

The MDCB Exam

Reliability & Validity

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Historical View

- ❑ The MDCB originated as a task group of the AAMD and a certification committee was formed.
- ❑ The MDCB was formally incorporated in 1988.
- ❑ In 1988 the first exam was administered at the Annual AAMD meeting in Calgary, Canada.
- ❑ In July 2010 The first cut score study workshop was held.
- ❑ In September 2010 the MDCB was granted accreditation for the MDCB exam by the National Commission for Certifying Agencies.

Historical View

- ❑ In October 2010 a Strategic Planning Session was conducted to determine the direction of the MDCB and establish future goals.
- ❑ In September 2011 the first computer based exam was administered.
- ❑ In 2012 MDCB went to a biannual administration of the exam.
- ❑ In 2013 Routes 2 and 3 were merged.
- ❑ In 2014 the most recent JTA was performed and is repeated every 5 years thereafter.

Historical View

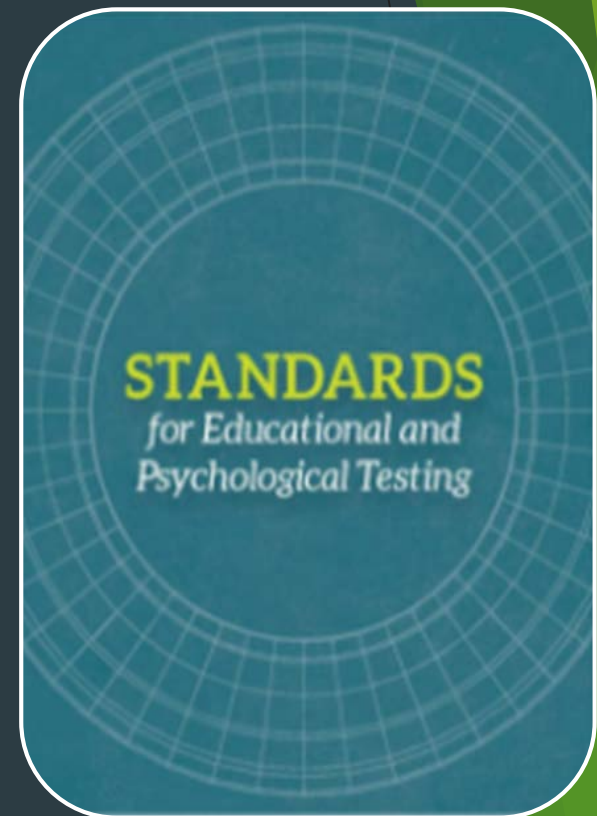
- ❑ In 2015 all Route 1 candidates were required to have a Bachelor's Degree and completion of a JRCERT accredited program.
- ❑ In 2017 there is only one route to eligibility: a Bachelor's Degree and completion from a JRCERT accredited dosimetry program.
- ❑ There is still a foreign equivalence.

Criteria for exam development

- ❑ Validity - Exam is based on verified knowledge.
- ❑ Reliability - Scores reported are representative of candidates skills and knowledge.
- ❑ Both of these criteria are upheld in the 4 major components of the exam development:
 - ❑ The JTA.
 - ❑ The Cut Score Study.
 - ❑ Exam equating - a memo is generated that reports on the equating to the cut score.
 - ❑ Item Development.

Job Task Analysis (JTA)

- ❑ *Standards for Educational and Psychological Testing -2014(1999).*
- ❑ Recognized as *the gold standard in guidance on test development in the US and other countries.*
- ❑ Published jointly by:
 - American Educational Research Association (AERA).
 - American Psychological Association (APA).
 - National Council on Measurement in Education (NCME).



Job Task Analysis (JTA)

- The process involved in performing the JTA:
 - Review the standard.
 - 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 program was instituted.”
 - ▶ “Some form of job or practice analysis provides the primary basis for defining the content domain.”

