

## Canadian Partnership for Quality Radiotherapy

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### Quality Assurance Guidelines for Canadian Radiation Treatment Programs

A guidance document on behalf of:

Canadian Association of Radiation Oncology

Canadian Organization of Medical Physicists

Canadian Association of Medical Radiation Technologists

Canadian Partnership Against Cancer

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**CPQR**  
Canadian Partnership for  
Quality Radiotherapy

**PCQR**  
Partenariat canadien pour  
la qualité en radiothérapie

## Quality Assurance Guidelines for Canadian Radiation Treatment Programs

### Preface

Approximately 50% of all incident cases of cancer require radiation treatment at some point during the management of the disease (Delaney et al., 2005). In Canada, in 2014, it is estimated there were approximately 196,900 new cases of cancer (Canadian Cancer Society, 2015) and approximately 118,350 courses of radiation treatment were administered (CARO, 2013). There are currently 47 radiation treatment facilities in Canada. In all provinces and territories cancer treatment is funded by the provincial or territorial governments. Radiation treatment equipment is either licensed by the Canadian Nuclear Safety Commission (CNSC) or registered by the appropriate provincial authority, depending on energy and other criteria.

The Canadian Partnership for Quality Radiotherapy (CPQR) is an alliance amongst the three key national professional organizations involved in the delivery of radiation treatment in Canada: the Canadian Association of Radiation Oncology (CARO), the Canadian Organization of Medical Physicists (COMP), and the Canadian Association of Medical Radiation Technologists (CAMRT), with financial and strategic backing from the Canadian Partnership Against Cancer (CPAC), a national resource for advancing cancer prevention and treatment. The mandate of the CPQR is to support the universal availability of high quality and safe radiotherapy for all Canadians through system performance improvement and the development of consensus-based guidelines and indicators to aid in radiation treatment program development and evaluation.

This document, *Quality Assurance Guidelines for Canadian Radiation Treatment Programs*, outlines the overarching elements of quality that are important in all radiation treatment programs, together with key quality indicators for periodic programmatic self-assessment and quality improvement. The intent of these guidelines is to outline benchmarks for achievement by radiation treatment programs rather than describing standards of compliance. The document is one in a suite of guideline documents created by CPQR that include:

- *Technical Quality Control Guidelines for Canadian Radiation Treatment Programs*, which outlines key elements of radiation treatment equipment quality control;
- *National System for Incident Reporting – Radiation Treatment Minimum Data Set* (piloting to be completed in 2016) that provides guidance for reporting radiation treatment incidents nationally and helps users navigate the National System for Incident Reporting – Radiation Treatment (NSIR-RT) database managed by the Canadian Institute of Health Information;
- *Patient Engagement Guidelines for Canadian Radiation Treatment Programs* (to be released in 2016) that outlines overarching elements of quality that are important to ensuring that patients and family members are engaged in the care process and satisfied with both the process of care and the outcomes of care.

## Quality Assurance Guidelines for Canadian Radiation Treatment Programs

When considered together, these documents address all aspects of quality and safety related to radiation treatment delivery. All CPQR documents are considered living documents and are reviewed and revised at regular intervals by CPQR to maintain relevance in the Canadian radiation treatment environment.

Ownership of CPQR documents resides jointly with the national professional organizations involved in the delivery of radiation treatment in Canada – CARO, COMP, CAMRT and CPAC. Enquiries regarding this document should be addressed to CPQR, c/o EDG Consulting, 68 Ironstone Drive, Red Deer, Alberta, T4R 0C1, or via email to [administration@cpqr.ca](mailto:administration@cpqr.ca).

### Abbreviations and Definitions

<b>Abbreviations</b>	
AAPM	American Association of Physicists in Medicine
CAMRT	Canadian Association of Medical Radiation Technologists
CAPCA	Canadian Association of Provincial Cancer Agencies
CARO	Canadian Association of Radiation Oncology
CCPM	Canadian College of Physicists in Medicine
COMP	Canadian Organization of Medical Physicists
CMQ	Collège des médecins du Québec
CNSC	Canadian Nuclear Safety Commission
CPAC	Canadian Partnership Against Cancer
CPQR	Canadian Partnership for Quality Radiotherapy
NSIR-RT	National System for Incident Reporting-Radiation Treatment
ICRU	International Commission on Radiation Units and Measurements
KQIs	Key Quality Indicators
RCPSC	Royal College of Physicians and Surgeons of Canada
RTQAC	Radiation Treatment Quality Assurance Committee
WHO	World Health Organization
<b>Definitions</b>	
Cancer Program	The multidisciplinary cancer program that encompasses the radiation treatment program.
Clinical Physics Activities	Activities performed by Medical Physicists that are related to the provision of radiation treatment and/or assuring a safe radiation treatment environment.
Organization	The hospital, cancer centre, or institution in which the radiation treatment program resides.
Radiation Treatment Facility	The physical location where radiation treatment is administered.

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Radiation Treatment Program	The personnel, equipment, information systems, policies and procedures, and activities required for the safe delivery of radiation treatment according to evidence-based and/or best practice guidelines.
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### 1. Introduction

The *Quality Assurance Guidelines for Canadian Radiation Treatment Programs* highlight important elements of radiation quality assurance that should be common to all radiation treatment programs in Canada. They are not intended to replace detailed specifications, standard operating procedures or centre-based policies, but rather to support the development and maintenance of a national strategy for radiation treatment quality assurance. The ultimate objective is to assure the highest quality radiation treatment for all Canadians as an integrated element of overall cancer care and minimize the risk of medical errors and untoward clinical outcomes. Responsibility for implementation of quality assurance programs and monitoring of quality indicators should be taken at the highest operational levels of all cancer treatment organizations and provincial cancer agencies.

