Medical Dosimetry Certification Board (MDCB) Perspective on “Teaching Physics to Dosimetrist”

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Acknowledgments

Many thanks to the members of the MDCB board but special thanks to Bud Baker who provided the historic background of the MDCB
Historical Perspective

- In early 1980, American Association of Medical Dosimetrists (AAMD) formed a Task Group called ‘Certification Committee’ to look into the feasibility of evaluating dosimetrists credential.
- A private company ‘Credentialing Services Inc, (CSI)’ was contracted to provide psychometric and logistical services.
- Medical Dosimetry Certification Board, MDCB was formed with logo
Early Examination

- A group of Subject Matter Experts was appointed to write questions for the exam item bank under the direction of CSI, managed by Dr Jim Hecht.
- These questions became the foundation of the item bank and were expanded in number through exam writing workshops over a period of 3 years.
First Examination

- In 1988 the MDCB was incorporated in the state of Maine.
- In same year, the first exam, was offered at a single location in Calgary, Canada during the AAMD annual meeting.
- MDCB examination was taken by 136 eligible candidates.
- 85% candidates passed the MDCB exam.
Examination Pattern

- Typically there are 155 questions
  - K type
  - Multiple choice
  - Matching
  - True & False

- Passing raw scores had been traditionally 60-66%.

- There are a few exceptions some year.
Question Analysis

- Since the 1988 first exam, detailed psychometric statistics for each question in the item bank as well as overall exam performance has been maintained.
- As the item bank grew, questions were either discarded or refined so the overall exam difficulty could be predicted and defended through statistical analysis.
Examination Acceptability

- After the first exam in 1988, the exam has been offered in multiple locations (20-30) in the US and Canada distributed in major cities.
- Since 2004, the MDCB exam is being offered in South Korea.
- Various other countries in Pacific Rim, Europe and Latin America has shown interest in hosting MDCB examination.
MDCB Board

- The MDCB board consists of 11 volunteer members.
- The tenure of each member is 5 years.
- It consists of members from every radiation related societies:
  - Five At Large Members of the board are certified medical dosimetrist (CMD).
  - One member each from ASRT, AAMD, AAPM, ACMP, ACR and ASTRO.
Examinations

- In 1991 a continuing education requirement was tied to the CMD credential renewal.
- In 1994 first Practice Analysis Study was conducted by CSI to incorporate the growing trends in technology for dosimetrists to reflect exam content specifications directly tied to the results.
Recent Changes

- In 2000-01, The Scope of Practice in Medical Dosimetry was approved by the MDCB Board.
- In 2003, managerial services of the MDCB was given to the AMC, Albuquerque, NM for a 3 year contract.
- Thomson Prometric becomes the exam administrator in 2004.
- From Aug 2005, the MDCB will be managed by a management firm ‘Association Headquarters Inc’, AH, Mount Laurel NJ who will provide member services automated through web.
Medical Dosimetry Programs

- There are 75 JRCERT accredited therapist programs, some of them provide dosimetry training.
- There are only 5 formal dosimetry programs and a handful schools (20) that provide medical dosimetry program.
- JRCERT is getting involved in accreditation of the medical dosimetry program.
Changes in Examination

- In 2004, Thomson Prometric (then Chauncey Group International) conducted a web based Practice Analysis Exam content specifications.

- Current examinations are based on the 2004 practice analysis that represent the current practices of Medical Dosimetry.
Training & education

- Typically most formal program gives BS degree
- Some programs offer MS degree
- Certificate programs
- Education and contents are variable 2 wks to 4 years
Medical Dosimetrist Course

An Intensive Two Week Training Program

As a radiation therapist entering the world of dosimetry, I discovered the need for formal training on the principles of medical dosimetry. This intensive two week course at MTMI addressed the fundamentals and their application within the clinic. I found that the course and staff were excellent at providing me the skills necessary to become a more confident, effective dosimetrist. I would recommend this course to anyone looking to advance their dosimetry skills or review for CMD exam.

Thanks to everyone at MTMI for the hard work put into making this course a beneficial experience.

Mary Robertson, B.A., RT(R)
Schools

- 2 weeks to 4 years
- First web based training program initiated under guidance of Dr Art Boyer at Stanford University.
- Due to demand of dosimetrists, lots of schools have opened in recent years
- Education and training varies significantly
## Exam Contents & Necessary Physics Education

<table>
<thead>
<tr>
<th>Topic</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiation Physics</td>
<td>20%</td>
</tr>
<tr>
<td>Dose Calculation Methods</td>
<td>25%</td>
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<tr>
<td>Treatment Planning</td>
<td>30%</td>
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<tr>
<td>Localization</td>
<td>8%</td>
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<tr>
<td>Brachytherapy</td>
<td>5%</td>
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<tr>
<td>Quality Assurance</td>
<td>3%</td>
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<tr>
<td>Professional responsibilities</td>
<td>2%</td>
</tr>
<tr>
<td>Computers &amp; Computer Networking</td>
<td>5%</td>
</tr>
</tbody>
</table>
Radiation Physics (20%)

- Radioactivity
- Production of x-rays
- Interaction of radiation with matter
  - Photon
  - Electrons
- Treatment unit characteristics
- Treatment planning computers
- Radiation measurements
Dose Calculation Methods (25%)

- Applied mathematics (geometry, trigonometry)
- External beam calculation
- Beam modifying devices (wedge, bolus, blocks, etc)
- Irregular Field calculation
- Special calculation (off-axis, gap, entrance, exit etc)
- Tissue inhomogeneity
- Electron beam calculation
- Interaction of radiation with matter
Treatment Planning (30%)

- Isodose curve parameters
- Isodose distribution
- Electron beam dose distribution
- Clinical Oncology
- Radiobiology
- Dose volume histogram
- IMRT
- Dose and fractionation
Localization (8%)

- Acquisition of patient data
- Immobilization & Positioning
- Treatment devices (bite block, breast board etc)
- Treatment simulations
- Imaging (CT, MRI, PET)
- CT-simulation, DRR, DCR etc
- Image registration (fusion)
Brachytherapy (5%)

- Radioactive source characteristics
- Dose distribution
- Source localization
- HDR/LDR
Radiation Protection (2%)

- Maximum permissible dose
  - NCRP, ICRP recommendations

- Radiation monitoring
  - Personnel
  - Patients

- Protection through
  - Time
  - Distance
  - Shielding
Quality Assurance (3%)

- Equipments
  - Treatment Machines
  - Simulators
- Treatment planning computer
- Clinical Aspects
  - Chart reviews
  - Film reviews
  - Plan checks
Professional Responsibilities (2%)

- MDCB code of ethics
- Standard Precautions
- CPR
- Responsible fiscal practices (billing)
- HIPPA & Fed regulation
Computers & Networks (5%)

- Data importing & exporting
- System management
  - Tape backup
  - Routine maintenance
  - Up/down loading
- Algorithms
  - TPS software
  - Calculations
Text Books

Physics of Radiation Therapy – Faiz M Khan
Treatment Planning G. Bentel
Task Group Reports AAPM, NCRP
CT-simulation Coia et al
Thanks