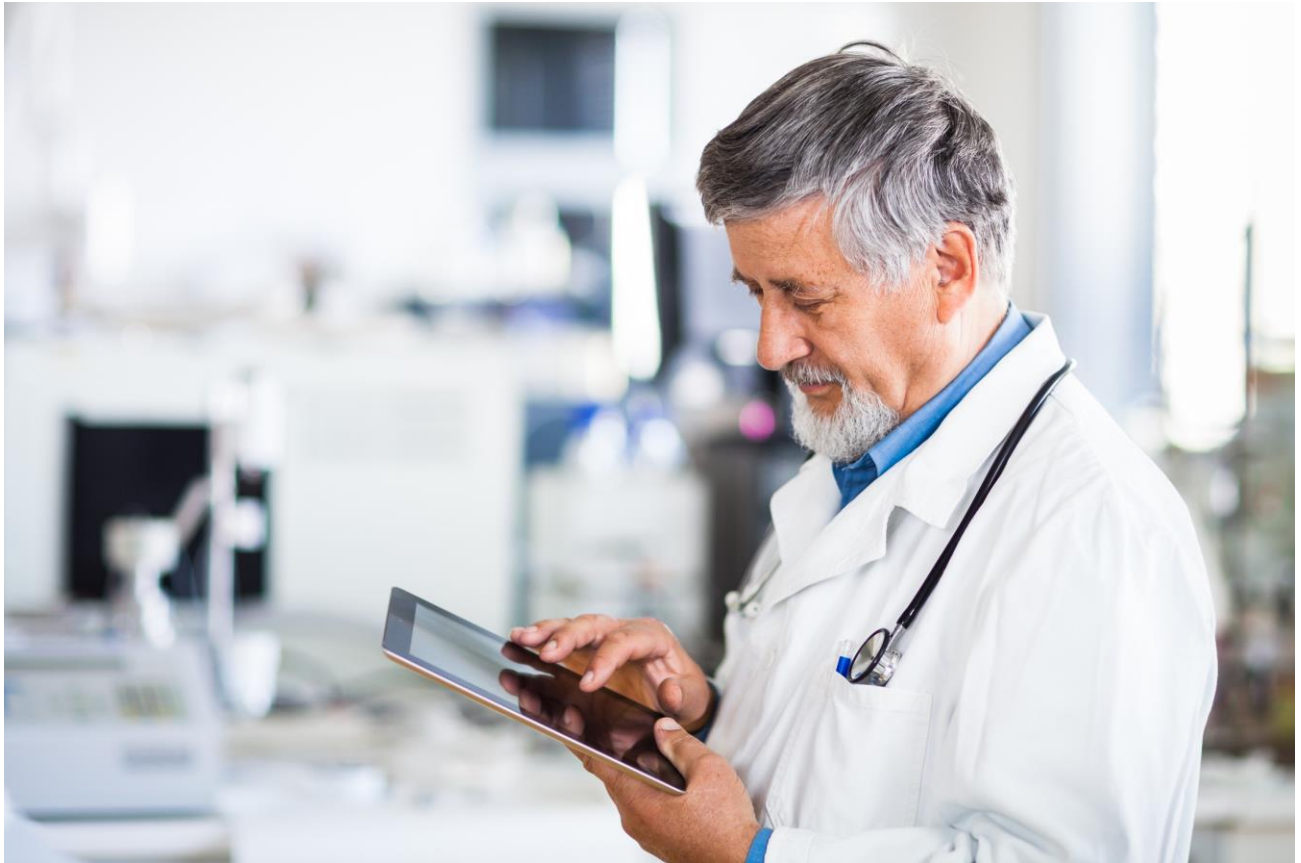




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Radiation Oncology Peer Review Guidance Document for Lung Cancer