Job Task Analysis (JTA)

- ❑ What is the JTA?
- ❑ Also known as the Role Delineation Study.
- ▶ The JTA is a systematic process identifying:
 - ❑ Content: Domains.
 - ❑ Tasks: What do you do?
 - ❑ Knowledge: What do you need to know to competently perform the tasks?
- ❑ The purpose of the job analysis study is to:
 - *Validate the tasks and knowledge needed to practice Medical Dosimetry.*
 - *Develop test specifications for the CMD exam.*
- ❑ The JTA is conducted every 5 years.

Job Task Analysis (JTA)

- ▶ Steps of the Job Task Analysis:
 1. Conduct of a planning meeting.
 2. Development of the survey instrument.
 3. Dissemination of the survey.
 4. Analysis of the survey data.
 5. Development of the test specifications.
 6. Linkage of Task and Knowledge Statements.
 7. Test Specification Crosswalk.

Job Task Analysis (JTA)

► Task Force Meeting:

Step 1 (Feb 2014)

- ❑ 12 - 15 SMEs (MDCB issues a notice for SME's).
- ❑ Diverse Demographic SME's were chosen from across the US - Canada.
- ❑ Confirmed Commitment to Confidentiality.
- ❑ Review of Knowledge & Task Statements from previous JTA from 2009.
- ❑ Ranked the Knowledge & Task statements from 0-4 (0 -no importance, 4 - very important).
- ❑ Results were given to Prometric who developed the initial draft of the survey.
- ❑ Task Force reviewed results for further refinement.

Job Task Analysis (JTA)

▶ Survey Pilot Test:

Step 2

- ❑ 25-30 SMEs, not from original task force, completed the test survey and made suggestions on how to improve the survey.
- ❑ The original Task Force members, reviewed and revised the survey on April 1, 2014 based on the pilot test comments.

Job Task Analysis (JTA)

▶ Dissemination of the final survey by the MDCB: Step 3

- ❑ Delivered online to both non-CMDs and CMDs in April 2014.
- ❑ The survey consisted of background and general information, professional responsibilities (tasks), recommendations for test content, marketing questions, and a section for comments.
- ❑ All task and knowledge statements were rated from 0 (of no importance) - 4 (very important) by the participants.

Job Task Analysis (JTA)

► Analysis of the Survey Data:

Step 4

- ❑ The purpose of the survey was to validate the tasks performed by a dosimetrist and the knowledge required to perform those tasks.
- ❑ A mean importance rating for each task and knowledge statement was established as a cut point for inclusion in test development.
- ❑ Only knowledge and tasks with a mean rating of 2.50 or above were included in the test specs (remember they are ranked 0-4).

Job Task Analysis (JTA)

► Development of the Test Specifications: Step 5

- A meeting consisting of half of the participants from the initial task force and half from NEW SME's was held in May 2014 to develop the actual test specifications based on the job analysis study results that included the following:
 - Finalizing the task statements.
 - Finalizing the knowledge required.
 - Establishing the percentage test content weights for each domain of the exam.
 - Creating a link between the task and knowledge.

Job Task Analysis (JTA)

► Survey Results:

- ❑ In all 4245 dosimetrists were eligible to take the survey with a response rate just over 13% (sufficient numbers to meet the requirements to conduct statistical analysis).
- ❑ The majority of respondents were CMD's with certifications in radiography or radiation therapy, were on the job trained, had been in the field 10+ years with planning as their main responsibility in a community hospital, held a Bachelor's degree, did not specialize in treatment planning of any particular anatomical site, and were female white (non-Hispanic).
- ❑ All 75 identified tasks passed with a score of 2.5 except for Quality Assurance (perform IMRT QA measurement and analysis) which scored a 2.4 to 2.49 indicating it was a borderline importance task.
- ❑ All knowledge statements identified passed with a score of 2.5.

