



## Practice Analysis Report: Breast Sonography - Effective July 2021

### Introduction

The ARRT establishes the job relatedness of an examination via a practice analysis (also called a job analysis). Practice analyses document the role to be credentialed, the topics to be covered by the examination used in the credentialing decision, as well as the degree of emphasis that each topic receives. The rationale for practice analyses is outlined in *The Standards for Educational and Psychological Testing* (American Educational Research Association, American Psychological Association, National Council on Measurement in Education, 2014) and in the National Commission for Certifying Agencies (NCCA) *Standards for the Accreditation of Certification Programs* (NCCA, 2021). Legislation and legal precedent also stress the importance of practice analysis in the development and validation of certification exams. The ARRT conducts a practice analysis for each discipline approximately every five years. Regular updates are important for professions that continually evolve due to advances in technology because they help ensure that the content specifications and other certification requirements reflect current practice.

This report describes the practice analysis for Breast Sonography conducted from July 2018 to April 2020. The project sought to identify tasks currently required of the typical breast sonographer and to determine what knowledge and cognitive skills are required to effectively perform those tasks.

To accomplish this task, ARRT hosted several meetings with a committee of subject matter experts (SMEs) to develop a survey of job tasks; evaluate survey results; and revise the content specifications, content outline, and clinical experience requirements. ARRT selected seven SMEs for this committee from across the United States and from a range of practice settings (e.g., hospitals, clinics, educational programs). These SMEs represented a range of expertise including six certified and registered breast sonographers and one radiologist.

All statistical analyses were performed by trained statisticians employed by ARRT and meetings were primarily conducted by ARRT's Exam Development Coordinators with psychometric support provided by ARRT psychometric staff.

The ARRT Board of Trustees reviewed all changes to exam content and eligibility requirements before giving approval in July 2020. The first exam under the new content and eligibility requirements was administered in July 2021.



## Task Inventory

### Survey Development

ARRT begins the practice analysis process by revising the task inventory, which is a listing of clinical and supporting procedures related to practice. The committee reviewed the previous task inventory and content outline before creating an updated list of job tasks by adding, deleting, or rewording tasks as necessary to reflect changes in the profession.

The committee used the updated job task list to create a survey for distribution to individuals working in the profession. The first section of this survey consisted of 86 questions asking current breast sonographers how frequently they perform each task utilizing a six-point scale with the following options: *Never Perform*, *Yearly*, *Quarterly*, *Monthly*, *Weekly*, and *Daily*. Based on past research, ARRT uses a frequency scale with absolute anchors because data from scales like importance and criticality, which use subjective anchors, have inferior statistical properties (Babcock, Risk, & Wyse 2020). The data gathered by absolute anchor frequency scales also correspond well to medical imaging practice as defined by external data sources (Babcock & Yoes, 2013) and add value beyond advisory committee members' judgement without data (Wyse & Babcock, 2018).

To reduce the length and burden of the practice analysis survey, the committee identified tasks from the previous task inventory that they believed were so ubiquitous in practice that over 90% of respondents would report that they do perform the task. The following tasks were omitted from the survey and included in the new task inventory without further discussion:

- Review patient's relevant previous imaging exams prior to the breast sonography exam
- Interview patient to acquire clinical history (e.g., previous breast exams, personal and family history, prior surgeries) and document findings
- Explain the breast sonography examination to the patient
- Respond as appropriate to patient's questions regarding breast health by referencing ACR guidelines
- Perform visual breast examination based on patient communication documenting location of lumps, scars, and breast changes, per protocol
- Select equipment appropriate to the patient and the examination to be performed (e.g., transducer)
- Differentiate normal anatomy from abnormal findings during the breast sonography exam
- Clean or disinfect instruments and equipment, according to protocol
- Perform second look ultrasound for patients with positive screening results from mammography

The second section of the survey included 15 questions regarding the respondent's role and workplace such as hours worked, primary job title, and department composition.

### Survey Sample

ARRT staff identified an initial population of 3,107 breast sonographers from the ARRT database of certified and registered technologists. All listed breast sonography as either their primary or secondary discipline and were working in a hospital or clinic as a technologist (or other similar title). Of these 3,107 breast sonographers, 814 possessed a breast sonography certification and the remaining 2,293 did not. The final sample consisted of all 814 registrants with a breast



sonography certification and a random sample of 664 of registrants without a breast sonography certification for a total of 1,478 breast sonographers.

