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Review article

BQUATRO audits in radiotherapy: Crossperspectives between auditors and audited departments

Audit clinique en radiothérapie selon la méthode BQUATRO : regards croisés entre auditeurs et services audités

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ABSTRACT

Since 2011, the Belgian College of Physicians for Radiation Oncology has implemented a national program of peer-reviewed clinical audits in radiotherapy departments, aiming to enhance quality practices, safety culture, and promote professional experience sharing. This article summarizes the theoretical and practical aspects of this peer audit process providing cross-perspectives of auditors and audited departments. National audits have been carried out using the BQUATRO methodology and framework whereby radiotherapy departments are audited every 5 to 6 years. The audit is carried out by a multidisciplinary team of clinically active radiotherapy professionals. Peer reviewed clinical audits have been carried out in Belgium since 2010 resulting in all radiotherapy departments having been audited at least twice. Audits have helped reinforce team engagement, highlight often-underestimated strengths, and structure continuous improvement initiatives. Auditors have also developed crossfunctional expertise and a better understanding of organizational challenges. The BQUATRO peer-reviewed clinical audit differs from traditional regulatory approaches by its collaborative and constructive posture. It promotes organizational learning and practice alignment among Belgian radiotherapy departments. The peer-reviewed clinical audit process is a strategic lever for improving quality of care in Belgian radiotherapy. Its sustainability and expansion to other countries represent key improvement opportunities for radiotherapy centres.

Mots clés :
Audit clinique
Qualité
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RÉSUMÉ

Depuis 2011, le Collège de médecins pour les centres de radiothérapie belges a mis en place un programme national d'audits cliniques par les pairs dans les services de radiothérapie, visant à renforcer les pratiques de qualité, la culture de sécurité et à promouvoir le partage d'expériences professionnelles. Cet article résume les aspects théoriques et pratiques de ce processus d'audit par les pairs, en croisant les perspectives des auditeurs et des centres audités. Les audits nationaux ont été réalisés selon la méthodologie et le référentiel BQUATRO, dans lesquels les services de radiothérapie sont audités tous les 5 à 6 ans. L'audit est mené par une équipe multidisciplinaire de professionnels cliniquement actifs en radiothérapie. Des audits cliniques par les pairs sont réalisés en Belgique depuis 2010, permettant à tous les services de radiothérapie d'avoir été audités au moins deux fois. Ces audits ont contribué à renforcer l'engagement des équipes, à mettre en lumière des points forts souvent sous-estimés, et à structurer des initiatives d'amélioration continue. Les auditeurs ont également développé une expertise transversale et une meilleure compréhension des enjeux organisationnels. L'audit clinique par les pairs selon la méthode BQUATRO se distingue des approches réglementaires traditionnelles par sa posture collaborative et constructive. Il favorise l'apprentissage organisationnel et l'harmonisation des pratiques entre les services

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de radiothérapie belges. Le processus d'audit clinique par les pairs constitue un levier stratégique pour améliorer la qualité des soins en radiothérapie en Belgique. Sa pérennisation et son extension à d'autres pays représentent des opportunités clés d'amélioration pour les centres de radiothérapie.

1. Introduction

In a healthcare system that is increasingly challenged by the need for transparency, efficiency and safety, peer audits offer a valuable complement to traditional regulatory approaches. Clinical audits ensure the quality and safety of clinical practice by promoting a safety culture and continuous improvement within audited departments. They are designed to be both rigorous and supportive and are part of a continuous improvement dynamic, based on the sharing of experience between professionals. In the context of radiotherapy, clinical audits are not only a best practice but also a legal requirement across European Union member states, as mandated by the Council Directive 2013/59/Euratom. This directive obliges member states to ensure that clinical audits are carried out in accordance with national procedures, reinforcing their essential role in maintaining high standards of radiation protection and patient care.

Since 2011, peer reviewed clinical audits have been conducted in all Belgian radiotherapy departments, initially based on the International Atomic Energy Agency (IAEA)'s Quality Assurance Team for Radiation Oncology (QUATRO) tool [1,2]. This has been led by the Belgian College for Physicians in Radiation Oncology, a commission appointed by the Ministry of Health whose mission is to promote quality of radiotherapy on a national level [3]. It was decided that the IAEA QUATRO audit methodology was the most convenient solution to carry out these audits from 2011 to 2015 [4]. In 2015, a modified version called BQUATRO was introduced to better suit the Belgian context and integrate new technologies [5]. The second audit cycle (2017–2023) using BQUATRO was launched and involved a team of four auditors: a radiation oncologist, a medical physics expert, a radiation therapist, and a quality manager. In 2024 the BQUATRO was reviewed, and a third cycle has started with updated quality criteria. A previous publication confirmed both the relevance and feasibility of peer-reviewed audits within a national framework. The article also demonstrated strong professional engagement, validated the suitability of the assessment framework, and highlighted the capacity of centres to implement the recommended improvements [6].

