

## 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

### 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, it is estimated there will be approximately 220,400 new cases of cancer in 2019 (Canadian Cancer Society, 2019) and around 103,551 courses of radiation treatment were administered in 2017 (data from the Canadian Association of Radiation Oncology (CARO) biannual human resource survey of Canadian radiation oncology programs). There are currently 48 radiation treatment facilities in Canada.

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: CARO, the Canadian Organization of Medical Physicists (COMP), and the Canadian Association of Medical Radiation Technologists (CAMRT), together with financial and strategic backing from the Canadian Partnership Against Cancer (CPAC), which works with Canada's cancer community to reduce the burden of cancer on Canadians. The vision and 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 outlines the overarching elements of quality that are important in all radiation treatment programs, together with Key Quality Indicators (KQIs), 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 describe standards of compliance. This document is one in a suite of guideline documents created by the CPQR that include:

- The suite of *Technical Quality Control Guidelines for Canadian Radiation Treatment Programs* that outlines key elements of radiation treatment technology quality control;
- *National System for Incident Reporting – Radiation Treatment Minimum Data Set*, which 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 Guidance for Canadian Radiation Treatment Programs*, which outlines overarching elements of quality that are important to ensure that patients and family members are engaged in the care process and satisfied with both the process and outcomes of care;
- *Patient Education Guidance for Canadian Radiation Treatment Programs*, which provide guidance on activities radiation treatment programs can incorporate to ensure that patients and family members are adequately and appropriately educated in their care;

- *Guidance on the collection and use of Patient Reported Outcomes in Canadian radiation treatment programs*, which provides guidance for radiation treatment programs on how they can enhance and optimize the collection and use of patient reported outcomes (PROs) in routine clinical practice; and
- *Guidance on the use of common nomenclature and data sets in Canadian radiation treatment programs*, which supports the use of common nomenclature and a minimum data set of clinical, dosimetric and PRO data elements to be recorded across radiation treatment programs. The aim is to harmonize community practice and improve quality performance and patient outcomes.

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 the CPQR to maintain relevance in the Canadian radiation treatment environment.

Ownership of the CPQR documents resides jointly with the national professional organizations involved in the delivery of radiation treatment in Canada – CARO, COMP, CAMRT and CPAC. All documents can be accessed online at [www.cpqr.ca](http://www.cpqr.ca).

## Abbreviations and Definitions

<b>Abbreviations</b>	
AAPM	American Association of Physicists in Medicine
CAMRT	Canadian Association of Medical Radiation Technologists
CARO	Canadian Association of Radiation Oncology
CCPM	Canadian College of Physicists in Medicine
CIHI	Canadian Institute for Health Information
CMQ	Collège des médecins du Québec
CNSC	Canadian Nuclear Safety Commission
COMP	Canadian Organization of Medical Physicists
CPQR	Canadian Partnership for Quality Radiotherapy
ICRUM	International Commission on Radiation Units and Measurements
IROC	Imaging and radiation oncology core
KQIs	Key Quality Indicators
OAR	Organs at risk
PRO	Patient Reported Outcomes
RCPSC	Royal College of Physicians and Surgeons of Canada
RTQAC	Radiation Treatment Quality Assurance Committee
SBRT	Stereostatic body radiotherapy
TNM	Tumour Node Metastasis
WHO	World Health Organization
<b>Definitions</b>	
Cancer Program	The interprofessional 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.
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 of 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.

The World Health Organization (WHO) (1988) defined quality assurance in radiation 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 consistent reporting of outcomes through harmonized treatment practice.

## 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 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 Canadian Nuclear Safety Commission (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).

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 for Canadian Radiation Treatment Programs* document using a critical approach to 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.

To support local, regional and national efforts to track compliance with commonly accepted quality benchmarks, in 2017 the CPQR partnered with Accreditation Canada on the development of a Qmentum module for radiotherapy, based largely on the KQIs included in version 2 of this guidance document. 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.

