Competency based education and training programs and their place in radiation oncology

Daniel Scanderbeg, PhD, DABR
Associate Professor
Radiation Medicine & Applied Sciences

UC San Diego
RETHINKING MEDICAL PHYSICS
Disclosures

- Varian
Learning Objectives

- Be familiar with some technological advances
- Be able to identify key components of a competency based education program
- Learn what types of media can be used for competency education
Outline

○ Techniques and Technology
  • Brachy: 2D -> 3D planning; AccuBoost (NIBB)
  • EBRT: (Online) Adaptive radiotherapy; Knowledge-based planning (KBP)

○ Safety Culture
  • Process QA

○ Competency Education
  • Structure
  • Implementation
Brachy: 2D -> 3D Planning
Brachy: 2D -> 3D Planning
Brachy: 2D -> 3D Planning

Recommend recording the minimum dose to the most irradiated tissue volume adjacent to the applicator.

Brachy: 2D -> 3D Planning

- HRCTV: 75-90 Gy$_{\text{EQD2}}$
- IRCTV: 60 Gy$_{\text{EQD2}}$
- Bladder: $\leq$ 90 Gy$_{\text{EQD2}}$
- Rectum: $\leq$ 75 Gy$_{\text{EQD2}}$
- Sigmoid: $\leq$ 70 Gy$_{\text{EQD2}}$
- D90 > PD
- V100 > 90%

Recommendations from GEC-ESTRO

Pötter R Radiother Oncol 78:67, 2006
Kirisits C IJROBP 62:901, 2005
Brachy: AccuBoost (NIBB)

- Utilizes existing HDR system
- Localization via mammography unit
- Special cones affix to mammo unit for treatment
Brachy: AccuBoost (NIBB)
Brachy: AccuBoost (NIBB)

<table>
<thead>
<tr>
<th>Patient name</th>
<th>RadOnc #</th>
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<tbody>
<tr>
<td></td>
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<table>
<thead>
<tr>
<th>Treatment date</th>
<th>10/15/2012</th>
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<tbody>
<tr>
<td>Treatment fraction</td>
<td>1 of 5</td>
</tr>
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<table>
<thead>
<tr>
<th>Mammo. unit gantry angle [degrees]</th>
<th>0deg</th>
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<tbody>
<tr>
<td>Source size (cm)</td>
<td>16.20</td>
</tr>
<tr>
<td>Source strength (Ci)</td>
<td>96</td>
</tr>
<tr>
<td>Plate separation (38.00 mm)</td>
<td>58</td>
</tr>
<tr>
<td>Percent isodose line ([7%–100%])</td>
<td>100%</td>
</tr>
<tr>
<td>Prescription breast dose (Gy) per fraction</td>
<td>1.06</td>
</tr>
<tr>
<td>Center dose rate (Gy/h)</td>
<td>12.67</td>
</tr>
<tr>
<td>Treatment time [minutes] for 3 catheters</td>
<td>4.74</td>
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</table>

<table>
<thead>
<tr>
<th>Catheter #</th>
<th>Dose from catheter [Gy]</th>
<th>Dose calculation medium</th>
<th>Dwell [s]</th>
<th>Total time [minutes]</th>
<th>Dwell time [s]</th>
<th>Dwell time [Gy]</th>
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<tr>
<td>1</td>
<td>6.59</td>
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<td>16</td>
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<td>2.57</td>
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<td>7.9</td>
<td>7.3</td>
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<tr>
<td>3</td>
<td>7.3</td>
<td>breast</td>
<td>7.9</td>
<td>7.3</td>
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<tr>
<td>4</td>
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<td>7.3</td>
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<tr>
<td>5</td>
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<td>7.9</td>
<td>7.3</td>
<td>7.3</td>
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<tr>
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<td>7.9</td>
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<td>7.9</td>
<td>7.3</td>
<td>7.3</td>
<td>2</td>
</tr>
</tbody>
</table>

Calculated by: ___________________________  Checked by: ___________________________
PTVs with more anterior (A) and posterior margin (B) for displacement, and one centrally located with the smallest margins (C)
Cone beam CTs with cervix displaced and the appropriate PTVs displayed. A) displaced anteriorly by gas, B) displaced posteriorly, and C) centrally located.
XRT: Knowledge Based Planning

**without KBP**
- fundamentally flawed and dangerous
- poorly optimized and/or wrong clinical trade-offs
- good OAR dose sparing and target coverage
- excellent conversion of clinical goals into optimization objectives/priorities
- best possible dose distribution for the given technique (e.g. VMAT)

**with KBP**

From: K. Moore

UC San Diego
XRT: Knowledge Based Planning

3 mos. before QC  3 mos. after QC

Moore et al, IJROBP 81, 545-551 (2011)
General: Errors

- Increased complexity of advancing technology => more opportunities for errors
- Technology evolving rapidly (upgrades)
- Lack of Knowledge/education/information/training
- Teamwork, poor communication
- Time shortage/fatigue
- Equipment failure/poor feedback from system
- Poor instructions/written procedures (manufacturers, within)
- Wrong person doing the task
- Lack of proper equipment
- Inattention/distraction
- Relying on computers too much
General: Errors

1) Error Example
   1) NRC Information notice 2013-16
   2) 2013 Fx 1 of 3 - Applicator placed in patient’s rectum instead of vagina
   3) Vagina = 69% of PD
   4) Rectum 132% of PD
   5) Not ME – did not differ by > 50% for fractionated dose
   6) Not ME – total dose did not differ by > 20%
Errors

INFORMED CULTURE
Those who manage and operate the system have current knowledge about the human, technical, organizational and environmental factors that determine the safety of the system as a whole.