Quality assurance in radiation treatment is defined by the World Health Organization (WHO) as, “all procedures that ensure consistency of the medical prescription, and safe fulfillment of that prescription, as regards to the dose to the target volume, together with minimal dose to normal tissue, minimal exposure of personnel and adequate patient monitoring aimed at determining the end result of treatment” (WHO, 2008). A quality assurance program must therefore address all aspects of the timely delivery of radiation treatment, including programmatic organization, the qualifications of the personnel involved in radiation treatment, the performance of the planning and treatment equipment, policies and procedures, incident monitoring, and reporting.

### 2. Guideline and Indicator Development Process

This document is intended to provide a unified, national quality assurance framework for radiation treatment programs across Canada and a set of Key Quality Indicators (KQIs) for monitoring programmatic performance. It is based on the premise that quality assurance is an essential element of good clinical care and is intended to foster a culture of continuous quality improvement in radiation treatment programs across Canada. These guidelines and indicators are consistent with the Government of Canada and CNSC regulatory requirements (Government of Canada, 1997; Government of Canada, 2000; AECB, 2000; CNSC, 2006), recommendations from the World Health Organization (WHO, 2008; WHO, 2009), American Association of Physicists in Medicine (AAPM) (AAPM, various dates) and other international professional organizations (BIR et al., 2008), and Accreditation Canada’s “Cancer Care and Oncology Services” standards (Accreditation Canada, 2015).

The original CPQR *Quality Assurance Guidelines for Canadian Radiation Treatment Programs* document was released on April 3, 2011 and published online. There was rapid uptake and utilization by radiation treatment programs across Canada as a means of motivating quality improvement. Based on initial feedback from the community, and as part of its continuous reevaluation process, the CPQR reviewed the KQIs of the original *Quality Assurance Guideline* document critically using a modified Delphi process based on consensus of stakeholders across Canada. This process has resulted in a robust set of radiation treatment KQIs that are relevant to Canadian radiotherapy practice, scientifically sound, evidence-based, unambiguous, and feasible to use.

## Quality Assurance Guidelines for Canadian Radiation Treatment Programs

As the document continues to be utilized broadly by radiation treatment centres across Canada, and internationally, there will be a greater emphasis placed on compliance. With this end in mind, CPQR has partnered with Accreditation Canada on the development of a Qmentum module for radiotherapy. Accreditation Canada is a national standards and accreditation body that focuses on the development of standards that benefit the health service industry through improvements in quality, safety, and efficiency. “The Qmentum program is designed to focus on quality and safety throughout all aspects of the hospital system – from governance and leadership to direct care and infrastructure” (Accreditation Canada, 2015). The integration of a radiation treatment component into this standards accreditation process places a high priority on quality and safety practices within individual radiation treatment centres.

### Summary of Key Quality Indicators: Organizational

KQI		Indicator Measure	Section Reference
<b>Organizational Quality Indicators</b>			
1	The radiation treatment program has clearly defined its reporting structure, and the responsibilities of all personnel and committees, to ensure accountability for the quality of care it provides.	0 or 1	3.2
2	There is a Radiation Treatment Quality Assurance Committee (RTQAC) responsible for monitoring adherence to written policies and procedures regarding quality assurance activities.	0 or 1	3.3
3	The Radiation Treatment Quality Assurance Committee (RTQAC) has documented terms of reference that meet all the requirements for composition, committee chair, meeting frequency, and accountabilities as outlined in Section 3.4.	0 or 1	3.4
4	The Radiation Treatment Quality Assurance Committee (RTQAC) has a “blame-free” process for personnel to access the committee and to report concerns about radiation treatment quality or safety.	0 or 1	3.5
5	There is a radiation safety program that has written policies and procedures to address the safe use of ionizing radiation according to the pertinent laws and regulations specified in Section 3.6.	0 or 1	3.6
6	The radiation treatment program has written policies and procedures that address the reporting, investigation, action, documentation, and monitoring of radiation treatment incidents.	0 or 1	3.7



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7	The radiation treatment program identifies critical radiation treatment incidents as defined by Section 3.7.	0 or 1	3.7
8	The radiation treatment program reports critical radiation treatment incidents as per requirements of local, provincial, and/or national organizations.	0 or 1	3.7

### Summary of Key Quality Indicators: Personnel

KQI		Indicator Measure	Section Reference
<b>Personnel Quality Indicators</b>			
9	The radiation treatment program has a process for assuring that personnel have the necessary qualifications, credentials, certifications, and licenses to fulfill their duties.	0 or 1	4.2
10	Percentage of Radiation Oncologists certified by the Royal College of Physicians and Surgeons of Canada (RCPSC) or the Collège des médecins du Québec (CMQ).	0-100 %	4.3
11	Percentage of eligible Medical Physicists certified by the Canadian College of Physicists in Medicine (CCPM) or equivalent.	0–100%	4.4
12	Percentage of Radiation Therapists licensed by the provincial regulatory body, or where such a body does not exist, who are members of the Canadian Association of Medical Radiation Technologists (CAMRT).	0–100%	4.5
13	There is an identified head of the radiation treatment program.	0 or 1	4.6
14	There is an identified Radiation Safety Officer who reports directly to the CEO of the organization or senior leadership delegate (other than the head of the radiation treatment program).	0 or 1	4.7
15	There is a radiation safety training program for all personnel at a level appropriate to their job function, according to national regulatory guidelines described in Section 4.8.	0 or 1	4.8

### Summary of Key Quality Indicators: Radiation Treatment Equipment

KQI		Indicator Measure	Section Reference
<b>Radiation Treatment Equipment Quality Indicators</b>			