Job Task Analysis (JTA):

Development of Test Content Weights

Knowledge Domains	No. of Statements	% Weight
1. Radiation Physics	10	17
2. Localization	9	7
3. Treatment Planning	14	38
4. Dose Calculation Methods	7	15
5. Brachytherapy	7	7
6. Radiation Protection	6	7
7. Quality Assurance and Standard of Care	12	9

Job Task Analysis (JTA)

▶ Linkage of Task and Knowledge Statements: Step 6

- ❑ Verify that the 4 steps of the JTA were completed.
- ❑ Verify that each knowledge area included on exam is related to the performance of at least one task.
- ❑ Linking tasks with knowledge ensures content validity.
- ❑ Linking tasks with knowledge provides guidance for the item writer.

▶ Test Specification Crosswalk: Step 7

- ❑ A comparison of the previous test specifications and the new specifications was performed showing minor changes.

Test Specifications:

The End Result

▶ 2009

- Radiation Physics
- Localization
- Treatment Planning
- Dose Calculations Methods
- Brachytherapy
- Radiation Protection
- Quality Assurance
- Professional Responsibilities
- Fundamentals of Computers

▶ 2014

- Radiation Physics
- Localization
- Treatment Planning (Fundamentals of computers)
- Dose Calculations Methods
- Brachytherapy
- Radiation Protection
- Quality Assurance & Standard of Care (professional responsibilities)

Cut Score Study

- ▶ Establish Passing Score - *"The Standards"*
 - ❑ The MDCB with Prometric conducts an in person meeting of 10 -12 SMEs.
 - ❑ SME's were chosen across US and Canada with diverse experience and education levels.
 - ❑ The initial task is to define what is a "minimally qualified candidate".
 - ❑ The SME's determine what that minimally qualified candidate will know for certification.
 - ❑ Also identify knowledge that may be more challenging.
 - ❑ The SME's are asked to practice rate the exam questions - "How many out of 100 minimally qualified candidates do you think WILL answer this question correctly?"

Cut Score Study

▶ The Angoff method:

- ❑ Based on responses a cut score is computed and reviewed by SMEs.
- ❑ SMEs have the opportunity to alter their cut score ratings.
- ❑ Then the exam is administered to SMEs.
- ❑ While taking the exam, the SMEs predict how many minimally-qualified candidates will get each question correct.
- ❑ After the administration of the exam to the SME's the resulting RATING predictions for each question are analyzed and discussed and then affirmed or revised during the group discussion.

▶ The Beuk method: is an adjustment for the variability of each SME's estimate of the cut score and passing rate.

Cut Score Study

- ▶ Prometric used the Angoff method supplemented by the Beuk method.
 - ❑ Exam results were discussed and the SME's were again given the opportunity to revise ratings.
 - ❑ The following items were analyzed:
 - ✓ Reliability of the panel- The more homogeneous the panel the higher the reliability.
 - ✓ Standard Deviation of Judgement - amount of difference in the ratings-(goal to be below the statistical benchmark of 0.8).
 - ✓ Standard Error of Judgement - The average amount of deviation among the panel members (a score below 2.0 between the first and second ranking demonstrated validity in the cut score).
 - ❑ Again, a cut score is established.

Cut Score Study

► Considerations:

- ❑ Setting a cut score too low - allows a large number of people who are not minimally qualified to practice dosimetry.
- ❑ Setting a cut score too high - creates a injustice by preventing a large number of candidates who are "minimally-qualified" from getting credentialed as a CMD.
- ❑ The cut score must be independent of any desired pass rate.
- ❑ Once a final cut score is agreed upon the recommendation is submitted MDCB Board.

Equating

- ▶ Once the Job Task Analysis and the Cut Score Study are complete, each subsequent administered exam can now be equated to the determined passing score.
 - ❑ The cut score, or passing score, identifies what the minimally qualified candidate *will* know.
 - ❑ The exam is scored based on the cut score determined at the cut score study workshop. Each of the exams is then equated to that cut score as a result of the statistical analysis of each item's stats and the exam as a whole.
 - ❑ Every exam candidate's score is based on the same cut score.
 - ❑ Each exam has a percentage of equate questions (based on best practice guidelines) which ensures that each exam and exam candidate is measured to the same standard.
 - ❑ To equate the two exams the Tucker method was used.

