

Improvement in Reporting Skills of Radiology Residents with a Structured Reporting Curriculum

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Rationale and Objectives: Radiology residents must acquire dictation and reporting skills to meet Accreditation Council for Graduate Medical Examination requirements and provide optimal patient care. Historically, these skills have been taught informally and vary between institutions and among radiologists. A structured curriculum improves resident report quality when using a quantitative grading scheme. This study describes the implementation of such a curriculum and evaluates its utility in tracking resident progress.

Materials and methods: We implemented a three-stage reporting curriculum in our diagnostic radiology residency program in 2009. Stages 1 and 2 involve instruction and formative feedback composed of suggestions for improvement in a 360° format from faculty, peers, and others within the resident's sphere of influence. The third stage involves individual, biannual, written feedback with scored reports specifically assessing four categories: succinctness, spelling/grammar, clarity, and responsible referral. Biannual scores were collected from 2009 to 2013, sorted by year of residency training (R1 to R4), and average training level scores were statistically compared.

Results: Review of 1500 reports over a 4-year period yielded a total of 153 scores: 54, 36, 29, and 34 from R1, R2, R3, and R4 residents, respectively. The mean (standard deviation) scores for R1, R2, R3, and R4 residents were 10.20 (1.06), 10.25 (0.81), 10.5 (0.74), and 10.75 (0.69), respectively. Post hoc analysis identified significant differences between R1 and R4 residents ($P = .012$) and R2 and R4 residents ($P = .009$).

Conclusions: Residents' reporting scores showed significant improvement over the course of their residency training. This indicates that there may be a benefit in using an organized reporting curriculum to track resident progress in producing reports that may improve patient care.

Key Words: Milestone; dictation; report; reporting; core curriculum; communication skills; scoring; core.

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The Accreditation Council of Graduate Medical Education (ACGME) has recently released the Next Accreditation System, which requires the individual specialties to develop specific milestones that residents should meet at expected intervals throughout their training within the six core competencies (1,2). Two of the six core competencies outlined by the ACGME are patient care/technical skills and interpersonal/communication skills (1). The graduating resident is expected to meet milestone level 4 of these core competencies. For example, in diagnostic radiology under interpersonal/communication skills, the resident "communicates complex and difficult information, such as errors, complications, adverse events, and bad news" (3).

Radiologists provide quality patient care by communicating succinct, clear, and accurate information to referring physicians (4). This can be in the form of the radiology report and through direct consultation with clinicians on a specific patient's imaging needs. Recent evidence suggests primary care physicians are generally very satisfied with radiology reports, but they differ in what aspects of the report they value most (5). Because the radiology report is the primary and most frequent mode of communication, it is important for radiology residents to complete their training with competent effective dictation and reporting skills. Furthermore, it is notable that improper communication is the second most common reason for malpractice lawsuits (6) and can lead to significant patient and referring physician dissatisfaction with care (7). Thus, obtaining excellent communication skills may help avoid malpractice lawsuits, improve patient care, and indirectly lower health-care costs.

Training in radiology reporting focuses on establishing skills to provide a succinct, accurate, clear, and confident report that prioritizes imaging findings, includes pertinent negatives, documents responsible referral, and provides adequate explanation of imaging recommendations. These skills, which are developed during residency training, impact patient care by forming the basis for future reporting patterns.

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Historically, the method through which most residents have attained reporting skills has been a role model apprenticeship paradigm (1). This informal paradigm offers both advantages and disadvantages. One advantage is one-on-one personal lectureship by program faculty who tells the trainee what to say and how to say it. A major disadvantage of this approach is the broad variability across faculty radiologists (8). This informal method lacks standardization and may cause conflict not only in educating residents but also in the evaluation of reporting skills. As radiology reports become more standardized, it is necessary for training programs to prepare residents by implementing a curriculum that follows a similar trend (9–11).

The purpose of this article is to describe the implementation of a three-stage reporting curriculum with achievement cutoffs and evaluate its effect on residents' core communication and reporting skills.