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16	There are technical quality control policies and procedures for all radiation planning and treatment equipment.	0 or 1	5.2
17	Compliance with technical quality control policies and procedures is monitored by the Radiation Treatment Quality Assurance Committee (RTQAC).	0 or 1	5.2
18	For new equipment a quality control procedure is implemented during installation and commissioning and tested prior to clinical use.	0 or 1	5.3
19	For new equipment all personnel involved with its calibration, operation, or maintenance are appropriately trained.	0 or 1	5.3
20	There is an independent audit of radiation treatment machine calibration or dosimetry at least annually.	0 or 1	5.5
21	There are written policies and procedures to be followed in the event of an emergency, whereby acute failure of either equipment or systems, has the potential to affect safety.	0 or 1	5.6

## Summary of Key Quality Indicators: Policy and Procedure

KQI		Indicator Measure	Section Reference
<b>Policy and Procedure Quality Indicators</b>			
22	The radiation treatment policies and procedures are reviewed, and revised if required, at least every two years.	0 or 1	6.1
23	Percentage of patients meeting Canadian Association of Radiation Oncology (CARO) wait time guidelines for referral to consultation in the preceding year.	0–100%	6.2
24	Percentage of patients meeting Canadian Association of Radiation Oncology (CARO) wait time guidelines for ready-to-treat to start of treatment in the preceding year.	0–100%	6.2
25	Patients are identified using at least two patient-specific identifiers before any radiation planning or treatments provided.	0 or 1	6.3
26	Percentage of newly diagnosed patients receiving radiotherapy in the preceding year that had a cancer stage assigned.	0–100%	6.4
27	The radiation treatment program has processes for selecting and reviewing clinical practice guidelines.	0 or 1	6.5
28	The radiation treatment program utilizes and regularly reviews radiation planning and treatment guidelines.	0 or 1	6.6

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29	There is documentation of informed consent for radiation therapy prior to the delivery of treatment.	0 or 1	6.7
30	The radiation treatment program provides written or online educational materials about radiation treatment planning, treatment delivery, side effects, and follow-up to patients and their families.	0 or 1	6.8
31	There are policies and procedures for authorizing a course of radiation treatment or any change to a previously authorized course of radiation treatment.	0 or 1	6.9
32	The radiation treatment prescription meets all criteria outlined in Section 6.10 to deliver treatment addressing dose prescription, site and laterality, patient identification, and authorization.	0 or 1	6.10
33	Percentage of adjuvant or curative radiotherapy treatment plans that undergo Radiation Oncologist peer review prior to the start of treatment.	0–100%	6.11
34	Percentage of adjuvant or curative radiotherapy treatment plans that undergo Radiation Oncologist peer review before 25% of the prescribed dose has been administered.	0–100%	6.11
35	Percentage of adjuvant or curative radiotherapy treatment plans that undergo Radiation Oncologist peer review at any point in time.	0–100%	6.11
36	Radiotherapy treatment plans, dose calculations, and patient set-ups are independently reviewed prior to beginning treatment in all cases.	0 or 1	6.12
37	There is a process for confirming female patients of reproductive age are not pregnant prior to radiation treatment planning and delivery.	0 or 1	6.13
38	There are policies and procedures to monitor patients with pacemakers/defibrillators or implantable devices during radiation treatment.	0 or 1	6.14
39	Patients receiving radiation treatment are evaluated at intervals appropriate to patient context during treatment by a Radiation Oncologist or designate.	0 or 1	6.15
40	When radiation treatment is being delivered a Radiation Oncologist and a Medical Physicist are present at the radiation treatment facility or capable of responding within a time limit set by the program.	0 or 1	6.16
41	There are policies and procedures guiding the planning and safe delivery of emergency radiation treatment.	0 or 1	6.17

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42	The radiation treatment program maintains paper or electronic records of the radiation treatment plan with sufficient detail to allow the plan to be reconstructed.	0 or 1	6.18
43	The radiation treatment program, as part of the multidisciplinary cancer program, is accredited by Accreditation Canada.	0 or 1	6.19
44	Percentage of patients treated with curative-intent radiotherapy for whom the radiation treatment program reviews treatment-related toxicity outcomes. These outcomes are regularly compared to available benchmarks.	0–100%	6.20
45	Percentage of patients treated with curative-intent radiotherapy for whom the radiation treatment program reviews relevant disease control or survival outcomes. These outcomes are regularly compared to available benchmarks.	0–100%	6.20

### 3. Programmatic Organization

#### 3.1. Organizational Integration and Resources

The radiation treatment program is an integrated part of a multidisciplinary cancer program. The radiation treatment program works with the organization leadership to assure adequate human, structural, and informational resources for the safe delivery of radiation treatment according to evidence-based and/or best practice guidelines.

#### 3.2. Accountability

Within the radiation treatment program, there are clearly defined accountabilities for the quality of care that is delivered to patients. These accountabilities are defined through the program's reporting structure and through the responsibilities of all personnel directly involved in delivering that care. Such accountabilities extend through the program committees to the head of the radiation treatment program (Section 4.6), who oversees all aspects of the clinical program, up to the organization's CEO and board of directors.

Key Quality Indicator #1	Indicator Measure
The radiation treatment program has clearly defined its reporting structure, and the responsibilities of all personnel and committees, to ensure accountability for the quality of care it provides.	0 or 1

### 3.3. Radiation Treatment Quality Assurance Program

The radiation treatment program has a comprehensive quality assurance program that encompasses all aspects of radiation treatment planning and delivery that directly or indirectly impacts patient care with, at a minimum, the following components:

- A Radiation Treatment Quality Assurance Committee (RTQAC);
- Detailed written policies and procedures for all quality assurance activities in the program; and
- A process for the retention of documents pertaining to quality assurance activities.

