Clinical Investigation: Quality Assurance


Yaacov Richard Lawrence, M.R.C.P.,*†‡ Michal A. Whiton, M.D.,*§
Zvi Symon, M.D.,†‡ Evan J. Wuthrick, M.D.,*¶ Laura Doyle, M.S.,*
Amy S. Harrison, M.S.,* and Adam P. Dicker, M.D., Ph.D.*

*Department of Radiation Oncology, Jefferson Medical College of Thomas Jefferson University, Philadelphia, Pennsylvania; †Department of Radiation Oncology, Sheba Medical Center, Tel HaShomer, Israel; ‡Sackler School of Medicine, Tel Aviv University, Israel; §Department of Radiation Oncology, Skagit Valley Hospital Regional Cancer Care Center, Mt. Vernon, Washington; and *Department of Radiation Oncology, Ohio State University, Columbus, Ohio

Summary
Physician-led peer review chart rounds are an essential part of the quality assurance process in radiation oncology. We performed a survey of North American Academic institutions to understand the structure and utility of these meetings. We uncovered large variations regarding attendance, departmental scheduling conflicts, which cases are reviewed, and the length of time spent on each case. Many centers do not review brachytherapy and radiosurgical cases. Recommendations are made based on our findings.

Purpose: In light of concerns regarding the quality of radiation treatment delivery, we surveyed the practice of quality assurance peer review chart rounds at American academic institutions.

Methods and Materials: An anonymous web-based survey was sent to the chief resident of each institution across the United States.

Results: The response rate was 80% (57/71). The median amount of time spent per patient was 2.7 minutes (range, 0.6–14.4). The mean attendance by senior physicians and residents was 73% and 93%, respectively. A physicist was consistently present at peer review rounds in 66% of departments. There was a close association between attendance by senior physicians and departmental organization: in departments with protected time policies, good attendance was 81% vs. 31% without protected time (p = 0.001), and in departments that documented attendance, attending presence was 69% vs. 29% in departments without documentation (p < 0.05). More than 80% of institutions peer review all external beam therapy courses; however, rates were much lower for other modalities (radiosurgery 58%, brachytherapy 40%–47%). Patient history, chart documentation, and dose prescription were always peer reviewed in >75% of institutions, whereas dosimetric details (beams, wedges), isodose coverage, intensity-modulated radiation therapy constraints, and dose–volume histograms were always peer reviewed in 63%, 59%, 42%, and 50% of cases, respectively. Chart rounds led to both minor (defined as a small multileaf collimator change/repeated port film) and major (change to dose prescription or replan with dosimetry) treatment changes. Whereas at the majority of institutions changes were rare (<10% of cases), 39% and 11% of institutions reported that minor and major changes, respectively, were made to more than 10% of cases.

Conclusion: The implementation of peer review chart rounds seems inconsistent across American academic institutions. Brachytherapy and radiosurgical procedures are rarely reviewed. Attendance by senior physicians is variable, but it improves when scheduling clashes...
are avoided. The potential effect of a more thorough quality assurance peer review on patient outcomes is not known. © 2012 Elsevier Inc.

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## Introduction

Quality assurance (QA) refers to a program for the systematic monitoring and evaluation of a project, service, or facility to ensure that output is of a high standard. The concept of QA was developed in manufacturing industry as a means to continuously improve highly complex production methods. During the past half century the concept of QA has increasingly been applied to health care to improve patient outcomes and limit expenditure. In the specialty of radiation oncology, QA methods have been extensively applied to the medical physics aspects of treatment planning and delivery; both the American Association of Physicists in Medicine and the American College of Radiology (ACR) have published guidelines on the subject. By contrast, there has been little focus on the peer review QA of clinical cases by physicians.

The aim of this study was to document physician-led QA as practiced at academic medical centers in the United States. In particular we examined the function of the weekly meetings used to peer review cases, variously referred to as QA conference or chart rounds. We did not investigate medical physics QA as applied to treatment planning and delivery.

## Methods and Materials

We surveyed the utilization of peer review QA meetings within North American academic institutions that have residency programs accredited by the Accreditation Council for Graduate Medical Education (ACGME). The chief resident(s) of each institution were invited via e-mail to complete an anonymous online survey questionnaire designed by the use of Survey Monkey software (Menlo Park, CA).