MATERIALS AND METHODS

This study is exempt from institutional review as it is research regarding an educational curriculum not involving minors (12). In 2009, our residency implemented a standardized reporting curriculum. The role model apprenticeship paradigm is now augmented by a formal curriculum based on the American College of Radiology's practice guidelines for communication of diagnostic imaging findings, helping to create a more consistent learning environment (13). This is further delineated with the new ACGME milestones in which the core competency of interpersonal and communication skills has been split into ICS1: effective communication with patients, families, and caregivers and ICS2: effective communication with members of the health-care team (3). Under the level 4 expectations for ICS2 (for graduating residents), the written/electronic milestone states: "efficiently generates clear and concise reports that do not require substantive faculty member correction on all cases" (3). This milestone is specifically addressed with the curriculum currently in practice at our institution, which analyzes this aspect of the report as part of the scoring process.

The first stage of the curriculum occurs during orientation, at which time residents individually complete three online modules, each lasting approximately 30–60 minutes, achieving a passing score of at least 75% (14). These modules provide a basic foundation in reporting before residents ever dictate a radiology report. Table 1 outlines the modules and their respective subsections. Module 1 focuses on foundations of radiology reporting (key findings, clinical urgency, and general concepts). Module 2 describes the report components. Module 3 covers communication beyond the radiology report (responsible referral). Residents must place documentation of passing modules 1–3 in their portfolios (4). Completion of these modules is followed by a session with the radiology program director. This session lasts approximately 1–1.5 hours. It is both didactic and involves an active learning

portion requiring residents to identify preferable statements when given choices. This experience furthers the discussion of the modules and clarifies what is meant by reports that emphasize the use of succinct, clear, confident, and accurate wording, as listed in Table 2.

The second step in the curriculum, which was in place before the new curriculum implementation, involves suggestions for improvement on monthly formative faculty evaluations of resident communication and reporting skills. Monthly evaluations, which are part of most residency training programs, are completed by attending radiologists, peers, and others within the resident's sphere of influence as part of the 360° process. Each faculty member who worked with that resident over the previous month is asked to respond to two statements on these evaluations regarding resident reporting as follows: "resident recognizes, appropriately communicates, and documents in the patient record urgent or unexpected radiologic findings," and "resident produces radiologic reports that are accurate, concise, and grammatically correct." Resident communication is rated by faculty on a 5-point scale as 1, poor; 2, below average; 3, average; 4, above average; or 5, excellent. Formative faculty evaluations are not anonymous, allowing residents to specifically address faculty comments.

The third step in the reporting curriculum, which was implemented in 2009, involves biannual resident report scoring. Resident reports are first scored 6 months after matriculation. Ten reports, dictated with a variety of attending radiologists covering a variety of modalities from the prior 6 months, are submitted by each resident. The program director confirms the faculty and modality variety during scoring and has the option to require resubmission if sufficient variety is lacking. These 10 reports are scored by a single evaluator, the program director. Each resident report is scored in four skill subcategories with a maximum of 3 points in each category for a total of 12 possible points (perfect score). Skill areas assessed include succinctness, grammar and spelling, clarity, and appropriate/responsible referral (Fig 1). The report grading categories are based on what the residents learn in the teaching modules, as well as from working individually with faculty, and are reinforced on formative faculty evaluations. Deductions are taken in quartiles for each error in the 10 reports, with all scores ending in 0.25, 0.50, 0.75, or 0. In other words, each instance of spelling/grammatical error, verbosity, use of unclear jargon, or lack of responsible referral warrants a deduction of 0.25 points per instance. Each deduction taken is explained in the program director comments at the bottom of the score card.