Key Quality Indicator #2	Indicator Measure
There is a Radiation Treatment Quality Assurance Committee (RTQAC) responsible for monitoring adherence to written policies and procedures regarding quality assurance activities.	0 or 1

### 3.4. Radiation Treatment Quality Assurance Committee (RTQAC)

Composition and Organization of the RTQAC:

- The RTQAC is comprised, at a minimum, of a Radiation Oncologist, a Medical Physicist, and a Radiation Therapist with operational responsibility for quality assurance in the radiation treatment program;
- The RTQAC is chaired by a Radiation Oncologist, Medical Physicist or Radiation Therapist;
- The RTQAC is a standing committee that meets at regular intervals – no fewer than four times per year (i.e. quarterly); and
- The RTQAC reports to the head of the radiation treatment program (Section 4.6) and/or other committees or groups with responsibility for quality within the radiation treatment program, cancer program, or organization.

Duties and Responsibilities of the RTQAC:

- The RTQAC confirms that all equipment quality control procedures (Section 5.2) are adhered to, and that appropriate documentation is maintained;
- The RTQAC confirms that all radiation treatment policies and procedures are adhered to and investigates instances of non-compliance;
- The RTQAC reviews radiation treatment incidents, verifies that the incidents were appropriately managed according to the radiation treatment program, cancer program, and/or organization policies and procedures, and that the necessary steps were taken to prevent incidents from recurring, particularly for critical incidents (Section 3.7) or when a significant trend in the pattern of less severe incidents is identified;
- The RTQAC oversees the reporting of incident data to local, provincial, national, and/or international organizations as required, with the aim of preventing similar incidents from occurring elsewhere;

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- The RTQAC defines and monitors, on a continuous basis, quality indicators for the radiation treatment program and reports indicator trends to the head of the radiation treatment program (Section 4.6) and/or other committees or groups with responsibility for quality within the radiation treatment program, cancer program, or organization.

Key Quality Indicator #3	Indicator Measure
The Radiation Treatment Quality Assurance Committee (RTQAC) has documented terms of reference that meet all the requirements for composition, committee chair, meeting frequency, and accountabilities as outlined in Section 3.4.	0 or 1

### 3.5. Access to Radiation Treatment Quality Assurance Committee (RTQAC)

There is a mechanism for personnel to access the RTQAC to report concerns about radiation treatment quality.

Key Quality Indicator #4	Indicator Measure
The Radiation Treatment Quality Assurance Committee (RTQAC) has a “blame-free” process for personnel to access the committee and to report concerns about radiation treatment quality or safety.	0 or 1

### 3.6. Radiation Safety Program

The radiation treatment program has a radiation safety program to oversee the safe use of radioactive devices and materials in compliance with the “Canadian General Nuclear Safety and Control Regulations” (Government of Canada, 2000), the “Canadian Nuclear Safety and Control Act” (Government of Canada, 1997), and all relevant CNSC regulations. The radiation safety program has written policies and procedures, as detailed in the CNSC regulatory guide G-121 “Radiation Safety in Educational, Medical and Research Institutions” (AECB, 2000).

The Radiation Safety Officer (Section 4.7) is responsible for the radiation safety program. With respect to matters of radiation safety, the Radiation Safety Officer reports to the organization’s CEO and/or other individuals, committees, or groups with responsibility for safety within the cancer program or organization. The Radiation Safety Officer reports as necessary, and at least annually, to the cancer program or organization quality committee or equivalent on matters pertaining to radiation safety in the radiation treatment program.

Key Quality Indicator #5	Indicator Measure
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There is a radiation safety program that has written policies and procedures to address the safe use of ionizing radiation according to the pertinent laws and regulations specified in Section 3.6.	0 or 1
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### 3.7. Radiation Treatment Incident Management

The radiation treatment program monitors, investigates, acts upon, documents, and reports radiation treatment incidents that occur at any point in the radiation treatment process from decision-to-treat through completion of treatment delivery, as outlined in the CPQR companion document *Incident Management Guidance for Canadian Radiation Treatment Programs* (currently being developed).

The radiation treatment program identifies critical radiation treatment incidents using the following criteria:

- Hardware or software errors that have a high probability of causing an unacceptable outcome for the patient or that pose an unacceptable risk to personnel or members of the public; or
- Errors resulting in >25% tumour underdose or OAR overdose, relative to the intended dose to these structures over the course of treatment that on the balance of probabilities, is likely to be associated with the development of significant late medical harm.

The radiation treatment program takes action to prevent critical radiation treatment incidents from recurring. The radiation treatment program reports critical radiation treatment incidents to local, provincial, national, and/or international organizations as required.

The radiation treatment program participates in the NSIR-RT, a central repository, to report, track and analyze incidents from their own centre system and anonymously from other Canadian centres. Through identifying and mitigating system vulnerabilities, the radiation program can potentially improve operational processes and ultimately patient safety locally and nationally.

Key Quality Indicators #6, 7, 8	Indicator Measure
The radiation treatment program has written policies and procedures that address the reporting, investigation, action, documentation, and monitoring of radiation treatment incidents.	0 or 1
The radiation treatment program identifies critical radiation treatment incidents as defined by Section 3.7.	0 or 1
The radiation treatment program reports critical radiation treatment incidents as per requirements of local, provincial, and/or national organizations.	0 or 1

## 4. Personnel

### 4.1. Competence

All personnel with direct or indirect responsibility for the provision of radiation treatment are educated, trained, qualified, and competent.

