Medical Dosimetrist Certification Board®

Steering the advancement of the Medical Dosimetry profession by establishing certification and continuing education standards to enhance quality patient care

Job Task Analysis
December 2023

Conducted by:

PROMETRIC

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Background

A job analysis study refers to specific procedures followed to gather descriptive information about the tasks performed on a job and the knowledge, skills, or abilities required to perform those tasks. The job analysis study identifies the exam content domains and establishes the content validity, the extent to which the content covered by an examination is representative of the tasks and knowledge needed to perform a job.

The job task analysis was conducted in accordance with *The Standards for Educational and Psychological Testing*[1] (1999). (*The Standards)* is the definitive authority in testing and outlines the criteria for the evaluation of tests, testing practices, and the effects of test use. It was developed jointly by the American Psychological Association (APA), the American Educational Research Association (AERA), and the National Council on Measurement in Education (NCME). Through adherence to practices defined in *The Standards,* exams developed following these guidelines are likely to be determined to be valid and defensible.

As stated in Standard 14.14,

> "The content domain to be covered by a credentialing test should be defined clearly and justified in terms of the importance of the content for credential-worthy performance in an occupation or profession. A rationale should be provided to support a claim that the knowledge or skills being assessed are required for credential-worthy performance in an occupation and are consistent with the purpose for which the licensing or licensure program was instituted…Some form of job or job analysis provides the primary basis for defining the content domain…"

[1] American Educational Research Association, American Psychological Association, National Council on Measurement in Education. (1999). *The Standards for Educational and Psychological Testing*. Washington, DC: American Psychological Association.

Conduct of the Job Task Analysis

Development of Task and Knowledge Statements

For the initial phase of the study, a group of volunteer subject matter experts (certified medical dosimetrists), representative of various demographic groups within the profession, was selected to participate in a task group. Factors for selection of the subject matter experts were related to gender, geographic location, job setting, job title, number of years certified, and number of years working in the field.

The task group reviewed the results of the previous job task analysis conducted in 2018. Through review, discussion and revision of the previously identified task and knowledge statements, the group identified the current tasks and knowledge necessary for the performance of a medical dosimetrist.

Survey Construction

Following Task Force Meetings, Prometric staff developed a draft outline of the task and knowledge domains for survey of the dosimetry population.

Survey Review by Task Force

Each Task Force member was provided with a copy of the draft survey for review. Following review, a meeting of the Task Force was conducted to make any refinements to the initial task and knowledge statements identified.

Survey Pilot Test

The revised survey was used to conduct a pilot test. The purpose of the small-scale pilot test was for professionals in the field with no previous involvement in the development of the survey, to review and offer recommendations to improve the survey.

Pilot test participants reviewed the survey for clarity and comprehensiveness of content coverage. Task Force members reviewed the results of comments made by pilot test participants. As a result, further revisions were made and the survey was finalized.

The Survey

The final version of the survey not only incorporated the task and knowledge statements developed but queried participants about their background information and professional responsibilities. Participants also had the opportunity to provide comment that included recommendations for test content.

The survey was delivered online to nearly 5,000 CMDs and non-CMDs from email rosters provided by both the American Association of Medical Dosimetrists and the Medical Dosimetrist Certification Board. Respondents were asked to rate the knowledge and task statements on a scale of importance in the daily performance of medical dosimetry using a five-point scale (*0 = Of no importance* to *4 = Very Important*).

Development of the Test Specifications

A meeting was conducted to develop the test specifications based on the job analysis study results. Participants at this meeting were comprised of one-half the initial task force and one-half subject matter experts who had not previously participated in the development of the draft task and knowledge statements.