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Executive Summary

A modified Delphi process was used to reach professional consensus on best-practices for peer review of curative radiation treatments for patients with lung cancer, informed by the available literature findings. The multi-disciplinary group of participants included a patient representative from the Canadian Partnership for Quality Radiotherapy, radiation oncologists (ROs) with expertise in lung cancer, medical radiation therapists (MRT(T)s), medical physicists with expertise in lung cancer radiotherapy planning (MPs), a radiation oncology fellow, and administrative staff. A literature search was undertaken to identify candidate elements for peer review of proposed lung cancer radiotherapy plans for patients receiving either standard-fractionation external beam treatment (for locally-advanced disease) or SABR (for early-stage disease). Three Delphi rounds were undertaken (one pre-meeting, one at the face-to-face meeting, and one post-meeting) to quantify participants' rankings of the importance of each peer review candidate element, as well as the clarity of the wording for each. The final consensus voting showed very high agreement on several elements deemed essential for peer review, stratified by treatment type (locally-advanced vs. early-stage). A high level of consensus was reached on essential elements requiring review by a second RO. An additional number of optional elements were identified. Peer review was endorsed as an essential component of overall treatment quality assurance and should be completed ideally for all lung cancer patients undergoing radiotherapy with curative intent.



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BACKGROUND AND SUMMARY OF THE LITERATURE

Radiation Oncology peer review of radiation treatment plans is an essential component of quality assurance within radiation oncology clinical programs in Canada. Peer review is a key programmatic quality indicator identified by the Canadian Partnership for Quality Radiotherapy, and is included in the Accreditation Canada Q-mentum Module for Radiation Oncology.

Peer Review is broadly defined as “the evaluation of components of a radiation treatment plan by a second radiation oncologist”. The evaluation may be completed by a single radiation oncologist, or may be multidisciplinary in nature with one or more reviewing radiation oncologists involved. The common component to each approach is a second review by a radiation oncologist.

There are no completed randomized trials of peer review implementation at the population level that can inform policy for best clinical practice. A recent cross-sectional analysis of peer review outcomes in Ontario radiation oncology programs showed that changes are recommended in 3.3% of all (n=5,530) peer-reviewed treatment plans (data collected over a three-month period in each centre [n=14], 100% of centres participating). The types of changes recommended related to target volume (66%), tech/dosimetry (13%), organs at risk (11%), and other (10%). In a sub-group analysis of 491 lung cancer plans that underwent peer review across 14 radiotherapy centres, changes were recommended in 2.7% of lung cases (5.9% bilateral).

A number of additional case series are reported in general, but few report peer review findings explicitly for lung cancer cases. Rooney *et al* described the peer review of 122 curative intent lung cancer plans over 38 multidisciplinary sessions in Belfast, UK. Following peer review, 3% of plans were changed to either induction chemotherapy or palliative XRT. Overall, 27% of plans were adjusted following peer review and 6% had major changes to the plan. The changes were described as target volume decreased (N=3) or increased (N=7), one case had dose/fractionation changed, 11 had other changes recommended.

Lo *et al* reported on 60 patients’ lung SABR plans for curative treatment of NSCLC from 3 BC Cancer Centres during 2009-2011. The 60 patients’ lung plans contained 14 contours reviewed per case (472 contours in total). They found that 107 individual contours had major changes recommended (23%), only 157 (33%) of contours had no changes and 80% of plans had at least one major change recommended.

Table 1 - summarizes this body of relevant case-series.

Study Population	Number of cases	Percent events (minor/major)	Other key findings
Rooney et al (Belfast) 122 curative intent lung cancer plans over 38 multidisciplinary sessions	122 (plans)	3% changed after PR to either induction chemotherapy or palliative XRT 27% of plans were adjusted after PR	Target volume decreased (N=3) or increased (N=7) One case had dose/fractionation changed

Study Population	Number of cases	Percent events (minor/major)	Other key findings
		6% major changes to plan	11 had other changes recommended
Lo et al (BCCA) 2009 – 2011; 3 centres 60 patients lung SBRT plans for curative treatment of NSCLC 14 contours reviewed per case (472 contours in total)	472 (contours)	107 individual contours had major changes recommended (23%) 80% of plans had at least one major change recommended	Only 157 (33%) no changes
Rouette et al (CCO) 3 month cross-sectional 2014, 14 centres 5561 plans reviewed, 491 were lung cancer	491	2.7% of lung cases had changes recommended (5.9 % if bilateral)	Overall 3.3% of 5561 plans had changes recommended

METHODS

We conducted a modified Delphi process designed to achieve expert consensus on the required (and optional) elements of peer review for patients receiving potentially curative radiotherapy to the lung. We stratified the consensus process to consider peer review for cases treated for locally-advanced disease separately from those receiving stereotactic treatment (SABR) for early-stage disease, as the peer-review components were likely to be based on treatment technique. A detailed description of the methods is found in the appendix.

