knowledge, observation, and procedural skills.
* Demonstrate knowledge and application of the principles of evidence-based medicine in practice.
* Demonstrate clinical assessment of the scientific literature.
* Help teach medical students, peers, and other healthcare professionals.

***Behavior and Attitude Objectives:***

* Incorporate formative feedback into daily practice, positively responding to constructive criticism
* Follow-up interesting or difficult cases without prompting and share this information with appropriate faculty and fellow residents.

**Systems-based Practice**

***Knowledge-Based Objectives***

* Demonstrate ability to design cost-effective care plans.
* Demonstrate knowledge of funding sources
* Demonstrate knowledge of reimbursement methods.
* Demonstrate knowledge of the regulatory environment.
* Demonstrate knowledge of basic management principles such as budgeting, record keeping, medical records, and the recruitment, hiring, supervision, and management of staff.

***Skills***

* Review of literature, including ACR Appropriateness Criteria
* Attendance and participation in multi-disciplinary conference
* Interaction with department administrators.
* Membership and participation in local and national radiological societies

***Behavior and Attitude Objectives:***

* Advocate for quality patient care in a professional manner, particularly concerning imaging utilization issues

**SECOND ROTATION:**

**Patient Care**

***Knowledge-Based Objectives***

* Pre-Call Goals:
* Learn how to address breast abscesses. Breast infections require breast ultrasound to rule out an abscess.
* Know how to evaluate a breast surgery specimen radiograph and what is entailed in proper communication.
* Patients with problems after hours concerning breast biopsy complications should be referred to the physician ordering their procedure and/or referred to the Emergency Department.
* Improve imaging interpretation skills and demonstrate progress during subsequent rotation.
* Correlate and manage clinical and imaging findings on patients with breast problems, report significant or unexpected findings to referring physicians.
* Develop appropriate diagnostic treatment plan based on the clinical presentation, imaging findings, and prior imaging.
* Demonstrate sufficient knowledge of breast disease and its application to imaging findings to generate meaningful differential diagnoses and patient management plan.
* Oversee customized breast imaging workups.
* Counsel patients concerning imaging findings.
* Perform exams responsibly and safely, assuring that the correct exam is performed.
* Develop percutaneous breast biopsy skills.
* Help prepare cases for multidisciplinary tumor board.

***Skills***

* Continue to develop US biopsy skills
* How to perform ultrasound-guided core biopsies and fine-needle aspirations
* How to perform stereotactic core biopsy
* RAD/PATH correlation (continued)

***Behavior and Attitude Objectives:***

* Work with the health care team in a professional manner to provide patient centered care, and
* Notify referring clinician for urgent, emergent, or unexpected findings, and document in dictation.

**Medical Knowledge**

***Knowledge-Based Objectives***

* Reading: Ikeda, *Breast Imaging Requisites*; Chapters 6-10
	+ - Selections from Tabar’s Atlas of Calcifications
		- Stavros, *Breast Ultrasound*
		- Liberman & Morris, *Breast MRI*
* Continued interpretation of digital/analog mammography, ultrasound, and MRI
* Mammographic equipment and techniques
* Mammographic reporting and medical legal aspects of mammography
* Patient management principles
* Correlation of breast pathology to imaging biopsy procedures (QA)

***Skills***

* Continue to develop US biopsy skills
* How to perform ultrasound-guided core biopsies and fine-needle aspirations
* How to perform stereotactic core biopsy
* RAD/PATH correlation (continued)

***Behavior and Attitudes*:**

* Recognize limitations of personal competency and ask for guidance when appropriate

**Interpersonal and Communication**

***Knowledge-Based Objectives***

* Provide a clear report based on BIRADS lexicon
* Provide direct communication to referring physicians, and documenting communication in report.
* Demonstrate skills in obtaining informed consent, including effective communication to patients of the risks, benefits, complications, and alternatives to the procedure.
* Demonstrate the verbal and non-verbal skills necessary for face-to-face listening and speaking to patients, physicians, families, and support personnel.

***Skills***

* Participation as an active member for the Radiology team by communicating with clinicians face-to-face, providing consults, answering phones, problem solving and decision-making.
* Act as a contact person for technologists and nurses in managing patient and imaging issues.
* Practice experience in dictating radiological reports.