This work examines the perspectives of both a BQUATRO auditor and an audited radiotherapy department, highlighting their experiences, the challenges encountered, and the benefits derived from the audit process.

2. The Belgian radiotherapy context

Currently, Belgium possesses 24 primary radiation oncology departments involved in the delivery of approximately 40,000 radiation treatment courses per year. There is quite an even distribution between departments located in the Flemish and the Walloon region with a concentration of centres found in the Brussels region [7]. Of the 24 radiation oncology departments currently active, eight possess at least one satellite site resulting in a total of 11 satellite sites. A satellite site is dependent on the primary site but located geographically away from the primary centre. In 2023, there were 92 clinically active external beam radiotherapy devices. The Royal Decree of 17 September 2005 sets the standards that a radiotherapy department must meet to be officially recognized as a medical technical service. It outlines specific requirements regarding infrastructure, equipment (e.g., having at least two linear accelerators), staffing, and patient volume (treating a minimum 500 new patients per year) to ensure quality and safety in radiotherapy care.

This current radiotherapy landscape will probably change with the publication of Belgian law amending the coordinated law of July 10th 2008 concerning hospitals and other healthcare establishments, which requires clinical networking between hospitals and the potential fusion of some radiation oncology departments. In parallel, the government, through legal frameworks and expert recommendations, is progressively designating reference centres for specific oncological treatments leading to the centralisation of certain cancer treatments.

3. The BQUATRO audit methodology

The implementation of the clinical audit process requires a reference manual which describes the organisation of the audit as well as a structured grid of the quality criteria that will be reviewed during the audit. The BQUATRO manual defines these elements and is used throughout the audit process [5]. The document, along with a checklist outlining the quality criteria, is provided to the departments undergoing the audit. The audited department is made aware of the audits and audit schedule through national communications and meetings. Once the audits teams have been defined (yearly auditor meeting), the department is contacted by the auditors and the dates of the on-site visit are set. Prior to the audit, the department is required to conduct a collective self-assessment based on the BQUATRO checklist and to centralize the documents requested by the auditors (department layout, indicators, protocols, incident reports, organizational charts, dashboards, etc.). These are then submitted to the auditors.

As previously mentioned, the BQUATRO auditor is a healthcare professional specialized in radiotherapy (radiation oncologist, medical physics expert, radiation therapist, or quality manager). The auditor's role is to verify that the organisational, clinical and equipment practices of the audited department comply with the quality standards defined by BQUATRO and what is considered good clinical practice. All auditors are trained during a one-day session in which they are familiarized with the BQUATRO manual as well as the skills necessary to carry out clinical audits. It is important to note that auditors participate on a voluntary basis and/or are officially released from their departmental duties during the audit mission. They are reimbursed solely for expenses incurred, such as travel and meals, without receiving any additional financial compensation.

The on-site audit is carried over 3-to-4-day period out by the multidisciplinary team of trained auditors composed of one radiation oncologist, medical physics expert, radiation therapist and quality manager. All quality criteria are assessed through observations, interviews, document review and clinical case reviews. Principal findings are shared with the audited department during an exit briefing, followed by a comprehensive written audit

report within 6 weeks. This report includes a detailed account of all recommendations for improvement, as well as commendations recognizing areas of excellence and best practices observed during the evaluation. The department is given the opportunity to provide feedback concerning this report within a limited timeframe. While the audits may highlight practices that deviate from best standards, they do not have the authority to ban any technique. Decisions about the continuation or modification of treatments remain the responsibility of the hospital and relevant health authorities, based on broader clinical, ethical, and legal considerations. Within this context, there is no provision for early reassessments or follow-up audits.

All Belgian radiotherapy departments and their satellite sites (n = 24 primary radiotherapy departments) are audited every 5 years by a team of 20 auditors.

4. Feedback of auditors and audited departments

The observations, feedback and difficulties encountered by the auditors and the audited departments are discussed on a yearly basis during the auditors' meetings. Some observations are also directly reported to the person coordinating the national clinical audits. Over the years, the above-mentioned points have been recorded and regrouped in order to provide a summary of the benefits, challenges and lessons learned by the auditors and the audited departments.

5. The BQUATRO auditor

5.1. The challenge of being a good auditor

An auditor must possess certain competencies and work practices in order to allow for the audit to be carried out in the best conditions possible. These are summarised hereafter.