FINAL DELPHI ROUND RESULTS

a) Standard-Fractionation Radiotherapy for Locally-Advanced Disease: Six elements of proposed radiotherapy plans were deemed to be essential to the peer review process (see Table 2 below). On the final survey round, these six elements were endorsed as being either essential or important to review by 90% to 100% of panel members.

Further, among the six essential elements, 80% or more of Delphi panel members thought that the peer review should be done by a radiation oncologist and should not be delegated.

An additional three elements were defined as generally optional for peer review, with recommendations for peer review in certain circumstances as addressed in Table 2.

b) SABR for Early –Stage Disease: Five elements of proposed radiotherapy plans were deemed to be essential to the peer review process (see Table 3). On the final survey round, these five elements were

endorsed as being either essential or important to review by 90% to 100% of panel members. The Delphi Panel was unanimous in endorsing that all five elements should be reviewed by a radiation oncologist.

An additional four elements were defined as generally optional for peer review, with recommendations for peer review in certain circumstances as addressed in Table 2.



Table 2 - Best Practices for Locally Advanced Non-Small Cell Lung Radiotherapy Peer Review: Essential and Optional Elements

Peer-Review Element	Qualifying Statements	Elaborations
Section 1: Essential Elements of Peer-Review (level 1 priority)		
Patient Selection		
1.1 Indications for Radiotherapy and Decision to Treat	May be omitted if case has been presented at MTB	<p>Rationale: Role of radiotherapy and treatment intent (curative vs palliative) requires clinical judgement and peer review of indications for radiotherapy is highly important.</p> <p>Strong endorsement for importance (92% voted important or essential); 100% indicated a second RO should be involved with review.</p>
Radiotherapy Prescription		
1.2 GTV (Gross Tumour Volume)	<p>Includes verification of quality of the image registration</p> <p>Includes laterality verification</p> <p>Includes confirming quality image registration</p>	<p>Rationale: Segmentation of the GTV is a critical step in design of the radiotherapy plan and requires judgement of the attending RO (based on multiple acquired images and consideration of patient-specific factors).</p> <p>Ensuring correct laterality of treatment is included in reviewing the GTV.</p> <p>Ensuring that images used for planning are registered appropriately is included in reviewing the GTV.</p> <p>Strongly endorsed by the Delphi Panel (90% voted essential to peer review; 95% voted that review be done by at least one other RO).</p>

Peer-Review Element	Qualifying Statements	Elaborations
1.3 CTV (Clinical Target Volume)		<p>Rationale: As per GTV. RO judgement may often be required regarding expansion of GTV and editing CTV for OAR where necessary.</p> <p>Strongly endorsed by the Delphi Panel (85% voted essential to peer review; 90% voted that review be done by at least one other RO)</p>
1.4 ITV (Internal Target volume)	Particularly important when CTV central or close to diaphragm	<p>Rationale: Same as CTV. RO judgment may be required as a simple summation of CTV across 4D imaging may not be optimal.</p> <p>Strongly endorsed by Delphi Panel (92% voted important or essential; 76% endorsed a second RO be involved)</p>
1.5 Dose and Fractionation		<p>Rationale: This element is critical to an appropriate treatment plan.</p> <p>Although often dose and fractionation are determined by local policy and may be protocol-driven, mistakes may be made in protocol selection and propagated thereafter, hence, peer-review is strongly recommended.</p> <p>92% of Delphi Panel endorsed as important/essential for peer review.</p>
Critical Organs at Risk		
1.6 OAR Dose (lung, V20)	V20 critical to review V10, 5, mean lung dose optional but recommended	<p>Rationale: V20 is the most robust predictor of pulmonary toxicity.</p> <p>Acceptability of V20 may be dependent on patient-specific factors (e.g. Pulmonary function, underlying lung disease) and should be reviewed by an RO.</p>