There is some room for subjectivity in this scoring system, that is, if a vague term is used in the appropriate manner, no points are deducted. Residents at the R1, R2, R3, and R4 levels must achieve minimum target scores of 9.0, 9.5, 10.0, and 11.0, respectively, which were developed after the initial experiences with this system. Finally, the resident receives specific written feedback about each deduction at the bottom of each score card. These reports are scored in a random order without review of the prior reports or other residents' score

TABLE 1. Outline of Online Reporting Modules*

Module 1: Preliminary Considerations
Section 1: Key findings
Section 2: Clinical urgency (triage)
Section 3: General concepts
Module 2: Components of a Report
Section 1: Demographics
Section 2: Indication for study
Section 3: Technical procedural
Section 4: Comparison/supplementary
Section 5: Body
Section 6: Summary/impression
Module 3: Communication Outside of the Report
Section 1: Personal/telephone contact
Section 2: Conferences
Section 3: Patient communication
Section 4: Contact technology

*Reporting curriculum modules available at <http://crr.medinfo.ufl.edu> were developed by Chris Siström and Linda Lanier at the University of Florida through a Radiological Society of North America grant.

cards. Residents may repeat the report scoring process as many times as needed without penalty until they meet the minimum cut-off score for their level of training, and only the final score is retained in their portfolios. Every 6 months, residents receive individual report score cards with written feedback tracking their progress and noting areas where they can improve. Written feedback allows residents to identify and remediate communication and reporting skills knowledge gaps, thus helping to fulfill the ACGME core competencies of communication skills and practice-based learning improvement and progress in the radiology milestones (1,3). If a resident is identified as requiring remediation, that is, they received a score below the target cutoff, they undergo a more detailed educational session with the program director to review the specific deductions taken on their reports. They then submit 10 new reports from the subsequent 3 months for reevaluation. Report scoring results are included in the resident's quarterly education committee reviews and semiannual program director evaluations.

Between 2009 and 2013, 1500 reports (10 per resident, twice per year) were scored. This yielded a total of 54 R1, 36 R2, 29 R3, and 34 R4 scores. In the case of individuals not reaching the cut-off score for their level of training on the first attempt, only the original score was used in the data analysis. This data was determined to be ordinal and nonparametric. Means were thus compared between the four groups using a Kruskal–Wallis test, and the individual means were compared using Mann–Whitney *U* tests. An adjustment for multiple comparisons was not necessary in this case because the comparisons were considered a priori in the hypothesis of the article. Not making an adjustment creates no increase in the risk of type I error and does not minimize the increased risk of type II error. All data analyses were performed on Statistical package for the social sciences (SPSS), version 20.

RESULTS

The range (mean \pm standard deviation) for the 54 R1, 36 R2, 29 R3, and 34 R4 scores were 8.5–12.0 (10.20 \pm 1.06), 8.5–12 (10.25 \pm 0.81), 9–12 (10.50 \pm 0.74), and 9.25–12 (10.75 \pm 0.69), respectively (Table 3). Eight residents failed to meet their target score on one occasion each. In each instance, the resident remediated successfully on their second attempt.

A Kruskal–Wallis test, used to identify a significant difference among the mean scores (Fig 2), was significant with χ^2 (df, 3; $n = 153$) = 8.88, $P = .031$. Post hoc Mann–Whitney *U* tests, which were run to compare pairwise differences between the individual groups (Table 4), showed a significant difference between R1 and R4 ($U = 627$, $Z = -2.51$, $P = .012$) and R2 and R4 ($U = 393.5$, $Z = -2.594$, $P = .009$). The R3 versus R4 comparison approached significance with a value of $P = .088$ but was not significantly different. All other between-group comparisons were determined to be insignificant without P values $< .05$ (Fig. 3).

DISCUSSION

In the last decade, radiology reporting has trended toward more standardization, and the Radiological Society of North America (RSNA) is now involved in this process as well. The widespread use of picture archiving and communication systems has allowed for much quicker turnaround times for reports, with improvements being made regularly to streamline the process (15). Although this has led to improved satisfaction from consulting physicians, reports are expected to be completed much more rapidly with the same accuracy and clarity (16). One solution to this dilemma is the use of standardized reporting templates. Some authors argue that structured reporting can lead to more rapid report turnaround time, improved communication, and more satisfied referring providers (17). Consequently, the RSNA has invested in a radiology reporting initiative to standardize and create structured report templates (18). These templates are designed to produce consistency among radiologists and improve communication with referring physicians (9).