5.1.1. Experience and objectivity

Being a BQUATRO auditor is both enriching and demanding. The auditor must demonstrate a high level of objectivity and integrity, along with strong clinical expertise. Maintaining a professional and impartial attitude throughout the audit process is essential. The auditor must avoid any conflict of interest and ensure that his assessments are based on facts and accurate observations. The auditor must be capable of evaluating clinical practices based on defined quality criteria, while also drawing on their own knowledge and experience in the field. Building a trusting relationship with the staff of the audited center is essential. The auditor should be open to dialogue and ready to listen to the staff's concerns and suggestions. Respecting the confidentiality of information collected during the audit is crucial. Sensitive data must be handled with the utmost care to protect patient privacy and the reputation of the audited centre.

5.1.2. Preparation and collaboration

Thorough preparation is essential for a successful audit. Prior to the visit, auditors must familiarize themselves with the BQUATRO audit methodology and content, reviewing protocols and planning the audit steps. Effective preparation helps ensure that the audit process runs smoothly and efficiently, improving efficiency and reducing unexpected issues. During the audit, establishing a collaborative and trusting relationship with the department's staff is key. This is facilitated by an auditor who is impartial, open-minded, observant, and free from bias. Building trust and mutual respect creates an open and constructive environment, which is fundamental to the success of the audit.

5.1.3. Observation and analysis

During the audit, the auditor must be able to structurally and objectively observe and analyse clinical practices, facilities, equipment, and organizational aspects of the radiotherapy department. The auditor verifies the accuracy of radiotherapy equipment and ensures that treatment protocols are properly followed by comparing this to the defined quality criteria and good clinical practice. Clinical practice and treatment techniques can evolve faster than the BQUATRO quality criteria — this requires for the auditors to be flexible and aware of currently published material or change in practice. The auditor must be detail-oriented and must be able to formulate clear and constructive recommendations in a timely manner. Recommendations should be delivered clearly and constructively. It is important to highlight not only areas that require improvement but also the strengths of the audited department. Balanced feedback supports a culture of continuous improvement.

5.2. Benefits of being an auditor

Becoming a BQUATRO auditor involves responsibilities and requires specific competencies. However, it also offers valuable opportunities for both professional and personal development.

5.2.1. Professional development

BQUATRO auditors gain in-depth expertise in radiotherapy and quality assurance. They benefit from continuous training and the opportunity to work alongside domain experts, which enhances their skills and knowledge of best practices. It is essential to participate in regular training to stay up to date with the latest technological advances and best practices in radiotherapy. Training should cover both the technical aspects of auditing and the interpersonal skills necessary to conduct an effective audit.

5.2.2. Contribution to care improvement

By participating in audits, auditors play a key role in improving the quality of radiotherapy treatments. They help identify gaps and propose constructive recommendations, thereby actively contributing to patient safety and treatment optimization.

5.2.3. Networking and collaboration

Audits allow auditors to collaborate with professionals from different radiotherapy departments. This fosters knowledge, experience sharing, and strengthens connections within the radiation oncology community. Auditors should develop strong communication, critical thinking, and time management skills. They must be able to work in a team and handle potentially stressful situations with composure and professionalism.

In summary, becoming a BQUATRO auditor offers opportunities for professional development, meaningful contributions to care improvement, and networking with experts in the field.

6. The audited department

6.1. Challenges encountered by an audited department

6.1.1. Organizational and logistical challenges

Preparing for and participating in an audit can be time-consuming, often requiring staff to balance audit activities with ongoing clinical responsibilities. Limited personnel or administrative support can hinder the ability to gather documentation or implement recommendations. This, however, has been facilitated by the presence of quality managers in all radiotherapy departments through the publication of the 2010 National Cancer Plan which finances one quality manager per radiotherapy department

[8]. During the audit, it can be difficult to ensure availability of key staff and alignment of schedules with the auditors.

6.1.2. Psychological and cultural challenges

The audited department's staff may feel inspected or fear negative evaluations, which can create stress or resistance. Departments may also be hesitant to alter established practices, especially if they feel their current methods are effective. It may also not be very easy to establish a collaborative, trusting and open atmosphere with auditors during the audit.

6.1.3. Technical and procedural challenges

Gathering accurate and comprehensive data to support the audit and to provide to the auditors can be complex and time-consuming. Addressing the audit recommendations may prove to be difficult, especially when changes require significant investment or restructuring.

6.1.4. Communication and feedback

If the audit feedback is vague, unclear or overly technical, it may be hard for departments to interpret and act on it. The department's lack of structured follow-up can lead to missed opportunities for improvement or sustained change.

6.2. Benefits of being audited

The audit preparation is often an opportunity to unite the team around constructive introspection on its clinical processes and the organizational aspects supporting their clinical practice. A well-prepared audit not only allows for a better assessment but also serves as a catalyst for relaunching dormant quality improvement projects.

6.2.1. Quality improvement

Audits provide an external and constructive perspective on departments' clinical practice without any punitive logic. They help pinpoint gaps in practice or discrepancies between current practices and established standards or guidelines. The audits encourage the departments to align with the latest clinical evidence and best practices. By identifying and addressing potential risks in the departments' workflow, audits can contribute to safer care delivery.