Peer-Review Element	Qualifying Statements	Elaborations
		<p>Thresholds for V20 are typically local policy/protocol-driven, however some exceptions exist where additional peer review is recommended:</p> <ul style="list-style-type: none"> • Significantly high V5 (>65-70%), or mean lung dose (>20 Gy) • In a setting of previous thoracic radiation or surgery • No established protocols for V20 • Treatment re-planning is required
<p>Section 2: Optional Elements of Peer Review Quality Assurance (level 2 priority)</p>		
<p>2.1 OAR contours (Heart, lungs, esophagus, spinal canal)</p>	<p>Recommended in some circumstances (see comments)</p>	<p>Rationale: OAR contouring generally done by MRT(T)s and checked by Attending RO.</p> <p>In some circumstances additional peer review is recommended, including:</p> <ul style="list-style-type: none"> • Unusual distortion of anatomy due to malignancy or previous surgery • GTV close to brachial plexus (apex tumour) • Pancoast or other tumours adjacent to spine/spinal cord • Significant mediastinal disease abutting/obscuring esophageal contour
<p>2.2 PTV Dosimetric Coverage and Dose homogeneity</p>	<p>Recommended when planning protocol dose-constraints are not met on initial plan, or when no planning protocol is active.</p>	<p>Rationale: PTV coverage is usually evaluated by treatment planners and medical physics.</p> <p>However, individualization may be required in certain circumstances where trade-offs between dose homogeneity and coverage of treatment volumes occurs, or dose coverage constraints prove otherwise difficult to meet (for example,</p>

Peer-Review Element	Qualifying Statements	Elaborations
		accepting sub-optimal PTV coverage to meet spinal cord constraints). Peer review is recommended in these circumstances.
2.3 Point of Maximum Dose	Recommended when PTV close to critical OAR (e.g., esophagus, brachial plexus)	Rationale: RO judgement may be required to assess trade-offs between dose homogeneity and coverage of treatment volumes

Table 2 - Best Practices for SABR Lung Radiotherapy Peer Review: Essential and Optional Elements

Peer-Review Element	Qualifying Statements	Elaborations
Section 1: Essential Elements of Peer-Review (level 1 priority)		
Patient Selection		
1.1 Indications for Radiotherapy and Decision to Treat	May be omitted if case has been presented at Tumour Board or equivalent	<p>Rationale: Role of radiotherapy requires clinical judgement particularly in special circumstances (no tissue biopsy, multiple lesions). Peer review of indications for radiotherapy is highly important.</p> <p>Strong endorsement for importance (92% voted important or essential); 100% indicated a second RO should be involved with review.</p> <p>A record of surgical consultation is preferred, but does not require being peer-reviewed.</p>
Radiotherapy Prescription		
1.2 GTV (Gross Tumour Volume)	Includes ensuring correct lesion or lesions is/are contoured	Rationale: Segmentation of the GTV is a critical step in design of the radiotherapy plan and requires judgement of the attending RO

Peer-Review Element	Qualifying Statements	Elaborations
		<p>(based on multiple acquired images and consideration of patient-specific factors).</p> <p>Ensuring that correct laterality and correct lesion (or lesions) are contoured is included in reviewing the GTV.</p> <p>Unanimously endorsed by the Delphi Panel.</p>
1.3 CTV (Clinical Target Volume) and ITV (internal target volume)		<p>Rationale: As per Locally Advanced Case. Some programs omit CTV and use only ITV.</p> <p>Unanimously endorsed by the Delphi Panel.</p>
1.4 OAR contours	Conditional on location of PTV	<p>Rationale: OARs are critical to review in SABR cases owing to high dose, however, only OARs in the region of the PTV require to be peer-reviewed.</p> <p>Specific recommendations:</p> <ul style="list-style-type: none"> • Proximal bronchi (“danger zone”) contoured for central lesions <p>Brachial plexus contoured for all apical lesions</p>
1.5 Dose and Fractionation		<p>Rationale: This element is critical to an appropriate treatment plan. Although often protocol-driven, mistakes may be made in protocol selection and propagated thereafter, hence, peer-review is strongly recommended. The Delphi Panel unanimously endorsed as essential for peer review.</p>
1.6 Composite Plan Review	For cases who have had previous chest radiotherapy	<p>Rationale: The composite plan should be reviewed in a patient planned for SABR who has had previous SABR or other chest radiotherapy.</p>
Section 2: Optional Elements of Peer Review Quality Assurance (level 2 priority)		
2.1 PTV Dosimetric Coverage	Recommended when planning protocol dose-	<p>Rationale: PTV coverage is usually ensured by treatment planners, medical physics and the Attending RO. However, individualization may be required in exceptional circumstances where constraints</p>

