Advancing Radiotherapy Quality through an Adaptive Multicenter Clinical Audit Framework

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ABSTRACT

Clinical audits are a key instrument for improving quality and patient safety in radiotherapy, yet their implementation remains limited and heterogeneous across many healthcare systems.

CAT-ClinART was developed to establish a sustainable, peer-to-peer clinical audit programme at regional level, with the long-term objective of creating a scalable framework. The programme combines three complementary pillars: multidisciplinary on-site clinical audits based on the IAEA QUATRO methodology, independent dosimetry audits, and systematic collection of quality indicators for benchmarking and quality improvement.

To ensure sustainability, the programme incorporates a structured auditor training pathway, including technical and soft-skills training, supervised participation in audits, and continuous methodological refinement through satisfaction surveys and debriefing sessions. To date, five audits have been completed, including three training audits and two audits led by locally trained auditors. The first audit generated 32 prioritized recommendations, demonstrating the programme's ability to identify actionable opportunities for improvement and support quality-driven change.

CAT-ClinART provides a practical and adaptive peer-to-peer quality improvement framework that integrates clinical audits, dosimetry audits, quality indicators, and auditor training into a single approach. Designed for sustainable regional implementation and future national and international deployment, it not only evaluates clinical practice but also builds local expertise, promotes stakeholder engagement, and establishes the foundations for long-term implementation and scalability.

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INTRODUCTION

Clinical audit is a key tool for improving quality and patient safety in radiotherapy and is required under the European Basic Safety Standards Directive (2013/59/Euratom). However, the EU-funded QUADRANT project highlighted considerable variability in clinical audit implementation, underscoring the need for sustainable national audit infrastructures.

Building on the IAEA QUATRO peer-review methodology, CAT-ClinART was established as a regional network integrating multidisciplinary clinical audits, dosimetry audits, quality indicators, and structured auditor training.

Audits are conducted by actively practicing Radiation Oncologists, Medical Physicists, and RTTs, creating bidirectional learning that transfers best practices to both audited centres and auditors' own institutions, promoting harmonized and equitable radiotherapy services.

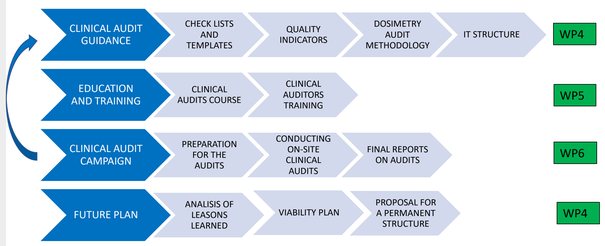
CAT-ClinART is designed as a continuous quality improvement programme rather than an accreditation exercise, fostering collaboration, shared learning, and sustainable implementation.

METHODS AND MATERIALS

CAT-ClinART brings together the 10 public Radiation Oncology departments in Catalonia, the Catalan Department of Health, and the National Dosimetry Laboratory. The consortium comprises 51 professionals, including Radiation Oncologists, Medical Physicists, RTTs, project managers, health authority representatives, and IT specialists.

The project is organized into three technical work packages (Fig. 1).

Fig 1. Project working packages and tasks



Clinical audits have now entered the implementation phase. Each site visit generates a comprehensive audit report including an assessment of all checklist domains, prioritized recommendations (high, medium or low priority), and an implementation difficulty rating assigned by the audited centre to facilitate action planning.

Following each audit, structured debriefing meetings and participant surveys are used to refine the methodology and strengthen auditors' technical and communication skills, ensuring continuous improvement throughout the project.

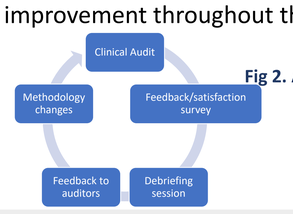


Fig 2. Audit methodology improvement loop

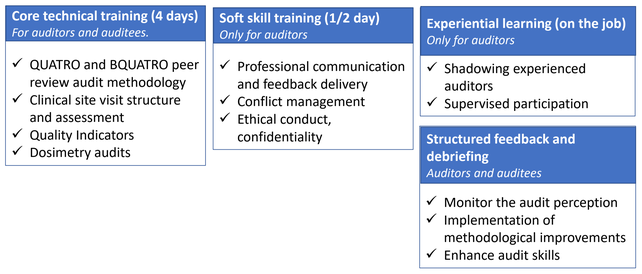
RESULTS

TRAINING FRAMEWORK

- ✓ The training framework has been defined and tested (Fig.3)
- ✓ The audit course had **50** participants from all consortium partners.
- ✓ 11 auditors have been selected and trained.