### 4.2. Credentials, Certifications, and Licensing

The radiation treatment program, through the RTQAC or another appropriate mechanism, has a process for assuring that personnel have the necessary credentials from the relevant professional colleges, associations or licensing bodies, and that these credentials are up-to-date.

Key Quality Indicator #9	Indicator Measure
The radiation treatment program has a process for assuring that personnel have the necessary qualifications, credentials, certifications, and licenses to fulfill their duties.	0 or 1

### 4.3. Radiation Oncologists

Radiation Oncologists are licensed to practise medicine by the relevant provincial medical college or licensing authority, and certified in Radiation Oncology by the Royal College of Physicians and Surgeons of Canada (RCPSC) or the Collège des médecins du Québec (CMQ).

Key Quality Indicator #10	Indicator Measure
Percentage of Radiation Oncologists certified by the Royal College of Physicians and Surgeons of Canada (RCPSC) or the Collège des médecins du Québec (CMQ).	0–100 %

### 4.4. Medical Physicists

Eligible Medical Physicists who independently perform clinical physics activities relating to radiation treatment are certified by the Canadian College of Physicists in Medicine (CCPM) or equivalent.

Key Quality Indicator #11	Indicator Measure
Percentage of eligible Medical Physicists certified by the Canadian College of Physicists in Medicine (CCPM) or equivalent.	0–100%



#### 4.5. Radiation Therapists

Radiation Therapists meet provincial licensing requirements. Where such a provincial regulatory body does not exist, membership to the Canadian Association of Medical Radiation Technologists (CAMRT) is another measure of qualification.

Key Quality Indicator #12	Indicator Measure
Percentage of Radiation Therapists licensed by the provincial regulatory body, or, where such a body does not exist, who are members of the Canadian Association of Medical Radiation Technologists (CAMRT).	0–100%

#### 4.6. Head of the Radiation Treatment Program

The head of the radiation treatment program has clearly defined responsibilities for all clinical aspects of the radiation treatment program and has commensurate clinical and administrative experience to fulfill those responsibilities.

Key Quality Indicator #13	Indicator Measure
There is an identified head of the radiation treatment program.	0 or 1

#### 4.7. Radiation Safety Officer

A qualified individual (CNSC, 2006) is designated as having primary responsibility for all aspects of radiation safety (Section 3.6) in the radiation treatment program. The Radiation Safety Officer is certified by the CNSC (CNSC, 2011). With respect to matters of radiation safety, the Radiation Safety Officer reports directly to the organization’s CEO or senior leadership delegate with responsibility for safety within the cancer program or organization (other than the head of the radiation treatment program). The Radiation Safety Officer reports as necessary, and at least annually, to the cancer program or organization quality committee or equivalent, on matters relating to radiation safety in the radiation treatment program.

Key Quality Indicator #14	Indicator Measure
There is an identified Radiation Safety Officer who reports directly to the CEO of the organization or senior leadership delegate (other than the head of the radiation treatment program).	0 or 1

#### 4.8. Radiation Safety Training

All personnel in the facility regularly receive radiation safety training at a level appropriate to their job function. The training follows accepted recommendations, such as those detailed in the CNSC regulatory guide G-313 “Radiation Safety Training Programs for Workers Involved in Licensed Activities with Nuclear Substances and Radiation Devices, and with Class II Nuclear Facilities and Prescribed Equipment” (CNSC, 2006). Participation in radiation safety training activity is monitored as part of the employee performance evaluation program.

Key Quality Indicator #15	Indicator Measure
There is a radiation safety training program for all personnel at a level appropriate to their job function, according to national regulatory guidelines described in Section 4.8.	0 or 1

#### 4.9. Continuing Education

There is a continuing education program with internal seminars, rounds, and conferences to ensure that personnel are exposed to new developments in radiation treatment and radiation treatment quality assurance. Continuing education requirements of licensing organizations or professional associations are adhered to when applicable. Continuing education activity is monitored as a part of the employee performance evaluation program.

#### 4.10. Staffing Levels

The radiation treatment team works with the organization leadership to assure staffing levels for each of the professional disciplines and other required personnel that are adequate to safely deliver radiation treatment according to evidence-based and/or best practice guidelines. Provincial, national, or professional staffing guidelines are adhered to when available.

### 5. Radiation Treatment Equipment

Radiation treatment equipment includes radiation treatment planning and delivery equipment and all major accessories used in the radiation treatment program. Specifically, this includes all teletherapy and brachytherapy treatment devices, treatment simulation devices, treatment planning computer systems, electronic information systems that are integrated with the above equipment, and calibration and quality assurance devices used in relation to the above equipment.

### 5.1. Responsibility for Equipment Quality Control

The RTQAC (Section 3.4) monitors equipment quality control activities and indicators of equipment performance, confirms that all equipment quality control procedures are adhered to and assures that appropriate documentation is maintained.

### 5.2. Equipment Quality Control Procedures

The radiation treatment program has quality control procedures for all radiation planning and treatment, and all major accessories, that describe the tests to be performed, the frequency of the tests, the qualifications of the individuals performing the tests, the tolerances associated with any measurement, and the procedures to be followed in the event that a test fails or a measurement falls outside an allowed tolerance. The purpose of quality control testing is to ensure that the equipment adheres to acceptable performance standards over the useful life of the equipment. For radiation treatment equipment, the quality control procedures include specific protocols to be followed for calibrating the radiation output of the equipment and the frequency of calibration. The CPQR *Technical Quality Control* suite of guidelines can be found at [www.cpqr.ca](http://www.cpqr.ca).