The role of standardization in radiology reporting has been questioned by some authors. In cohort studies by Johnson et al., accuracy (10) and clarity (11) of structured reporting systems (SRS) versus free-text reporting were assessed. They found that the accuracy of reporting brain magnetic resonance imaging stroke findings was diminished with the use of SRS, whereas clarity was similar between SRS and free-text reports. However, the authors mention that many of the limitations of the SRS could be attributed to the intrinsic structure of the SRS. They recommended various avenues for SRS improvement, such as allowing flexibility in the definition of terms. Conversely, there are arguments that suggest standardized reporting may decrease errors and make reports more thorough and understandable to the consulting physician

TABLE 2. Suggested Words and Phrases to Avoid with Rationale for Avoidance

1. Vague or unclear jargon* that can be replaced with more descriptive anatomic terms
 - a. Aspect
 - b. Visible
 - c. Non-specific
2. Vague or ambiguous terms used in place of the word “normal”
 - a. Negative (can mean bad or normal)
 - b. Intact
 - c. Maintained or well-maintained
 - d. Preserved
 - e. Unremarkable
3. Statements with no information that refer readers back to the body of the report or to prior reports
 - a. Stating something is unchanged without describing its current appearance (e.g., lines are unchanged)—This is the same as saying “read the prior report”
 - b. As above in an impression—This is the same as saying “read my report”
 - c. Description of “stable finding” without further description as normal or abnormal
4. Vague reference to prior examinations without specifying the date of study
5. Vague description of study limitations or findings without explanation of importance
 - a. Pulmonary vascular congestion without stating which vessels are involved
 - b. Degenerative disease without further describing location or severity
 - c. Vascular calcification without specifying location or severity
6. Phrases lengthening the report that can be omitted without changing the report meaning
 - a. Appearance of
 - b. Evidence of
7. Words and phrases that imply uncertainty, doubt, and insecurity without explanation
 - a. Essential, essentially
 - b. Relative, relatively
 - c. Gross or grossly
8. Vague qualitative, judgment, or statistical words and phrases
 - a. Quite
 - b. Some
 - c. Good
 - d. Satisfactory
 - e. Significant
9. Redundant or incorrect anatomical descriptions
 - a. Bilateral lungs, orbits, or kidneys—This is redundant as these organs are always bilateral
 - b. Lung fields—No such anatomy
10. Vague recommendations or lack of communication of recommendations
 - a. Clinical correlation recommended
 - b. Additional imaging recommended without explanation as to why
 - c. Additional imaging recommended without documenting clinician communication
11. Repetitive use of phrase “There are” or “there is” at the beginning of all sentences

*Jargon definition: nonsensical, meaningless talk, vague meaning, or convoluted phrasing.

(19,20). Organizations such as the RSNA are investing in this process with the belief that templates specific to the subspecialties will lead to fewer medical errors (9,21).

The implementation of ACGME reporting milestones is likely to further the movement toward standardization. As the expectations of residents become more specific, training programs will be encouraged to implement more structured curricula that ensure the education and verification of those milestones. This process may require more complex curricula and assessment methods than what most programs currently use. For example, under patient care and technical skills 1: consultant, the level 4 milestone states, “integrates current research and literature with guidelines, taking into consider-

ation cost effectiveness and risk-benefit analysis, to recommend imaging” (3).

Some radiology training programs have begun to implement various formal and informal mechanisms to teach and assess reporting and communication skills (Table 5). Approaches have included: implementation of an Objective Structured Clinical Examination (22); use of detailed reports feedback (23); pre- and postassessment of resident’s knowledge of dictation and reporting skills following didactic lectures (24); and incorporation of reporting skills into systems-based practice projects (25). The authors of the first approach showed that their Objective Structured Clinical Examination, a standardized method of assessment, was effective in evaluating residents’

