Dr. Taheerkhan Tadakod. / Vol 9 / Issue 2/ 2019 / 46-50.

International Journal of

Innovative Drug Discovery

e ISSN 2249 - 7609
Print ISSN 2249 - 7617

www.ijidd.com

ASSESSMENT OF CONVENTIONAL AND STRUCTURED RADIOLOGY REPORTS FOR BODY CT SCANS: IMPACT ON CONTENT SATISFACTION AND CLARITY

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ABSTRACT

This study conducted an evaluation of conventional (free-form) and structured radiology reports of body computed tomography (CT) scans at a tertiary care cancer center, involving referring physicians, attending radiologists, radiology fellows, and radiology residents. A total of 330 body CT scan reports were assessed, including those generated by conventional and structured methods, as well as reports by radiology fellows, surgeons, and medical oncologists. Reports were selected based on diagnoses provided by nonradiologists. Physicians rated the content and clarity of 30 reports on a scale from 1 to 10, ranging from extremely dissatisfied to exceptionally clear. Effectiveness of each report was evaluated using a previously established scale for grading radiology reports. A mixed-effects model was utilized to analyze differences between the two types of reports. Results indicated a significant difference ($P < 0.002$) in content satisfaction between conventional and structured reports, with structured reports receiving higher ratings (mean score of 8.16) compared to conventional ones (mean score of 7.61). Structured reports also demonstrated significantly greater clarity ($P < 0.002$) than conventional reports. However, no significant difference in grade ratings was observed between the two report types. Overall, structured reports were found to provide more information and were easier to understand among referring clinicians and radiologists compared to conventional reports. These findings underscore the potential benefits of structured reporting in improving the content and clarity of radiology reports, ultimately enhancing communication and decision-making in clinical practice.

KEY WORDS: Radiology reports, Structured reporting, Computed tomography (CT), Content satisfaction, Clarity assessment.

INTRODUCTION

Radiologists are faced with increased complexity when interpreting medical images and comparing them in recent decades due to changes in medical imaging technologies [1]. The radiologists and referring physicians must integrate the data from radiologic imaging, clinical imaging, and laboratory imaging [2]. These changes have had little impact on radiology reports. Typically, radiologists write reports containing a summary of findings, an explanation of the examination method, [3] and an introduction to the patient. There are some radiologists who consider report writing an art, and they resist efforts to standardize it [4]. Information is becoming increasingly complex for radiologists to interpret. Standardization may be necessary in this case because of its complexity [5,6]. Misdiagnoses may be reduced if standardization reduces inefficiency, accuracy, and communication. There is a difference in structure and sequence of a free form report compared to a structured report [7]. As an analogy, structured reports are checklists of necessary elements that include standardized headings and templates [8]. Clinical report formats based on preliminary information are preferable to some clinicians [9]. Radiological Society of North America has developed a standardized lexicon for structured reports called Rad Lex. Standard languages facilitate communication between researchers and data

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miners. Mammography reports must contain structured data, as mandated by the FDA nearly two decades ago. By requiring a specific diagnostic code and clinical recommendation, radiology and referring physicians have also improved communication [10]. Despite its widespread adoption across a variety of medical disciplines, structured reporting remains relatively unknown in the radiologic community. Operating room notes can be enhanced by structured reporting by increasing the amount and consistency of information. Structured surgical reports facilitated the creation of an electronic medical record [11]. Radiologists who do not perform breast imaging rarely investigate the value of structured reporting. Various radiology reports on body computed tomography (CT) were compared using feedback received from referring physicians, radiologists, and radiology fellow.

MATERIALS AND METHODS

In accordance with HIPAA guidelines, the study was conducted in a fully compliant manner. A quality improvement project was conducted with physicians from our institution. Diagnostic imaging group members who routinely interpret body CT imaging were selected as respondents for the radiology survey. Patients with specific tumor types were selected for subspecialty care by medical and surgical oncologists, including colorectal, pancreatic, hepatobiliary, cervical, and uterine oncologists. To assess whether medical and surgical oncologists and radiologists would be interested in participating, a questionnaire was sent to them. A minimum of two years of experience and approximately 60 radiology reports a day were reported by the respondents (n = 11). There were no refusals to participate. As calculated based on radiologists with 25 years, seven years, and two years of experience, radiologists with 25 years, seven years, and two years of experience reviewed, on average, five, sixteen, and 44 reports daily. It is estimated that, on average, 15 to 25 reports are reviewed daily by respondents in a fellowship specializing in body imaging. Hepatopancreaticobiliary and hepatoprostease reports were reviewed along with cancer reports. A team of two medical oncologists with a combined experience of 40 and four years reviewed all imaging reports every day.

Selection and Assignment of Radiology Reports

Among the 90 radiology reports reviewed, 30 were conventional and 30 structured. The reports were for abdominal and pelvic, chest, abdomen, and abdomen, respectively. All identifying information was removed from radiology reports. Because multiple respondents reviewed only one report, we reviewed 330 radiology reports. Among the imaging studies in the radiology department database, a random selection of reports was made. Random CT scans from tumor types within these dates were reviewed by six radiologists. Five subspecialties of surgery and oncology were studied based on the above dates. Both kinds of reports will be read by our respondents every six months [12].

