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Quality of radiotherapy

Development of indicators of the quality of radiotherapy for localized prostate cancer

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ABSTRACT

Purpose: To develop a set of indicators of the quality of radiotherapy (RT) for localized prostate cancer.
Methods and materials: Following a comprehensive review of the literature to identify candidate quality indicators, we utilized a modified Delphi technique to develop a set of indicators of the quality of RT for localized prostate cancer. The first Delphi round consisted of an online survey in which radiation oncologists were asked to rate the importance of the candidate quality indicators. The second round was a face-to-face meeting of a smaller group of radiation oncologists to discuss, rate, and rank a final set of quality indicators.
Results: The literature review identified 57 candidate quality indicators. After the two rounds of the Delphi process, a final set of 25 indicators was agreed upon. The set includes quality indicators covering all aspects of prostate cancer radical RT management: pre-treatment assessment, external beam RT, brachytherapy, androgen deprivation therapy, and follow-up.
Conclusions: This new set of quality indicators is more comprehensive than others described in the literature, and can be applied to patterns of care studies that assess the quality of RT for prostate cancer. The process used to develop this set of indicators can be readily adapted for use in other contexts.
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Quality of health care is one of the major domains of health services research, an area of medical research that describes how health systems work, investigates how they go wrong, and seeks to discover better ways to deliver health services [1]. Quality improvement in health care has been recognized as a priority by policy-making bodies and governments in Canada, as is the case in many jurisdictions [2]. Prostate cancer radiotherapy (RT) represents an ideal context to study quality of RT delivery, since prostate cancer is the most common cancer in Canadian men [3], RT (either external beam RT (EBRT) or brachytherapy), is used to treat at least one third of men at initial diagnosis [4], and RT is highly technical, with continuous advances in technology that require consideration for clinical adoption.

In order to improve quality of care, it is clearly important to measure quality adequately. The conceptual framework for the measurement of quality of medical care was developed over 40 years ago by Donabedian, who stratified the assessment of quality into three domains: structure, process, and outcome [5]. In Radiation Oncology, *structure* refers to the human, technical, and financial resources needed to provide care, such as center facilities, simulation and treatment equipment, manpower, organizational structures, volume of cases, and provider of education and experience. *Process* is the way that care is delivered; for patients receiving RT, this includes pre-treatment assessment, patient counseling of benefits and risks of treatment, planning and delivery of RT, supportive care during RT, and follow-up after RT. *Outcome* refers to the consequences of the care that has been provided, such as disease control and survival rates, treatment complications, patient satisfaction, and quality of life [1,6]. In order to achieve optimal patient outcomes, it is necessary to identify and correct deficiencies in both structure and process.

One way to measure the quality of care is to develop quality indicators that describe the care that should occur for a particular patient in a specific clinical circumstance. In the United States, several groups have developed sets of quality indicators for RT of localized prostate cancer. The most extensive set of prostate quality indicators, developed by the RAND Corporation, is based on data that are now over ten years old [7]. Two more recent sets of prostate quality indicators have been developed, but they are less comprehensive. The American Medical Association Physician Consortium for Performance Improvement (AMA PCPI) has developed six quality indicators [8], and 10 indicators have been developed by Quality Research in Radiation Oncology (Q-RRO) [9]. Two

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Canadian groups have developed quality indicators for prostate cancer surgery [10,11], but no Canadian quality indicators specific to prostate cancer RT exist.

It is in this context that the project Steering Committee set out to develop a set of current quality indicators for RT of localized prostate cancer that would be sufficiently comprehensive to address all components of the process of care, from pre-treatment assessment to follow-up. This project included a National Patterns of Care Study in prostate cancer RT; the overall research program goal was to measure the quality of prostate cancer RT across Canada, by measuring adherence to a validated set of quality indicators. We chose to focus on the *process* of care, since these indicators are often considered to be the best measure of quality [12]. Process indicators are also more appealing to physicians, because they are often based on data from clinical trials, they focus more on "what we do" rather than on "who we are" or "where we work" (structure measures), and feedback from process measures is more likely to result in rapid improvement in quality of care compared to structure measures (since it is typically easier to change practices than to change conditions of practice) [6]. When studying process as it relates to quality of care, it is important to consider both *technical* process (whether medically appropriate decisions where made when diagnosing and treating the patient) and *interpersonal* process (the way that the clinician relates to the patient) [6]. We decided to limit the initial set of quality indicators to the *technical* process of care, and plan to develop *interpersonal* quality indicators in a future project.