Key Quality Indicators #16, 17	Indicator Measure
There are technical quality control policies and procedures for all radiation planning and treatment equipment.	0 or 1
Compliance with technical quality control policies and procedures is monitored by the Radiation Treatment Quality Assurance Committee (RTQAC).	0 or 1

### 5.3. Introduction of New Equipment

Before new equipment is introduced into clinical service a complete safety analysis is performed, a quality control procedure is implemented and tested, and all personnel involved with the calibration, operation or maintenance of the device are trained in the operation of the device, in the radiation safety issues associated with the device, and in the emergency procedures associated with a failure of the device or major accessory.

Key Quality Indicators #18, 19	Indicator Measure
For new equipment a quality control procedure is implemented during installation and commissioning, and tested prior to clinical use.	0 or 1
For new equipment all personnel involved with its calibration, operation, or maintenance are appropriately trained.	0 or 1

#### 5.4. Equipment Obsolescence

Equipment or software that is unable to provide the functionality required for modern, standard-of-care patient treatment is defined to be obsolescent and is targeted for replacement with contemporary equipment or software. Equipment or software that consistently does not meet the quality standards defined in the relevant CPQR *Technical Quality Control Guideline* is targeted for replacement or major upgrade. Equipment or software replacements or upgrades occur in a timely manner so as not to adversely affect the availability or quality of radiotherapy services.

#### 5.5. External Dosimetry Audit

An independent machine dosimetry audit is conducted on an annual basis. Audit services are available from institutions such as the Imaging and Radiation Oncology Core (IROC) QA Centre in Houston, Texas (MD Anderson, n.d.). The audit results are reviewed by the head of the radiation treatment program, the RTQAC, and the heads of the Radiation Oncology, Medical Physics, and Radiation Therapy departments.

Key Quality Indicator #20	Indicator Measure
There is an independent audit of radiation treatment machine calibration or dosimetry at least annually.	0 or 1

#### 5.6. Emergency Procedures

There are clearly defined procedures to be followed in the event of acute failure of equipment or systems that could affect patient, staff, or public safety.

Key Quality Indicator #21	Indicator Measure
There are written policies and procedures to be followed in the event of an emergency, whereby acute failure of either equipment or systems, has the potential to affect safety.	0 or 1

### 6. Policies and Procedures

#### 6.1. Policy and Procedure Manual

The radiation treatment program has policies and procedures for clinical care, treatment planning, and treatment delivery that include, but are not limited to, those identified in Sections 6.1 to 6.20. These policies and procedures are to be reviewed at least every two years, revised as necessary, and readily available to staff as reference material. The manual outlines the processes to be used for revising policies and procedures as well as controlling versions, including the dissemination of current versions to relevant personnel and the deletion of outdated versions to avoid confusion.

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Key Quality Indicator #22	Indicator Measure
The radiation treatment policies and procedures are reviewed, and revised if required, at least every two years.	0 or 1

### 6.2. Radiation Treatment Wait Times

The radiation treatment program monitors patient wait times in relation to provincial, national, and/or professional guidelines. The wait time indicators defined by CARO provide a nationally recognized framework for uniform reporting of wait times among radiation treatment programs in Canada (CARO, 2000). The radiation treatment program reports wait times to local, provincial, and/or national organizations as required.

Key Quality Indicators #23, 24	Indicator Measure
Percentage of patients meeting Canadian Association of Radiation Oncology (CARO) wait time guidelines for referral to consultation in the preceding year.	0–100%
Percentage of patients meeting Canadian Association of Radiation Oncology (CARO) wait time guidelines for ready-to-treat to start of treatment in the preceding year.	0–100%

### 6.3. Patient Identification

Patients are positively identified using at least two patient-specific characteristics before any treatment or service is provided. Patient-specific identifiers include name, date of birth, medical record number, and photographs.

Key Quality Indicator #25	Indicator Measure
Patients are identified using at least two patient-specific identifiers before any radiation planning or treatments provided.	0 or 1

### 6.4. Cancer Staging

The radiation treatment program, as part of the multidisciplinary cancer program, uses the Tumour Node Metastasis (TNM) tumour staging system (Sobin et al., 2009) or another valid staging system where indicated, to aid in prognostication, multidisciplinary treatment planning, and the analysis and reporting of outcomes.

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Key Quality Indicator #26	Indicator Measure
Percentage of newly diagnosed patients receiving radiotherapy in the preceding year that had a cancer stage assigned.	0–100%

### 6.5. Clinical practice Guidelines

The radiation treatment program, together with the multidisciplinary cancer program, follows evidence-based clinical practice guidelines, and has processes for selecting and regularly reviewing guidelines to be sure that they reflect current research and best practice information. The radiation treatment program has a process to decide among conflicting guidelines or multiple recommendations.

Key Quality Indicator #27	Indicator Measure
The radiation treatment program has processes for selecting and reviewing clinical practice guidelines.	0 or 1

### 6.6. Radiation Planning and Treatment Guidelines

The radiation treatment program follows institutional radiation planning and treatment guidelines and has processes for selecting and regularly reviewing guidelines to be sure that they reflect current research and best practice information. The radiation treatment program has a process to decide among conflicting guidelines or multiple recommendations.

Key Quality Indicator #28	Indicator Measure
The radiation treatment program utilizes radiation planning and treatment guidelines.	0 or 1

### 6.7. Informed Consent

Informed consent for radiation treatment is obtained from the patient, the patient’s legal guardian, or an appropriate substitute decision maker when the decision to treat is finalized. Informed consent consists of: providing information about the recommended treatment, alternate treatments, expected outcomes, and potential side effects in a language that is understood; respecting cultural beliefs and values; reviewing the consent form; allowing time for reflection; answering questions; and recording the decision in the medical record.