The issues addressed included departmental demographics (location, number of patients receiving treatment), attendance at QA meetings by various disciplines (reported as 100% attendance, 75% attendance, etc.), the thoroughness with which different treatment modalities (external beam, radiosurgery, brachytherapy) were peer reviewed, use of advanced technologies within the department (such as cone-beam imaging, stereotactic radiosurgery, stereotactic body radiation therapy [SBRT]), depth of discussion regarding patient’s history and staging workup, and frequency with which treatment changes were recommended.

A second survey was sent out to the same recipients in mid-2011 focusing on issues raised by the initial survey (barriers to attendance by key personnel, types of changes recommended during conference).

Statistical analysis was performed on Excel (version 12.3, Microsoft, Redmond, WA) and Stata Statistical package (version 11.1, TX). Time per patient was calculated by dividing the total weekly clinical QA conference time by the number of patients peer reviewed per week. To understand the degree to which complex new treatment techniques were used at each institution, nine avant-garde procedures were selected: SBRT for Stage I non-small-cell lung cancer with four-dimensional computed tomography-based planning, SBRT for liver metastases, SBRT for spinal metastases, fractionated stereotactic radiotherapy for central nervous system tumors, intensity-modulated radiation therapy (IMRT) for glioblastoma, IMRT for postprostatectomy prostate cancer, IMRT for gynecologic cancers, IMRT for breast cancer, and segmented fields for breast cancer. Each institution was given a complexity score based on how many of these procedures were routinely performed; possible scores ranged from 0 to 9. To facilitate statistical analysis, the various categoric variables were converted into arbitrary scores (e.g., regarding questioning of resident physicians: if residents were questioned about every case a score of 4 was assigned; if they were questioned about more than half of patients, a score of 3; if for less than half of patients, a score of 2; if they were never queried on evidence, a score of 1).

A change-score was calculated to reflect the number of changes made at peer review chart rounds: changes never made yielded a score of 0, <10% of cases changed yielded a score of 1, 10% to 50% of cases changed yielded a score of 2, more than 50% of cases changed yielded a score of 3, and for more than half of patients, a score of 4 was assigned. The number of cases reviewed per week was converted into arbitrary scores (e.g., less than 100 cases: 0, 100 to 250 cases: 1, >250 cases: 2).

## Results

The response rate was 80% (n = 57/71). Responders were well distributed across the United States. The institutions that responded were mostly moderate to high volume; the median number of patients receiving treatment was 75 to 100 (range, <30 to >250). Five institutions reported having more than 150 patients receiving treatment at any one time.

Sixty percent of responding institutions hold chart rounds for fewer than 2 hours per week (range, 1–6 hours). Overall, the median amount of time spent per patient during QA was 2.7 minutes (range, 0.6–12 minutes) (Fig. 1). Although more than 80% of institutions peer review all external-beam therapy courses, the rates were significantly lower for other modalities: 58% for radiosurgery cases and 40% to 47% for various types of...
brachytherapy. Notably, 18% of institutions never peer review radiosurgical cases, 39% of institutions never peer review preimplant or postimplant dosimetry for prostate brachytherapy, and 29% never peer review gynecologic brachytherapy cases (Fig 2).

Patient history, chart documentation, and dose prescription were always peer reviewed in 78% institutions, and the finer details of dosimetry such as the number or angle of beams or wedges, isodose coverage, IMRT constraints, and dose–volume histograms were always reviewed in 63%, 59%, 42%, and 50% of cases, respectively. Cone-beam computed tomography images were never peer reviewed in 51% of institutions (Fig. 3).

Clinical residents attended chart rounds more fastidiously than did attending physicians: 82% of institutions reported 100% attendance by residents during chart rounds, whereas only 23% of institutions reported perfect attendance by physicians. At the majority of institutions, physics and dosimetry staff were always present. However, there were mixed practices regarding protocol personnel and nursing staff. Twenty-six percent of programs reported that protocol personnel were always present, whereas 37% of programs reported no such presence (Fig. 4).