ARRT's survey vendor mailed the survey in May 2019. A total of 449 recipients returned their survey by close in August of 2019, for an absolute response rate of 30.3%. ARRT staff screened responses to ensure that the surveys were correctly filled out by the intended population, retaining 419 for an effective response rate of 28.3%.

## **Analysis**

ARRT psychometric staff first calculated the percentage of respondents who report performing the task and the percent who report performing the task daily or weekly (Table 1). ARRT allows tasks performed by 40% or more of respondents to be included on the task inventory without further discussion so that committees may focus on discussions most likely to impact task inclusion. However, committees still review all survey results and may choose to include tasks below the threshold or reject tasks above the threshold as they see fit based on their joint expertise.

ARRT psychometric staff next compared the percent of entry-level (0-5 years of experience) and experienced (6+ years) respondents performing each task to ensure that the tasks included on the inventory are relevant to entry-level practice. Table 2 provides a list of tasks that differed in a potentially meaningful way and staff presented these results to the committee for discussion.

Finally, ARRT staff summarized results for the 15 items that covered the respondent's role and workplace (Tables 3 - 17).



Table 1  
Percent of technologists performing tasks

Item	Task	% Performing	% Daily/Weekly
1	Review imaging request to verify information is accurate, appropriate, and complete (e.g., patient history, clinical diagnosis, physician's orders)	99.8	99.0
2	Respond as appropriate to patient's questions regarding breast health by referencing ACR guidelines	98.1	93.8
3	Refer patient's questions regarding findings and follow-up to the supervising physician (e.g., radiologist, surgeon) or referring provider	98.8	95.7
4	Respond as appropriate to questions regarding accreditation of ultrasound facilities and personnel	85.5	33.3
	<i>Explain the benefits and limitations of breast imaging utilizing the following modality:</i>	---	---
5	breast sonography	99.0	96.4
6	automated whole breast ultrasound	41.7	22.7
7	2D mammography	87.1	77.9
8	3D mammography	89.2	83.4
9	MRI	78.3	49.1
10	nuclear medicine (e.g., sentinel node injection, BSGI, PET/CT)	57.0	22.1
11	CT	41.5	9.8
12	Select technique in accordance with sonography protocol as determined by the supervising physician (e.g., radiologist, surgeon)	97.8	94.2
	<i>Adjust machine settings for image optimization using the following as appropriate:</i>	---	---
13	TGC	97.3	96.1
14	power	85.4	77.6
15	overall gain	99.0	97.8
16	frequency	95.4	90.3
17	amplitude	83.4	73.9
18	depth of field	99.3	98.6
19	focal zone	98.6	97.4
20	harmonic imaging	95.2	89.9
21	spatial compounding	79.2	67.6
22	Position patient to demonstrate the desired anatomy (e.g., oblique, supine, decubitus, upright) providing for patient safety, comfort, and modesty	99.5	98.1
23	Use proper ergonomics when performing sonographic exams to prevent work related musculoskeletal disorders	97.8	96.4



Item	Task	% Performing	% Daily/Weekly
	<i>Optimize the breast sonography exam using the following as appropriate:</i>	---	---
24	stand-off pad	83.7	41.8
25	color Doppler	97.8	93.8
26	power Doppler	82.4	62.3
27	panoramic imaging	74.0	35.0
28	fremitus	65.8	25.0
29	elastography	35.8	15.5
30	3D	16.7	8.7
31	Minimize ultrasound bioeffects	81.8	76.7
32	Annotate images to indicate anatomic plane, area of interest, and other relevant information per ACR practice parameters	98.6	97.4
33	Identify and communicate sonographic echo patterns to the supervising physician (e.g., radiologist, surgeon) using appropriate terminology (e.g., anechoic, hypoechoic, hyperechoic, isoechoic)	98.6	97.1
34	Obtain images that demonstrate appropriate findings during the breast sonography exam	99.3	98.1
35	Identify clinical versus non-clinical sonographic artifacts	97.4	94.5
36	Evaluate scanning technique for diagnostic quality and take corrective action as necessary	98.1	93.0
	<i>Utilize the following tools in post processing:</i>	---	---
37	dynamic range	78.6	62.5
38	cine loop	79.1	63.9
39	gain	88.6	83.1
40	annotations and measurements	96.7	89.0
41	Record, display, archive, and retrieve images using PACS	98.5	97.0
	<i>Correlate sonographic images and findings with the following:</i>	---	---
42	physical findings	99.3	98.3
43	prior ultrasound	99.3	97.8
44	automated whole breast ultrasound	28.0	21.1
45	mammogram	98.3	97.1
46	ACR BI-RADS classification	94.0	89.1
47	breast MRI	89.4	62.7
48	CT	75.8	26.6
49	PET/CT	70.9	22.4
50	Review preliminary breast sonography findings with supervising physician (e.g., radiologist, surgeon)	98.8	97.4



