Practice Analysis Report: Bone Densitometry - Effective July 2022

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 Bone Densitometry conducted from March 2020 to April 2021. The project sought to identify tasks currently required of the typical Bone Densitometry Technologist 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). All seven of these SMEs were certified and registered technologists.

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 2021. The first exam under the new content and eligibility requirements was administered in July 2022.

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 50 questions asking current Bone Densitometry Technologists 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:

- Clean and disinfect work area facilities and equipment.
- Explain procedure of DXA exam including positioning, duration, and notification policy of results.
- Review patient records and provider's request to determine appropriate anatomical sites to scan.
- Screen female patients of childbearing age about the possibility of pregnancy.
- Enter accurate patient data necessary to initiate scan to utilize correct reference data.
- Take appropriate precautions to minimize occupational radiation exposure.
- Take appropriate precautions to minimize radiation exposure to the patient.
- Keep all unnecessary persons out of the immediate area during radiation exposure.
- Select appropriate scan mode and perform necessary scans.
- Review scan results to identify bone density measurements that may be inaccurate due to artifacts, unusual anatomy, pathology, or positioning errors and rescan if necessary.
- Evaluate scan results for technical problems (e.g., incorrect scan mode or site) and take corrective action.

The second section of the survey included 16 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 9,128 individuals from the ARRT database of certified and registered technologists who listed bone densitometry as either their primary or secondary discipline and were working in a hospital or clinic as a technologist (or other similar title). Staff initially sampled 200 individuals certified and registered in bone densitometry and a further 800 from the total population of individuals working in bone densitometry (some of the 800 were also certified and registered in bone densitometry).

ARRT's survey vendor mailed the survey in May 2020. A total of 399 recipients returned their survey by close in August 2020, for an absolute response rate of 39.9%. ARRT staff screened responses to ensure that the surveys were correctly filled out by the intended population, retaining 248 for an effective response rate of 24.8%.

Analysis

ARRT psychometric staff first calculated the percentage of respondents who report performing the task and 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. Task results are provided in Table 1 while demographics and workplace item results are given in Tables 2 - 5 as presented to the practice analysis committee.

Table 1
Percent of technologists performing tasks

Item	Task	% Performing	% Daily/Weekly
1	Perform routine QC tests on scanning equipment according to manufacturer guidelines.	97.2	93.9
2	Record results of QC tests in binder, chart, or database.	87.9	85.1
3	Inspect and interpret results of routine QC tests and determine need for corrective action.	87.4	82.6
4	Arrange for corrective action or repairs based on the results of QC tests as needed.	78.5	61.6
5	Coordinate software upgrades with manufacturer when recommended.	57.5	15.0
6	Troubleshoot equipment errors (e.g., contact manufacturer for guidance) if needed.	83.7	46.9
7	Troubleshoot computer software errors (e.g., contact manufacturer for guidance) as needed.	78.9	44.3
8	Inspect equipment to make sure it is operable and safe (e.g., cables, cords, table pads).	89.8	75.6
9	Ensure that cross-calibration between new/existing machines is performed as needed.	36.1	17.4
10	Please answer this task as "monthly."	100.0	0.0
11	Verify current clinical indications meet specifications of CMS billing and coding guidelines if appropriate.	56.5	43.5
12	Import previously archived or baseline studies for direct comparison.	82.6	76.9
13	Educate new residents, staff technologists, ancillary staff, or students regarding bone densitometry.	82.8	33.2
14	Answer basic questions put forth by patient, patient's family, or authorized representative (or refer them to appropriate resources) concerning bone health, fall prevention, exercise, and nutrition.	96.8	91.5
15	Direct patients to where they can find more information about low bone density.	89.0	72.4
16	Educate patients about drug therapies related to bone health.	52.8	43.1
17	Provide assistance to patients with disabilities or limited mobility.	98.0	86.3
18	Use proper body mechanics and/or ergonomic devices to promote personnel safety.	99.6	97.6
19	Record patient history relevant to bone densitometry.	98.4	98.4
20	Ask patients about their peak height, maximum height, or height loss.	90.3	89.9
21	Measure and record patient's current height.	95.5	93.9
22	Measure and record patient's current weight.	95.1	93.5
23	Determine if patient has recently received a radiopaque contrast agent or radionuclide if needed.	94.4	93.5
24	Determine if patient has recently ingested contraindicated medications or supplements (e.g., calcium) if needed.	94.4	94.4
25	Review prior scans and reproduce patient positioning during follow-up scan appointments.	97.2	96.0
26	Ensure that artifact-producing objects (e.g., zippers, buttons, jewelry, medical devices) within scan area have been removed from the patient when possible.	100.0	100.0

