Job Analysis Report

The International Society for Clinical Densitometry (ISCD)

Certified Bone Densitometry Technologist (CBDT®)

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Submitted to:

ISCD
The International Society For Clinical Densitometry

Executive Summary

This report describes the methodology and procedures used to conduct a job analysis and develop the exam specifications for the International Society for Clinical Densitometry (ISCD) Certified Bone Densitometry Technologist (CBDT®) certification examination.

The three major activities that comprise the job analysis process described in this report are as follows:

1. **Job Analysis Committee Meeting** – A gathering of subject matter experts (SMEs) to discuss and develop a description of the scope of practice
2. **Job Analysis Survey** – A large-scale survey of practitioners not involved with the SME panel to validate the task and knowledge statements developed by the committee
3. **Development of Examination Specifications** – The development of an Examination Content Outline by the committee based on the results of the survey

Several practitioners were assembled by ISCD to serve as subject matter experts (SMEs). The individuals selected represent a wide variety of work-related characteristics such as years of experience, work setting, geographic location, and areas of specialty. This helps in developing a scope of practice that is reflective of the roles and responsibilities of the job role and is relatively free from bias. By analyzing the experiences and expertise of current practitioners, the results from the job analysis become the basis of a validated assessment that reflects the competencies required for competent job performance.

The job analysis process utilized in this study yields exam specifications that accurately reflect the scope of practice, allowing for the development of fair, accurate, and realistic assessments of candidates' readiness for certification. The resultant Examination Content Outline (Appendix E) indicates a 125-item examination with content distribution requirements at the competency area (content domain) level as well as topic (content subdomain) level. The five competency areas are:

1. Bone Concepts
2. Radiation Safety and Science
3. Technology and Equipment
4. Scan Acquisition
5. Scan Analysis

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Introduction

This report describes the methodology and procedures used to conduct a job analysis and develop the exam specifications for the International Society For Clinical Densitometry (ISCD) Certified Bone Densitometry Technologist (CBDT®) certification examination.

The job analysis was conducted in accordance with principles and practices outlined in the *Standards for Educational and Psychological Testing*[1], which describe principles and guidelines for all aspects of test development, including content validation.

A job analysis (sometimes referred to as a practice analysis, job task analysis, role delineation study, work analysis, or competency profiling) is a scientific inquiry conducted to identify the tasks and work activities conducted, the context in which those tasks and activities are carried out, and the competencies (knowledge areas, skills, and abilities) required to perform a job role successfully[2]. Different methods can be used which may differ in the levels of specificity in analyzing and describing different work elements, with the choice of method largely dependent on the intended purpose and use of the results. The methodology of the current analysis was tailored to the creation of exam specifications for test development.

When completed, the job analysis process utilized in this study yields exam specifications that accurately reflect the scope of practice, allowing for the development of fair, accurate, and realistic assessments of candidates' readiness for certification. The job analysis is typically performed every 5 to 7 years so that the content outline represents the current scope of practice. Because it serves as the primary basis for content validity evidence, as required by the aforementioned standards, the job analysis is a primary mechanism by which a certifying body or regulatory board can ensure the accuracy and defensibility of an exam. It serves as the foundation of the certification exam and is critical to the success of the entire exam development process. All necessary documentation verifying that the validation process has been implemented in accordance with professional standards is included in this report.

This report is divided into the major activities of the job analysis process, which are:

1. **Job Analysis Committee Meeting** – A gathering of subject matter experts (SMEs) to discuss and develop a description of the scope of practice
2. **Job Analysis Survey** – A large-scale survey to practitioners not involved with the SME panel to validate the task and knowledge statements developed by the committee
3. **Development of Examination Specifications** – The development of an Examination Content Outline by the committee based on the results of the survey

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[1] American Educational Research Association, American Psychological Association, National Council on Measurement in Education (2014). *Standards for Educational and Psychological Testing*. Washington, DC: AERA.

[2] Sackett, P.R., Walmsley, P.T., Laczo, R.M. (2012). *Job and work analysis: Industrial and Organizational Psychology.* In N. Schmitt, S. Highhouse (Eds.), Comprehensive Handbook of Psychology, Volume 12. New York, NY: John Wiley and Sons.

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Job Analysis Committee Meeting

ISCD selected subject matter experts (SMEs) to represent a wide variety of work-related characteristics such as years of experience, work setting, geographic location, and areas of specialty to develop a scope of practice that is reflective of the roles and responsibilities of the job and is relatively free from bias. See Appendix A for a complete list of the SMEs and their qualifications.

