Improving Accuracy in Reporting CT Scans of Oncology Patients:

Assessing the Effect of Education and Feedback Interventions on the Application of the Response Evaluation Criteria in Solid Tumors (RECIST) Criteria

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Rationale and Objectives: In February 2010, our radiology department adopted the use of the Response Evaluation Criteria in Solid Tumors (RECIST) 1.1 criteria for newly diagnosed oncology patients. Prior to staff used RECIST 1.1, we hypothesized that education and feedback interventions could help clarify differences between RECIST 1.0 and the newly adopted RECIST 1.1 guidelines and result in appropriate and accurate utilization of both reporting systems. This study evaluates the effect of education and feedback interventions on the accuracy of computed tomography (CT) reporting using RECIST criteria.

Materials and Methods: Consecutive CT scan reports and images were retrospectively reviewed during three different periods to assess for compliance and adherence to RECIST guidelines. Data collected included interpreting faculty, resident, type, and total number of errors per report. Significance testing of differences between cohorts was performed using an unequal variance *t*-test. Group 1 (baseline): RECIST 1.0 used; prior to adoption of RECIST 1.1 criteria. Group 2 (post distributed educational materials): Following adoption of RECIST 1.1 criteria and distribution of educational materials. Group 3 (post audit and feedback): Following the audit and feedback intervention.

Results: The percentage of reports with errors decreased from 30% (baseline) to 28% (group 2) to 22% (group 3). Only the difference in error rate between the baseline and group 3 was significant ($P = .03$).

Conclusion: The combination of distributed educational materials and audit and feedback interventions improved the quality of radiology reports requiring RECIST criteria by reducing the number of studies with errors.

Key Words: RECIST; quality; report; CT scans.

The quality and accuracy of the radiology report is critical for the appropriate management of oncology patients, both on and off clinical trials. The Response Evaluation Criteria in Solid Tumors (RECIST 1.0), generated by a multidisciplinary group of physicians, were initially published in 2000 to provide a standardized, simplified set of rules for measuring and reporting tumor burden in oncology patients. This facilitates accurate determination of tumor response to therapy to direct future treatment decisions (1). The RECIST 1.0 criteria were subsequently widely adopted by academic institutions, cooperative groups, and the pharmaceutical industry. It was subsequently determined that tumor response could accurately be assessed using fewer lesions, and in an effort to improve the accuracy of choosing and measuring appropriate lymph node target lesions, the original criteria were revised by the RECIST Working Group yielding RECIST 1.1 criteria (2) (Table 1).

The RECIST 1.0 criteria were adopted at our institution in 2005 following a didactic educational session and used exclusively until February 2010. In February 2010, the RECIST 1.1 criteria were adopted for use in the reports of any newly diagnosed oncology patients while the reports of any patient who had imaging prior to that date would continue to use RECIST 1.0 criteria. Our departmental computed tomography (CT) report standard includes a table of RECIST-defined indicator lesion measurements identified by lesion number, series number, image number, and size in mm. The table reports the current indicator lesion measurements as well as the corresponding measurements from the most recent comparison CT scan. Though adoption of both sets of RECIST criteria was viewed positively by our oncologists, the departmental application of the RECIST 1.0 criteria had not been consistent and low-volume readers had difficulty applying the specifics of the criteria. Because of this, education was deemed necessary to increase departmental accuracy using RECIST, and a formal QA assessment was initiated.

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TABLE 1. Summary Comparison of Guideline Characteristics in RECIST 1.0 and RECIST 1.1

	RECIST 1.0	RECIST 1.1
Maximum number of target lesions	10	5
Maximum number of target lesions per organ	5	2
Axis to measure lymph nodes	Long	Short
Minimal lymph node size for target lesion in millimeters (mm)	10	15
Minimum size for target lesion (non-lymph node) (mm)	10	10

RECIST, Response Evaluation Criteria in Solid Tumors.

Educational interventions such as distribution of educational materials and audit with feedback have demonstrated the ability to improve physician practice by improving process outcomes (3,4). Distributed educational materials (DEM) represent a passive dissemination strategy that may use monographs, electronic publications in peer-reviewed journals, clinical practice guidelines, or audiovisual materials to improve knowledge, awareness, professional skills, or patient outcomes (3,6). Audit and feedback (A & F) is defined as any summary of clinical performance of health care over a specified period, given in a written, electronic, or verbal format (5). Before adopting RECIST 1.1 criteria and transitioning staff to the utilization of both RECIST criteria, we hypothesized that educational interventions such as these could improve the application and accuracy of reporting. Given that DEM and A & F represent the two most studied forms of educational intervention, we employed these in our study (3,4). This study evaluates whether the distribution of educational materials and audit with feedback intervention significantly improved the accuracy of reporting CT scans for oncology patients.

MATERIALS AND METHODS

The study was approved by the Institutional Committee for the Protection of Human Subjects.

The CT scan images and reports of all oncology scans performed over three 1-month periods were evaluated for adherence to RECIST guidelines. The three periods (cohorts) were: 1) pre-RECIST 1.1 introduction, 2) post RECIST 1.1 adoption and distribution of educational materials intervention, and 3) post audit and feedback intervention.

Scan Review

All CT scan reports and axial images for each of the study groups were retrospectively reviewed by a medical student (H.A.) trained to identify specific types of errors. All errors recorded by the student were subsequently reviewed and confirmed by two faculty radiologists (N.M., P.L.) experienced in body imaging and in the application of the RECIST criteria with 9 and 14 years of post-residency experience, respectively. Data collected included interpreting faculty, resident, each specific type of error made, and total number of errors made per study (Table 2). Each error type counted equally toward the total error score for each reader. Readers were not penalized for making the same type of error repeatedly within the same study. Errors were also subcategorized into major versus minor errors. A major error was defined as one that could result in misinterpretation of disease response, such as using lesions <10 mm or measuring a lymph node in the incorrect axis. Minor errors were defined as those unlikely to result in misinterpretation of disease response, such as measuring a lesion using the wrong window/level settings or slice thickness.

Educational Interventions

DEM. The DEMs created for this study included a concise summary of RECIST 1.0 and 1.1 criteria and guidelines for utilization, including appropriate indicator lesion selection, measurement techniques, and reporting standards. These were provided in the following formats: a two-page summary handout was printed and placed in radiologists' mailboxes, sent via e-mail, posted in all radiology reading rooms, and placed in the departmental Google documents folder. Staff radiologists and trainees also attended a 1-hour audiovisual presentation that highlighted the key features and differences of RECIST 1.0 and 1.1, the rationale for revision of the criteria, and provided a detailed summary of proper utilization and application of RECIST 1.0 and RECIST 1.1 criteria. The presentation consisted of 76 slides, with multiple imaging examples of common errors made and how to avoid them. In addition, the presentation was electronically distributed to all staff radiologists and trainees.

A & F. One month after the DEM intervention, the reports and images of all CT scans of oncology patients over a 1-month period were reviewed and analyzed on a picture archive and communication system (PACS) workstation. Errors in the application of the RECIST criteria were tabulated. Each staff radiologist then received an email providing a summary of their clinical accuracy in applying the RECIST criteria over this audit period, including the total number of scans read, number of scans with errors, total number of errors, and a list of all specific errors committed with the accompanying scan accession numbers to enable review.

Cohorts

The study population was generated from a PACS search using the institutional oncology provider names. Each cohort was defined by all CT scans performed on oncology patients over selected 1-month periods.

Group A, baseline. All CT scans performed on oncology patients over a 1-month period during which time RECIST 1.0 were the sole criteria used (prior to introduction of the RECIST 1.1 criteria) in the institution. No educational