Materials and methods

A modified Delphi technique was used to develop the quality indicators for the process of care in localized prostate cancer RT. The Delphi method is a consensus building process that uses a series of questionnaires administered in rounds. In a traditional Delphi approach to reaching consensus, there are two to four rounds of rating or ranking: a group of experts completes questionnaires in order to increasingly refine rankings of candidate quality indicators. There is also an opportunity provided to identify additional quality indicators. This is an iterative process in which subsequent rounds build on the results of the previous round [13–15]. The "modified" Delphi approach implies at least one face-to-face meeting of a group. This approach has been utilized by other groups to develop quality indicators for prostate cancer [7,10].

Literature review

Our first step was to identify candidate quality indicators by literature review of established prostate cancer quality indicators, relevant prostate cancer treatment guidelines, and recent prostate radiotherapy clinical trial protocols. Medline and Embase databases were searched using the terms "quality of health care", "quality indicators, health care", "prostatic neoplasms", and "radiotherapy". The Web of Science database was searched using the following terms: quality indicat*, prostat*, radioth*, quality measure, and performance measure. A cited reference search of selected papers was also performed. All relevant papers were reviewed for content, and those that contained indicators of the quality of RT for prostate cancer were used.

A comprehensive review of treatment guidelines was performed to identify possible indicators of the quality of RT for prostate cancer. Each Canadian provincial cancer agency's website was searched to determine whether a treatment guideline for prostate cancer management existed. All Canadian provincial guidelines were reviewed, as well as a Canadian Consensus document [16]. Representative national guidelines from the United States and Europe were also reviewed.

Finally, a review of clinical trial protocols was performed using the National Cancer Institute (NCI) clinical trials database. Studies were searched under the headings "prostate cancer", "stage I, II, and III", and "treatment". Only phase three trials were reviewed, so that a standard arm could be used to identify potential quality indicators. A detailed review of the clinical trial protocols was necessary, and was only possible for the Radiation Therapy and Oncology Group (RTOG) trials, for which there is open internet access to trial protocols.

Steering committee and guiding principles

Recognizing the heterogeneity of the existing sets of indicators of the quality of RT for prostate cancer and the absence of existing standards for identifying quality indicators, we struck a Steering Committee to establish the principles that would guide the development of our set of quality indicators. The Steering committee (MB, BD, RP, TP, and JPB) identified the following: quality indicators should be selected on the basis of their importance ratings amongst the Delphi participants (criteria described further below); the resulting set of selected quality indicators should be appropriately comprehensive (e.g., should cover important aspects of technical medical care) and coherent (e.g., post-treatment indicators should mirror pre-treatment indicators); the set should also be "manageable" in number, allowing them to be applied efficiently to a Patterns of Care study (that is, comprehensive but not exhaustive). Applying these principles should result in a set of indicators with content validity (e.g., the indicator measures quality of care appropriately and consistently) and relevance (e.g., the indicator deals with an aspect of care that affects a large number of patients, and may potentially be correlated with patient outcomes). Finally, the selection of quality indicators should not necessarily be limited by considerations of feasibility (e.g., the ease of abstraction on a chart review or the requirement to be already available in an administrative database).

Round one

The first round of the modified Delphi process was carried out by means of an online survey. The survey population consisted of a sample of expert genito-urinary (GU) radiation oncologists. Each of the 37 Canadian cancer centers with RT facilities identified a specific GU radiation oncologist 'Center Representative' at the time of the Patterns of Care Study inception. In addition, we invited the GU Radiation Oncologist Tumor Group leader from each centre (if different from the Center Representative) to participate. Thus, in total, 48 radiation oncologist opinion leaders in GU oncology from across Canada comprised the study sample cohort.

The survey described each candidate quality indicator and asked respondents to rate the indicators on a Likert scale of 1–9, with one being "not important at all as a quality indicator", and nine being "absolutely essential to include as a quality indicator". After each rating question, respondents were provided with an opportunity to comment or suggest additional quality indicators. We included open-ended questions, asking participants to suggest criteria for certain quality indicators where appropriate (e.g., the minimal number of core biopsies considered adequate for patient selection). Only radiation oncologists who performed brachytherapy were asked to rank the quality indicators relating to brachytherapy planning and procedure.