Peer-Review Element	Qualifying Statements	Elaborations
	constraints are not met on initial plan	prove difficult to meet – peer review is recommended in these circumstances.
2.2 Point of Maximum Dose	Recommended only in exceptional circumstances are identified	Rationale: The location of maximum dose point is generally protocol driven and rarely requires independent review.
2.3 Doses to OAR	Generally not required if protocol constraints met, but exceptions may occur - particularly for peripheral tumours	Rationale: DVH acceptability is usually ensured by treatment planners, medical physics, and the attending RO.
2.4 Best Practices for image guidance and verification	Generally not required if protocol-driven, but exceptions exist	<p>Rationale: Image guidance is essential to successful SABR delivery, and is usually protocol-driven. RO presence at the treatment unit is also based on local policy. However peer review by a second RO may be considered in several exceptional circumstances:</p> <ul style="list-style-type: none"> • Presence of non-dedicated (versus dedicated) SABR teams • Newly established SABR programs • Challenging Issues for quality image guidance (i.e., tumour/OAR change, change in patient anatomy requiring re-planning) <p>Specifics on these issues is beyond the scope of this document but may be addressed by ongoing Communities of Practice</p>



APPENDIX: GUIDANCE DEVELOPMENT METHODS

This project was designed as a formal Delphi process seeking Pan-Canadian consensus on best practices for peer review for specific non-small cell lung cancer patient populations. The project was an extension of initial work done by the Cancer Care Ontario Lung Cancer Community of Practice group. A literature review was undertaken to identify an initial list of lung cancer peer-review elements. This list was supplemented with patterns of practice findings from a pan-Canadian survey. A steering committee refined the list to reduce ambiguity and to propose draft wording of each peer-review element. Candidate peer review elements were grouped into three subgroups: volume segmentation for target volumes and field-based target considerations, organs at risk, dosimetric and plan quality, and other.

The Delphi panel was constructed by first inviting radiation oncologists who had participated in a pan-Canadian Delphi panel addressing key quality indicators for radiotherapy for lung cancer. This list was supplemented with selected invitees from medical physics and medical radiation therapy with a demonstrated interest in lung cancer radiotherapy and/or peer review, and a patient representative with experience in lung cancer from the CPQR. The final list was chosen to ensure multidisciplinary and regional representation.

The first Delphi round involved an anonymous online survey of panel members regarding the list of candidate peer review elements. Participants were asked to rate each element on its perceived importance for ensuring quality of radiotherapy, and to indicate whether peer review on the element required a second radiation oncologist or could be achieved with an alternative quality assurance process. Rankings were based on a four-point Likert scale (“not important” to “essential”). Second, participants were asked to rate each element for clarity on a comparable four-point scale. Finally, participants were given the opportunity to suggest additional candidate elements.

The second Delphi round involved a face-to-face meeting comprising the steering committee and lung radiation oncology experts with representation from all Canadian geographical regions. Participants included a lay patient, 11 ROs, 4 MPs, 4 MRT(T)s and 3 administrative staff. Each group of candidate elements was reviewed by first presenting the first-round survey results, open discussion, and final voting after discussion was considered sufficiently complete to vote. Software used during the iterative Delphi discussion allowed for anonymous voting on candidate QIs to facilitate immediate feedback and interpretation of variation. In the third Delphi round, elements that were endorsed by the second round were discussed by the steering group for final wording. A brief survey of the Delphi panel was used to determine degree of agreement (yes/no) with the status and wording of each element.