REPORTING CULTURE
An organizational climate in which people are prepared to report their errors and near-misses.

JUST CULTURE
An atmosphere of trust in which people are encouraged (even rewarded) for providing essential safety-related information, but in which they are also clear about where the line must be drawn between acceptable and unacceptable behavior.

FLEXIBLE CULTURE
An organization is able to reconfigure itself in the face of high tempo operations or certain kinds of danger – often shifting from the conventional hierarchical mode to a flatter mode.

LEARNING CULTURE
An organization must possess the willingness and the competence to draw the right conclusions from its safety information system and the will to implement major reforms.

Safety Culture
Competency Assessment

World Health Organization: Radiotherapy Risk Profile
## Competency Assessment

### Table 3: Potential risk area

<table>
<thead>
<tr>
<th>Stages</th>
<th>Staff Bronx</th>
<th>Suggested preventive measures</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Communication</td>
<td>Guideline</td>
</tr>
<tr>
<td>Assessment of patient &amp;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>decision to treat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prescribing treatment protocol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positioning &amp;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>immobilization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simulation &amp; imaging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment information transfer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient setup</td>
<td></td>
<td></td>
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<tr>
<td>Treatment delivery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment review</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Peer review process
- Evidence-based practice
- Standard protocol
- Competency certification
- Consultation with others
- QA check & feedback
- Incident monitoring
- New staff & equipment orientation
- Competency certification
- Incident monitoring
- Clear documentation
- Treatment sheet check
- Record & verify system
- In vivo dosimetry
- Competency certification
- Incident monitoring
- Supervisor audit
- Incident monitoring
- Imaging: Portal film
- In vivo dosimetry
- Competency certification
- Incident monitoring
- Independent audit
Competency Assessment

1) What is competence?
   - “The ability to do something well”
Competency Assessment

1) What is competence?
   1) “The ability to do something successfully and efficiently”
2) What is efficiency?
   1) “Performing or function in the best possible manner with the least waste of time and effort”
Competency Assessment

“The competency assessment can be accomplished through a variety of methods including the assessment of information from current and previous employers, collecting peer feedback, verifying certification and licensure, reviewing test results with a written or oral competency, and observation of skills. The assessment must be thorough and focus on the particular competency needs for the clinical staff's assignment. Use of a self-assessment, such as a skills checklist, as the sole assessment method does not constitute a competency assessment.”

- The Joint Commission, 2009
Competency Assessment

1) How is the program structured?

2) What does the program look like?
   1. **Transfer sufficient knowledge**
      • The program must be designed to transfer specific and sufficient knowledge to enable competency.
   2. **Provide sufficient skills training**
      • The program must incorporate sufficient hands on skill development to enable competency.
   3. **Foster a functional attitude**
      • The program must provide sufficient mentoring for the trainee to develop a positive, functional attitude.
Structure - Design

- Specialized Procedure
  - Common to all disciplines
    - Level 1
      - Physics
      - RO
      - Therapy
    - Level 2
      - Physics
      - RO
      - Therapy
    - Level 3
      - Physics
      - RO
      - Therapy
    - Level 4
      - Physics
      - RO
      - Therapy
### Structure - Content

<table>
<thead>
<tr>
<th>Levels</th>
<th>Content</th>
<th>Participants</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction</td>
<td>Voice over online presentations</td>
<td>Everyone</td>
<td>Knowledge</td>
</tr>
<tr>
<td>2. Discipline Specific Knowledge</td>
<td>Literature review, supervised observation, day in the life</td>
<td>Everyone</td>
<td>Knowledge/Attitude</td>
</tr>
<tr>
<td>3. Essential Competencies</td>
<td>Supervised performance of the procedure</td>
<td>Residents/Full time staff</td>
<td>Skills/Attitude</td>
</tr>
<tr>
<td>4. Maintenance of Certification</td>
<td>Performance of minimum # of procedure per term</td>
<td>Those certified at Level 3</td>
<td>Skills</td>
</tr>
</tbody>
</table>
Structure - Content

Level 1
Level 1 is open to all staff and provides a basic introduction to Permanent Seed Implant Prostate Brachytherapy. Level 1 is comprised of voice-over presentations with associated quizzes. Success in the quizzes (> 80%) is a prerequisite for progression to Level 2.