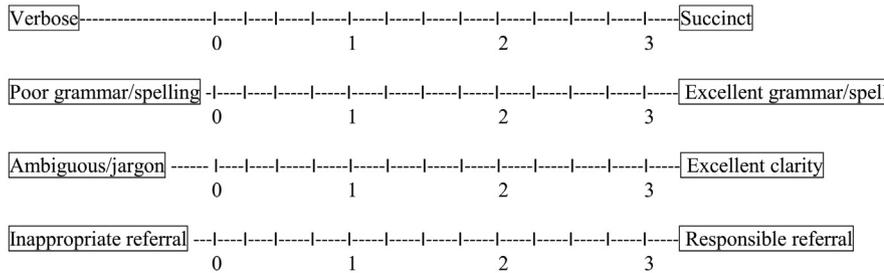
Radiology Reporting Score Card

Resident name: _____

PGY* status: _____

Month/Year: _____

Written Communication Skills



Minimum milestone scores:

R1: 9.0

R2: 9.5

R3: 10.0

R4: 11.0

Program Director comments: _____

Your Score: _____

Figure 1. Resident dictation report score card. PGY, postgraduate year; R1, radiology training year 1; R2, radiology training year 2; R3, radiology training year 3; R4, radiology training year 4.

TABLE 3. Descriptive Statistics

Year	Number	Minimum	Maximum	Mean	SD
R1	54	8.5	12	10.20	1.06
R2	36	8.5	11.88	10.26	0.81
R3	29	9	12	10.47	0.74
R4	34	9.25	12	10.77	0.69

R1, radiology training year 1; R2, radiology training year 2; R3, radiology training year 3; R4, radiology training year 4; SD, standard deviation.

communication skills (22). The second method noted improvements in professionalism following the creation of a professionalism booklet for the staff to read (23). The authors of the third method noticed significant improvement in the scoring of resident’s understanding of dictation and reporting skills between postgraduate years 2 through 4 following didactic lectureship (24). In the last approach, a resident’s systems-based project focused on improving dictation and reporting skills of younger radiology residents (25).

This study is similar to those described previously in which we demonstrated significant improvement in resident reports after implementation of a reporting curriculum. However, analyzing improvement in report scores with training level-specific achievement expectations is a more unique approach that addresses particular ACGME core competency mile-

stones for resident education. The Radiology Residency Education Committee reviews the learning modules and evaluation process annually (4). This process comprehensively verifies that a resident’s communication skills support their promotion or need for remediation by the integration of their formative 360° evaluation and individual feedback in the form of report scoring. This is done in concordance with their level of training and demonstrated aptitude with regard to the ACGME milestones (2,3).

In the curriculum described in this article, standardized reporting was encouraged to the degree that guidelines were established and residents were held accountable for achieving training level cutoffs in four categories that are important based on literature consensus. Specifically, the first category assessed is succinctness versus verbosity, a vital radiology reporting skill (26). Succinctness examines how well the resident can convey their imaging findings with few extraneous or unnecessary words. One author states, “a good report is not only accurate in content, but is also concise, clear, and pertinent in style” (26). In another article discussing the desires of referring physicians, the authors state “an internist has 12 minutes with a patient and can’t take 20 minutes to read a radiology report” (27). Because referring physicians will often forgo reading an entire radiology report, being succinct is invaluable. The second category assessed is clarity, a topic that is mentioned explicitly under both interpersonal

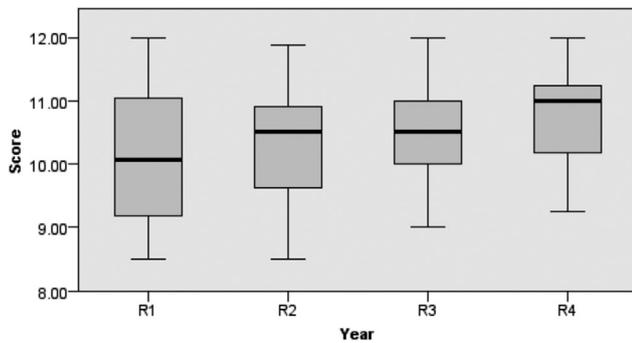


Figure 2. Box-and-whisker plot of independent samples Kruskal-Wallis test. R1, radiology training year 1; R2, radiology training year 2; R3, radiology training year 3; R4, radiology training year 4.