- ✓ The selected auditors have shadowed international QUATRO and B-QUATRO auditors in the first three clinical audits.
- ✓ At the moment, two clinical audits have been conducted by the regional auditors on their own.

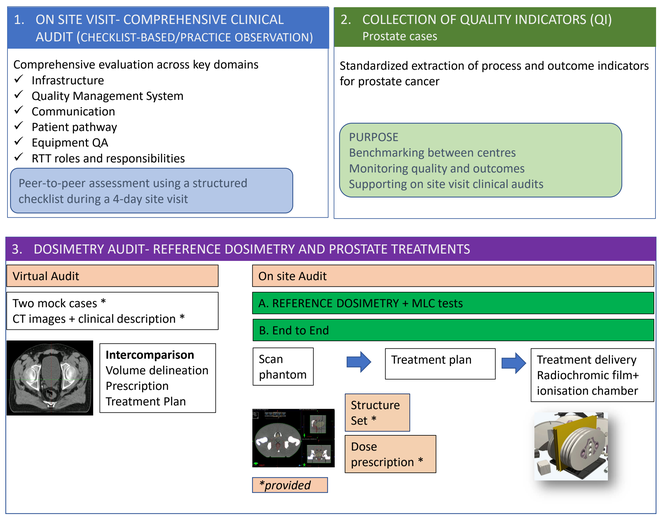
Fig 3. Training framework



AUDIT FRAMEWORK

- ✓ The audit framework consists of three distinct parts covering different angles of quality in radiotherapy (Fig.4)

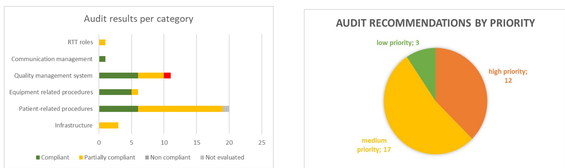
Fig 4. Audit framework



PILOT ON SITE VISIT AUDIT

- ✓ To date, the audited centres have received between 21 and 49 recommendations, classified by audit domain and prioritized according to their expected impact on patient safety and quality improvement (high, medium and low priority), providing each centre with a structured roadmap for continuous quality improvement (Fig. 5)

Fig 5. Example of audit results, report to the center



RESULTS

CONTINUOUS METHODOLOGICAL IMPROVEMENT

Debriefing meetings after each pilot audit led to several improvements:

- ✓ Pre-audit virtual meetings to align expectations and define the agenda.
- ✓ Joint review of the centre's self-assessment to identify priorities.
- ✓ Daily auditor debriefings to improve consistency.
- ✓ Clearer roles for auditors in training.
- ✓ Simplified REDCap documentation for more efficient reporting.

These changes resulted in progressively higher post-audit satisfaction scores from Audit A to D (Fig. 6).

Fig 6. Overall audit experience survey results. Likewise scale 0 being the lowest score, 5 the highest. Centers are ordered temporarily, A fist center being audited D last center.

CONCLUSIONS

- ✓ CAT-ClinART demonstrates the feasibility of implementing a regional peer-to-peer clinical audit network integrating multidisciplinary clinical audits, dosimetry audits, quality indicators, and structured auditor training.
- ✓ The programme generates standardized, prioritized, and actionable recommendations, while continuously refining its methodology through structured feedback and debriefing.
- ✓ By engaging actively practicing Radiation Oncologists, Medical Physicists, and RTTs as auditors, the programme promotes bidirectional knowledge transfer, accelerating the dissemination of best practices across participating centres.
- ✓ Rather than functioning as an accreditation programme, CAT-ClinART establishes a sustainable culture of continuous quality improvement, collaboration, and shared learning.
- ✓ **CAT-ClinART provides a scalable framework for implementing sustainable clinical audits and promoting equitable, high-quality radiotherapy services.**

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