As there is no well-accepted precedent for defining "agreement" in the Delphi process, and since substantial variation in survey responses was seen (see below), the Steering Committee chose to summarize the survey results using three previously utilized

and not mutually exclusive criteria [17]: ⩾33% of respondents agree that the quality indicator is "essential" (rated 9), ⩾50% agree that the quality indicator is "very important" (rated 8–9), and ⩾75% agree that the quality indicator is "important" (rated 7–9). These criteria were chosen with the intent to identify those quality indicators that at least a small but significant proportion of respondents (arbitrarily set at 33%) identified as critical, and those that the majority of respondents identified as important. Using these criteria, candidate quality indicators were first divided (for the purposes of discussion at round two) into two groups: those either meeting or not meeting all three of these criteria. A further sensitivity analysis to explore the extent to which different applications of 'agreement' criteria would affect the final list was also performed. Additional quality indicators suggested by the survey respondents formed a third group. Finally, the survey results were reviewed to identify data quality: extent of missing data, presence of systematic outliers (e.g., respondents who might have reversed the scale) or indiscriminate use of the scale (e.g., respondents who identified all indicators as "essential" or all as "not important at all").

Round two

The second round of the modified Delphi process was a face-to-face meeting (April 30, 2009, in Toronto, Ontario). The objective of the meeting was to develop a consensus set of Canadian indicators of the quality of RT for localized prostate cancer. A group of twenty GU radiation oncologists from those that completed the online survey was invited to participate. This group was selected such that members represented cancer centers from all Canadian provinces. The meeting was chaired by two of the principal investigators (MB and BD), but facilitated by a non-content expert, the Associate Director of the Queen's Executive Decision Centre, who employed Group Decision Support Software (GDSS) technology [18]. This technology allowed participants to put forward ideas and opinions anonymously (by entering text comments by keyboard into a shared display), facilitated immediate review of comments, and also allowed for electronic capture of the proceedings.

The ranking process consisted of a series of votes using the GDSS technology, allowing for viewing and voting of quality indicators in real-time. For each vote, participants were asked to identify highest ranking indicators by selecting a specific number of quality indicators which they felt should be included in the final set. After each vote, the ranking was displayed, and the quality indicators were again discussed. The group was also given the option to refine the wording of quality indicators to better reflect their meaning, and to combine two or more similar quality indicators into a single indicator. After four iterative votes, a rank order of quality indicators was agreed upon. An email survey was sent to participants following the meeting to determine criteria for those quality indicators that had been left 'open-ended' during the ranking process. For example, there was agreement that "minimum dose for EBRT for low-risk disease" should be a quality indicator, but determination of what the minimum dose should be required follow-up input by the participants.

Results

Literature review

Our literature review identified 56 potential indicators of the quality of RT for prostate cancer. One additional indicator was suggested by our group which was not based on literature review. This resulted in a total of 57 candidate quality indicators in five main categories: pre-treatment assessment (PTA), EBRT, brachytherapy, androgen deprivation therapy (ADT), and follow-up.

Round one

Survey response rate and respondent demographics

The survey response rate was 81%, with 39 of 48 GU radiation oncologists completing the survey. Ninety percent of respondents saw >50 new prostate cancer patients annually, and 44% saw >100 new prostate cancer patients annually. Most radiation oncologists (72%) had been treating prostate cancer for >10 years, with 21% having treated prostate cancer for >20 years. Approximately half (51%) had formal training related to prostate cancer beyond residency training: 14 had brachytherapy training, and six had undertaken a clinical and/or research fellowship. All respondents were involved in prostate cancer clinical trials, with 54% acting as principal investigators, and 67% as collaborators or co-investigators. Just under half of the radiation oncologists (44%) performed brachytherapy.

Data quality

There were no missing data items, no systematic outliers (respondents who could have potentially had the scale reversed), and no evidence of indiscriminate use of the scale (respondents who answered all questions "essential" or all questions "not important at all").

Grouping of quality indicators based on criteria

Applying our criteria to the survey responses on each quality indicator (⩾33% agreement that the quality indicator is "essential", ⩾50% agreement that the quality indicator is "very important", and ⩾75% agreement that the quality indicator is "important") showed that 32 quality indicators met all three criteria (Table 1), and the remaining 25 quality indicators did not (Appendix 1). Appendix 1 also indicates the eight quality indicators that met at least one (but not all three) of the initial selection criteria.