Prior to the job analysis committee meeting, three SMEs were interviewed to help provide background information on the job role, the history of the credential, and the anticipated future of the job role. These interviews were conducted between April 22, 2021 and April 28, 2021.

PSI Services LLC (PSI) conducted a job analysis committee meeting on May 27, 2021 with the SMEs to discuss the scope of practice and develop a list of tasks and knowledge areas that reflect the job role. PSI led the SMEs in refining task and knowledge statements and organizing them into a domain and subdomain structure. The outgoing exam content outline was used as a resource when developing the knowledge and tasks. See Appendix B for the presentation used to orient the job analysis committee at the beginning of the meeting.

The job analysis committee developed 14 task statements, as follows:

1. Perform and interpret results of quality control (QC) tests on scanning equipment
2. Obtain patient medical history
3. Ensure artifact-producing objects have been removed
4. Evaluate factors than can invalidate or interfere with scan results/validity
5. Apply radiation safety principles (e.g., ALARA) with patient and technologist
6. Obtain and enter patient data into the DXA equipment (e.g., height, weight)
7. Use appropriate positioning devices
8. Determine appropriate scan sites
9. Acquire bone densitometry scan
10. Analyze scans according to manufacturer specifics
11. Determine appropriate placement for regions of interest (ROI)
12. Evaluate quality of measurements for validity
13. Record and save scan results
14. Respond to patient concerns regarding bone health

The job analysis committee developed 56 knowledge statements across five content domains, as follows.

1. **Bone Concepts**
    A. Key Terms
        1. Osteoporosis and Low Bone Mass
        2. Bone Mineral Density (BMD)
        3. T-scores and Z-scores
        4. Fracture Risk Assessment (FRAX®)

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B. Bone Science
    1. Anatomy and physiology
    2. Bone types (e.g., trabecular, cortical)
    3. Remodeling cycle (e.g., formation, resorption)
    4. Fractures (e.g., atypical)
C. Osteoporosis
    1. Primary osteoporosis (e.g., Type 1, Type 2)
    2. Secondary osteoporosis
    3. Risk factors
    4. Prevention
    5. Treatments (e.g., antiresorptive, anabolic)
    6. Bone Mass Measurement Act (i.e., reimbursement and coverage)

2. Radiation Safety and Science

A. X-Ray Science
    1. Ionizing radiation factors (e.g., time, mA, kVp)
    2. Dual energy X-Ray Absorptiometry (DXA)
B. Basic Methods of Protection and Radiation Safety
    1. ALARA
    2. Who to protect (e.g., patient, technologist, pregnant women)
    3. Protection methods (e.g., time, distance, shielding)
    4. Radiation dose (e.g., units, comparison)

3. Technology and Equipment

A. BMD Measurement
    1. Testing devices (e.g., advantages/disadvantages of DXA, QCT, and QUS)
    2. Types of scanners (e.g., dual energy/fan beam, CT, ultrasound)
B. DXA Standard Practices
    1. Calibration
    2. Quality assurance (QA) (e.g., accuracy, precision)
    3. Quality control (QC) (e.g., spine phantom, shifts, drifts)
    4. Precision assessment (e.g., calculating LSC)
    5. Cross-calibration
    6. Data management (e.g., backup, archive)

4. DXA Scan Acquisition

A. Scan Selection
    1. Central vs. Peripheral
    2. Scan site substitution
    3. Patient health information
    4. Scan mode selection (e.g., body habitus)
B. Positioning
    1. Spine
    2. Femur/hip
    3. Forearm/distal radius
C. Artifacts
    1. Anatomical
    2. Internal and external
    3. Motion
    4. Contrast agents

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D. Serial Scanning
    1. Reproducibility
    2. Previous scan settings, parameters, and positioning
    3. Least Significant Change (LSC)
E. Other Measurements
    1. Total Body/composition scan
    2. Vertebral Fracture Assessment (VFA)
    3. Atypical Femur Fracture (AFF) scans
    4. Trabecular bone scores (TBS)

5. Scan Analysis

A. Analysis Procedures
    1. Specific sites (e.g., spine, hip, forearm)
    2. Baseline vs. serial
    3. Regions of interest (ROI)
    4. Bone mapping/edge detection
    5. Errors and automatic adjustments
    6. Scan validity (e.g., erroneous BMD elevations, excluding vertebrae)
B. Guidelines and Reporting
    1. ISCD Official Positions
    2. WHO Diagnostic Criteria
    3. NHANESIII Database
    4. National Osteoporosis Foundation (NOF)

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Development of Exam Specifications

The Job Analysis Committee met on July 30, 2021 to review the results of the survey, finalize the tasks and knowledge that would comprise the next Examination Content Outline, and finalize the content weighting for the examination.

