

Strategies for Improving the Value of the Radiology Report: A Retrospective Analysis of Errors in Formally Over-read Studies

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Abstract

Purpose: The radiology report is a critical component of the Imaging Value Chain. Unfortunately, the quality of this aspect of a radiologist's work is often heterogeneous and fails to add significant value to the referring provider and, ultimately, the patient. Gauging what defines quality can be elusive; however, we elucidate techniques that can be employed to ensure that reports are more comprehensible, actionable, and useful to our customers.

Methods: Four hundred consecutive studies (July-August 2015) submitted to our institution with request for a formal over-read were reviewed retrospectively, specifically focused on analyzing differences in language, organization, and impression between the outside reports and the formal over-reads performed at our institution. The formal over-reads were classified into one of the following categories: (1) no clinically significant change; (2) emergent clinically significant change; (3) nonemergent clinically significant change. Clinically significant changes were further classified as either perceptual or cognitive errors.

Results: A total of 12.4% of formally over-read reports had clinically significant changes. Of these, 22.2% were emergent changes. Clinically significant changes were composed of 64.4% perceptual error and 35.6% cognitive error. Four strategies were discovered specifically related to reporting techniques that helped mitigate these errors on formal over-reads: (1) synthesizing varied anatomic findings into a cohesive disease process; (2) integration of relevant electronic health record data; (3) use of structured reporting; and (4) forming actionable impressions.

Conclusions: We identify, through examples, four strategies for reporting that add value through reduction of radiologic error, helping to mitigate the 12.4% clinically significant error rate found in reinterpretation of outside studies.

Key Words: Structured report, actionable impression, clinical data, error, over-read

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INTRODUCTION

The passage of the Affordable Care Act in March of 2010 ushered in major changes to health care delivery in the United States. Although these changes have taken place in stages, one constant theme has been reducing cost and expanding access through a focus on delivering higher-quality care that is of greater value to all stakeholders. The ACR has responded to this mandate by creating a framework, known as Imaging 3.0[®], to help its members meet the growing demands of patients, referring

providers, and payors to deliver greater value for imaging services. The central tenet of Imaging 3.0 is to deliver imaging care that is beneficial and necessary, and avoid imaging care that is not [1]. This begins at the moment a referring provider considers requesting an imaging study and extends through to the generation of a radiology report.

Adapted from the business community, a process map for Imaging 3.0 known as the Imaging Value Chain has been established [2], in which two links of the chain are "Interpretation and Reporting" and "Communication," both of which reflect opportunities to add value through quality report generation. Yet, although there is consensus among radiology thought leaders about the necessity of providing greater value, gauging what defines value with regard to the radiology report itself can be elusive [3]. Without a thorough understanding

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of the meaning of value for radiology reporting, this aspect of a radiologist's work is difficult to improve and is often heterogeneous. Typical reports, in the eyes of our referring colleagues and, ultimately, the patient, may fail to add significant value. The purpose of our study is to better define features of a high-quality report and identify strategies and styles that could be employed to improve the value of radiology reporting.

METHODS

One reason that defining quality radiology reporting is difficult is that each imaging study is unique, and thus a "control" report for comparison is often nonexistent. Rarely are two separate reports for the same study dictated by different radiologists available for comparison. If this were the case, a side-by-side comparison could be performed to determine, in the eyes of stakeholders, which report was more valuable. Therefore, there are few examples in the existing literature of how to translate the Imaging 3.0 support columns to daily reporting practice and, in turn, improve patient care.

At our academic institution we routinely over-read a multitude of studies from outside institutions for patients who have their care transferred to our institution. These formal over-reads are requested by our referring colleagues for both inpatients and outpatients and include all modalities. Having two different reports for the same study (one from an outside institution and one generated by a radiologist at our institution) provides a framework to analyze differences in reporting to (1) establish an interobserver error rate and (2) identify factors that contribute to this error rate through direct comparison. Moreover, this analysis allows us to suggest techniques that may be employed to generate reports of higher value.

Four hundred consecutive studies that were submitted to our institution from July to August 2015 with request for a formal over-read were selected for analysis. These studies were reviewed retrospectively, specifically focused on analyzing differences in language, organization, and impression between the outside reports and the formal over-reads performed at our institution. After the two were compared, the formal over-reads were classified into one of the following categories: (1) no clinically significant change; (2) emergent clinically significant change, defined as a necessary change in clinical decision making performed within 12 hours; or (3) nonemergent clinically significant change, defined similarly, with timeframe greater than 12 hours. These determinations were derived through evaluating the longitudinal course

of each patient's stay. Specifically we sought to identify how each patient's treatment plan and course was altered if there was a discrepancy in our formal over-read report versus the outside report.

Studies that were determined to have clinically significant changes were then analyzed further, specifically dividing errors into perceptual errors, defined as those that occur during image interpretation when the abnormality is not detected or appreciated, or cognitive errors, defined as those that occur during image interpretation resulting in an incorrect diagnosis being given to a detected abnormal finding. An examination of these errors was then conducted to elucidate patterns of reporting that may contribute to these errors. Finally, suggestions were generated for how to improve reporting to avoid these errors and ultimately add greater value to the radiology report.

RESULTS

Of the 400 consecutive studies reviewed, 362 studies had outside reports available for comparison at the time of formal over-read; those studies without outside reports were excluded from analysis. By modality, these 362 studies were composed of 295 CT, 54 MRI, and 13 ultrasound studies. By subspecialty, the composition of these studies was 179 neurologic, 144 abdominal, 22 cardiothoracic, 14 musculoskeletal, and 3 pediatric.

In our analysis, 12.4% (45/362) of formally over-read reports had clinically significant changes. Of these, 22.2% (10/45) were emergent changes. The other 77.8% (35/45), though not emergent, were deemed clinically impactful. The 12.4% of reports with clinically significant changes was statistically significant when compared with RADPEER-based interobserver agreement data over the same time period for studies conducted at our institution and read solely by radiologists at our institution, where there was a discrepancy rate of 4.8% (P value < .001). These results are summarized in [Figure 1](#).

Further evaluation of the 45 studies with clinically significant changes revealed that 64.4% (29/45) were perceptual errors and 35.6% (16/45) were cognitive errors.

DISCUSSION

Our analysis, which identified a 12.4% error rate in the 362 formally over-read studies, is similar to interobserver agreement data in the existing literature. For example, the frequency of major disagreements between radiologists when reading emergency department plain films was

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