Variation in respondents' ratings

Although several quality indicators did not meet all criteria, there was considerable variation in responses, and each of the 57 quality indicators had at least one respondent rate it as nine ("essential"). Likewise, no indicator was universally rated as "essential". Fig. 1 displays the distribution of responses (range, and inter-quartile range) for those indicators meeting all three criteria and listed in Table 1, where (by definition) consensus on the importance of the indicators was reasonably high. Fig. 2 displays the distribution of responses for those indicators not meeting all three criteria (Appendix 1), where the variation in expert opinion varied considerably more than those indicators in Table 1. Note that an additional five new quality indicators were suggested by respondents (Appendix 2).

Round two

Sixteen GU radiation oncologists from across Canada participated in the face-to-face meeting in Toronto. Participants agreed that the principles established by the Steering Committee for selecting quality indicators were appropriate.

Voting and ranking

Initially, the group was asked to review the 25 quality indicators that did not meet all three criteria (listed in Appendix 1), along with the five additional quality indicators that had been suggested in the online survey (Appendix 2) to determine if any should be moved forward for consideration along with those indicators listed in Table 1. In keeping with the principle of appropriate comprehensiveness of the indicator set, we felt that initially all quality indicators should be considered by the experts (regardless of their initial ranking in Round One). One EBRT indicator was re-worded before

Table 1
The 32 quality indicators, listed by category, which met all three criteria ($\geqslant$33% agreement quality indicator is "essential", $\geqslant$50% agreement quality indicator is "very important", and $\geqslant$75% agreement quality indicator is "important"), and their mean ranking score.

	Quality indicator	Percent agreement			Mean score
		Essential (9)	Very important (8–9)	Important (7–9)	
Pre-treatment assessment	Pre-treatment evaluation includes Gleason score	94.9	100	100	8.95
	Pre-treatment evaluation includes PSA	89.7	100	100	8.9
	Needle biopsy pathology report comments on Gleason Grades 1–5 and Gleason Score	89.7	97.4	97.4	8.82
	Documentation that potential complications were presented to patient	79.5	94.9	97.4	8.69
	Bone scan for high risk patients	78.9	94.7	100	8.74
	Documentation that alternative treatment modalities were presented to patient	76.9	89.7	94.9	8.38
	Documentation of risk category (low, intermediate or high)	68.4	89.5	94.7	8.45
	Pre-treatment evaluation includes DRE	64.1	82.1	89.7	8.31
	CT pelvis for high risk patients	64.1	69.2	92.3	8.3
	Documented assessment of urinary function	53.8	84.6	92.3	8.26
	Documentation that patient was offered the opportunity to consult with another specialist	48.7	69.2	89.7	7.87
	Use of clinical TNM staging	48.7	64.1	79.5	7.74
	Documented assessment of bowel function	46.2	66.7	82.1	7.87
	Documented assessment of co-morbidity	44.7	71.1	92.1	7.95
	Documented assessment of sexual function	43.6	59	79.5	7.74
	Needle biopsy pathology report comments on presence or absence of extra-capsular extension into fat	43.6	56.4	84.6	7.64
EBRT	Use of CT in EBRT treatment planning	84.6	100.0	100.0	8.85
	DVH recorded for PTV, rectum, and bladder	69.2	84.6	89.7	8.41
	3D conformal RT or intensity modulated RT used	66.7	87.2	97.4	8.51
	Dose volume constraint on the rectum for EBRT	59.0	71.8	82.1	7.92
	Delivery of adequate dose for EBRT	51.3	84.6	94.9	8.15
Brachytherapy	Brachytherapy procedure performed with TRUS, CT or MRI guidance	93.8	100	100	8.47
	Pre-implant brachytherapy planning with TRUS, CT or MRI	81.3	87.5	87.5	7.53
	Brachytherapy patient counseling/education on radiation safety/protection	62.5	100	100	8.18
	Post-implant dosimetric assessment following low dose rate brachytherapy using CT and/or MRI	50	81.3	93.8	7.82
	Post-implant dosimetry report includes D90, V100	43.8	81.3	87.5	7.65
ADT	Adjuvant ADT for high risk patients	64.1	92.3	92.3	8.41
	Counseling on appropriate calcium and vitamin D supplementation for patients on ADT	46.2	66.7	82.1	7.77
Follow-up	Follow-up assessment includes PSA	69.2	97.4	100	8.67
	Follow-up assessment includes assessment of ADT toxicity	57.9	86.8	97.4	8.42
	Follow-up assessment includes assessment of bowel function	43.6	87.2	97.4	8.28
	Follow-up assessment includes assessment of urinary function	41	79.5	94.9	8.13

PSA, prostate specific antigen; DRE, digital rectal examination; EBRT, external beam radiation therapy; DVH, dose volume histogram; PTV, planning target volume; TRUS, trans-rectal ultrasound; ADT, androgen deprivation therapy.