Considered a living document, the *Quality Assurance Guidelines for Canadian Radiation Treatment Programs* has undergone numerous reviews and three revisions since the original document release in 2011. For the current guidance document revision, feedback from the Canadian radiation treatment community has suggested that, in addition to existing met or not met measures and compliance scales, there is a need to allow measurement of incremental changes in compliance for certain KQIs. The fourth and current version of this guidance document includes updates to the KQI measures to reflect this input:

1. Compliance measures 0 or 1 are indicated for KQIs that should be in place within radiation treatment programs. These KQIs are discrete measures, which are either met or not met.
2. Scale measures 0%-100% are indicated for KQIs that programs can expect to see incremental improvements in over time. These KQIs can be directly quantified using data mined from a program’s records to yield a specific percentage compliance.
3. Progressive compliance measures—none, some, most, all—are indicated for KQIs that include multiple components that programs can expect to see incremental improvements in over time. These KQIs involve qualitative measures that do not yield a specific percentage but rather an approximate range of compliance.



## Summary of Key Quality Indicators: Organizational

KQI		Indicator Measure	Section Reference
<b>Organizational Quality Indicators</b>			
1	The radiation treatment program ensures adequate staffing levels for personnel that are required to safely deliver radiation treatment according to best evidence and practice guidelines.	None Some Most All	3.1
2	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.	None Some Most All	3.1
3	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	3.2
4	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 3.3.	None Some Most All	3.3
5	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	3.4
6	There is a radiation safety program that has written policies and procedures to address the safe use of ionizing radiation, specified in Section 3.5., according to the pertinent laws and regulations.	0 or 1	3.5
7	The radiation treatment program has written policies and procedures that address the reporting, investigation, action, documentation, and monitoring of radiation treatment incidents.	None Some Most All	3.6
8	The radiation treatment program identifies critical radiation treatment incidents as defined by Section 3.6.	0 or 1	3.6
9	The radiation treatment program reports critical radiation treatment incidents as per requirements of local, provincial, and/or national organizations.	0 or 1	3.6

## Summary of Key Quality Indicators: Personnel

KQI		Indicator Measure	Section Reference
<b>Personnel Quality Indicators</b>			
10	The radiation treatment program has a process for assuring that personnel have the necessary credentials, certifications, and licenses to fulfill their duties.	0 or 1	4.1
11	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 %	4.2
12	Percentage of Medical Physicists certified by the Canadian College of Physicists in Medicine (CCPM) or equivalent.	0–100%	4.3
13	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%	4.4
14	There is an identified head of the radiation treatment program.	0 or 1	4.5
15	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	4.6
16	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 4.7.	None Some Most All	4.7

## Summary of Key Quality Indicators: Radiation Treatment Equipment

KQI		Indicator Measure	Section Reference
<b>Radiation Treatment Equipment Quality Indicators</b>			
17	There are technical quality control policies and procedures for all radiation planning and treatment equipment.	None Some Most All	5.2
18	Compliance with technical quality control policies and procedures is monitored by the Radiation Treatment Quality Assurance Committee (RTQAC).	None Some Most All	5.2
19	For new equipment (hardware and/or software) or treatment technique, a quality control procedure/process is implemented prior to clinical use.	None Some Most All	5.3
20	For new equipment (hardware and/or software) or treatment technique all personnel involved are appropriately trained.	None Some Most All	5.3
21	There is an independent audit of radiation treatment machine calibration or dosimetry at least annually.	0 or 1	5.5
22	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>			
23	Policies and procedures have a planned review date, with a regular planned review cycle, ideally every two years.	0 or 1	6.1.1
24	The radiation treatment program has processes for selecting and reviewing clinical practice guidelines.	None Some Most All	6.1.2
25	The radiation treatment program utilizes and regularly reviews radiation planning and treatment guidelines.	None Some Most All	6.1.3
26	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
27	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
28	Patients are identified using at least two patient-specific identifiers before any radiation planning or treatments provided.	0 or 1	6.3.1
29	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	6.3.2
30	There is a process for confirming female patients of reproductive age are not pregnant prior to radiation treatment planning and delivery.	0 or 1	6.3.3
31	There are policies and procedures to monitor patients with pacemakers/defibrillators or other implantable devices during radiation treatment.	0 or 1	6.3.4
32	There is documentation of informed consent for radiation therapy prior to the delivery of treatment.	0 or 1	6.4.1
33	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.	None Some Most All	6.4.2
34	Percentage of adjuvant or curative radiotherapy treatment plans that undergo Radiation Oncologist peer review prior to the start of treatment.	0–100%	6.5