Physics Presentation
- Physics - Level 1 - Presentation
- Physics - Level 1 - Quiz

MRT(T) Presentation
- MRT(T) - Level 1 - Presentation
- MRT(T) - Level 1 - Quiz

Radiation Safety Presentation
- Radiation Safety - Presentation
- Radiation Safety - Level 1 - Quiz

Orientation to the OR Suite - Presentation

Level 2
Level 2 is available upon successful completion of Level 1 activities. The focus here is on guided self-study and observation of the procedure.

Readings
- LDR Prostate Brachytherapy - CAPCA. Link to Publication

Quiz
- Level 2 - Quiz
Restricted: ‘Not available until you achieve a required score in Physics - Level 1 - Quiz.’

Procedure Observation - Competency Checklist
- Level 2 - Competency Checklist
- Level 2 - Competency Checklist
Restricted: ‘Not available until you achieve a required score in Physics - Level 1 - Quiz.’
Structure - Content

UC San Diego Competency Program Home

Assigned Competency Modules
- Brachytherapy - HDR - GYN Cylinder - The Content Admin is dscanderbeg@ucsd.edu
- Annual Radiation Safety Training - PACU (Prostate Implants) - The Content Admin is dscanderbeg@ucsd.edu

As an administrator for this organization you can create a new competency using the button below.

CREATE A NEW COMPETENCY

Completed Competency Modules
You have not completed any competencies yet. Get to work already! :)

Competency user groups that you belong to
- Thornton PACU Staff
- Dan
Structure - Content

Annual Radiation Safety Training - PACU (Prostate Implants) Competency Program

Completion Status

Documents

Click on a document to download and read it. If there is a checkbox beside the document link, use it to confirm that you have read the document.

Documents currently associated with this competency program.

- Prostate Seed Discharge Instructions.pdf
- Radiation Safety for PACU V.3.pptx

- Confirm that you have read the document
- Confirm that you have read the document
Structure - Content

HDR Gyn Cylinder - Part 3
Dr. Dan Scanderbeg - UC San Diego
UCSD Radiation Oncology Learning Center
ucsd.radonlearningcenter.org

Brachytherapy – HDR - GYN Cylinder Competency Program

Completion Status

Documents
Click on a document to download and read it. If there is a checkbox beside the document link, use it to confirm that you have read the document.
Documents currently associated with this competency program:
- HDR Emergency Procedures.pdf  ✔ confirm that you have read the document
- HDR GYN Cylinder Treatment SOP_final.pdf  ✔ confirm that you have read the document
- hdr_operating_procedures.pdf  ✔ confirm that you have read the document

Videos
Click on a video to watch it. If there is a checkbox beside the video link, use it to confirm that you have watched the video.
Videos currently associated with this competency program:
- HDR Gyn Cylinder - Part 3.mp4  ✔ confirm that you have watched the video
- HDR Gyn Cylinder - Part 2.mp4  ✔ confirm that you have watched the video
- HDR Gyn Cylinder - Part 1.mp4  ✔ confirm that you have watched the video

Quiz
Got it all figured out? Take the quiz ↓

Clinical Observation Checklist Items
When you’re ready, contact dacanderbeg@ucsd.edu to schedule a time to have them observe you perform the following tasks, then use the button below to request that they sign off on these items.

Able to plan and treat an HDR cylinder independently

https://aamd.org
### Annual dose limits

**Ionizing Radiation Annual Occupational Dose Limits**

<table>
<thead>
<tr>
<th></th>
<th>Background</th>
<th>Whole Body</th>
<th>Eyes</th>
<th>Extremities</th>
<th>Skin</th>
<th>Fetal*</th>
<th>Gen. Public</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>300 mrem</td>
<td>5,000 mrem</td>
<td>15 rem</td>
<td>15,000 mrem</td>
<td>50,000 mrem</td>
<td>500 mrem</td>
<td>100 mrem</td>
</tr>
<tr>
<td>Background</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>Whole Body</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eyes</td>
<td>15 rem</td>
<td>15,000 mrem</td>
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<td>Gen. Public</td>
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</tbody>
</table>

(*) NOTE: Fetal exposure limit is restricted to the gestation period. All other doses are annual limits.

This chart shows the annual dose limits for occupational exposure. The body can receive up to 5,000 mrem while the extremities can receive up to 50,000 mrem. An occupational worker than can expect to receive 10% or more of their occupational limit will be monitored with dosimetry badges. No one will receive amount close to 10% from exposure to a prostate seed implant patient. If you were in direct contact with the patient's groin for an hour, you would receive approximately 2.5 mrem, which is < 0.1% of the annual occupational exposure limit. However, following the principles of ALARA, you should minimize your time with the patient and maximize distance between you and the patient.
Media
Simulation Training
Summary

- Technology
- Competency Assessments
  - Must adequately assess competence
  - Must be usable, non-frustrating
  - Hands on component
  - Mentoring
  - Department support
  - Media