the first vote: "Use of linear accelerator with treatment energy $\geqslant$10 MV" was changed to "For patients not receiving IMRT, high energy ($\geqslant$10 MV) used". This change was in response to the group's general agreement that for IMRT, 6 MV is appropriate – and in some cases preferable – to higher energy. These 30 quality indicators were then ranked by participants. The quality indicators to receive the most votes (followed by their category in brackets) were "Use of daily target localization" (EBRT), "For patients not receiving IMRT, high energy ($\geqslant$10 MV) used" (EBRT), "Adequate number of cores taken at prostate biopsy" (PTA), and "Location and number of positive cores" (PTA). The group agreed to combine the latter two indicators into a single indicator ("Adequate number of cores taken at prostate biopsy, with location and number of positive cores specified"), and thus three quality indicators were added to the 32 quality indicators in Table 1. Participants were then asked to choose 15 quality indicators from this resultant set of 35, based on their validity and relevance as a potential quality measure. Discussion and debate followed each vote, leading, in some cases, to refining the descriptions of the quality indicators (by re-wording and/or combining indicators).

Open-ended quality indicators

Two 'open-ended' quality indicators requiring further clarification were included in the final set of fifteen: "Adequate number of cores taken at prostate biopsy", and "Delivery of adequate dose" for EBRT. In the follow-up survey, a minimum of six cores at prostate biopsy was determined to be adequate. With respect to dose, a minimum dose of 70 Gy for low risk, 74 Gy for intermediate risk without ADT, 70 Gy for intermediate risk with ADT, and finally, 70 Gy for high risk (assuming ADT) were determined to be adequate. There was greatest agreement of the minimum dose for low risk and high risk patients (data not shown).

A set of quality indicators for evaluation of patterns of care

Ultimately, a final set of quality indicators was agreed upon as those of highest priority for use in the evaluation of patterns of practice. Table 2 lists the final set of quality indicators, which includes 22 indicators from the original list of 32 that met all three inclusion criteria as well as three from the list of 25 indicators that did not meet all criteria. The final list was endorsed by the Steering Committee, taking into account the rankings and deliberations of content experts in round two, and keeping in mind the pragmatic approach of limiting the list to those items on which there was strong consensus but without attempting to be exhaustive. Of note is the fact that several of the final quality indicators were created by combining candidate indicators with similar characteristics or to avoid redundancy.