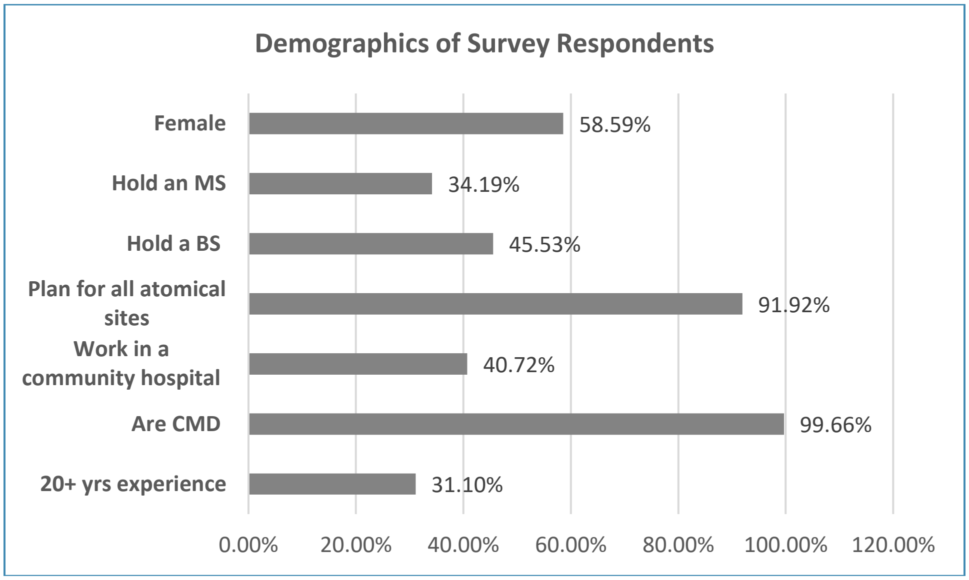
The survey responses indicated that a representative group of professional dosimetrists completed the survey in sufficient numbers to meet the requirements to conduct statistical analysis. This was evidenced by the distribution of responses for each of the background information questions and was confirmed through discussion with the Committee.

Only statements with a mean rating of 2.50 or above were included in the test specifications. Finally, in order to determine weights for each of the test content areas each member of the task force was asked to individually assign a percentage weight to each of the domains identified from the survey and compare those weights to the weights assigned by the survey respondents. Through discussion the final weights were assigned to the content areas outlined below.

Content Areas	No. of Statements	% Weight
1. Radiation Physics	10	14%
2. Localization	7	8%
3. Treatment Planning	54	42%
4. Dose Calculation Methods	20	13%
5. Brachytherapy	8	5%
6. Radiation Protection	9	9%
7. Quality Assurance and Standard of Care	12	9%

Demographic Characteristics of Survey Respondents

Details of the background information of the 531 survey respondents are outlined below and reflect majority characteristics.



2023 Test Specifications Matrix

Details of the findings for categories and subcategories are outlined below.

MDCB CMD Test Specifications Matrix Derived from the 2023 Job Task Analysis	
Domain	**Weight**
I: Radiation Physics	14%
1. Identify the types of radioactive decay (e.g., alpha, beta, gamma)	
2. Describe the production of X rays and particle beams	
3. Differentiate between the characteristics of X rays and particle beams (e.g., attenuation, stopping power)	
4. Distinguish between the types of interaction of radiation with matter	
5. Identify treatment machine characteristics (e.g., gamma source, HDR, LINAC, MR, proton, photon, orthovoltage and superficial X-rays)	
6. Recognize geometric characteristics (e.g., magnification, minification)	
7. Recall half-lives of radioactive elements (e.g., cesium, iridium)	
8. Distinguish between imaging modalities (e.g., CBCT, CT, KV/MV, MRI, PET, SGRT)	
9. Recognize the relationship between the Hounsfield unit and the CT density table	
10. Calculate radiation computations (e.g., absorbed dose, activity, dose equivalent, exposure, HVL, radiation units)	
II: Localization	8%
1. Manage patient data (e.g., assess, import, translate, validate)	
2. Consult on patient positioning	
3. Consult on patient immobilization and motion management techniques	
4. Assess simulation parameters (e.g., adequate prep, complete data sets, full treatment windows)	
5. Evaluate rigid image registration, deformable registration, and image fusion	
6. Describe IGRT techniques (e.g., CBCT, CT on rails, fiducials, fluoroscopy, infrared, KV-KV, MV-MV, SGRT, ultrasound guidance)	
7. Construct localization of patient within treatment planning system (TPS)	
III: Treatment Planning	42%
1. Evaluate isodose distributions and dose metrics	
2. Recall site specific clinical oncology (e.g., anatomy, common treatment techniques, disease, dose and fractionation schemes modes of spread)	
3. Review radiobiology (e.g., BED, dose tolerances, hypofractionation, LET, RBE, time dose fractionation calculation)	
4. Identify cross-sectional anatomy	
5. Recognize treatment delivery systems (e.g., advantages, limitations, machine differences)	
6. Define special treatment procedures (e.g., SBRT, SRS, TBI, TSEI/TBE)	
7. Describe planning methodologies (e.g., adaptive radiotherapy, compensator, electron, forward, inverse, MCO, robust planning, stereotactic)	
8. Identify OAR constraints under specific protocols (e.g., AAPM/TG-101, QUANTEC, RTOG, Timmerman)	
9. Describe computer systems management (e.g., archiving and backup, DICOM data transfer, routine maintenance, scripting)	
10. Discuss automated treatment planning processes (e.g., auto-contouring, auto-planning, scripting, templating)	
11. Define planning structures as outlined by ICRU	
12. Assess optimization functions (e.g., EUD, minimum and maximum DVH)	
13. Recognize implanted devices and their impact on planning (e.g., CGMs, fiducial, pacemakers, prosthetics, SpaceOAR gels)	