The committee reviewed the demographic results and confirmed that the results matched expectations and impressions of the practitioner population, suggesting that the respondent sample is reflective of the target population.

The committee elected to retain all the tasks, but made two minor text edits:

- Task 4: Evaluate factors that can invalidate or interfere with **validity of** scan results~~validity~~
- Task 6: Obtain and enter patient data into the DXA equipment ~~(e.g., height, weight)~~

The committee elected to discard three knowledge areas due to low ratings and a consensus agreement that they represented knowledge that only some practitioners require:

- 1C6 – Bone Mass Measurement Act (i.e., reimbursement and coverage)
- 4E3 – Atypical Femur Fracture (AFF) scans
- 4E4 – Trabecular Bone Score (TBS)

The committee then reviewed the draft content weighting, discussing any adjustments necessary to align the number of items per content area for adequate content coverage on the assessment. The draft content weighting was developed by calculating the criticality value (mean importance rating multiplied by the mean frequency rating) and then determining a percentage weight based on the relative weight of the criticality value for each content area.

See Table 4 for a summary of the content weighting determination. The final Examination Content Outline can be found in Appendix E.

Table 4.

Content Weighting Determination.

Knowledge Statements		Criticality	Percentage	# Items
1A1	Osteoporosis and low bone mass	21.6	2.4%	3
1A2	Bone Mineral Density (BMD)	21.7	2.4%	3
1A3	T-scores and Z-scores	22.4	2.5%	3
1A4	Fracture Risk Assessment (FRAX®)	15.1	1.7%	2
1B1	Anatomy and physiology	20.3	2.3%	3
1B2	Bone types (e.g., trabecular, cortical)	14.6	1.6%	2
1B3	Remodeling cycle (e.g., formation, resorption)	11.7	1.3%	2
1B4	Fractures (e.g., atypical)	17.0	1.9%	2
1C1	Primary osteoporosis (e.g., Type 1, Type 2)	15.6	1.7%	2
1C2	Secondary osteoporosis	13.5	1.5%	2
1C3	Risk factors	19.2	2.2%	3
1C4	Prevention	15.3	1.7%	2
1C5	Treatments (e.g., antiresorptive, anabolic)	14.8	1.7%	2

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Knowledge Statements		Criticality	Percentage	# Items
2A1	Ionizing radiation factors (e.g., time, mA, kVp)	11.4	1.3%	2
2A2	Dual energy X-Ray Absorptiometry (DXA)	17.6	2.0%	2
2B1	ALARA	19.0	2.1%	3
2B2	Who to protect (e.g., patient, technologist, pregnant women)	19.3	2.2%	3
2B3	Protection methods (e.g., time, distance, shielding)	17.6	2.0%	2
2B4	Radiation dose (e.g., units, comparison)	13.7	1.5%	2
3A1	Testing devices (e.g., advantages/disadvantages of DXA, QCT, and QUS)	8.9	1.0%	1
3A2	Types of scanners (e.g., dual energy/fan beam, CT, ultrasound)	7.4	0.8%	1
3B1	Calibration	18.3	2.1%	3
3B2	Quality assurance (QA; e.g., accuracy, precision)	21.5	2.4%	3
3B3	Quality control (QC) (e.g., spine phantom, shifts, drifts)	21.1	2.4%	3
3B4	Precision assessment (e.g., calculating LSC)	14.0	1.6%	2
3B5	Cross-calibration	7.8	0.9%	1
3B6	Data management (e.g., backup, archive)	19.3	2.2%	3
4A1	Central vs. peripheral	14.1	1.6%	2
4A2	Scan site substitution	15.2	1.7%	2
4A3	Patient health information	20.0	2.2%	3
4A4	Scan mode selection (e.g., body habitus)	18.9	2.1%	3
4B1	Spine	23.9	2.7%	3
4B2	Femur / hip	23.8	2.7%	3
4B3	Forearm / distal radius	19.6	2.2%	3
4C1	Anatomical	18.7	2.1%	3
4C2	Internal and external	18.3	2.1%	3
4C3	Motion	16.2	1.8%	2
4C4	Contrast agents	12.1	1.4%	2
4D1	Reproducibility	20.8	2.3%	3
4D2	Previous scan settings, parameters, and positioning	21.0	2.4%	3
4D3	Least Significant Change (LSC)	15.9	1.8%	2
4E1	Total body/composition scan	5.6	0.6%	1
4E2	Vertebral Fracture Assessment (VFA)	7.0	0.8%	1
5A1	Specific sites (e.g., spine, hip, forearm)	23.0	2.6%	3
5A2	Baseline vs. serial	22.0	2.5%	3
5A3	Regions of interest (ROI)	22.7	2.5%	3
5A4	Bone mapping/edge detection	21.6	2.4%	3
5A5	Errors and automatic adjustments	17.6	2.0%	2
5A6	Scan validity (e.g., erroneous BMD elevations, excluding vertebrae)	17.7	2.0%	3
5B1	ISCD Official Positions	16.4	1.8%	2
5B2	WHO Diagnostic Criteria	16.6	1.9%	2
5B3	NHANESIII Database	12.0	1.4%	2
5B4	National Osteoporosis Foundation (NOF)	10.0	1.1%	1

