MDCB
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
November 2018

Conducted by:

PROMETRIC

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Medical Dosimetrist Certification Board®

Background

The first Medical Dosimetry Certification Board (MDCB) certification exam in medical dosimetry was administered 1988. It was provided at a single site as a paper and pencil exam. By 1991, the exam was administered annually in 15 test sites in major cities in the United States and Canada. The hallmark of the exam was its “shotgun” start with simultaneous administration in all test locations.

Later the exam was delivered internationally, in South Korea and Hong Kong whenever there was a minimum of ten test candidates for those sites. With the advent of the computer-based test in September of 2011, the exam became available in approximately 150 sites outside North America. As a result, candidates from the Far East, the Middle East, Australia and Europe have challenged the exam.

To continue to assure that the exam continues to have relevance to current dosimetry practice, a job task analysis (JTA) is conducted every five years in accordance with best practices. A job analysis study may also be referred to as a practice analysis, role and function study or role delineation study. Details on the procedure of the JTA are provided in this report.

MDCB’s Job Task Analysis was conducted by Prometric, MDCB’s service partner for test development and administration services. Prometric has more than 20 years of experience in the testing industry. They serve test takers worldwide who take more than seven million tests each year in more than 180 countries.

Job Task Analysis Study Adherence to Professional Standards

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 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 region, job setting, experience, gender and ethnicity.

The task group reviewed the results of the previous job task analysis conducted in 2014. 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:

Task & Knowledge Importance
0 = Of no importance
1 = Of little importance
2 = Of moderate importance
3 = Important
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.

531 responses were used for analysis. Based on the analysis of survey responses, 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. 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	21	16%
2. Localization	11	8%
3. Treatment Planning	54	40%
4. Dose Calculation Methods	20	15%
5. Brachytherapy	8	6%
6. Radiation Protection	9	7%
7. Quality Assurance and Standard of Care	12	9%

Linkage of Task and Knowledge Statements

Task and knowledge linking is conducted before the release of the job task analysis. Linkage verifies that each knowledge area included on an examination is related to the performance of one or more important tasks.

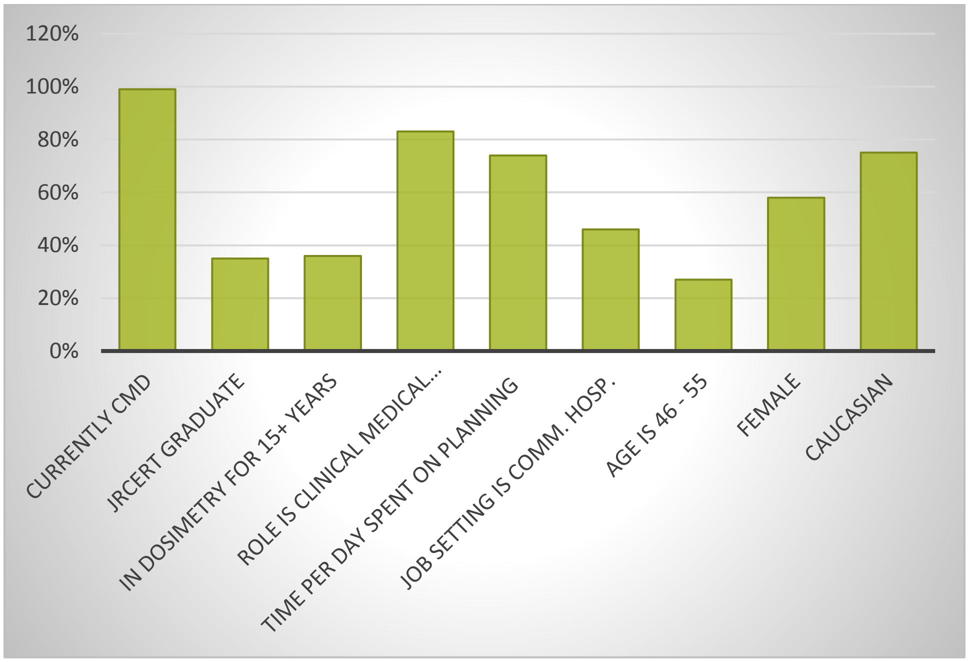
Development of Test Specification Crosswalk

Finally, the Test Specifications Committee compared the prevailing test specification categories and sub-categories to the newly developed specifications to determine if each of the new sub-categories were correctly identified within the correct category. 2014 test specifications follow.