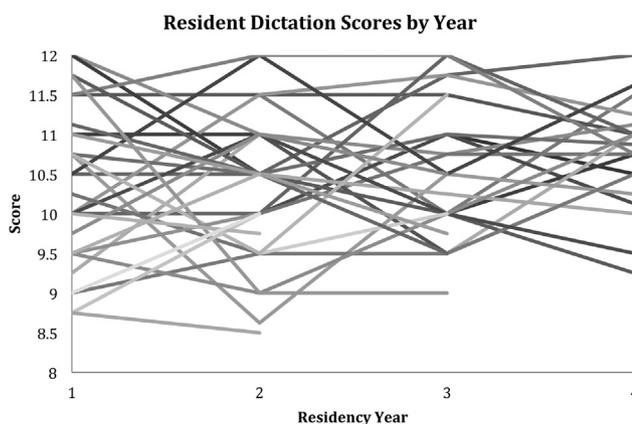


Figure 3. Scatter plot of individual resident scores by year in training.

TABLE 4. Mann-Whitney *U* Comparisons to Identify Significant Differences between Means

Years	Mann-Whitney <i>U</i>	Wilcoxon <i>W</i>	<i>Z</i>	<i>P</i> value
R1-R2	918	2403	-0.45	.655
R1-R3	659.5	2144.5	-1.19	.236
R1-R4	627	2112	-2.51	.012
R2-R3	468.5	1134.5	-0.71	.477
R2-R4	393.5	1059.5	-2.60	.009
R3-R4	370.5	805.5	-1.70	.088

R1, radiology training year 1; R2, radiology training year 2; R3, radiology training year 3; R4, radiology training year 4.

P value defined as significant if < 0.05 .

and communication skills core competency assessment milestones (3,26). Because radiologists often serve as consultants, they must be able to communicate findings to referring physicians as clearly as possible. However, jargon filled radiology reports with vague, ambiguous, insecure, unconfident, noncommittal wording is a longstanding habit formed over a period of years as faculty radiologists have done what has traditionally been referred to as “hedging” and “developing their own unique styles.” Many become emotionally attached to their own personal style and are unwilling to consider changing to meet modern standards.

Unfortunately, this stagnates and inhibits instruction in radiology resident reporting. A case review, titled “Pitfalls of the Vague Radiology Report,” examined 10 cases with corresponding vague radiology reports. All patients had delays in diagnosis of serious conditions because of lack of clarity in the radiology report, and each patient sought compensation and filed malpractice lawsuits. Eight of the 10 cases were found in favor of the patient or involved the patient receiving a substantial monetary settlement (28). Radiologists differ in their opinions on words and phrases to avoid, and finding universally acceptable language is highly unlikely. That said, there is a movement in radiology resident education toward avoiding vague words if possible in favor of more specific descriptions of the findings (3,6,8,9). Thus, the goal of the curriculum is to encourage residents to clearly describe the findings using detailed imaging and anatomical phrases, as well as to state the importance of the findings. All language in Table 2 is allowed as long as it is explained clearly, for example, instead of saying the bowel gas pattern is nonspecific with no further explanation, residents are asked to describe the bowel gas pattern (bowel loop shape and caliber) and then state the importance of the finding (may indicate ileus or is of uncertain etiology). One of the benefits of maintaining the role model apprentice system is that it allows faculty to help residents learn in what context it is appropriate to use vague or nonspecific terms. The third category assessed is grammar and spelling, an elementary core skill. Because the radiology report is a legally binding medical document, it may be dissected in detail during malpractice lawsuits. Literature suggests proofreading for grammatical, spelling, and typographical errors is needed to decrease the risk and incidence of malpractice suits (7). The American College of Radiology reporting guidelines specifically recommend proofreading for typographical errors (13). One benefit of standardized reporting is the intrinsic grammar and spell-check programs. Despite these programs, typographical and grammatical errors are still found in radiology reports. The fourth and final category assessed is responsible referral, which addresses communication and documentation of unexpected, urgent, or emergent imaging findings, as well as appropriate explanation and documentation of imaging recommendations to referring physicians. The timely communication of significant or unexpected findings constitutes an obligation that the radiologist has to the referring physician and ultimately the patient. The lack of responsible referral greatly hinders the radiologist and referring physician’s ability to provide high-quality patient care and invites malpractice suits (7).