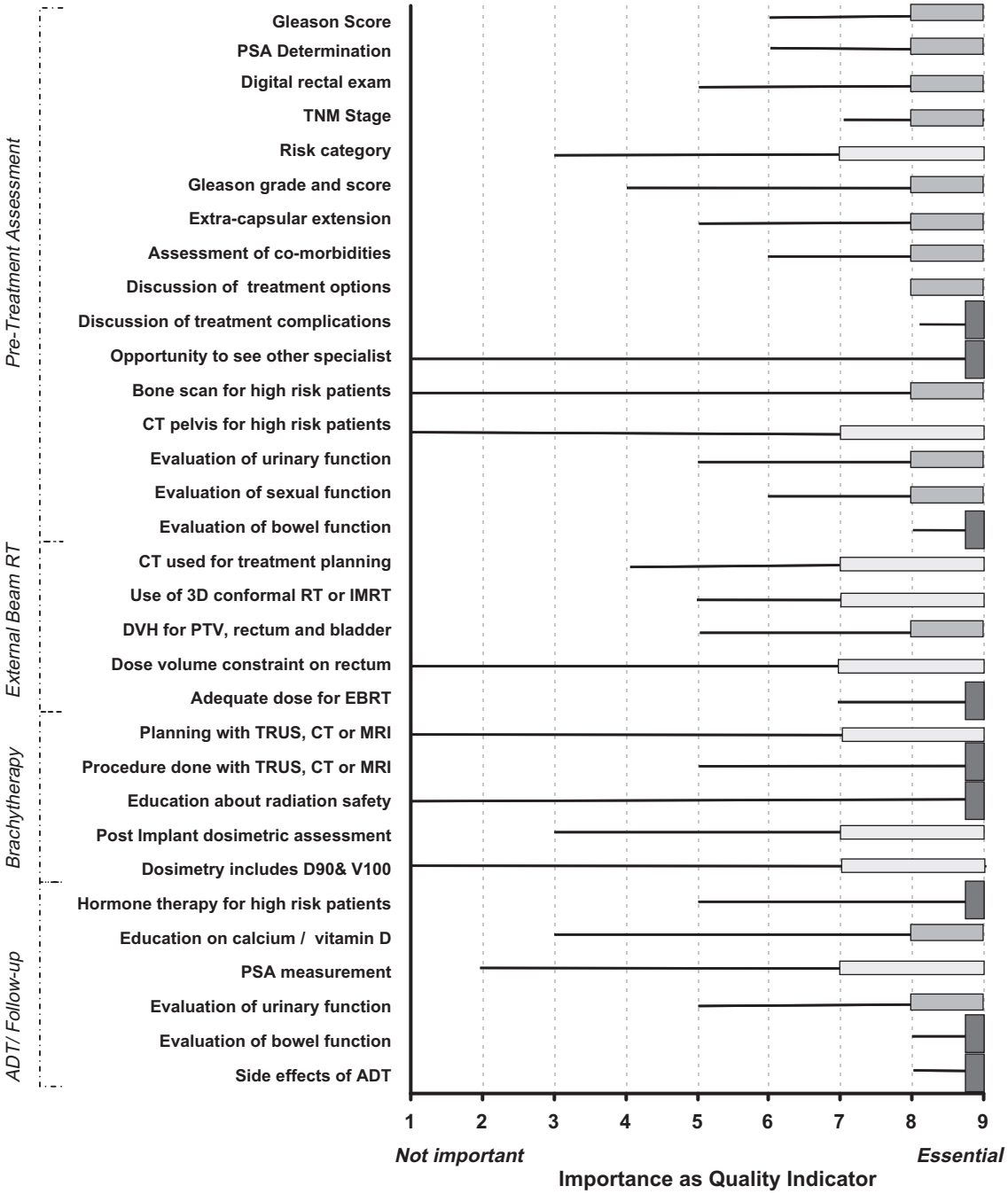

Fig. 1. Distribution of responses for the 32 quality indicators meeting all three criteria, presented by category. Each line represents the range of importance scores across all respondents. Each box represents the 25th to 75th quartile of responses, with darker shading illustrating a higher level of agreement. PSA: prostate specific antigen; CT: computed tomography; IMRT: intensity modulated radiation therapy; DVH: dose volume histogram; PTV: planning target volume; EBRT: external beam radiation therapy; TRUS: trans-rectal ultrasound; MRI: magnetic resonance imaging study; ADT: androgen deprivation therapy.

To test the robustness of the final indicator set, we returned to the primary survey data from round 1 to perform a sensitivity analysis exploring the extent to which different applications of 'agreement' criteria would affect the final list. We note that applying any of the three criteria individually would have identified very few indicators not included in the final list (as indicated by the shaded indicators in Appendix 1); including only those indicators meeting the inclusion criterion for "important" (score 7–10), for example would have indentified only one additional indicator (documented offer of clinical trial participation) compared to the final set. Likewise, applying only the criterion of "essential", "very important" or mean score >7.5 would have identified only one, two, and zero indicators, respectively.

Discussion

This project has created a current and comprehensive set of indicators of the quality of RT for localized prostate cancer that reflects recent technical improvements in this treatment context. Additionally, this set of 25 quality indicators comprises all aspects of the RT management of patients with localized prostate cancer management, from pre-treatment assessment to follow-up.