6.2.2. Professional development and collaboration

Through the audits, staffs are encouraged to critically assess their own work and consider areas for improvement. The audit process also encourages multidisciplinary discussions, improving communication and teamwork and further strengthens team collaboration.

6.2.3. Organizational benefits

By participating in audits, departments demonstrate commitment to quality standards, which is valuable for regulatory bodies and accreditation processes. The audits also provide external validation of department's practice and (often) underestimated strengths and can thus play a role in highlighting areas in which the department excels. Finally, audits allow for the identification of inefficiencies and can thus lead to better resource utilization and streamlined workflows. The audit also reinforced the departments' ability to justify their needs (human resources, technological investments) to their management, based on objective recommendations.

6.2.4. Patient-centred outcomes

The recommendations emitted by audits can encourage departments in implementing enhancements in care processes and help standardize procedures. This results in the reduction of variability in patient treatment that often then translates into better patient experience.

7. Discussion

BQUATRO audits fall within a framework of organizational learning. These audits generate actionable recommendations that, once implemented, drive initiatives aimed at enhancing the quality of care provided to radiotherapy patients. The last audit cycle demonstrated that the majority of recommendations emphasized organizational issues, while substantial recommendations targeted clinical processes, infrastructure, and staffing. Importantly, the audits revealed that most recommendations from the first audit cycle had been implemented by the second cycle. These findings underscore the value of iterative audit cycles in encouraging continuous quality improvement and compliance with evolving standards in radiotherapy practices [6,9]. Feedback from both audited departments and auditors indicates that the audit process fosters a shared understanding of clinical workflows, encourages open dialogue among professionals, and promotes the exchange of best practices. This collaborative environment helps teams reflect on their procedures, align on quality standards, and cocreate solutions to improve patient care — ultimately strengthening collective intelligence within and across departments. The multidisciplinary composition of the audit team is a major strength, as it allows for multiple perspectives and effective evaluation of how quality requirements are integrated into daily clinical practice.

Unlike traditional regulatory audits, peer audits are experienced as less stressful by staff: they offer a more human-centred approach, conducive to expressing difficulties, uncertainties, and innovations within the field. Feedback is also better received because it comes from peers who understand the realities of clinical work. Audits also have a long-term structuring impact: they help revive discontinued initiatives, align objectives across departments, and promote harmonization of practices between departments. The positive impact of clinical peer-reviewed audits relies on several key conditions. First, the audit framework must be genuinely recognized by healthcare professionals and who should view it as a meaningful tool for quality improvement. This is favoured through the organisation of regular communication campaigns addressed to the radiotherapy community (national meeting, e-mails, reports. . .). The continued availability and dedication of auditors is also crucial, especially as they face increasing workloads or understaffing [10,11]. Additionally, institutions need to formally recognize the time and effort invested in audit activities, ensuring that this work is valued and supported.

One of the most persistent challenges is the implementation of postaudit recommendations — without structured follow-up, action plans often remain incomplete or ineffective. Having dedicated personnel to ensure this — such as quality managers — can favour the implementation of corrective actions. The crucial role of dedicated quality managers in the implementation of quality improvement initiatives and setting up a quality management system has previously been demonstrated [12,13]. The arrival of quality managers in all radiation oncology departments has also played a fundamental role in the acceptance and integration of clinical audits as quality improvement tools by departments. A similar conclusion was also made in France where quality managers have played a fundamental role in implementing the quality management elements made mandatory by the Autorité de sûreté nucléaire (ASN) [14,15]. Indeed, quality managers plan and oversee the entire audit preparation process. They organize audit awareness meetings with all team members and ensure that the BQUATRO reference framework is well understood and that its quality criteria are translated into concrete actions. The quality manager is also responsible

for centralizing and verifying the availability, compliance, and accessibility of key documents: procedures, incident reports, training materials, etc. Finally, quality managers contribute to drafting the post-audit action plan based on peer recommendations in collaboration with the department management. They coordinate the implementation of corrective or preventive actions and monitor the progress of the action plan.

To ensure the long-term success and sustainability of the audit process, strong and ongoing support at both hospital management and national entities is essential. This includes not only policy and financial backing but also integration into broader healthcare quality strategies.

8. Conclusion

Amid growing demands for care safety and traceability, BQUATRO provides a collaborative, transparent, and respectful framework. Since its launch in 2011, its development and sustained presence have become a significant asset to the Belgian healthcare system. When well prepared and properly supported, these audits benefit both departments and individual professionals, serving as a powerful driver of progress and improvement. While organizing and maintaining these clinical audits can present certain challenges, they undeniably bring significant benefits to both the audited departments and the auditors themselves. This, in turns, leads to optimized patient care and patient experience.

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