Item	Task	% Performing	% Daily/Weekly
51	Explain diagnostic findings to patient under the direction of the supervising physician (e.g., radiologist, surgeon)	93.1	87.3
52	Perform preventive maintenance (e.g., filters) on breast sonography equipment as indicated	76.2	37.7
53	Identify, report, and document any ultrasound equipment malfunctions (e.g., transducer, monitor)	96.4	44.7
54	Perform regional lymph node and axillary sonography	98.8	94.6
	<i>Perform breast sonography of the following lymph node areas for new cancer diagnoses, per protocol:</i>	---	---
55	axilla	97.6	91.4
56	supraclavicular	65.8	29.9
57	internal mammary	81.0	56.0
58	Perform screening breast ultrasound, per protocol, using a free hand technique with conventional equipment	68.9	46.9
59	Perform screening breast ultrasound, per protocol, using an automated system	26.1	16.8
60	Perform second look ultrasound for patients with positive screening results from MRI	89.7	55.7
61	Perform survey breast ultrasound for multifocal and multicentric disease for patients with a new diagnosis of breast cancer	80.6	46.8
62	Respond as appropriate to questions from patient or patient's family regarding interventional procedures	95.2	84.4
63	Verify informed consent as necessary	93.6	84.0
64	Verify that time-out procedure is performed when necessary	89.9	83.9
65	Select and prepare equipment for interventional procedures	90.4	86.8
66	Position the patient to provide access for interventional procedures	90.9	87.8
67	Use sterile or aseptic technique when indicated	93.8	89.3
68	Communicate effectively with performing physician during interventional procedures	92.1	87.3
	<i>Assist with the following breast ultrasound interventional procedures and associated imaging:</i>	---	---
69	cyst aspiration	90.4	70.6
70	fluid aspiration	84.0	55.3
71	drain insertion	34.3	14.6
72	fine needle aspiration	68.1	43.4
73	needle core biopsy	85.3	75.4
74	skin punch biopsy	26.6	10.3
75	vacuum-assisted core biopsy	72.2	58.5
76	clip placement	83.0	77.0
77	lymph node tattooing	10.1	7.0



Item	Task	% Performing	% Daily/Weekly
78	sentinel node injection	28.3	17.5
	<i>pre-op needle localization using:</i>	---	---
79	wire localization	67.5	42.7
80	radioactive seed location	15.0	10.7
81	magnet localization (e.g., Magseed)	9.1	6.7
82	radar localization (e.g., SAVI Scout®)	16.3	11.0
83	radiofrequency localization (e.g., LOCalizer)	11.0	9.6
84	Provide post-care instructions for interventional procedures	85.2	78.0
85	Follow environmental protection standards for handling and disposing of bio-hazardous materials (e.g., sharps, blood, body fluids)	94.0	89.3
86	Clean, disinfect, or sterilize facilities and equipment, per protocol	96.9	93.5

Table 2.

*Percent performing select tasks for entry-level (0-5 years) and experienced (6+ years) breast sonographers*

Item	Task	Entry-Level	Experienced
4	Respond as appropriate to questions regarding accreditation of ultrasound facilities and personnel	80.6	88.0
26	Optimize the breast sonography exam using the following as appropriate: power Doppler	75.6	85.6
30	Optimize the breast sonography exam using the following as appropriate: 3D	9.6	20.1
31	Minimize ultrasound bioeffects	76.3	84.4
38	Utilize the following tools in post processing: cine loop	73.7	81.7
52	Perform preventive maintenance (e.g., filters) on breast sonography equipment as indicated	68.1	80.1
57	Perform breast sonography of the following lymph node areas for new cancer diagnoses, per protocol: internal mammary	86.8	78.2
58	Perform screening breast ultrasound, per protocol, using a free hand technique with conventional equipment	64.2	71.2
71	Assist with the following breast ultrasound interventional procedures and associated imaging: drain insertion	26.3	38.2
83	Assist with the following breast ultrasound interventional procedures and associated imaging: pre-op needle localization using radar localization radar localization (e.g., SAVI Scout®)	21.2	13.9



Table 3.