This study identified a statistically significant improvement in resident dictation scores between first- and second-year residents compared to fourth-year residents indicating that resident reports improved in the four analyzed categories when using an achievement-based reporting curriculum. The scores showed more variability in earlier years of training with wider ranges of scores and larger standard deviations in R1 and R2 versus R3 and R4 years. This trend is likely due

TABLE 5. Summary of Prior Studies Assessing Radiology Communication and Reporting Skills: Methods Used and Results

Study	Method	Results
Williamson et al., 2002 (22)	An Objective Structured Clinical Examination (OSCE)-assessed communication skills across levels of education	Reporting skills improved after OSCE with increasing level of training in the program
Donnelly and Strife, 2006 (23)	Detailed feedback reports focusing on professionalism and communication	Found benefit in providing a professionalism booklet, providing feedback on performance
Woodfield and Mainiero, 2008 (24)	Assessed reporting and communication learning objectives with pre- and postlecture tests	Found significant improvement in test scores following a didactic lecture
Buchmann et al., 2008 (25)	Residents are required to identify a systems problem and propose a solution	Residents were able to learn systems-based practice concepts by recognizing system errors and offering a solution

to some residents acquiring basic dictation skills more quickly than others or possibly having more skills before residency matriculation.

The dictation and reporting curriculum described herein is one approach at a single institution. It has limitations and challenges. First, it is limited by a degree of subjectivity of faculty and the report grader. Although this was controlled to an extent by having a single report evaluator during the study period use a consistent report score card that followed structured guidelines for assessment, it is not possible to determine if the evaluator may have been influenced by cultural and educational trends in communication and reporting. If a different faculty member had graded reports, it is possible that his/her opinion on what constitutes a good report may have differed, even within the constructs of a clearly defined curriculum using the same report score card. A single evaluator scored the residents' reports limiting the risk of interevaluator variability. This does however introduce possible intraevaluator bias because names were not redacted from score sheets and personal opinions about the residents could have affected the scoring process. This bias was limited to some degree by the fact that the scoring faculty reviewed resident reports at various levels of training in random order on the same or various days. In between report scoring sessions, the scoring faculty did not review previous resident scores. Although it is possible, it is unlikely that the reviewer could recall scores of individual residents in the midst of grading 300 reports biannually over a period of days or weeks. Another limitation is the lack of controls. Because the communication and reporting curriculum was introduced residency wide, it was not possible to compare improvement among residents with and without a structured curriculum experience. Although this study found significant improvement in R1 and R2 compared to R4 residents, it is impossible to say if this happened as a result of the structured teaching curriculum or if it would have occurred without such a cur-

riculum. Furthermore, it is difficult to assess the degree to which the curriculum and/or the role model instruction influenced the improvement in residents' reporting skills. With attending physicians and residents working side-by-side daily for 4 years, it is impossible to control for the bias of role modeling that may occur. Regardless of the described limitations, this article provides a method for programs to track resident progress in communication and reporting skills. Perhaps, a future study could retrospectively compare resident report scores before and after curriculum implementation. It may also be valuable as future research to assess referring physicians' satisfaction with resident reports throughout training.

In summary, this article describes three steps to implement an achievement-based dictation and reporting curriculum and assesses its utility. Five years after implementation of the curriculum, assessment of resident report scores shows progressive improvement in major areas of value in radiology communication skills. Teaching and assessing these skills throughout residency while following the ACGME training milestones will give program directors and clinical competency committee members a method to assess resident milestone levels and may allow graduates to develop high-quality core communication habits that could improve patient care and potentially decrease malpractice lawsuits.

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