The Bone Densitometry Equipment Operator Examination

The purpose of the Bone Densitometry Equipment Operator Examination, which is made available to state licensing agencies, is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of operators of bone densitometry equipment. The American Registry of Radiologic Technologists® (ARRT®) administers the examination to state-approved candidates under contractual arrangement with the state and provides the results directly to the state. This examination is not associated with any type of certification by the ARRT.

The knowledge and skills covered by the examination were determined by administering a comprehensive practice analysis survey to a nationwide sample of bone density equipment operators. The results of the practice analysis are reflected in this document.\(^1\)

The task inventory for the Bone Densitometry Equipment Operator Examination may be found on the ARRT website (arrt.org). The content specifications identify the knowledge area underlying performance of the tasks on the task inventory. Every content category can be linked to one or more activities on the task inventory.

The major content categories of the examination are outlined below. Subsequent pages describe in detail the topics covered within each major section.

<table>
<thead>
<tr>
<th>Content Category</th>
<th>Number of Scored Questions(^2)</th>
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<tr>
<td>A. Basic Concepts</td>
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<tr>
<td>B. Equipment Operation</td>
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<td>C. Radiation Safety</td>
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<td>D. DXA Scanning of Forearm</td>
<td>6</td>
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<tr>
<td>E. DXA Scanning of Lumbar Spine</td>
<td>10</td>
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<tr>
<td>F. DXA Scanning of Proximal Femur</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
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</table>

\(^1\) A special debt of gratitude is due to the hundreds of professionals participating in the project as committee members, survey respondents and reviewers.

\(^2\) Each exam includes an additional 15 unscored (pilot) questions. On the pages that follow, the approximate number of scored questions allocated to each content category appears in parentheses.
A. Basic Concepts (10)

1. Osteoporosis
   A. World Health Organization (WHO)
      Definition and Diagnostic Criteria
   B. Primary vs. Secondary
   C. Type I (postmenopausal) vs. Type II (senile)

2. Bone Physiology
   A. Functions of Bone
      1. structural support & protection
      2. storage of essential minerals
   B. Types of Bone
      1. cortical bone
      2. trabecular bone

B. Equipment Operation (15)

1. Computer Console
   A. Major Components
   B. File Management

2. Fundamentals of X ray Production
   A. Properties of X ray Beam
      1. quality (kVp)
      2. quantity (mA)
      3. duration/time (S)
   B. Filters and Collimators
   C. X ray Energy Production

3. Types of DXA Systems
   A. Pencil Beam Systems
   B. Fan Beam Systems

4. Quality Control
   A. Equipment Safety (electrical, pinch points, emergency stop)
   B. Use of Phantoms and/or Calibration
   C. In Vivo Precision Study
   D. Troubleshooting
      1. shift or drift
      2. pass/fail
      3. need for service
   E. Record Maintenance

C. Bone Remodeling Cycle
   1. resorption/formation
   2. osteoblasts/osteoclasts

3. Bone Health
   A. Nutrition
   B. Exercise
   C. Risk Factors
      1. controllable (smoking, alcohol, calcium, vitamin D, hormone therapy, medications)
      2. uncontrollable (heredity, race, gender, age, medical conditions)

5. Measuring BMD
   A. Basic Statistical Concepts
      1. mean
      2. standard deviation
      3. coefficient of variation
   B. Reporting Patient Results
      1. BMD formula
      2. Z-score
      3. T-score
   C. FRAX® (WHO Fracture Risk Assessment Tool)
   D. Vertebral Fracture Assessment (VFA)

6. Determining Quality in BMD
   A. Precision
   B. Accuracy
   C. Factors Affecting Accuracy and Precision
      1. scanner
      2. operator
      3. patient variables
C. Radiation Safety (9)

1. Fundamental Principles
   A. ALARA
   B. Basic Methods of Protection
      1. time
      2. distance
      3. shielding

2. Biological Effects of Radiation
   A. Long-Term Effects
   B. Radiosensitive Tissues/Organs

3. Units of Measurement
   A. Absorbed Dose (e.g., Rad/Gray)
   B. Exposure (e.g., Rem/Sievert)

4. Radiation Protection in BD
   A. General Protection Issues
      1. radiation signs posted
      2. door closed
      3. only patient and operator in room
   B. Occupational Protection
      1. scanner-operator distance
      2. personnel monitoring
      3. exposure records
   C. Patient Protection
      1. comparison levels of radiation
         a. peripheral DXA
         b. central DXA
         c. natural background radiation
         d. airline flight
         e. chest x ray
      2. strategies to minimize patient exposure
         a. patient instructions
         b. correct exam performance

D. DXA Scanning of Forearm (6)

1. Anatomy
   A. Regions of Interest
   B. Bony Landmarks
   C. Radiographic Appearance
   D. Adjacent Structures

2. Scan Acquisition
   A. Patient Instructions
   B. Patient Positioning
   C. Evaluating Pre-Set Scan Parameters

3. Scan Analysis
   A. Accurate ROI Placement
   B. BMC, Area and BMD
   C. T-score, Z-score

4. Common Problems
   A. Poor Bone Edge Detection
   B. Nonremovable Artifacts
   C. Variant Anatomy
   D. Fractures or Pathology

5. Follow-Up Scans
   A. Unit of Comparison
      1. BMD
      2. T-score
   B. Reproduce Baseline Study
E. DXA Scanning of Lumbar Spine (10)

1. Anatomy
   A. Regions of Interest
   B. Bony Landmarks
   C. Radiographic Appearance
   D. Adjacent Structures

2. Scan Acquisition
   A. Patient Instructions
   B. Patient Positioning
   C. Evaluating Pre-Set Scan Parameters

3. Scan Analysis and Printout
   A. Accurate ROI Placement
   B. BMC, Area and BMD
   C. T-score, Z-score

4. Common Problems
   A. Poor Bone Edge Detection
   B. Nonremovable Artifacts
   C. Variant Anatomy
   D. Fractures or Pathology

5. Follow-Up Scans
   A. Unit of Comparison
      1. BMD
      2. T-score
   B. Reproduce Baseline Study

F. DXA Scanning of Proximal Femur (10)

1. Anatomy
   A. Regions of Interest
   B. Bony Landmarks
   C. Radiographic Appearance
   D. Adjacent Structures

2. Scan Acquisition
   A. Patient Instructions
   B. Patient Positioning
   C. Evaluating Pre-Set Scan Parameters

3. Scan Analysis and Printout
   A. Accurate ROI Placement
   B. BMC, Area and BMD
   C. T-score, Z-score

4. Common Problems
   A. Poor Bone Edge Detection
   B. Nonremovable Artifacts
   C. Variant Anatomy
   D. Fractures or Pathology

5. Follow-Up Scans
   A. Unit of Comparison
      1. BMD
      2. T-score
   B. Reproduce Baseline Study