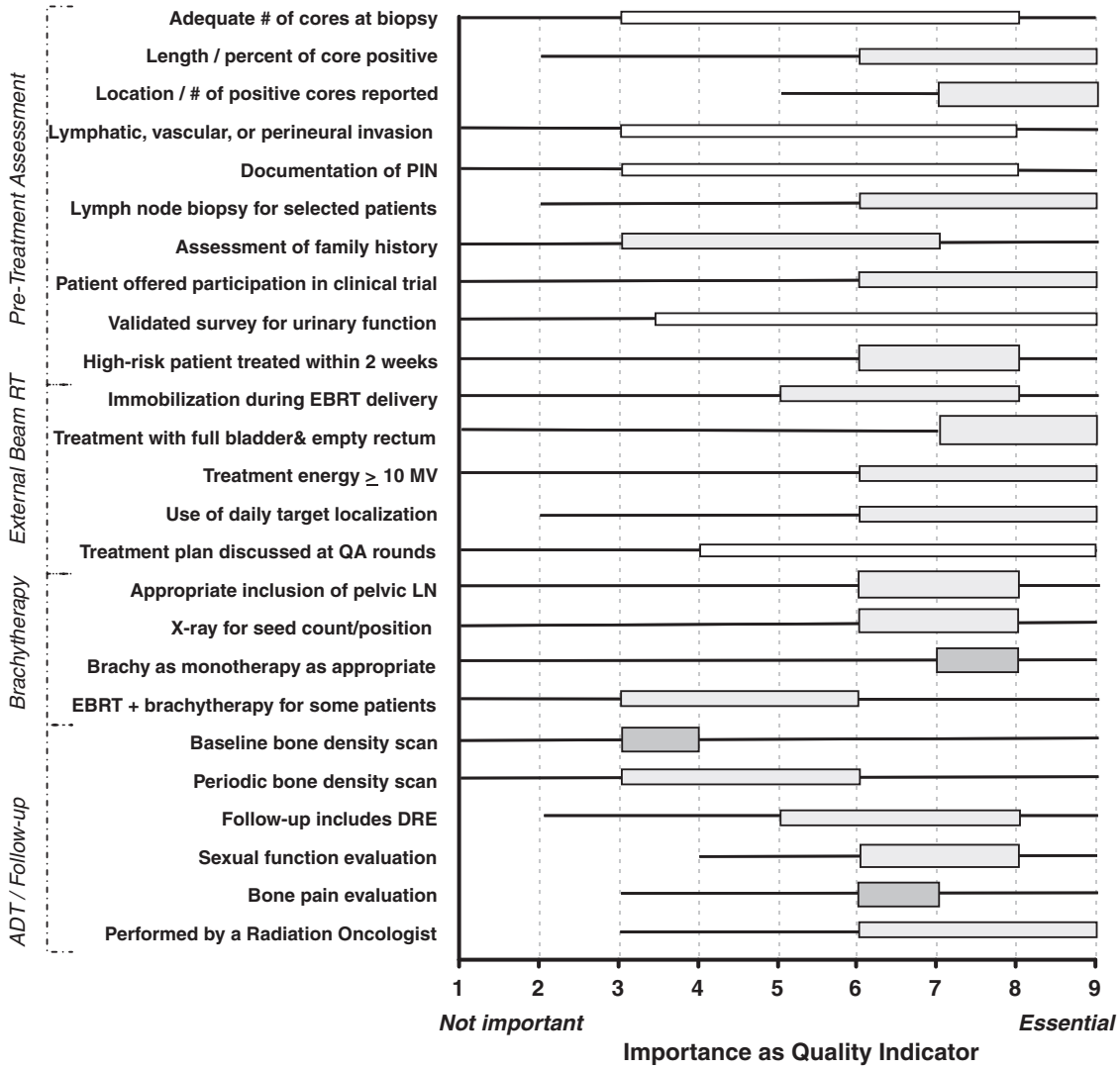

Fig. 2. Distribution of responses for the 25 quality indicators which did not meet all three criteria, presented by category. Each line represents the range of importance scores across all respondents. Each box represents the 25th to 75th quartile of responses, with darker shading illustrating a higher level of agreement. PIN: prostatic intra-epithelial neoplasia; EBRT: external beam radiation therapy; QA: quality assurance; LN: lymph nodes; DRE: digital rectal examination; ADT: androgen deprivation therapy.

Existing sets of quality indicators have some advantages over our current set. The largest set of quality indicators from the RAND Corporation [7] includes structure and outcome indicators, as well as interpersonal indicators, none of which were included within the scope of our project. We have subsequently initiated a project to develop interpersonal quality indicators for prostate cancer RT. As well, in future, we plan to develop and measure outcome indicators for the cohort of patients included in the Canadian Patterns of Care study, thereby exploring the relationship between process indicators and outcome indicators in terms of predictive validity (how strongly the various process indictors are associated with relevant outcomes).

Notwithstanding these limitations, this new set of process quality indicators is more inclusive and current than existing sets of indicators. The RAND quality indicators, though comprehensive, are based on evidence that is now over 10 years old [7], and none relate to either brachytherapy or ADT. Similarly, the AMA PCPI set contains no brachytherapy or follow-up quality indicators [8], and the Q-RRO set contains no PTA or follow-up indicators [9].

The use of a modified Delphi technique with input from across Canada was intended to obtain the views of GU radiation oncologists from a variety of practice settings and with differing educational backgrounds, thus facilitating applicability and uptake of the quality indicators nation-wide. It is important to stress, however, that these quality indicators do not necessarily represent uniform consensus amongst the GU radiation oncologists involved in the Delphi technique; it was obvious that there was a large variation in importance rating amongst radiation oncologists for many quality indicators (exemplified in Figs. 1 and 2).