*How many hours per week do you work in imaging?*

Response	Count	Percentage
15 or fewer hours	17	4.0
16 to 31 hours	64	15.2
More than 31 hours	339	80.7

Table 4.

*How many hours do you work specifically as a breast sonographer?*

Response	Count	Percentage
Fewer than 8 hours	49	11.7
8 to 20 hours	176	42.1
More than 20 hours	193	46.2

Table 5.

*Approximately how many breast ultrasounds do you typically perform in a week?*

Response	Count	Percentage
1-9	58	1.4
10-25	180	13.8
26-75	157	43.0
More than 75	18	37.5

Table 6.

*How many years have you worked as a breast sonographer?*

Response	Count	Percentage
Less than 1 year	9	2.1
1 to 5 years	128	30.5
6 to 10 years	108	25.7
More than 10 years	175	41.7

Table 7.

*What best describes your primary title*

Response	Count	Percentage
Breast Sonographer	114	28.6
General Sonographer	104	26.1
Mammographer	162	40.7
Manager/Supervisor	8	2.0
Other	10	2.5

Table 8.

*Which of the following best describes your place of employment? (mark all that apply)*

Response	Count	Percentage
Dedicated Breast Center	224	45.4
Satellite Clinic (Hospital-Affiliated)	58	11.8
Freestanding Image Center	53	10.8
Community	107	21.7
Academic	36	7.3
Other	15	3.0





Table 9.

*How many breast sonographers are employed in your department?*

Response	Count	Percentage
1-3	182	43.9
4-6	149	35.9
7-10	49	11.8
More than 10	35	8.4

Table 10.

*Is your facility accredited? If so, by what organization? (mark all that apply)*

Response	Count	Percentage
Not Accredited	34	6.9
American College of Radiology	365	73.6
American Institute of Ultrasound in Medicine	9	1.8
National Accreditation Program for Breast Centers	67	13.5
American Society of Breast Surgeons	9	1.8
Other	12	2.4

Table 11.

*Does your facility require breast sonographers to be certified and registered in breast sonography?*

Response	Count	Percentage
Yes, preferably through ARRT	74	17.8
Yes, preferably through ARDMS	104	25
Yes, either ARDMS or ARRT	116	27.9
No, certification in mammography or sonography is adequate	114	27.4
Other	8	1.9

Table 12.

*Which of the following certifications do you hold? (select all that apply)*

Response	Count	Percentage
R.T.(BS)(ARRT)	208	20.6
R.T.(M)(ARRT)	266	26.4
ARDMS(BS)	169	16.7
R.T.(S)(ARRT)	22	2.2
R.T.(R)(ARRT)	325	32.2
R.T.(Other)	19	1.9

Table 13.

*Which of the following transducers do you use when performing breast ultrasound? (mark all that apply)*

Response	Count	Percentage
Transducer - L22 MHz	12	1.8
Transducer - L18 MHz	198	29.4
Transducer - Hockey Stick (Linear Array)	62	9.2
Transducer - L12 MHz	249	37.0
Transducer - L10 MHz	49	7.3
Transducer - Other	103	15.3



Table 14.

*Which of the following breast screening guidelines does your facility follow? (mark all that apply)*

Response	Count	Percentage
ACR	412	80.2
ACS	83	16.1
USPSTF	3	0.6
ACOG	11	2.1
Other	5	1.0

Table 15.

*Have there been any overall changes in breast sonography staffing at your facility in the past year?*

Response	Count	Percentage
Yes, additional staff (FTE)	116	27.8
Yes, decreased staff (FTE)	29	6.9
No changes	273	65.3

Table 16.

*Have you received training in ergonomics related to performance of breast sonography?*

Response	Count	Percentage
Yes	170	40.8
No	247	59.2

Table 17.

*How would you describe your level of expertise in breast sonography?*

Response	Count	Percentage
Entry level	20	4.8
Intermediate	111	26.5
Seasoned	288	68.7



## Changes to Task Inventory

The practice analysis committee met in August 2019 to review the practice analysis survey data and determine whether any tasks should be dropped from or added to the task inventory. The committee also clarified the wording of several tasks.

