How to set up a QA programme

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Outline

• Organization structure for QA
• QA teams and composition
• Key roles & responsibilities of QA teams
• Equipment QA
• Process QA
• Training & development
• Audit and review
Structure of Oncology QA System

- Evolved over time for compatibility with service provisions and evolving hospital structure for quality & risk management.
- The changes implemented were aimed at ensuring that RT service meeting specified standard and minimizing the possibility of clinical/radiation incidents.
Oncology Quality & Risk Management System

1. Oncology Q&RM Committee
   - Performance & Information
     - Performance reporting
     - Disease coding
     - Data quality
     - Patient resources
   - Clinical Quality
     - Clinical standards
     - Clinical protocols
     - Service delivery
     - Clinical audits
   - Systems & Risks
     - Manpower
     - Equipment
     - Workload
     - Workflow/processes
     - Training
     - Incidents

2. QA Committee
Radiotherapy QA Committee

Chairman: Head of Radiation Oncology

Members: Representatives from:
- Clinical management team
- Medical physics
- Radiation therapist
- Nursing
RT QA Committee- Responsibilities

• Review/develop QA structure
• Review/define objectives, policy, and quality standard
• Review/identify service areas, where QA is critical in preventing clinical incident and/or maintaining quality standard
• Form QA teams/appoint team members to review/develop specific QA measures/protocols
• Monitor & review QA measures
• Arrange for internal & external audit
Goals

• Prevent clinical/radiation incident, and
• Maintain/improve service quality
  ▶ Prevent systematic errors
  ▶ Avoid/Minimize procedural errors
  in the radiotherapy service chain
Guidance Documents

- ESTRO 1999: Practical Guidelines for the Implementation of a Quality System in Radiotherapy
- IAEA Publication 1296. General guidelines on clinical and physical aspects of QA in radiotherapy
- AAPM Report 46. Comprehensive guidance on physical and equipment aspects of QA
- IAEA TRS-430. Comprehensive guidance on commissioning & QA of TPS
- IAEA TECDOC 1588. Guidance on commissioning and QA of 3DCRT & IMRT
RT QA Structure

RT QA Committee
Terms of ref:
- Design, implement & manage QA system
- Define standards/policy
- Quality manual
- Monitor, review & remedy QA measures

QA Teams
Terms of ref:
- QA programme
- QC protocols
- Procedural guidelines
- Documentation
- Compliance checklist
- Review & update

Internal Audit
Terms of ref:
- Independent review of QA system, QC protocols and compliance

External Audit
Terms of ref:
- Quality audit of key products/services

QA Teams
Terms of ref:
- QA programme
- QC protocols
- Procedural guidelines
- Documentation
- Compliance checklist
- Review & update
Performance Standard & Action Level

Depends on:

- Type of treatment services (e.g. 2D, 3DCRT, IMRT)
- Type of equipment facilities (e.g. sophistication, precision)
- Age and maintenance status of equipment
- Staff competency

Machine (treatment modality) based QA protocols
## Typical Critical Areas in RT

<table>
<thead>
<tr>
<th>Systematic errors</th>
<th>Equipment malfunction</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Improper equipment commissioning</td>
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<tr>
<td></td>
<td>Improper dosimetry calibration</td>
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<tr>
<td>Patient specific procedural errors</td>
<td>Planning and dose calculation</td>
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<tr>
<td></td>
<td>Patient identification</td>
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<tr>
<td></td>
<td>Patient set up</td>
</tr>
<tr>
<td></td>
<td>Machine parameter</td>
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</table>
Basic QA Approach

• Against systematic error- A system which monitors the performance of each service system (e.g. a linear accelerator) and make corrective measures if any of the performance indicators deviates from the predefined standard by a certain amount (action level).

• Against procedural error- A system of independent/counter checking on every critical process (e.g. patient treatment set up) in the RT operation chain and make correction as appropriate.
# QA Teams

<table>
<thead>
<tr>
<th>QA Team</th>
<th>Team Member</th>
<th>Key Function</th>
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</thead>
<tbody>
<tr>
<td>Clinical management</td>
<td>ROs</td>
<td>QA of patient management process, clinical protocols &amp; guidelines</td>
</tr>
<tr>
<td>Patient data</td>
<td>RO, RTT, Record Clerk</td>
<td>QA of patient data &amp; documentation, record management</td>
</tr>
<tr>
<td>Treatment Planning</td>
<td>RO, ROMP, RTTs</td>
<td>QA of patient immobilization, treatment planning &amp; simulation</td>
</tr>
<tr>
<td>External beam treatment</td>
<td>RO, ROMP, RTTs</td>
<td>QA of external beam treatment delivery</td>
</tr>
<tr>
<td>Brachytherapy treatment</td>
<td>RO, ROMP, RTT</td>
<td>QA of brachytherapy treatment planning &amp; delivery</td>
</tr>
<tr>
<td>Medical physics</td>
<td>ROMPs</td>
<td>QA of equipment, radiation dosimetry, treatment plan dose calculation</td>
</tr>
</tbody>
</table>
Responsibilities of QA Teams