The use of our three criteria to define 'agreement' broke the 57 candidate quality indicators into two groups, those with 'most agreement' among those who participated in the online survey, and those with 'less agreement'. However, all 57 quality indicators, regardless of whether they met our criteria, were reviewed by the participants of the face-to-face meeting and were considered for inclusion in the final set. In fact, the final set of quality indicators includes three quality indicators that originally did not meet the three criteria for 'agreement'. Since all quality indicators were eligible for inclusion in the final set, we are confident that a similar set of indicators would have been developed, regardless of the criterion applied.

Table 2
The quality indicators, listed by category, identified as most important for evaluation of quality of radiotherapy for prostate cancer. The top 15 ranked indicators resulting from the second Delphi round are identified.

	Quality Indicator	Ranking (top 15)
Pre-treatment assessment	Pre-treatment evaluation includes documentation of PSA, DRE-derived T category, and Gleason Score	2
	Minimum of six cores taken at prostate biopsy, with location and number of positive cores specified	15
	Bone scan for high risk patients	14
	CT pelvis for high risk patients	
	Documentation that alternative treatment modalities were presented to patient	11
	Documentation that treatment side effects/ complications discussed	10
	Documented assessment of urinary function	12
	Documented assessment of bowel function	
	Documented assessment of co-morbidity	13
	Documented assessment of sexual function	
EBRT	3D conformal RT or intensity modulated RT used	3
	Dose volume constraint on the rectum and bladder	7
	Use of daily target localization	8
	Delivery of adequate dose: 70 Gy for low risk, intermediate risk with ADT, and high risk with ADT, and 74 Gy for intermediate risk without ADT	6
Brachytherapy	Image guidance for brachytherapy using TRUS, CT or MRI	1
	Pre-implant brachytherapy planning with TRUS, CT or MRI	
	Brachytherapy patient counseling/education on radiation safety/protection	
	Post-implant dosimetric assessment following low dose rate brachytherapy using CT and/or MRI	
	Post-implant dosimetry report includes D90, V100	9
ADT	Adjuvant ADT for high risk patients	5
	Counseling on appropriate calcium and vitamin D supplementation for patients on ADT	
Follow-up	Follow-up assessment includes PSA	4
	Follow-up assessment includes assessment of sexual function	
	Follow-up assessment includes assessment of bowel function	
	Follow-up assessment includes assessment of urinary function	

PSA, prostate specific antigen; DRE, digital rectal examination; EBRT, external beam radiation therapy; DVH, dose volume histogram; TRUS, trans-rectal ultrasound; CT, computed tomography; MRI, magnetic resonance imaging study; ADT, androgen deprivation therapy.

Our goal is to apply the final set of quality indicators to describe patterns of care and corresponding compliance on quality measures in prostate cancer RT in Canada. Currently, we are undertaking a detailed chart review of a random sample of men treated curatively with radiation for localized prostate cancer at each cancer centre in Canada providing RT. Once data collection and analysis are complete, the management of patients at each centre will be measured against the quality indicators. Feedback on this compliance at individual cancer centers will be generated and sent to each center RT Division Head to advise them of their practice patterns compared to the national quality of care standards. This feedback loop will accomplish knowledge translation of the quality indictors, the national performance standards, and quality measure performance within the individual RT programs, allowing correction of process issues where required.

Other potential uses for these quality indicators include the ability to perform international comparisons. For example, Q-RRO (formerly the Patterns of Care Study) performs US national surveys on prostate cancer on a regular basis [9,19–21], and Canadian-US comparisons could be undertaken. The Delphi process could also be applied to other disease sites to develop quality indicators in areas where quality of care measurement is needed. Ultimately, performance on these quality indicators may be correlated with outcomes, such as disease control and toxicity. Improvements in process of care indicators are expected to improve the quality of patient care as reflected by improvements of outcome measures.

Conclusion

A set of 25 quality indicators of the quality of RT for prostate cancer has been created with the participation of GU radiation oncologists from across Canada utilizing a modified Delphi technique. This set is appropriate for the assessment of patterns of care in Canada, but may be equally appropriate in comparable health care settings, since the indicators largely reflect current knowledge rather than issues related to health care structuring. Our technique for developing quality indicators could be easily adapted for use in other contexts to measure quality of care.

Conflict of Interest statement

No conflicts of interest exist.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.radonc.2011.02.013.

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