

Quality Assurance in Radiation Oncology: Addressing a Changing Treatment Landscape

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Abstract

Innovation within the field of radiation oncology has led to new and complex treatment techniques that require increasing coordination among care teams. Quality assurance and quality improvement initiatives must keep pace with this ever-changing treatment landscape to ensure that quality of care remains high as new technology and treatment processes are adopted. Physicians should be engaged in these quality assurance and quality improvement initiatives and need updated resources to fulfill this essential role. With this in mind, the updated Quality Assurance Team for Radiation Oncology (QUATRO) guidelines by the International Atomic Energy Agency (IAEA) provide a resource for radiation oncology treatment centers. The QUATRO guidelines have served as a detailed template for performing health care audits and establishing quality assurance measures and plans specific to resources available across low-, middle-, and high-income countries. The new QUATRO guidelines provide additional tools focused on treatment delivery, reporting, and management of deviations in treatment delivery, oncology information systems, academic education, and brachytherapy. Radiation oncologists, physicists, and radiation therapists are encouraged to familiarize themselves with these quality assurance tools and use them to guide quality assurance initiatives tailored to the needs and resources of their institution.

Key words: radiation oncology, quality assurance, quality improvement, health care audits

As the field of radiation oncology continues to advance, the use of more complex treatment modalities involving larger multidisciplinary teams is increasing. As treatment complexity grows, there is a greater need for appropriate and sophisticated quality assurance measures.¹ This has led to quality improvement initiatives becoming an increasingly integral part of modern medical practice.

The highly specialized technology, equipment and professional training requirements that are essential to safe and effective radiation therapy procedures cannot be overstated. The regular review and verification of the elements of treatment processes, as well as patient-specific decision-making and procedures, are necessary for continuous quality improvement.

The spectrum of activities in the patient care process must be under-

taken under an umbrella of continuous quality improvement. The process of care includes the evaluation and development of a clinical plan, preparation for treatment through simulation dosimetry and pretreatment review and verification, treatment including set-up, delivery, and on-treatment evaluation, as well as post-treatment verification and follow-up care. These processes should all be coordinated within a quality management and improvement framework that also includes quality management of equipment and software.² The benefits of these activities extend beyond direct patient care

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and can enhance the robustness of clinical research trial results.

Health Care Audits

One of the most common methodologies utilized in quality assurance programs is a health care audit, which involves observing and analyzing clinical performance over a specified time frame, followed by observer feedback regarding ways to improve the care delivery. Physician engagement is central to the success of health care audits as physician involvement lends credibility to any recommended improvements and has been associated with higher rates of successful implementation of quality improvement plans. Beyond improving the quality of care at an institution, physician engagement in quality assurance initiatives is also associated with improved communication between interdisciplinary colleagues and higher job satisfaction. In addition, it provides an opportunity to create a more collaborative environment between physicians and hospital administrators, putting physicians on more equal footing with administrators and flattening the hierarchy of leadership.³

Quality Assurance Team in Radiation Oncology Guidelines

Within radiation oncology, the International Atomic Energy Agency (IAEA) has created opportunities for physicians, medical physicists, and radiation therapists to become actively involved in a variety of quality assurance initiatives.⁴ The IAEA has a history of quality assurance projects dating back to 1969 when a postal audit program was created using thermoluminescence dosimetry to confirm the appropriate calibration of radiation therapy machines.⁵ The IAEA has now completed more than 15,500 dosimetric audits involving 2,500 radiation therapy treatment centers

across 139 countries. Given the widespread utilization of these dosimetric audits, the IAEA was approached by multiple countries and treatment organizations about performing more comprehensive health care audits. In response, the IAEA crafted a comprehensive quality assurance protocol, known as the Quality Assurance Team in Radiation Oncology (QUATRO) guidelines. These guidelines were the product of the IAEA QUATRO workshop held in Vienna in May 2005, which culminated in the 2007 publication of the recommended procedures for auditors participating in quality assurance missions.⁶ The published QUATRO guidelines have been extensively field tested by expert teams and found to be effective in systematically identifying clinical inadequacies and facilitating collaboration between international experts and local physician leaders to implement changes to improve the quality of care delivered.^{7,8} To date, more than 100 QUATRO missions have been performed involving 51 countries and 84 treatment facilities. The success of the QUATRO guidelines has resulted in multiple endorsements from professional societies and several countries creating their own national radiation quality assurance programs based on the QUATRO methodology. One example is B-QUATRO in Belgium where QUATRO audits were adapted to the Belgian context.⁹ In addition, QUATRO guidelines have been referred to by the European Commission in its guidelines for clinical audit.¹⁰

QUATRO audits are performed at the voluntary request of individual institutions and vary in scope from comprehensive audits of an entire department to partial audits focused on specific aspects of treatment delivery. A comprehensive audit consists of staff interviews; review of documentation, infrastructure, and dosimetric measurements; and observation of radiation therapy

practices. The scope of a comprehensive audit covers the appropriateness of diagnosis, treatment, and follow-up of patients, as well as dosimetry, medical radiation physics, machine calibration, infrastructure, staffing, and training programs.

The auditing team is composed of an experienced radiation oncologist, radiation therapy medical physicist, and a radiation therapist. When needed, an additional specialist, such as a radiation protection officer, may also be involved depending on the scope of the audit requested by the institution. The 2007 QUATRO guidelines consist of 37 checklists that guide the auditing team in performing a systematic and standardized assessment of the aforementioned aspects of clinical care. QUATRO audits culminate in confidential reports delivered to the requesting institution with recommendations on how to optimize the quality of patient care based on each institution's available resources.

Updated Guidelines

Since 2007, treatment modalities such as 3D conformal radiation, intensity-modulated radiation, volumetric-modulated arc therapy, stereotactic radiosurgery, and 3D high-dose-rate brachytherapy have become more widely utilized. Additionally, more advanced imaging modalities are playing a larger role in diagnosis, staging, and treatment planning. Given the continued innovation within radiation oncology, updated QUATRO guidelines are needed. In 2018, the IAEA began collaborating with a group of international experts to revise the QUATRO guidelines incorporating lessons gleaned from the prior decade of QUATRO missions and accounting for advances in technology.

The update of the QUATRO guidelines now includes a section dedicated to the introduction of new

technologies at radiation therapy centers, which builds upon more recent IAEA publications.¹¹⁻¹⁴ New technologies include treatment machines, physical infrastructure, hardware, software, updated processes, and changes in workflow including new treatment regimens. In addition to improving and modernizing the original 37 checklists, 5 new checklists have been incorporated into the guidelines to assist auditing teams in completing an audit. These 5 new checklists cover daily patient identification, treatment delivery, reporting and management of deviations in radiation therapy administration; brachytherapy procedures and planning; oncology information systems; and academic education. The emphasis on academic education and training helps ensure that individual facilities can sustainably and adequately train new staff to meet their needs as the communities they serve grow.

Conclusion

The second edition of the QUATRO guidelines will serve as an indispensable resource for radiation therapy health care audits. The publication reflects modern practice and technological challenges and provides guidance on implementation of future innovations in radiation oncology. Radiation oncologists, medical physicists, and radiation therapists are encouraged to familiarize themselves with these quality

management tools and use them to guide quality assurance initiatives tailored to the needs and resources of their institution. QUATRO audits may be requested in anticipation of implementing new technology to ensure adequate training, staffing, budgeting, quality assurance protocols, and a plan for its sustainable use. Physicians should continue to play a leading role in quality improvement, as their engagement remains key to the successful implementation and sustainability of quality assurance and improvement initiatives.

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