The following tasks were removed:

- Optimize the breast sonography exam using the following as appropriate:
  - Elastography
  - 3D

The following tasks were added:

- Explain the benefits and limitations of breast imaging utilizing the following modalities: automated whole breast ultrasound
- Adjust machine settings for image optimization using the following as appropriate: overall gain
- Use proper ergonomics when performing sonographic exams to prevent work-related musculoskeletal disorders
- Identify and communicate sonographic echo patterns to the supervising physician (e.g., radiologist, surgeon) using appropriate terminology (e.g., anechoic, hypoechoic, hyperechoic, isoechoic)
- Identify clinical versus non-clinical sonographic artifacts
- Utilize the following tools in post-processing: annotations and measurements
- Communicate effectively with performing physician during interventional procedures
- Assist with the following breast ultrasound interventional procedures and associated imaging: fluid aspiration

The Board of Trustees approved the final task inventory in January 2020. The final task inventory may be found on the ARRT website: <https://www.art.org/pages/art-reference-documents/by-document-type/task-inventories>



## Content Specifications and Clinical Experience Requirements

### Changes to Content Specifications

The practice analysis committee updated the content specifications based on changes to the task inventory and the field. The committee considered the knowledge and cognitive skills required to successfully perform the tasks in the final task inventory and verified that those topics were covered in the content specifications, adding additional content as necessary. The committee also removed any topics that could not be linked to the updated task inventory.

The updated content specifications were then made available for public comment in February 2020 and the committee met again in April 2020 to discuss the comments before making any final adjustments.

The most notable changes from the previous version of the content specifications were:

- Patient Care Section
  - Removed “patient rights and safety” area
  - Expanded “patient communications” area
  - Added “communication of imaging to supervising physician (radiologist, surgeon)” area
- Image Production Section
  - Expanded sonographer ergonomics area
  - Expanded “transducer cleaning” area to include a link to the January 2020 document produced by SDMS “Guidelines for Infection Prevention and Control in Sonography”
  - Removed “spectral Doppler”, “elastography”, and “3D”
- Procedures Section
  - Added “lobules” area
  - Added details to “postoperative breast changes” area

In addition, the committee edited all sections of the content specifications for clarity and updated terminology to reflect current practice.

The Board of Trustees approved the final content specifications in July 2021. The final content specifications may be found on the ARRT website: <https://www.arrt.org/pages/arrt-reference-documents/by-document-type/examination-content-specifications>

### Content Weighting

The practice analysis committee determined the number of items that should be assigned to each section of the exam through a process known as content weighting. First, the committee performed a bottom-up exercise where members individually estimated the number of unique items that should be included in each section. Second, the committee performed a top-down exercise where members individually estimated the relative proportion of the exam that should be dedicated to each section. Finally, ARRT staff provided the committee with summary values from the two exercises and the committee held a discussion to finalize their recommendation for the number of items assigned to each section (Table 18).



Table 18  
Number of Items per Section

Content Area	Number of Scored Items
<b>Patient Care</b>	<b>18</b>
Patient Interactions and Management (18)	
<b>Image Production</b>	<b>102</b>
Basic Principles of Ultrasound (37)	
Image Formation (32)	
Evaluation and Selection of Representative Images (33)	
<b>Procedures</b>	<b>65</b>
Anatomy and Physiology (15)	
Pathology (35)	
Surgical/Treatment Changes and Interventional Procedures (15)	
<b>Grand Total</b>	<b>185</b>

### Changes to Clinical Experience Requirements

ARRT created clinical experience requirements to verify that candidates have completed a subset of clinical procedures within a modality. Successful performance of these fundamental procedures, in combination with mastery of the cognitive knowledge and skills covered by the certification examination, provides the basis for the acquisition of the full range of clinical skills required in a variety of settings.

The practice analysis committee reviewed and updated the previous clinical experience requirements considering the final task inventory and content specifications. The updated clinical experience requirements were then made available for public comment in February 2020 and the committee met again in April 2020 to discuss the comments before making any final adjustments.

The most notable changes from the previous version of clinical experience requirements were:

- Clarified that a bilateral examination may be counted as two examinations
- Added interventional procedure examples.

The Board of Trustees approved the final clinical experience requirements in July 2021. The final clinical experience requirements may be found on the ARRT website: <https://www.arrt.org/pages/arrt-reference-documents/by-document-type/didactic-and-clinical-competency-requirements>



## Conclusion

Numerous individuals contributed to this project, as committee members, document reviewers, or as survey respondents. Periodic practice analysis is a necessary step in the life cycle of an exam program to ensure that the content of the exam and the eligibility requirements remain relevant with current practice. This study noted significant changes to the field of breast sonography, and thanks to the efforts of all involved it assures that the ARRT Breast Sonography exam program will continue to be an excellent assessment of breast sonographers wishing to demonstrate their qualifications by seeking certification and registration.