The presentation of cases at chart rounds led to both minor and major treatment changes. Sixty-one percent of institutions reported that minor alterations (defined as a small multileaf collimator change or request to repeat a port film) were recommended for fewer than 10% of treatment plans; conversely, 14% reported minor changes to at least 20% of treatment plans. Seventy-five percent of institutions reported that fewer than 10% of treatment plans required a major alteration (change to dose prescription or request to replan with dosimetry); conversely, 11% reported major changes to 10% or more of treatment plans.

The peer review conferences also seemed to have a pedagogic function. Clinical residents were queried on the clinical evidence for recommended changes and were asked to present the rationale and evidence behind the suggested change. Furthermore, residents were encouraged to ask questions and seek clarification. The peer review conferences also seemed to have a pedagogic function. Clinical residents were queried on the clinical evidence for recommended changes and were asked to present the rationale and evidence behind the suggested change. Furthermore, residents were encouraged to ask questions and seek clarification.

Several issues were raised after the analysis of the first survey, such as whether attendance at QA meetings is documented and/or protected, and the types of changes that were suggested during conferences. Therefore, a second survey was sent out in mid-2011. Forty-three responses were obtained. The anonymous nature of the survey prevented us from knowing whether the same institutions replied as in the initial investigation. Nonetheless, the demographics of reporting institutions from the two surveys were similar regarding both size of departments and regional locations.

The second survey demonstrated a significant association between protected time and attendance by senior physicians. In departments where the QA time was protected, 81% of institutions reported a high rate of attendance by senior physicians (75%–100% of time); however, at institutions where time was not protected, only 31% reported a high rate of attendance by senior physicians ($p = 0.001$). Documentation of attendance and the avoidance of scheduling complex procedures during QA chart rounds were also significantly associated with increased attendance of senior physicians (Table 1).

![Fig. 2. Frequency with which different case types are peer reviewed during chart rounds. Brachy = brachytherapy; GYN = gynecology.](image)
In the second survey, residents’ attendance at QA meetings was again reported as being high at all institutions, with the majority (93%) reporting perfect attendance and the remaining institutions (7%) reporting 75% attendance. Once again there was an association between departmental policy and attendance. The 25 departments that did not schedule simulations during QA had universally complete resident attendance, as opposed to only 83% perfect attendance at the 15 departments that did schedule simulations during QA conferences ($p < 0.05$). The results were similar for the scheduling of radiosurgery procedures during QA conference (100% vs. 86% complete attendance, $p = 0.07$).

The most frequent issues that arose at peer review chart rounds concerned normal tissue toxicity and the prescribed dose/fractionation schedule, followed by questions of target coverage and treatment technique, reported as being frequently changed at 20%, 21%, 14%, and 15% of institutions, respectively. Target volume definition was frequently changed at only 9% of institutions.

Discussion

The aim of QA efforts is to improve outcomes and eliminate medical errors. Informal peer review is a frequent feature of academic medical departments; radiation oncology is perhaps unique in having formalized the process. To our knowledge, this is the first study to document peer review chart round practices across the United States, and it provides a snapshot view of current practice. The importance of peer review in raising the clinical standards of our specialty has been emphasized in several recent publications (9, 10), reflected by the fact that every respondent to our survey regularly participated in such meetings, and peer review is a requirement for American College of Radiation Oncology accreditation (11).

Chart rounds are generally the only opportunity for senior physicians to examine one another’s cases, management decisions, and radiation treatment plans, and they are therefore uniquely important. Our results demonstrate large variations across the United States in attendance by key personnel, time dedicated to the meeting, and the extent to which different treatment modalities are reviewed.