35	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%	6.5
36	Percentage of adjuvant or curative radiotherapy treatment plans that undergo Radiation Oncologist peer review at any point in time.	0–100%	6.5
37	The radiation treatment program has a process for peer review of palliative radiotherapy plans.	0-1	6.5
38	Radiotherapy treatment plans, dose calculations, and patient set-ups are independently reviewed prior to beginning treatment in all cases.	None Some Most All	6.6
39	When radiation treatment is being delivered, a Radiation Oncologist and a Medical Physicist are present at the radiation treatment facility or are capable of responding within a time limit set by the program.	0 or 1	6.7.1
40	There are policies and procedures guiding the planning and safe delivery of emergency radiation treatment.	0 or 1	6.7.2
41	Percentage of newly diagnosed patients receiving radiotherapy in the preceding year that had a cancer stage assigned.	0–100%	6.8.1
42	The radiation treatment prescription meets all criteria outlined in Section 6.8.2 to deliver treatment addressing dose prescription, site and laterality, patient identification, and authorization.	0 or 1	6.8.2
43	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	6.8.3
44	Patients receiving radiation treatment are evaluated at intervals appropriate to patient context during treatment by a Radiation Oncologist or designate.	0 or 1	6.8.4
45	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%	6.8.5
46	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%	6.8.5
47	The radiation treatment program, as part of the interprofessional cancer program, is accredited by Accreditation Canada.	0 or 1	6.9

### 3. Programmatic Organization

#### 3.1. Organizational Integration, Resources and Accountability

The radiation treatment program is an integrated part of an interprofessional cancer program and 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.

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

Key Quality Indicator #1	Indicator Measure
The radiation treatment program ensures adequate staffing levels for personnel that are required to safely deliver radiation treatment according to best evidence and practice guidelines.	None Some Most All

Within the radiation treatment program, there are clearly defined and documented 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 4.5), who oversees all aspects of the clinical program, up to the organization’s CEO and board of directors.

Key Quality Indicator #2	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.	None Some Most All

#### 3.2. 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 #3	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

### 3.3. Radiation Treatment Quality Assurance Committee

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 4.5) 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. The committee ensures that the necessary steps were taken to prevent incidents from recurring, particularly for critical incidents (Section 3.6) 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; and
- 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 4.5) and/or other committees or groups with responsibility for quality within the radiation treatment program, cancer program, or organization.

Key Quality Indicator #4	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 3.3.	None Some Most All

### 3.4. Access to Radiation Treatment Quality Assurance Committee

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

Key Quality Indicator #5	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

### 3.5. 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 4.6) 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 #6	Indicator Measure
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 3.5.	0 or 1



### 3.6. 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.

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 organs at risk (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 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.

The radiation treatment program takes action to prevent critical radiation treatment incidents from recurring and communicates results of the incident investigation and any quality improvement lessons with members of the interprofessional team. The CPQR, with partner Canadian Institute for Health Information (CIHI), has developed an additional and complimentary guidance document to expand upon key elements of incident reporting and learning entitled, *National System for Incident Reporting – Radiation Treatment Minimum Data Set*.

