Redesigning IMRT for Low- and Middle-Income Countries

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Disclosures

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Outline

- Cancer: global burden of disease
- Radiotherapy: benefit and access
- Technology for low-middle income countries (LMIC)
IMRT (Intensity Modulated Radiation Therapy)

- IMRT allows for greatly enhanced organ sparing

Radiotherapy in Cancer Management

Advantages
- Non-invasive
- Allows organ preservation
- Low risk of morbidities
- Costs are low

Radiotherapy in Cancer Management

<table>
<thead>
<tr>
<th>Cancer type</th>
<th>Recommended optimal utilization rate of RT (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head &amp; Neck</td>
<td>78</td>
</tr>
<tr>
<td>Lung</td>
<td>76</td>
</tr>
<tr>
<td>Esophagus</td>
<td>80</td>
</tr>
<tr>
<td>Breast</td>
<td>83</td>
</tr>
<tr>
<td>Central Nervous System</td>
<td>92</td>
</tr>
</tbody>
</table>

Global Access to Radiation Therapy

Adapted from IAEA Dirac database

no reported machines

US: 18 times as many clinics per M people as in India

Impact of Reliability


- Reliability
- Simplicity
- Efficiency
- Reduced staffing requirements

NCI
Affordable Cancer Technology Program
Novel Ring-based Compensator IMRT

- Plastic shell 3D printed
- Fill plastic shell with Tungsten
- Treat each field through unique compensator

- Compensator vs. MLC IMRT
  - Upfront costs
  - Continuing maintenance
  - Power
  - QA, physics time & expertise
- Enables IMRT with $^{60}$Co, efficient use of dose
Van Schelt, J. et al. Med Phys, 2018

Van Schelt, J. et al. Med Phys, 2018
Gynecological plans

Compensator Resolution (H&N plans)

Monte Carlo Simulations (Geant4)

Beads (0.5 mm dia) W, Sn, Steel, Al
• Reliability
• Simplicity
• Efficiency
• Reduced staffing requirements

Complex radiation therapy workflow

• Reliability
• Simplicity
• Efficiency
• Reduced staffing requirements

Summary

• Acute need to radiation therapy in underserved areas of the globe
• Current methods have evolved organically
• Complex, time-consuming, error-prone
• Shift toward simplicity, efficiency
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Thank You!
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