1. Identify team members
2. Review and update existing QA protocols, procedural guidelines and compliance checklist
3. Prepare new QA protocols to support new treatment modalities.
4. Recommend training needs
5. Implementation of QA protocols
6. Monitor progress and review protocols
Physics QA Team

Review/development & implementation of physics QA protocols:

• Equipment QA (treatment, planning and simulation, computer network, dosimetry, etc)
• Acceptance testing & commissioning of RT equipment and radiation sources
• Dosimetry procedure QA (calibration, beam data acquisition)
• Treatment planning QA
• Treatment delivery procedure QA
• Documentation
Equipment QA

Review/prepare acceptance testing, commissioning and periodic QA programme for each RT & related equipment:

1. External beam treatment equipment
2. Afterloading brachytherapy equipment
3. Simulator, CT-simulator
4. Imaging equipment for planning, CT/MR/PET-CT
5. Computer network
6. Physics & dosimetry equipment

Refs:
AAPM Report 46- Provide comprehensive guidance on physical and equipment aspects of QA.
AAPM Report 83- QA in CT and CT-Simulator
IAEA Publication 1296- Give general guidelines on clinical and physical aspects of QA in radiotherapy
QA of Dosimetry Procedures

Review/preparation of QA protocols for dosimetry measurements, including:

1. Dose calibration
2. Planning beam data acquisition
3. Dose measurement (ionization, TLD and film dosimetry systems, etc.)

Refs.
IAEA TRS-398, IAEA TECDOC 1274
AAPM Reports 32, 67, 87
IPEM Report 81
Treatment Planning QA

Review/develop QA protocols for TPS, treatment planning and dose calculation processes

1 QA of TPS (including ATP & commissioning)

2 Independent checking of every treatment plans & dose calculations

3 Verification of plan transfer through computer network

Refs:
IAEA TRS-430- Give comprehensive guidance on acceptance, commissioning & QA of TPS
AAPM Report 62- Give guidance on QA for RT treatment planning
IPEM Report 81- General guidance including treatment planning
Independent Checking of Treatment Plans

1 Measurement based verification - New and complex treatments, e.g. first 50 IMRT patients.

2 Calculation based verification using an independent dose calculation system - applies to simple treatments and well established complex treatments.

All independent plan checking done by a different person.
Treatment delivery procedure QA

QA procedures perform by RTTs. Physicists play an advisory/supervisory role on:

- Patient identification
- Treatment parameter verification
- Patient immobilization
- Field geometrical verification
Monitoring & Review

The QA teams regularly monitor and review the effectiveness of the QA protocols and make improvement or upgrade whenever:

• New treatment modalities/technologies, e.g. IMRT, are introduced.
• More efficient QA techniques are developed
• Better QA equipment are available
Training & Development

• Staff training is an essential part of the quality & risk management system.

• Ensure every staff is appropriately trained and qualified for their specific tasks.

• A continued training and development program for members of staff, especially when new treatment procedures are introduced to ensure that the intended quality of treatment can be achieved and sustained.
Internal Audit

Heads of units or their delegations to regularly check if QA procedures are performed and according to protocols

- Observe process
- Inspect documentation

Helps to keep staff alertness and maintain the operation of the QA system
External Audit- Dose Calibration

• Dosimetry audit by Radiological Physics Centre (RPC), University of Texas MD Anderson Cancer Centre, USA. (A pre-requisite for RTOG clinical trials in radiotherapy.)

• IAEA-WHO Postal TLD Dosimetry Intercomparison Programme. (Radiotherapy dosimetry audit upon request by member state).

• Local multi-centre dosimetry inter-comparison. (E.g. whenever there is a change in dosimetry protocol, instrumentation, etc.)
External Audit- Treatment Dosimetry

- Treatment dosimetry credentialing (clinical trial specific) by RPC, UT MD Anderson Cancer Center, USA.

- Treatment planning credentialing (clinical trial specific) by Image-guided Therapy QA Center (ITC), Washington University, USA.

These are pre-requisites for RTOG trials.
Effective implementation of a QA system requires:

• A well-defined organization structure for QA
• Support by both the management and frontline staff
• Multidisciplinary QA teams with clearly defined roles and responsibility in developing, executing and reviewing the QA measures
• Process QA is as important as equipment QA
• An appropriate staff training programme
• QA system should be subject to internal audit and the key performance indicators should be subject to external audit
Thank you!