***Behavior and Attitudes***

* Work with the health care team in a professional manner to provide patient centered care, and
* Notify referring clinician for urgent, emergent, or unexpected findings, and document in dictation.

**Professionalism**

***Knowledge-Based Objectives*:**

* Discussion of issues stated under Professionalism Skills during daily clinical work.
* Training programs on harassment and discrimination.
* Participation in hospital-based educational activities.

***Skills***

* Demonstrate compassion (be understanding and respectful of patients, their families, and medical colleagues).
* Demonstrate excellence in performing responsibilities in a professional manner.
* .
* Demonstrate knowledge of issues of impairment.
* Demonstrate positive work habits, including punctuality and professional appearance.
* Demonstrate the broad principles of biomedical ethics.
* Demonstrate principles of confidentiality with all information transmitted during a patient encounter (HIPAA compliance).

***Behavior and Attitudes***

* Demonstrate honesty with patients and staff.
* Demonstrate sensitivity without prejudice on the basis of religious, ethnic, sexual or educational differences, and without employing sexual or other types of harassment
* Respect, compassion, integrity, and responsiveness to patient care needs that supersede self-interest.

**Practice-based Learning and Improvement**

***Knowledge-Based Objectives***

* Participate in Journal Club, clinical conferences, and independent learning.
* Learn about MQSA-directed mammographic audit and Quality Control.

***Skills***

* Analyze and develop improvement plans in the clinical practice, including knowledge, observation, and procedural skills.
* Demonstrate knowledge and application of the principles of evidence-based medicine in practice.
* Demonstrate clinical assessment of the scientific literature.
* Help teach medical students, peers, and other healthcare professionals.

***Behavior and Attitude Objectives:***

* Incorporate formative feedback into daily practice, positively responding to constructive criticism
* Follow-up interesting or difficult cases without prompting and share this information with appropriate faculty and fellow residents.

**Systems-based Practice**

***Knowledge-Based Objectives***

* Demonstrate ability to design cost-effective care plans.
* Demonstrate knowledge of funding sources
* Demonstrate knowledge of reimbursement methods.
* Demonstrate knowledge of the regulatory environment.
* Demonstrate knowledge of basic management principles such as budgeting, record keeping, medical records, and the recruitment, hiring, supervision, and management of staff.

***Skills***

* Review of literature, including ACR Appropriateness Criteria
* Attendance and participation in multi-disciplinary conference
* Interaction with department administrators.
* Membership and participation in local and national radiological societies

***Behavior and Attitude Objectives:***

* Advocate for quality patient care in a professional manner, particularly concerning imaging utilization issues

**THIRD ROTATION: YEAR THREE**

**Medical Knowledge and Patient Care**

***Knowledge-Based Objectives***

* Review previous *Requisites* chapters; also:
	+ - Selections from Tabar’s Atlas of Calcifications
		- Stavros, *Breast Ultrasound*
		- Liberman & Morris, *Breast MRI*
* Review patient management
* Run the breast imaging service, with oversight
* Correlate mammo/US/MRI
* Review medical legal issues
* Participate in Breast Cancer Tumor Board (Friday 10 AM, Cancer Center)
* Mammographic quality control
* Therapeutic considerations

**Additional Recommended Reading:**

* Lawrence Bassett and Valerie P. Jackson (book)
* Gilda Cardenosa – *Breast Imaging Companion*
* Robin L. Birdwell – *The Pocket Radiologist/Breast Imaging* (book)
* American College of Radiology – *BI-RADS - Mammography*

***Skills***

* Interventional procedures
* Breast MRI and MRI-guided biopsy

***Behavior and Attitude Objectives:***

* Work with the health care team in a professional manner to provide patient centered care, and
* Notify referring clinician for urgent, emergent, or unexpected findings, and document in dictation.
* Recognize limitations of personal competency and ask for guidance when appropriate

**Interpersonal and Communication**

***Knowledge-Based Objectives***

* Provide a clear report based on BIRADS lexicon
* Provide direct communication to referring physicians, and documenting communication in report.
* Demonstrate skills in obtaining informed consent, including effective communication to patients of the risks, benefits, complications, and alternatives to the procedure.
* Demonstrate the verbal and non-verbal skills necessary for face-to-face listening and speaking to patients, physicians, families, and support personnel.