Key Quality Indicator #29	Indicator Measure
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## Quality Assurance Guidelines for Canadian Radiation Treatment Programs

There is documentation of informed consent for radiation therapy prior to the delivery of treatment.	0 or 1
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### 6.8. Patient Education

The radiation treatment program provides patients and families with education about radiation therapy planning, treatment delivery, side effects, and follow-up using written or online materials in addition to verbal communication, while respecting cultural beliefs and values, literacy level, language, and functional abilities.

Key Quality Indicator #30	Indicator Measure
The radiation treatment program provides written or online educational materials about radiation treatment planning, treatment delivery, side effects, and follow-up to patients and their families.	0 or 1

### 6.9. Authorization of Radiation Planning or Treatment Procedures

There is a clearly defined process for authorizing a course of radiation treatment or any change to a previously authorized course of radiation treatment.

Key Quality Indicator #31	Indicator Measure
There are policies and procedures for authorizing a course of radiation treatment or any change to a previously authorized course of radiation treatment.	0 or 1

### 6.10. Treatment Prescription

The treatment prescription:

- Clearly references the prescribed dose to a particular plan point or isodose line according to the International Commission on Radiation Units and Measurements (ICRU) Report 50 (Jones, 1994) or ICRU Report 62 (Morgan-Fletcher, 1999), when a computer generated treatment plan is used;
- Includes sufficient information, including at a minimum, dose and fractionation, treatment site, and confirmation of laterality, to allow a qualified Radiation Therapist to deliver the treatment as intended without ambiguity;
- Uses at least two patient-specific identifiers, including at a minimum, the patient's name and medical record number; and
- Is authorized by a Radiation Oncologist, either in writing or by electronic signature.

Key Quality Indicator #32	Indicator Measure
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## Quality Assurance Guidelines for Canadian Radiation Treatment Programs

The radiation treatment prescription meets all criteria outlined in Section 6.10 to deliver treatment addressing dose prescription, site and laterality, patient identification, and authorization.	0 or 1
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### 6.11. Radiation Oncologist Peer Review of Treatment Plans

All radiation treatment plans administered with adjuvant or curative intent, and other plans where there is a significant potential for adverse patient outcome if tumour targets and/or normal structures are treated inappropriately, undergo Radiation Oncologist peer review of volumes and dosimetry ideally before the start of treatment in all cases, or if not possible, before 25% of the total prescribed dose has been delivered. This includes conventionally fractionated or hypofractionated treatment plans, high dose single fraction plans, stereotactic, and brachytherapy plans.

Key Quality Indicators #33, 34, 35	Indicator Measure
Percentage of adjuvant or curative radiotherapy treatment plans that undergo Radiation Oncologist peer review prior to the start of treatment.	0–100%
Percentage of adjuvant or curative radiotherapy treatment plans that undergo Radiation Oncologist peer review before 25% of the prescribed dose has been administered.	0–100%
Percentage of adjuvant or curative radiotherapy treatment plans that undergo Radiation Oncologist peer review at any point in time.	0–100%

### 6.12. Review of Treatment Plans, Dose Calculations, and Patient Set-ups

Every radiation treatment plan, dose calculation, and patient set-up is reviewed independently by a second professional (Radiation Oncologist, Medical Physicist, or Radiation Therapist as appropriate) prior to beginning treatment. There is a written procedure describing the minimum checks to be performed. While care is exercised with all treatments, particular attention is given to complex treatments, hypofractionated, stereotactic, or single fraction treatments and non-standard treatments that are used infrequently.

Key Quality Indicator #36	Indicator Measure
Radiotherapy treatment plans, dose calculations, and patient set-ups are independently reviewed prior to beginning treatment in all cases.	0 or 1



### 6.13. Pregnancy Status Prior to Radiation Planning and Treatment

The radiation treatment program has a process in place to confirm that all female patients of reproductive age are not pregnant prior to radiation treatment planning and delivery.

Key Quality Indicator #37	Indicator Measure
There is a process for confirming female patients of reproductive age are not pregnant prior to radiation treatment planning and delivery.	0 or 1

### 6.14. Pacemakers, Defibrillators, and Implantable Devices

There are policies and procedures to monitor patients with pacemakers or implantable cardioverter defibrillators, both referred to as cardiac implantable electronic devices, or any implantable electronic device that can be affected by varying levels and types of electromagnetic interference during radiation therapy planning or treatment. These policies and procedures should be in accordance with recommendations from the AAPM Task Group 34 (Marbach et al., 1994) outlined in AAPM Report No. 45 (Nath et al., 1994).

Key Quality Indicator #38	Indicator Measure
There are policies and procedures to monitor patients with pacemakers/defibrillators or implantable devices during radiation treatment.	0 or 1

### 6.15. Medical Review of Patients Receiving Radiation Treatment

Patients receiving radiation treatment are evaluated at regular intervals appropriate to patient context during treatment by a Radiation Oncologist or a qualified designate. A Radiation Oncologist or designate is also available to see patients for medical or treatment-related issues that arise between scheduled review sessions.

Key Quality Indicator #39	Indicator Measure
Patients receiving radiation treatment are evaluated at intervals appropriate to patient context during treatment by a Radiation Oncologist or designate.	0 or 1

### 6.16. Radiation Oncology and Medical Physics Availability

A Radiation Oncologist and a Medical Physicist are present at the radiation treatment facility or readily available and capable of responding within an appropriate time limit set by the radiation treatment program, whenever any radiation treatment is delivered.

Key Quality Indicator #40	Indicator Measure
When radiation treatment is being delivered, a Radiation Oncologist and a Medical Physicist are present at the radiation treatment facility or capable of responding within a time limit set by the program.	0 or 1

### 6.17. Emergency Radiation Treatments

The radiation treatment program has defined policies and procedures guiding the planning and delivery of emergency radiation treatments of patients and does not compromise any of the usual quality and safety measures that apply to the routine treatment of patients.