Our study has several weaknesses. (1) We surveyed institutions by questioning senior residents which inevitably created bias (e.g., regarding resident attendance); however, the approach was consistent between institutions. (2) Our results are dependent on responders’ memories and impressions. Inasmuch as we were entirely dependent on responders’ recollections, with no method of validation, we needed to be especially skeptical regarding the numeric results (e.g., the time spent on each patient during chart rounds). (3) The response rate was only 80%; we do not know how representative the responding institutions were of the entire population. It is possible that the 20% of institutions that did not respond are different from the others, (e.g., with busier and larger departments). (4) The questions asked in the survey stemmed from the authors’ personal experiences. (5) Some respondents indicated that at their institutions additional methods of QA were performed, for example in the form of a dedicated IMRT QA meeting. However, these additional methods were too diverse to classify and were not queried up front. (6) Departments may differ

![Fig. 3. Clinical parameters reviewed at quality assurance chart rounds. CBCT = cone-beam computed tomography; DVH = dose-volume histogram; IMRT = intensity-modulated radiation therapy; Pt = patient.](image)

![Fig. 4. Presence of various professions during radiation oncology quality assurance chart round meetings.](image)
regarding whether only new cases or also ongoing cases are reviewed, and how much time is dedicated to each; however, these issues were not addressed in the survey. (7) Our survey focused only on peer review chart rounds. It is likely that other forms of peer review take place within academic institutions (e.g., in the interactions between residents and attending physicians); however, these were not explored. (8) We were unable to accurately assess the clinical impact of peer review chart rounds regarding clinical outcomes and patient safety. This is a reflection both of our study’s retrospective design but also of the difficulty in predicting the end result of changing a specific treatment variable on a particular patient’s outcome.

The medical literature regarding physician-oriented QA peer review in radiation oncology is sparse. The ACR recommends regular review of port films, treatment interruptions, complications, and unexpected deaths (6). Additionally, the ACR advises that peer review conferences for all new patients be held to “conduct a documented review of plans of management for new patients by attending staff to the greatest degree possible” and that charts are reviewed throughout a patient’s therapy course. The ACR hence defines the need for two types of meetings: morbidity-and-mortality meetings (retrospectively understanding what went wrong in patients with poor outcomes such as unexpected toxicity) and peer review chart rounds (proactively and prospectively seeking to improve treatment and avoid errors by comprehensively reviewing all charts). It is the latter that was investigated in the current study.

Careful peer review of a contemporary treatment plan would be expected to include evaluation of the anatomic and tumor target volumes, IMRT constraints, nonhomogenous dose prescriptions (dose painting), dose—volume histogram, and other dosimetry specifics, in addition to patient history, diagnostics, and staging. It does not seem feasible that this can be performed in 2.7 minutes, the median amount of time spent per patient in our study. Yet, this figure itself is likely an overstatement because it includes time taken to quiz residents on their knowledge of medical literature. Some institutions peer review port films as the principle way to evaluate a complex three-dimensionally planned case, and this seems to us inadequate. The possible inadequacy of current practices is suggested by our finding that most changes made at peer review rounds relate to factors that can be quickly reviewed, such as prescribed dose and normal tissue toxicity concerns, as opposed to issues of target volume delineation, which were rarely changed and would require a more in-depth review.

We were unable to demonstrate an association between the structure of chart rounds (e.g., time spent per patient, physician attendance) and the frequency with which modifications were recommended. We cannot determine whether this reflects a true lack of correlation or simply the limitations of the study (its small size and retrospective nature). This is an important issue that requires further analysis based on a larger, prospectively gathered dataset.

Peer review of radiosurgery and brachytherapy procedures was not performed in more than 40% of institutions. This is of potential concern because both modalities involve high-dose radiation with curative intent. We suspect that two factors are involved: (1) technical problems with the review of such procedures, such as a different computer program being used, and (2) the fact that many of these procedures are single-day events, hence peer review will necessarily take place after the fact. Yet, technical issues can be overcome with appropriate information technology support, and after-the-fact peer review is better than no peer review at all.

### Recommendations

Although we were not able to determine the optimal structure of peer reviewed chart rounds, we found the variations between academic institutions disconcerting and suggest that some minimal requirements be decided upon (Table 2). In our opinion, this is especially the case for brachytherapy and radiosurgical procedures, in which spatial issues (applicator position, target definition) can have highly significant consequences. Furthermore, documentation of deviations noted and corrected would aid in understanding the impact of peer review chart rounds. Departmental policies should prevent scheduling clashes with QA meetings to ensure high attendance.