IV: Dose Calculation Methods	13%
1. Recognize external beam dose calculation and algorithms	
2. Analyze effects of beam modifying devices (e.g., bolus, compensators, Lucite, MLC, partial transmission blocks, wedges)	
3. Compute special calculations as needed (e.g., entrance/exit dose, gap calculations, off axis, re-treatments)	
4. Evaluate the need for corrections for tissue inhomogeneities and density overrides	
5. Evaluate deformable dose accumulations	
6. Identify sources of uncertainty and limitations in computer-based treatment planning (e.g., effects of dose grid matrices, calculation algorithms)	
V: Brachytherapy	5%
1. Identify radioactive source characteristics	
2. Describe HDR and LDR treatment and planning methods	
3. Identify brachytherapy treatment devices (e.g., cylinder, interstitial breast, needles, seed applicators, T&O, vaginal cuffs)	
4. Recognize surveying requirements (e.g., background pre- and post-implant, bedside dose, shielding)	
5. Recognize the role of the NRC and state regulations in dosimetry	
6. Compute brachytherapy calculations	
VI: Radiation Protection	9%
1. Cite ALARA and maximum permissible dose equivalent based on NCRP recommendations and regulatory guidelines (e.g., ICRU, NCRP)	
2. Cite mandatory radiation monitoring requirements for personnel and patients (e.g., worker, non-worker, pregnant worker)	
3. Explain the rationale for treatment vault design requirements (e.g., primary- vs secondary-barrier)	
4. Identify types of radiation detectors	
VII: Quality Assurance & Standard of Care	9%
1. Recognize the purpose of treatment machine commissioning and quality assurance in relation to patient safety	
2. Review plan checks, charts and images	
3. Differentiate types of measurement equipment (e.g., diodes, ion chambers, survey meters, TLD)	
4. Utilize record and verify systems and EMR	
5. Recognize the steps of treatment beam QA measurement and analysis (e.g., electron cut out factors, IMRT)	
6. Identify scope of practice based on AAMD Scope of Practice document and AAMD Practice Standards document	
7. Describe incident reporting process for patient safety (e.g., process improvement, quality improvement, RO-ILS, root cause analysis)	
8. Identify factors and limitations of deliverable plans	
9. Recognize QA requirements of simulation and treatment equipment	

Cut Score Study

A cut score study will be conducted to determine the passing score of the exam for the new test specifications on an upcoming exam when the new test specifications are employed. The cut score study is a recognized industry standard and follows proscribed steps to determine the final cut score. Participants for the study are selected from a group of subject matter expert medical dosimetrists who are representative of the demographically diverse dosimetry population.

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