Key Quality Indicators #7, 8, 9	Indicator Measure
The radiation treatment program has written policies and procedures that address the reporting, investigation, action, documentation, and monitoring of radiation treatment incidents.	None Some Most All
The radiation treatment program identifies critical radiation treatment incidents as defined by Section 3.6.	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, Credentials, Certifications, and Licensing

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

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

### 4.2. 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 #11	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 %

### 4.3. Medical Physicists

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, or are in the process of collecting sufficient work experience to meet certification requirements.

Key Quality Indicator #12	Indicator Measure
Percentage of Medical Physicists certified by the Canadian College of Physicists in Medicine (CCPM) or equivalent.	0–100%

#### 4.4. Radiation Therapists

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

Key Quality Indicator #13	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%

#### 4.5. 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 #14	Indicator Measure
There is an identified head of the radiation treatment program.	0 or 1

#### 4.6. Radiation Safety Officer

A qualified individual (CNSC, 2006) is designated as having primary responsibility for all aspects of radiation safety (Section 3.5) 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 #15	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

#### 4.7. 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 an employee performance evaluation and/or competency maintenance program.

Key Quality Indicator #16	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 4.7.	None Some Most All

### 5. Radiation Treatment Equipment

Radiation treatment equipment includes radiation treatment planning, positioning, 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.

The CPQR has developed additional and complimentary guidance documents to expand upon key elements of radiation treatment technology quality control that form part of the *Technical Quality Control Guidelines for Canadian Radiation Treatment Programs* suite.

## 5.1. 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 suite of CPQR *Technical Quality Control Guidelines for Canadian Radiation Treatment Programs* can be found at [www.cpqr.ca](http://www.cpqr.ca).

## 5.2 Responsibility for Equipment Quality Control

The RTQAC (Section 3.2) 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.

Key Quality Indicators #17, 18	Indicator Measure
There are technical quality control policies and procedures for all radiation planning and treatment equipment.	None Some Most All
Compliance with technical quality control policies and procedures is monitored by the Radiation Treatment Quality Assurance Committee (RTQAC).	None Some Most All

## 5.3. Introduction of New Equipment and Procedures

Before new equipment (hardware and/or software) or treatment techniques are introduced into clinical service, a complete safety analysis is performed, quality control procedures are 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.

For all locally programmed hardware such as linear accelerators, software such as treatment planning systems and treatment technique such brachytherapy, a quality control procedure is implemented during installation and commissioning, and tested prior to clinical use.

Key Quality Indicators #19, 20	Indicator Measure
For new equipment (hardware and/or software) or treatment technique, a quality control procedure/process is implemented prior to clinical use.	None Some Most All
For new equipment (hardware and/or software) or treatment technique all personnel involved are appropriately trained.	None Some Most All

#### 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 Guidelines for Canadian Radiation Treatment Programs* 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 of quality radiotherapy services.

#### 5.5. External Calibration or Dosimetry Audit

An independent machine calibration or 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, and discussed with the RTQAC, and heads of the Radiation Oncology, Medical Physics, and Radiation Therapy departments. The implementation of stereotactic body radiotherapy (SBRT) or cone-based stereotactic treatments requires a technique-specific external dosimetry audit before clinical implementation and technique-specific audits should be implemented when such commercial services are made available.

Key Quality Indicator #21	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 emergency failure of equipment or systems such as unplanned hardware and/or software (For example, a door interlock failure requiring a

specific procedure be followed prior to return to clinical service, or beam delivery while staff are exposed) that could affect patient, staff, or public safety.

Key Quality Indicator #22	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. Practice Guidelines and Manuals**

**6.1.1. 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 6.9. To ensure policies and procedures remain current, radiation treatment programs should have a regular planned review cycle, ideally every two years. While it may not be feasible to undertake a full review of each policy and procedure every two years, programs have a clear understanding of the lifecycle of each policy and procedure, and assess the need to review, and revise accordingly. The policy and procedure manual outlines the processes to be used for revising as well as controlling versions, including the dissemination of current versions to relevant personnel and the deletion of outdated versions to avoid confusion. Policies and procedures are readily available to staff as reference material.