Equating

- ▶ The following exam statistics were analyzed:
 - ❑ Reliability coefficient: consistency of answer responses (>0.8 is good, the January 2016 exam scored 0.91).
 - ❑ Subkoviak Agreement Coefficient: taking the same test on another day (desired range is 0.5 to 1.0, January 2016 exam scored 0.88).
 - ❑ Standard Error Of Measurement: Estimates the standard deviation if you took the exam several times in a row.
 - ❑ The P+ Value: How many candidates answered a question correctly? Relates to degree of difficulty of the question.
 - ❑ The Biserial Correlation: Measures scores on each question and correlates that to the entire test score.

Item Development

- ▶ How does a question make it's way to the board exam?
 - ❑ Items are developed using the test matrix derived from the JTA.
 - ❑ Our test developer Prometric, a division of Educational Testing Service, is the administrator of the SAT with world wide test sites.
 - ❑ All board members are item writers.
 - ❑ Items are also written by the non board item writers.
 - ❑ All item writers are subject to a confidentiality agreement, conflict of interest, and copyright assignment statement.

Item Development

- ❑ MDCB maintains guidelines for item writers.
- ❑ There are different categories of questions such as Hot Spots, Drag and drop, and 4 option multiple choice questions.
- ❑ Gone are the fill in the blank, “k” type, true and false, negative stem, and essay type questions.
- ❑ All questions have only one correct answer.