***Skills***

* Participation as an active member for the Radiology team by communicating with clinicians face-to-face, providing consults, answering phones, problem solving and decision-making.
* Act as a contact person for technologists and nurses in managing patient and imaging issues.
* Practice experience in dictating radiological reports.

***Behavior and Attitudes***

* Work with the health care team in a professional manner to provide patient centered care, and
* Notify referring clinician for urgent, emergent, or unexpected findings, and document in dictation.

**Professionalism**

***Knowledge-Based Objectives*:**

* Discussion of issues stated under Professionalism Skills during daily clinical work.
* Training programs on harassment and discrimination.
* Participation in hospital-based educational activities.

***Skills***

* Demonstrate compassion (be understanding and respectful of patients, their families, and medical colleagues).
* Demonstrate excellence in performing responsibilities in a professional manner.
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**Practice-based Learning and Improvement**

***Knowledge-Based Objectives***

* Participate in Journal Club, clinical conferences, and independent learning.
* Learn about MQSA-directed mammographic audit and Quality Control.

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* Analyze and develop improvement plans in the clinical practice, including knowledge, observation, and procedural skills.
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***Knowledge-Based Objectives***

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* Demonstrate knowledge of funding sources
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* Demonstrate knowledge of the regulatory environment.
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***Skills***

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* Attendance and participation in multi-disciplinary conference
* Interaction with department administrators.
* Membership and participation in local and national radiological societies

***Behavior and Attitude Objectives:***

* Advocate for quality patient care in a professional manner, particularly concerning imaging utilization issues