Item	Task	% Performing	% Daily/Weekly
27	Determine if patient anatomy, pathology, or other limitations require special consideration in patient positioning.	100.0	100.0
28	Position patient to scan desired region of interest (ROI) using bony landmarks and surface anatomical features.	100.0	99.6
29	Use positioning aids as needed to reduce patient movement and/or promote patient safety.	99.6	98.8
30	Record positioning details in patient records to ensure consistency.	81.0	74.9
31	Perform bone densitometry scans using a fan beam system.	82.7	82.3
32	Perform and analyze bone densitometry scans of the lumbar spine – PA utilizing DXA equipment.	92.3	91.9
33	Perform and analyze bone densitometry scans of the lumbar spine – lateral, utilizing DXA equipment.	35.9	25.3
34	Please answer this task as "quarterly."	100.0	0.0
35	Perform and analyze bone densitometry scans of the proximal femur utilizing DXA equipment.	99.6	98.4
36	Perform and analyze bone densitometry scans of the forearm utilizing DXA equipment.	98.4	84.1
37	Perform and analyze bone densitometry scans of the spine – VFA (vertebral fracture assessment) utilizing DXA equipment.	46.5	30.2
38	Perform and analyze bone densitometry scans on pediatric patients (ages 5-19) utilizing DXA equipment.	43.9	11.0
39	Perform and analyze bone densitometry scans of pediatric patients – total body less head (TBLH) utilizing DXA equipment.	15.7	6.5
40	Perform and analyze bone densitometry scans of the whole body to determine body composition.	20.6	6.9
41	Perform and analyze bone densitometry scans of the whole body utilizing DXA equipment to determine bone density.	21.9	10.5
42	Enhance or modify image appearance.	75.7	69.5
43	Evaluate automatic placement of region of interest (ROI) and modify if necessary (e.g., vertebral body exclusions, hardware).	97.2	94.3
44	Review scan results to determine if scanning an additional site is required in order to obtain more precise bone density measurements.	94.4	90.3
45	Evaluate accuracy of vertebral labels and intervertebral markers for scan of lumbar spine and modify if necessary.	98.4	96.8
46	Compare bone density measurements from two different occasions (for same patient) to assess changes over time.	90.3	87.1
47	Identify bone density measurements that require interpreting provider’s attention (e.g., low T-score, unreliable results).	79.4	69.2

Item	Task	% Performing	% Daily/Weekly
48	Identify exam-limiting patient anatomy or pathology that requires interpreting provider's attention (e.g., scoliosis, severe arthritis).	90.3	81.9
49	Perform an in vivo precision study.	16.6	1.7
50	Operate electronic digital imaging devices and record keeping information technology system devices including PACS and medical information systems.	96.2	96.2
51	Conduct system backup and archive as recommended by the manufacturer (e.g., external hard drive, DVD).	91.4	82.9
52	Utilize FRAX® tool to assess 10-year fracture risk.	80.0	79.5

Table 2.
Have you received training in ergonomics related to the performance of your job in medical imaging?

Response	Percentage
Yes	72.2
No	26.6

Table 3.
Have you personally had work loss due to a bone densitometry task-related musculoskeletal injury?

Response	Percentage
Yes	1.2
No	97.2
Unsure / Prefer not to answer	1.2

Table 4.
To the best of your knowledge, a bone densitometry technologist in your department had work loss due to a bone densitometry task-related musculoskeletal injury in the last year.

Response	Percentage
Yes	0.8
No	91.1
Unsure / Prefer not to answer	8.1

Table 5.
To the best of your knowledge, a bone densitometry technologist in your department had work loss due to a bone densitometry task-related musculoskeletal injury in the last three years.

Response	Percentage
Yes	1.2
No	86.2
Unsure / Prefer not to answer	11.7

Changes to Task Inventory

The practice analysis committee met in August 2020 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 added:

- Troubleshoot computer software errors (e.g., contact manufacturer for guidance) as needed.
- Import previously archived or baseline studies for direct comparison.
- Use proper body mechanics and/or ergonomic devices to promote personnel safety.
- Measure and record patient's current weight.
- Identify exam-limiting patient anatomy or pathology that requires interpreting provider's attention (e.g., scoliosis, severe arthritis).
- Conduct system backup and archive as recommended by the manufacturer (e.g., external hard drive, DVD).

The following task was removed:

- Assist patient onto and off the scanning table

The Board of Trustees approved the final task inventory in January 2021. The final task inventory may be found on the ARRT website: https://www.arrt.org/pages/arrt-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 2021 and the committee met again in April 2021 to discuss the comments before making any final adjustments.

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

- Patient Care
  - Added technologist ergonomics
  - Added infection control
- Image Production
  - Added software errors and upgrades
- Procedures
  - Added vertebral exclusions within lumbar spine
  - Added forearm length

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 6).

Table 6
Number of Items per Section

Content Area	Number of Scored Items
Patient Care	**17**
Patient Bone Health, Care, and Radiation Principles (17)	
Image Production	**20**
Equipment Operation and Quality Control (20)	
Procedures	**38**
DXA Scanning (38)	
Grand Total	**75**

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 2021 and the committee met again in April 2021 to discuss the comments before making any final adjustments.

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

- Clarified that mandatory and elective requirements cannot be counted on the same patient on the same day.
- A maximum of fifteen mandatory and elective procedures may be logged for each day.
- Added an elective procedure 'Perform and analyze a VFA scan using DXA equipment' with five repetitions.

The Board of Trustees approved the final clinical 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/clinical-experience-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 bone densitometry, and thanks to the efforts of all involved it assures that the ARRT Bone Densitometry exam program will continue to be an excellent assessment of bone densitometers wishing to demonstrate their qualifications by seeking certification and registration.