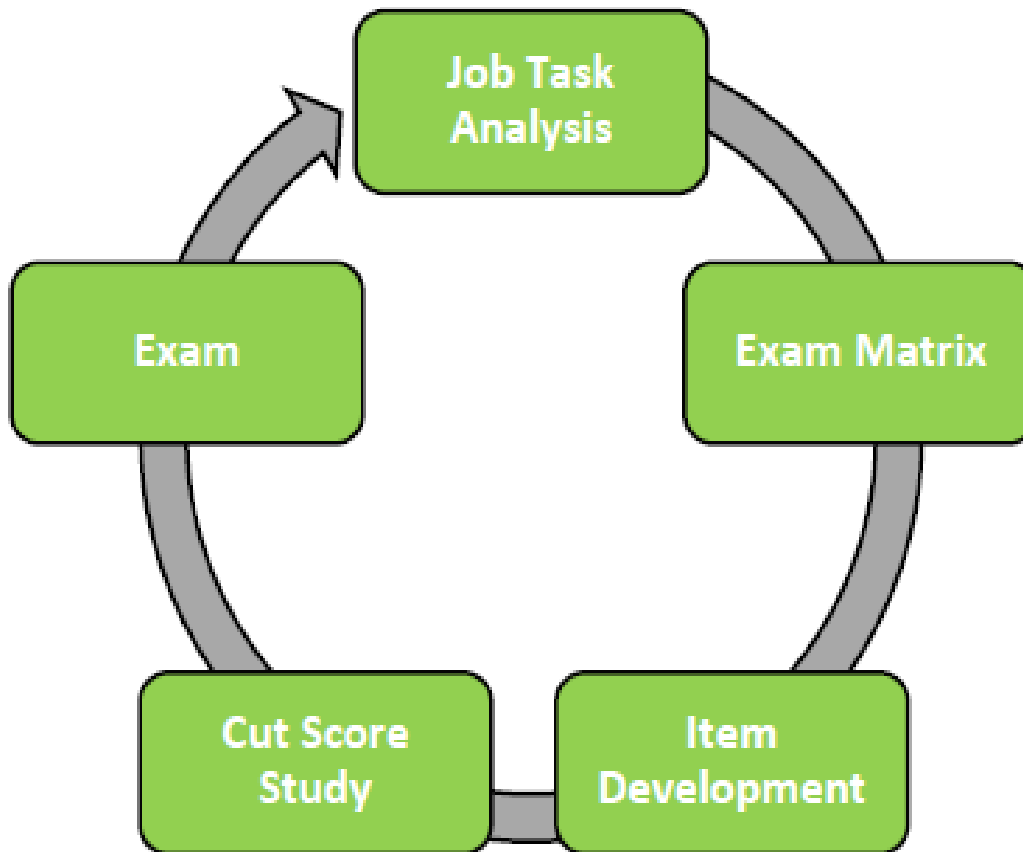
Item Development

- ▶ The item writer writes the typical multiple choice question.
 - ❑ The question consists of a stem and 3 incorrect options.
 - ❑ Stems are clear, complete, concise, with no extraneous words, no teaching, and can stand alone.
 - ❑ The question is researched and revised.
 - ❑ The questions are submitted to MDCB with references.
- ▶ Newly submitted questions are reviewed and revised by the 14 board members at the board meetings and are placed in a bank of non tested items.
- ▶ At monthly item review sessions, conducted by the Test Development Committee of the MDCB, the questions are reviewed again.
- ▶ The questions remain in a bank of usable non tested items until the next exam administration.

Item Development

- ▶ There are approximately 20 untested new items on each exam.
- ▶ The new items are reviewed again before an exam administration.
- ▶ There are 2 forms per exam administration provided there are 200 candidates taking the exam.
- ▶ 20 new untested questions per exam form are included for the purpose of gaining statistics. They are **NOT** included in the final exam grading. This practice is consistent with industry standards for a certification exam.
- ▶ A newly written test question may not perform well on the exam based on the statistical data and must either be corrected or discarded.
- ▶ Once statistics on the new items are reviewed the questions are moved to the usable bank for future exams.
- ▶ No one person writes the test questions.
- ▶ Board members have equal input on each exam question with representation from Dosimetrists, Radiation Oncologists, and Physicists.

Exam Development



Exam Administration Challenges:

Timeline

Prior to Exam	Process	MDCB Tasks
6 months (24 weeks)	Exam Handbook -MDCB Website	Prepares for Application Process
5 months (20-22 weeks)	Application Process Opens	Reviews Submitted Applications
3 months (14 weeks)	First Application Deadline	Reviews Submitted Applications
12 weeks	Final Deadline	Completes Application Process
11 weeks	Notification Letters Sent	Appeal Process Begins
9 weeks	Appeals Deadline	Appeal Process Ends
8 weeks	Appeal Decision Letters Sent	Prometric Notified of Examinees

Exam Administration Challenges

- ▶ Exam results are posted 6 weeks after administration.
- ▶ During the 6 weeks Prometric does the following:
 1. Scores the exam multiple times for accuracy.
 2. Gathers statistics on every question.
 3. Reports back to the MDCB on the recommended equated score based on the pre-determined cut score from the Cut Score Study.

Exam Administration Challenges

- ▶ In administering the exam, the challenge becomes the validity of the statistics.
- ▶ In order to collect good statistics, each exam form must have at least 100 test takers.
- ▶ In 2017 the MDCB has seen a decline in the number of test takers due to the elimination of the non Route 1 applicants.
- ▶ The possibility exists that to maintain good statistics, the exam may go to one administration per year.
- ▶ Among the considerations for moving to one administration per year is the fact that graduation dates for JRCERT approved programs vary.

Exam Administration Challenges:

Pass Rates

Year	Number of Candidates	Percent Pass
2/2017	126	72%
8/2016	174	70%
1/2016	135	77%
8/2015	118	77%
2/2015	132	67%
8/2014	167	48%
1/2014	154	59%
8/2013	142	48%
1/2013	134	59%
8/2012	219	56%
3/2012	185	66%
2011	350	52%
2010	346	49%

A Special Thanks To...

AAMD

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