**Appendix:**

**ACR Resident Curriculum in Breast Imaging**

1. **ONE**
	1. **Breast anatomy, physiology, and pathology**
		1. Breast development
		2. Normal breast anatomy and histology; alteration with age, pregnancy, menstrual cycle, and hormonal effects; male breast anatomy
		3. Pathologic appearance and clinical significance of
			1. Benign breast lesions
			2. Atypical ductal hyperplasia, atypical lobular hyperplasia, lobular carcinoma in situ, and other histologic risk factors
			3. Ductal carcinoma in situ, including its histologic subtypes
			4. Invasive ductal carcinoma not otherwise specified; subtypes of invasive ductal carcinoma (mucinous, medullary, papillary, tubular); invasive lobular carcinoma
			5. Other types of breast cancer, such as Paget’s disease and inflammatory carcinoma
			6. Other malignancies involving the breast, including phyllodes tumor, lymphoma, leukemia, sarcomas, and metastases
		4. Multifocal and multicentric carcinoma
		5. Margin analysis for specimens containing malignancy
	2. **Epidemiology**
		1. Risk factors for breast cancer
			1. Indications for genetic screening.
	3. **Mammographic equipment and technique**
		1. Both screen-film and full-field digital mammography
			1. Effect of breast thickness and composition on technique, image quality, and radiation dose.
			2. Mammographic positioning for craniocaudal and mediolateral oblique views
			3. Mammographic positioning for women with breast implants
			4. Rationale for breast compression
		2. Screen-film mammography
			1. High-intensity view boxes, view box masking
		3. Full-field digital mammography
			1. Characteristics of full-field digital mammographic systems, including advantages and limitations
			2. Effects of post-processing on the digital mammographic image
			3. Dedicated high-luminance, high-resolution viewing monitors
	4. **Mammographic interpretation**
		1. Optimal viewing conditions, including a low ambient light environment
		2. Demonstrate proficiency in
			1. Recognizing normal mammographic anatomy
			2. Recognizing the mammographic features of characteristically benign and suspicious breast calcifications
			3. Recognizing the mammographic features of characteristically benign and suspicious breast masses
			4. Recognizing the mammographic features of probably benign (BI-RADS 3) lesions
	5. **Diagnostic (problem-solving) mammography**
		1. Demonstrate proficiency in
			1. Correlation of palpable with imaging findings
			2. Evaluation and management of a palpable mass (or other focal symptoms) when there are no associated mammographic findings
	6. **Breast Ultrasound**
		1. Demonstrate proficiency in
			1. Scanning the breast
			2. Recognizing normal sonographic anatomy
			3. Recognizing features of simple cysts, complicated cysts, complex masses
			4. Recognizing differential features of benign and malignant solid masses
	7. **Reporting and medicolegal aspects of breast imaging**
		1. Demonstrate proficiency in producing breast imaging reports, including
			1. ACR BI-RADS lexicon terms for mammography, ultrasound, and MRI
			2. Lesion location
			3. Categorization of breast composition (BI-RADS breast density descriptors)
			4. Final assessment categories (ACR BI-RADS; MQSA regulatory requirements)
			5. Management recommendations
			6. Concordance between lesion descriptors and assessment categories
			7. Concordance between assessment categories and management recommendations
	8. **Interventional procedures**
		1. Principles, indications and contraindications, equipment, preparation, technique, advantages, disadvantages, accuracy, and auditing for
			1. Needle-wire localization guided by mammography
			2. Ultrasound-guided cyst aspiration
			3. Use and limitations of using markers to indicate the site of percutaneous biopsy
			4. Specimen radiography, including paraffin block radiography
		2. Assessment of imaging-pathologic concordance
		3. Post-procedure follow-up imaging
	9. **Other recommendations**
		1. Active participation in breast MRI interpretation
		2. Direct observation or videotape of mammographic positioning for routine and supplementary views
		3. Review of teaching file materials (film or digital images), especially using computer-based interactive formats.
		4. Log of numbers of mammograms and sonograms interpreted and of procedures performed by each resident.
2. **TWO**
	1. **Breast anatomy, physiology, and pathology**
		1. Pathologic appearance and clinical significance of
			1. Benign breast lesions
			2. Atypical ductal hyperplasia, atypical lobular hyperplasia, lobular carcinoma in situ, and other histologic risk factors
			3. Ductal carcinoma in situ, including its histologic subtypes
			4. Invasive ductal carcinoma not otherwise specified; subtypes of invasive ductal carcinoma (mucinous, medullary, papillary, tubular); invasive lobular carcinoma
			5. Other types of breast cancer, such as Paget’s disease and inflammatory carcinoma
			6. Other malignancies involving the breast, including phyllodes tumor, lymphoma, leukemia, sarcomas, and metastases
	2. **Epidemiology**
		1. Breast cancer incidence and mortality, including longitudinal trends
	3. **Mammographic equipment and technique**
		1. Both screen-film and full-field digital mammography
			1. Features of dedicated mammographic units, including target, filtration, automatic exposure control, and grids
			2. Factors affecting optical density, contrast, sharpness, and noise
			3. Selection of technique factors, including effects of milliampere-seconds, kilovolt peak, target and filter material choice, and density settings on image quality and radiation dose