Key Quality Indicator #23	Indicator Measure
Policies and procedures have a planned review date, with a regular planned review cycle, ideally every two years.	0 or 1

**6.1.2. Clinical Practice Guidelines**

The radiation treatment program, together with tumour groups and the interprofessional 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 #24	Indicator Measure
The radiation treatment program has processes for selecting and reviewing clinical practice guidelines.	None Some Most All

### 6.1.3. Radiation Planning and Treatment Guidelines

The radiation treatment program follows institutional radiation planning and treatment guidelines that include imaging considerations. There are defined processes for selecting and reviewing guidelines on regular intervals 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 #25	Indicator Measure
The radiation treatment program utilizes and regularly reviews radiation planning and treatment guidelines.	None Some Most All

### 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 national framework for uniform reporting of wait times among radiation treatment programs in Canada (CARO, 2000):

1. The interval between the date of the initial referral to radiation oncology and the date of the radiation oncology consultation reflects the waiting for radiation oncology consultation, and this should not exceed 10 working days.
2. For routine single modality treatments, the interval between the radiation therapy requisition date OR the radiation oncology consultation date, whichever is later, and the first day of therapy reflects the waiting for radiation therapy.
3. For multi-modality treatments, the interval between the target RT start date and the first day of therapy reflects the waiting for radiation therapy.
4. The waiting for radiation therapy should not exceed 10 working days.
5. As a quality indicator, radiation centres can report at regular intervals the number OR percentage of patients who have waited more than 10 working days for radiation oncology consultation or for radiation therapy.

The radiation treatment program reports wait times to local, provincial, and/or national organizations as required.



<b>Key Quality Indicators #26, 27</b>	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. Individual Safety Policies and Procedures**

#### **6.3.1. Patient Identification**

At least two person-specific identifiers are used to confirm that patients receive the service or procedure intended for them. Patient-specific identifiers include name, date of birth, medical record number, and photographs.

<b>Key Quality Indicator #28</b>	Indicator Measure
Patients are identified using at least two patient-specific identifiers before any radiation planning or treatments provided.	0 or 1

#### **6.3.2. Authorization of Radiation Planning or Treatment Procedures**

There is a clearly defined process for authorizing radiation planning, including imaging, and for authorizing a course of radiation treatment or any change to a previously authorized plan or course of radiation treatment.

<b>Key Quality Indicator #29</b>	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

#### **6.3.3. 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.

<b>Key Quality Indicator #30</b>	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

### 6.3.4. Pacemakers, Defibrillators and Other 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 #31	Indicator Measure
There are policies and procedures to monitor patients with pacemakers/defibrillators or other implantable devices during radiation treatment.	0 or 1

## 6.4. Patient Engagement and Education

Person-centered care is a cornerstone of a high quality radiation treatment program. The CPQR has developed additional and complimentary guidance documents detailing approaches to patient education and engagement. Centres are encouraged to access and review *Patient Engagement Guidance for Canadian Radiation Treatment Programs* and *Patient Education Guidance for Canadian Radiation Treatment Programs* on the CPQR website.

### 6.4.1. 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 #32	Indicator Measure
There is documentation of informed consent for radiation therapy prior to the delivery of treatment.	0 or 1

## 6.4.2. 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 #33	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.	None Some Most All

## 6.5. Radiation Oncologist Peer Review of Treatment Plans

Radiation Oncologist peer review of volumes and dosimetry is performed for 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. Ideally, this peer review is 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, single fraction plans, stereotactic, and brachytherapy plans.

The radiation treatment program has a policy for peer review of treatment plans administered with palliative intent that is suited to its systems and responsive to its needs. The policy defines the time at which peer review is required, and the parameters that determine the need for peer review. The parameters account for features of palliative-intent treatment plans that can increase the potential for adverse patient outcomes. Potential features can include: a threshold total dose (e.g. >30Gy), overlap with a previous treatment plan, a treatment plan created outside regular working hours.