Key Quality Indicator #41	Indicator Measure
There are policies and procedures guiding the planning and safe delivery of emergency radiation treatment.	0 or 1

### 6.18. Radiation Treatment Records

The radiation treatment program, together with the multidisciplinary cancer program, maintains paper or electronic records of the medical history and investigations, patient education and consent, treatment plan, each treatment fraction, medical evaluations during and following treatment, and clinical outcomes following treatment. Sufficient radiation treatment information is retained to allow the treatment plan to be reconstructed as a means of estimating the radiation dose delivered to tumour targets or normal tissues. Radiation treatment records are retained for periods of time as required by provincial, territorial, and/or national legislation, and/or professional guidelines when available. The privacy and confidentiality of the medical and radiation treatment record is maintained at all times according to provincial, territorial, or national legislation.

Key Quality Indicator #42	Indicator Measure
The radiation treatment program maintains paper or electronic records of the radiation treatment plan with sufficient detail to allow the plan to be reconstructed.	0 or 1

### 6.19. Cancer Program Accreditation

The radiation treatment program, as an integrated component of the multidisciplinary cancer program, participates in the Accreditation Canada “Cancer Care and Oncology Services” standards (Accreditation Canada, n.d.). The accreditation process involves programmatic audits of compliance with standards and required organizational practices, and fosters a culture of continuous quality improvement.

Key Quality Indicator #43	Indicator Measure
The radiation treatment program, as part of the multidisciplinary cancer program, is accredited by Accreditation Canada.	0 or 1

### 6.20. Analysis of Clinical Outcomes

The radiation treatment program, as part of the multidisciplinary cancer program has the personnel, information systems, and other infrastructure to support periodic audits of relevant clinical outcomes, such as treatment-related side effects, local control, patient survival, and/or patient quality of life, depending on specific objectives.

Key Quality Indicators #44, 45	Indicator Measure
Percentage of patients treated with curative-intent radiotherapy for whom the radiation treatment program reviews treatment-related toxicity outcomes.	0–100%
Percentage of patients treated with curative-intent radiotherapy for whom the radiation treatment program reviews relevant disease control or survival outcomes.	0–100%

## Quality Assurance Guidelines for Canadian Radiation Treatment Programs

### References

- Accreditation Canada, "Cancer care and oncology services" (n.d.).
- AAPM (American Association of Physicists in Medicine), "AAPM reports" (Available online, various dates).
- AECB (Atomic Energy Control Board), *Regulatory Guide G-121: Radiation Safety in Educational, Medical and Research Institutions* (2000).
- BIR (British Institute of Radiology), IPEM (Institute of Physics and Engineering in Medicine), NPSA (National Patient Safety Agency), Society and College of Radiographers, and RCR (Royal College of Radiologists), *Towards Safer Radiotherapy* (The Royal College of Radiologists, London, 2008).
- Canadian Cancer Society, *Canadian Cancer Statistics 2015* (2015).
- CAPCA (Canadian Association of Provincial Cancer Agencies), *Structural Standards for Quality Assurance at Canadian Radiation Treatment Centres* (2006).
- CARO (Canadian Association of Radiation Oncologists), "Definition of RT waiting," Manpower and Standards of Care in Radiation Oncology Committee (2000).
- CNSC (Canadian Nuclear Safety Commission), *Class II Nuclear Facilities and Prescribed Equipment Regulations* (2011).
- CNSC (Canadian Nuclear Safety Commission), *Regulatory Guide G-313: Radiation Safety Training Programs for Workers Involved in Licensed Activities with Nuclear Substances and Radiation Devices, and with Class II Nuclear Facilities and Prescribed Equipment* (2006).
- G. Delaney, S. Jacob, C. Featherstone, and M. Barton, "The role of radiotherapy in cancer treatment: estimating optimal utilization from a review of evidence-based clinical guidelines," *Cancer* **104** (6), 1129-37 (2005).
- Government of Canada, *Nuclear Safety and Control Act* (1997).
- Government of Canada, *General Nuclear Safety and Control Regulations* (2000).
- D. Jones (Reviewer), "ICRU report 50—prescribing, recording and reporting photon beam therapy," *Med. Phys.* **21** (6), 833 (1994).
- J.R. Marbach, M.R. Sontag, J. Van Dyk, and A.B. Wolbarst, "Management of radiation oncology patients with implanted cardiac pacemakers: report of AAPM Task Group No. 34," *Med. Phys.* **21** (1), 85–90 (1994).

## Quality Assurance Guidelines for Canadian Radiation Treatment Programs

S.L. Morgan-Fletcher, "Prescribing, recording and reporting photon beam therapy (supplement to ICRU report 50), ICRU report 62," *Brit. J. Radiol.* **74**, 294 (2001).

R. Nath, P.J. Biggs, F.J. Bova, C.C. Ling, J.A. Purdy, J. van de Geijn, and M.S. Weinhaus, "AAPM code of practice for radiotherapy accelerators: report of AAPM Radiation Therapy Task Group No. 45," *Med. Phys.* **21** (7), 1093-12 (1994).

MD Anderson, "Radiological physics center" webpage available at <http://rpc.mdanderson.org/RPC/> (n.d.).

L.H. Sobin, M.K. Gospodarowicz, and C. Wittekind (Editors), *TNM Classification of Malignant Tumours, 7th Edition* (Wiley-Blackwell, 2009).

WHO (World Health Organization), *Radiotherapy Risk Profile – Technical Manual* (WHO Press, Geneva, Switzerland, 2008).

WHO (World Health Organization), *International Classification for Patient Safety (ICPS)* (2009).