			4. Clinical image assessment for proper breast positioning, compression, exposure, contrast, sharpness, and noise
		2. Full-field digital mammography
			1. Effect of signal-to-noise ratio on radiation dose
	4. **Mammography quality assurance**
		1. Familiarity with content in the ACR *Mammography Quality Control Manual* [4]
		2. Purpose and frequency of performance of quality control tests performed by the technologist and physicist.
	5. **Mammographic interpretation**
		1. Demonstrate proficiency in
			1. Recognizing the mammographic features of characteristically benign and suspicious breast calcifications
			2. Recognizing the mammographic features of characteristically benign and suspicious breast masses
			3. Recognizing the mammographic appearance of indirect signs of malignancy (architectural distortion, asymmetries, etc)
			4. Recognizing the mammographic features of the surgically altered breast, including implants
		2. Principles, methods, strengths, and pitfalls of computer-aided detection and double reading.
	6. **Screening mammography**
		1. Controversies regarding screening women aged 40-49 years; younger than age 40
			1. Screening guidelines of the ACR, the American Cancer Society, the National Cancer Institute, the U.S. Preventive Services Task Force, and others
	7. **Diagnostic (problem-solving) mammography**
		1. Techniques and indications for and value of supplementary mammographic views
		2. Demonstrate proficiency in
			1. Performing the workup of lesions seen on only 1 standard (mediolateral oblique or craniocaudal) screening view
			2. Three-dimensional lesion localization
			3. Correlation of palpable with imaging findings
			4. Assessment of extent of disease for suspicious and for known-malignant lesions
	8. **Breast Ultrasound**
		1. Demonstrate proficiency in
			1. Recognizing features of simple cysts, complicated cysts, complex masses
			2. Recognizing differential features of benign and malignant solid masses
			3. Correlation with findings at mammography and clinical breast examination
		2. Limitations in the detection and assessment of microcalcifications
	9. **Breast MRI**
		1. Techniques
		2. Indications
		3. Demonstrate proficiency in
			1. Recognizing normal MRI anatomy
			2. Recognizing differential features of benign and malignant masses
			3. Recognizing differential features of benign and malignant non-mass-like enhancement
			4. Evaluating implant integrity
			5. Correlation with findings at mammography, ultrasound, and clinical breast examination
	10. **Reporting and medicolegal aspects of breast imaging**
		1. Demonstrate proficiency in producing breast imaging reports, including
			1. ACR BI-RADS lexicon terms for mammography, ultrasound, and MRI
			2. Lesion location
			3. Categorization of breast composition (BI-RADS breast density descriptors)
			4. Final assessment categories (ACR BI-RADS; MQSA regulatory requirements)
			5. Management recommendations
			6. Concordance between lesion descriptors and assessment categories
			7. Concordance between assessment categories and management recommendations
		2. MQSA regulatory requirements for reporting mammography results to referring clinician and patient
	11. **Interventional procedures**
		1. Principles, indications and contraindications, equipment, preparation, technique, advantages, disadvantages, accuracy, and auditing for
			1. Needle-wire localization guided by ultrasound
			2. Ultrasound-guided core biopsy (also fine-needle aspiration, if available)
			3. Stereotactically guided core biopsy (also fine-needle aspiration, if available)
			4. MRI-guided core biopsy and needle-wire localization.
			5. Use and limitations of using markers to indicate the site of percutaneous biopsy
			6. Specimen radiography, including paraffin block radiography
		2. Assessment of imaging-pathologic concordance
		3. Post-procedure follow-up imaging
	12. **Therapeutic and management considerations**
		1. Basic understanding of breast cancer treatment options
		2. Role of breast imaging in planning and monitoring of breast cancer treatment and post-treatment follow-up
	13. **Other recommendations**
		1. Hands-on performance of breast ultrasound examinations
		2. Active participation in breast MRI interpretation
		3. Review of teaching file materials (film or digital images), especially using computer-based interactive formats
		4. Log of numbers of mammograms and sonograms interpreted and of procedures performed by each resident
3. **THREE**
	1. **Breast anatomy, physiology, and pathology**
		1. Pathologic appearance and clinical significance of
			1. Benign breast lesions
			2. Atypical ductal hyperplasia, atypical lobular hyperplasia, lobular carcinoma in situ, and other histologic risk factors
			3. Ductal carcinoma in situ, including its histologic subtypes
			4. Invasive ductal carcinoma not otherwise specified; subtypes of invasive ductal carcinoma (mucinous, medullary, papillary, tubular); invasive lobular carcinoma
			5. Other types of breast cancer, such as Paget’s disease and inflammatory carcinoma
			6. Other malignancies involving the breast, including phyllodes tumor, lymphoma, leukemia, sarcomas, and metastases
	2. **Epidemiology**
		1. Breast cancer staging and survival rates by stage
	3. **Mammographic equipment and technique**
		1. Full-field digital mammography
			1. ACR Practice Guideline for the Performance of Whole Breast Digital Mammography [3]
	4. **Mammography quality assurance**
		1. Demonstrate proficiency in recognizing the mammographic appearance of artifacts for both screen-film and digital mammography