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Appendix E

Exam Content Outline

	Total	**125**
1	**Bone Concepts**	**31**
1A	Key Terms	11
1A1	Osteoporosis and low bone mass	3
1A2	Bone Mineral Density (BMD)	3
1A3	T-scores and Z-scores	3
1A4	Fracture Risk Assessment (FRAX)	2
1B	Bone Science	9
1B1	Anatomy and physiology	3
1B2	Bone types (e.g., trabecular, cortical)	2
1B3	Remodeling cycle (e.g., formation, resorption)	2
1B4	Fractures (e.g., atypical)	2
1C	Osteoporosis	11
1C1	Primary osteoporosis (e.g., Type 1, Type 2)	2
1C2	Secondary osteoporosis	2
1C3	Risk factors	3
1C4	Prevention	2
1C5	Treatments (e.g., antiresorptive, anabolic)	2
2	**Radiation Safety and Science**	**14**
2A	X-Ray Science	4
2A1	Ionizing radiation factors (e.g., time, mA, kVp)	2
2A2	Dual energy X-Ray Absorptiometry (DXA)	2
2B	Protection and Radiation Safety	10
2B1	ALARA	3
2B2	Who to protect (e.g., patient, technologist, pregnant women)	3
2B3	Protection methods (e.g., time, distance, shielding)	2
2B4	Radiation dose (e.g., units, comparison)	2
3	**Technology and Equipment**	**17**
3A	BMD Measurement	2
3A1	Testing devices (e.g., advantages/disadvantages of DXA, QCT, and QUS)	1
3A2	Types of scanners (e.g., dual energy/fan beam, CT, ultrasound)	1
3B	DXA Standard Practices	15
3B1	Calibration	3
3B2	Quality assurance (QA; e.g., accuracy, precision)	3
3B3	Quality control (QC; e.g., spine phantom, shifts, drifts)	3
3B4	Precision assessment (e.g., calculating LSC)	2
3B5	Cross-calibration	1
3B6	Data management (e.g., backup, archive)	3

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4	**Scan Acquisition**	**39**
4A	Scan Selection	10
4A1	Central vs. peripheral	2
4A2	Scan site substitution	2
4A3	Patient health information	3
4A4	Scan mode selection (e.g., body habitus)	3
4B	Positioning	9
4B1	Spine	3
4B2	Femur / hip	3
4B3	Forearm / distal radius	3
4C	Artifacts	10
4C1	Anatomical	3
4C2	Internal and external	3
4C3	Motion	2
4C4	Contrast agents	2
4D	Serial Scanning	8
4D1	Reproducibility	3
4D2	Previous scan settings, parameters, and positioning	3
4D3	Least Significant Change (LSC)	2
4E	Other Measurements	2
4E1	Total body / composition scan	1
4E2	Vertebral Fracture Assessment (VFA)	1
5	**Scan Analysis**	**24**
5A	Analysis Procedures	17
5A1	Specific sites (e.g., spine, hip, forearm)	3
5A2	Baseline vs. serial	3
5A3	Regions of interest (ROI)	3
5A4	Bone mapping / edge detection	3
5A5	Errors and automatic adjustments	2
5A6	Scan validity (e.g., erroneous BMD elevations, excluding vertebrae)	3
5B	Guidelines and Reporting	7
5B1	ISCD Official Positions	2
5B2	WHO Diagnostic Criteria	2
5B3	NHANESIII Database	2
5B4	National Osteoporosis Foundation (NOF)	1

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