Key Quality Indicators #34, 35, 36, 37	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%
The radiation treatment program has a process for peer review of palliative radiotherapy plans.	0-1

## 6.6. 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, hypofractionated, stereotactic, single fraction or infrequently used non-standard treatments where there is evidenced risk of increased error. Radiation treatment programs have a mechanism to ensure a plan has had all the required reviews prior to the beginning of treatment.

Key Quality Indicator #38	Indicator Measure
Radiotherapy treatment plans, dose calculations, and patient set-ups are independently reviewed prior to beginning treatment in all cases.	None Some Most All

## 6.7. Radiation Treatment Emergencies and Personnel Availability

### 6.7.1. Radiation Oncology and Medical Physics Availability

A Radiation Oncologist and a Medical Physicist are present at the radiation treatment facility, or are 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 #39	Indicator Measure
When radiation treatment is being delivered, a Radiation Oncologist and a Medical Physicist are present at the radiation treatment facility or are capable of responding within a time limit set by the program.	0 or 1

### 6.7.2. 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 quality and safety measures that apply to the routine treatment of patients.

Key Quality Indicator #40	Indicator Measure
There are policies and procedures guiding the planning and safe delivery of emergency radiation treatment.	0 or 1

## 6.8. Outcomes and the Use of “Big Data”

Understanding how treatment plans impact patient outcomes is essential to the planning and delivery of quality care. The CPQR has developed additional and complimentary guidance documents detailing approaches to PRO measurements, treatment plans and the ability to use “big data” to inform plan parameters. Centres are encouraged to access and review *Guidance on the collection and use of Patient Reported Outcomes in Canadian radiation treatment programs* and *Guidance on the use of common nomenclature and data sets in Canadian radiation treatment programs* on the CPQR website.

### 6.8.1. Cancer Staging

The radiation treatment program, as part of the interprofessional 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, interprofessional treatment planning, harmonized analysis and reporting of outcomes.

Key Quality Indicator #41	Indicator Measure
Percentage of newly diagnosed patients receiving radiotherapy in the preceding year that had a cancer stage assigned.	0–100%

### 6.8.2. Treatment Prescription

The treatment prescription:

- Follows recommendations set forth in *Standardizing dose prescriptions: An ASTRO white paper* (Evans et al., 2016);
- 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 simple or 3D conformal treatment plan is used, *ICRU Report 83* (Hodapp, 2012) when an intensity-modulated radiation therapy (IMRT) plan is used, *ICRU Report 89* (GEC-ESTRO, 2013) when a brachytherapy plan is used for the cervix and *ICRU Report 91* (GEC-ESTRO, 2014) when stereotactic treatments with small photon beams are 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, which can include the patient’s name, date of birth, medical record number, or photograph; and
- Is authorized by a Radiation Oncologist, either in writing or by electronic signature.

Key Quality Indicator #42	Indicator Measure
The radiation treatment prescription meets all criteria outlined in Section 6.8.2 to deliver treatment addressing dose prescription, site and laterality, patient identification, and authorization.	0 or 1

### 6.8.3. Radiation Treatment Records

The radiation treatment program, together with the interprofessional 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 #43	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

### 6.8.4. 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; patients are informed of this availability.

Key Quality Indicator #44	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

### 6.8.5. Analysis of Clinical Outcomes

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

Key Quality Indicators #45, 46	Indicator Measure
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%
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%

### 6.9. Cancer Program Accreditation

The radiation treatment program, as an integrated component of the interprofessional 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. Based on the KQIs contained within this guidance document, Accreditation Canada has a Qmentum module for radiotherapy, placing a high priority on quality and safety practices within individual radiation treatment centres.

Key Quality Indicator #47	Indicator Measure
The radiation treatment program, as part of the interprofessional cancer program, is accredited by Accreditation Canada.	0 or 1

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