		2. Regulation
			1. Equipment, quality control, and personnel (radiologist, technologist, physicist) requirements for ACR accreditation and MQSA certification
			2. Responsibilities of the lead interpreting physician
		3. Medical audit
			1. Audit definitions as provided by BI-RADS
			2. Desirable goals and benchmarks for standard outcome parameters, for both screening and diagnostic mammography [5-7]
			3. Auditing requirements for MQSA certification
	5. **Mammographic interpretation**
		1. Demonstrate proficiency in
			1. Recognizing the mammographic appearance of indirect signs of malignancy (architectural distortion, asymmetries, etc)
			2. Recognizing the mammographic features of the surgically altered breast, including implants
		2. Principles, methods, strengths, and pitfalls of computer-aided detection and double reading.
	6. **Diagnostic (problem-solving) mammography**
		1. Techniques and indications for and value of supplementary mammographic views
		2. Demonstrate proficiency in
			1. Performing the workup of lesions seen on only 1 standard (mediolateral oblique or craniocaudal) screening view
			2. Three-dimensional lesion localization
			3. Correlation of palpable with imaging findings
			4. Assessment of extent of disease for suspicious and for known-malignant lesions
	7. **Breast Ultrasound**
		1. Demonstrate proficiency in
			1. Recognizing features of simple cysts, complicated cysts, complex masses
			2. Recognizing differential features of benign and malignant solid masses
			3. Correlation with findings at mammography and clinical breast examination
		2. Controversies regarding the role of screening whole-breast ultrasound examination
	8. **Breast MRI**
		1. Strengths and limitations of kinetic and morphologic analysis
		2. Demonstrate proficiency in
			1. Recognizing differential features of benign and malignant masses
			2. Recognizing differential features of benign and malignant non-mass-like enhancement
			3. Evaluating implant integrity
			4. Correlation with findings at mammography, ultrasound, and clinical breast examination
		3. Limitations in the detection and assessment of lesions presenting as microcalcifications
		4. Controversies regarding the role of screening breast MRI examination
	9. **Reporting and medicolegal aspects of breast imaging**
		1. Demonstrate proficiency in producing breast imaging reports, including
			1. ACR BI-RADS lexicon terms for mammography, ultrasound, and MRI
			2. Lesion location
			3. Categorization of breast composition (BI-RADS breast density descriptors)
			4. Final assessment categories (ACR BI-RADS; MQSA regulatory requirements)
			5. Management recommendations
			6. Concordance between lesion descriptors and assessment categories
			7. Concordance between assessment categories and management recommendations
		2. Medicolegal aspects of all breast imaging and interventional procedures
			1. Understanding the supervisory responsibility for approving the technical quality of a given examination
			2. Communication issues and follow-up of abnormal findings
			3. Informed consent for invasive procedures
	10. **Interventional procedures**
		1. Principles, indications and contraindications, equipment, preparation, technique, advantages, disadvantages, accuracy, and auditing for
			1. Second-look ultrasound to substitute ultrasound guidance for MRI guidance
			2. Use and limitations of using markers to indicate the site of percutaneous biopsy
			3. Specimen radiography, including paraffin block radiography
			4. Galactography
		2. Assessment of imaging-pathologic concordance
		3. Post-procedure follow-up imaging
	11. **Other recommendations**
		1. Active participation in breast MRI interpretation
		2. Review of teaching file materials (film or digital imagines), especially using computer-based interactive formats
		3. Log of numbers of mammograms and sonograms interpreted and of procedures performed by each resident
4. **???**
	1. **Screening mammography**
		1. ACR Practice Guideline for the Performance of Screening Mammography [3]
	2. **Breast ultrasound**
		1. ACR Practice Guideline for the Performance of a Breast Ultrasound Examination [3]
	3. **Breast MRI**
		1. ACR Practice Guideline for the Performance of MRI of the Breast [3]
	4. **Interventional procedures**
		1. ACR Practice Guideline for the performance of Ultrasound-guided Breast Interventional Procedures[3]
		2. ACR Practice Guideline for the Performance of Stereotactically Guided Breast Interventional procedures [3]
		3. ACR Ultrasound-guided Breast Biopsy Accreditation Module (part of the ACR Breast Ultrasound Accreditation Program)
		4. ACR Stereotactic Breast Biopsy accreditation program
5. **REFERENCES**

3. American College of Radiology. 2005 practice guidelines and technical standards. Reston, VA: American College of Radiology; 2005.

4. American College of Radiology Committee on Quality Assurance in Mammography. Mammography quality control manual. Reston, VA: American College of Radiology; 1999.

5. Bassett LW, Hendrick RE, Bassford TL, et al. Quality determinants of mammography (clinical practice guideline number 13). Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, Agency for Health Care Policy and Research; 1994:74-85.

6. Sickles EA, Miglioretti D, Ballard-Barbash R, et al. Performance benchmarks for diagnostic mammography. Radiology 2005;235:775-90.

7. Rosenberg RD, Yankaskas BC, Abraham LA, et al. Performance benchmarks for screening mammography. Radiology 2006;241:55-66.

8. American College of Radiology. Appropriatness criteria. Reston, VA: American College of Radiology; 2002.