Content Areas	No. of Statements	% Weight
1. Radiation Physics	24	17%
2. Localization	9	7%
3. Treatment Planning	52	38%
4. Dose Calculation Methods	20	15%
5. Brachytherapy	9	7%
6. Radiation Protection	9	7%
7. Quality Assurance & 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.



2018 Test Specifications Matrix

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

MDCB Test Specifications Matrix Derived from the 2018 Job Task Analysis	
Domain	**Weight**
I. Radiation Physics	**16%**
1. Radioactive decay	
2. Production of X rays and particle beams	
3.Characteristics of X rays and particle beams	
4. Interaction of radiation with matter	
5. Treatment machine characteristics: LINAC (e.g., MR, proton, photon, orthovoltage and superficial X rays, gamma source)	
6.Geometric characteristics (e.g., magnification, minification)	
7. Radiation measurement	
8. Imaging modalities (e.g., MRI, PET, CT, ultrasound, SPECT, KV/MV, CBCT)	
9. Hounsfield unit conversion to CT density table in treatment planning systems	
10. Radiation units (e.g., activity, exposure, absorbed dose, and dose equivalent)	
II. Localization	**8%**
1. Acquisition of patient data	
2. Patient positioning	
3. Patient immobilization and motion management techniques	
4. Treatment simulations, TPS localization of patient	
5. Rigid image registration, deformable registration, image fusion	
6. IGRT (e.g., SGRT, CBCT, ultrasound guidance, KV-KV, MV-MV, infrared, fluoroscopy, CT on rails, fiducials)	
II. Treatment Planning	**40%**
1. Isodose distributions and dose metrics	
2. Site specific clinical oncology (e.g., disease, anatomy, modes of spread, common treatment techniques, dose and fractionation schemes)	
3. Radiobiology (e.g., dose tolerances, hypofractionation, time dose fractionation calculation, BED, RBE, LET)	
4. Cross-sectional anatomy	
5. Treatment delivery systems machine differences, limitations, and advantages	
6. Special treatment procedures (e.g., TBI, TSEI/TBE, IORT, SRS, SBRT)	
7. Planning methodologies (e.g., forward, inverse, compensator, robust planning)	
8. DICOM data transfer	
9. Computer systems management (e.g., archiving and backup, routine maintenance, scripting)	
10. Adaptive radiotherapy	
11. Autoplanning	
12. Autocontouring	
13. Implanted devices	

14. The accuracy and limitations of IGRT techniques	
IV. Dose Calculation Methods	**15%**
1. External beam dose calculation and algorithms	
2. Effects of beam modifying devices (e.g., wedges, bolus, partial transmission blocks, compensators, MLC)	
3. Special calculations (e.g., off axis, re-treatments, gap calculations, entrance/exit dose)	
4. Corrections for tissue inhomogeneities and density overrides	
5. Deformable dose accumulations	
6. Sources of uncertainty and limitations in computer-based treatment planning (e.g., effects of dose grid matrices)	
V. Brachytherapy	**6%**
1. Radioactive source characteristics	
2. HDR and LDR treatment planning	
3. HDR and LDR delivery systems	
4. Brachytherapy treatment device verification (e.g., seeds applicators)	
5. Secondary/independent calculation	
6. Surveying (e.g., background pre and post implant, shielding, bedside dose)	
7. Regulatory requirements for radioactive sources (e.g., NRC vs state requirements)	
VI. Radiation Protection	**7%**
1. ALARA and maximum permissible dose equivalent based on NCRP recommendations, regulatory guidelines (e.g., ICRU, NCRP)	
2. Radiation monitoring for personnel and patients	
3. Treatment vault shielding requirements	
VII. Quality Assurance and Standard of Care	**8%**
1. TPS commissioning and quality assurance	
2. Clinical data: plan checks, chart reviews, image reviews	
3. Measurement equipment (e.g., diodes, ion chambers, TLD, survey meters)	
4. Record and verify systems and EMR	
5. Treatment beam QA measurement and analysis (e.g., IMRT, electron cut out factors)	
6. AAMD Scope of Practice	
7. Incident reporting for patient safety (e.g., quality improvement, RO-ILS, root cause analysis, process improvement)	
8. Factors and limitations of deliverable plans	
9. QA requirements of simulation and treatment equipment	

Cut Score Study

In the spring of 2019, a cut score study will be conducted to determine the passing score of the exam for the new test specifications. 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.

The new test specifications will be employed for the first time with the administration of the April 2019 exam.

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