### Unanswered questions and future research

On the multiinstitutional level, QA does seem to identify serious problems and potentially improve outcomes (12). It is unknown to what degree intradepartmental peer review chart rounds influence patient safety and clinical outcomes; this would require a prospective multiinstitutional gathering of detailed information regarding changes made at these meetings (see proposed documentation in Table 2). Our study was entirely concerned with academic institutions; the role of peer review needs to be assessed in all types of radiation oncology practice.

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**Table 1** Attendance by senior physicians at quality assurance peer review chart rounds, as a function of departmental policies

<table>
<thead>
<tr>
<th>Policy</th>
<th>Not implemented</th>
<th>Implemented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of institutions</td>
<td>Institutions with good attendance</td>
<td>Number of institutions</td>
</tr>
<tr>
<td>Documentation of attendance</td>
<td>7</td>
<td>2 (29%)</td>
</tr>
<tr>
<td>Protected time</td>
<td>16</td>
<td>5 (31%)</td>
</tr>
<tr>
<td>Request not to page physicians during QA</td>
<td>27</td>
<td>13 (48%)</td>
</tr>
<tr>
<td>Simulations not scheduled during QA</td>
<td>18</td>
<td>8 (44%)</td>
</tr>
<tr>
<td>Brachytherapy not scheduled during QA</td>
<td>26</td>
<td>14 (54%)</td>
</tr>
<tr>
<td>Radiosurgery not scheduled during QA</td>
<td>21</td>
<td>10 (48%)</td>
</tr>
</tbody>
</table>

*Abbreviations: NS = not significant; QA = quality assurance.*

Good attendance refers to a senior physician reported attendance rate of 75% to 100%. Note: this was an observational, not interventional, study.
Table 2  Minimal recommendations for quality assurance peer review chart rounds

<table>
<thead>
<tr>
<th>General procedures</th>
<th>QA meetings to discuss all new cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency/timing</td>
<td>Weekly chart rounds</td>
</tr>
<tr>
<td></td>
<td>Discuss fractionated cases within 1 week of treatment commencement</td>
</tr>
<tr>
<td>Participants</td>
<td></td>
</tr>
<tr>
<td>Scheduling</td>
<td>Special procedures (SRS, brachytherapy) may be discussed post fact</td>
</tr>
<tr>
<td>Documentation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minutes of meeting, attendance and record of modification requested</td>
</tr>
<tr>
<td></td>
<td>Modification should be recorded both in the patient chart and within a specific QA chart rounds logbook; in the latter the following should be recorded: what modification was made, why the modification was made, implications for patient toxicity/tumor control if the modification had not been made</td>
</tr>
<tr>
<td>Quarterly departmental review of QA chart rounds</td>
<td>Attendance levels/scheduling issues</td>
</tr>
<tr>
<td>2D Plan review</td>
<td>Patient history and staging</td>
</tr>
<tr>
<td>3D/IMRT/tomotherapy Plan review</td>
<td>Field arrangement and portal images with associated DRRs</td>
</tr>
<tr>
<td>Single fraction radiosurgery and brachytherapy</td>
<td>Radiation dose and fractionation scheme</td>
</tr>
<tr>
<td></td>
<td>Radiation dose and fractionation</td>
</tr>
<tr>
<td></td>
<td>DVH for normal tissues and target structures</td>
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<tr>
<td></td>
<td>Review of hot and cold spots as appropriate</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Review logbook, and modifications made</td>
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<tr>
<td></td>
<td>Modify departmental policy accordingly</td>
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<td></td>
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</table>

Abbreviations: 2D = two-dimensional; 3D = three-dimensional; DRR = digitally reconstructed radiograph; DVH = dose–volume histogram; IMRT = intensity-modulated radiation therapy; QA = quality assurance; SRS = stereotactic radiosurgery.

Conclusion

Peer review is an important method to raise and maintain clinical standards, prevent medical errors, and possibly uncover departmental weaknesses. The practice of QA peer review chart rounds is inconsistent among academic radiation oncology departments in the United States, especially regarding brachytherapy and radiosurgical procedures. Degree of attendance by senior physicians is closely associated with the time being protected from other clinical responsibilities. Despite suboptimal attendance by key personnel and the fact that the full range of critical data available is rarely reviewed, changes are frequently made. The potential impact of a more thorough physician peer review on patient outcomes is not known and will be the subject of future study.

References