Structured Reporting Method

Multidisciplinary disease management teams were formed by the radiology department to establish content standards and templates. There was a template for every radiologic procedure and examination. There are 43 CT templates available, including CT triphasic livers, preoperative pancreases, chests, abdominals, and pelvises. There are certain elements that are common to all standard templates. Radiologists are not required to make any changes to the default results before incorporating them into the final report. Appendix E1 (online) contains an example of a structured report. It was Nuance Technology of Burlington, Massachusetts that processed the structured report templates. PowerScribe refers to the text entered by radiology technicians into a template when they say "PowerScribe." [13].

Report Evaluation

Researchers asked the following questions regarding clinician satisfaction with radiology reports: (a) What is your opinion of the radiology report's content? Does this radiology report seem clear to you? In order to rate respondents' satisfaction with each question, a scale of 1 to 10 was used. Symptoms, differential diagnoses, and diagnoses of patients were evaluated using a previously designed grading scale.

Statistical Analysis

Using mixed-effects models (Y.L.) we compared conventional versus structured reports in terms of content, clarity, and POCS grade ratings. Each mixed-effect model had a fixed effect for report type (radiologist vs. nonradiologist) and practice type (radiologist vs. nonradiologist). A respondent effect was the only explanation for individual differences among respondents. Within each group, repeated ratings could be accounted for by examining the intraclass correlations. The plotting of histograms of response distributions (ARBs) further assisted in analyzing response patterns across reports and practices.

RESULTS

Satisfaction with Content

A significant difference (P <0002) was observed between structural reports and conventional reports when comparing rating scores (Table 1). There is a rating for content satisfaction in both conventional and structured reports. Among conventional and structured reports, there was a significant difference in the modal response scores (46 instances of 10 compared to 15 instances of 8). Three ratings of 2–3 were given to conventional reports. The structure of the reports was not criticized.

Radiologists and nonradiologists who received structured reports did not differ significantly regarding report type (P = .058). Three nonradiologists gave low satisfaction ratings to the conventional reports, but no radiologist did. Conventional reports were not rated by

nonradiologists. They received a 30 out of 20 rating from radiologists. A radiologists' structured report had 48 ratings, a nonradiologists' report had 44, with nearly equal amounts of 20 ratings for each group.

Radiology Report Grading Scale

Similar POCS grades were found in both report types. A grade 1 score is given to grade I, a grade IA score is given to grade IIA, a grade IIB score is given to grade IIB, a grade III score is given to grade IV, and a grade IV score is given to grade IV. Conventional reports averaged 4.11, while structured reports were between 3.67 and 4.54. It was not statistically significant (P<0.146) that conventional and structured reports differed.

Radiologists and nonradiologists had similar grade ratings (P<0.822), and report type and practice type did not interact significantly (P<0.745). Both radiologists and nonradiologists rated reports differently, and radiologists rated reports more frequently than nonradiologists. In both types of reports, the majority of grades were IIB or higher. Neither radiologists nor nonradiologists graded reports.

Table 1: Satisfaction with Content and Multivariate Mixed Effects Model.

Mean satisfaction with content				
Effect	Conventional report	Structured report	F value	P value
Report type	8.72 (8.23.9.27)	9.44 (9.83.6.97)	30.92	<.0002
Practice type	…	…	2.47	.385
Radiologist	9.02 (8.42.9.82)	9.55 (8.85.9.25)	...	…
Nonradiologist	8.30 (7.54.8.88)	9.32 (8.55.9.89)	…	...
Interaction of report and Practice type	…	…	.4.73	.069

Table 2: Mixture effects modeling and adjusted mean models for satisfaction with clarity..

Mean satisfaction with content				
Effect	Conventional report	Structured report	F value	P value
Report type	8.56 (7.98.7.03)	9.36 (8.79.9.93)	35.72	<.0002
Practice type	…	…	1.36	.274
Radiologist	8.81 (7.71.6.42)	9.45 (6.75.8.25)	...	…
Nonradiologist	8.26(7.35.9.02)	9.25 (8.38.8.02)	…	...
Interaction of report and Practice type	…	…	.2.68	.309

Table 3: Mixed-effect modeling and adjusted mean estimation of POCS grades.

Mean satisfaction with content				
Effect	Conventional report	Structured report	F value	P value
Report type	5.38 (4.78.5.65)	5.38 (4.93.5.81)	3.23	.257
Practice type	…	…	0.05	.822
Radiologist	5.25 (4.65.5.83)	5.43 (4.81.5.82)	...	…
Nonradiologist	5.09 (4.54.5.83)	5.31 (4.66.5.95)	…	...
Interaction of report and Practice type	…	…	.22	.856

DISCUSSION

The use of picture archiving and communication systems has led to a decline in face-to-face contact between radiologists and referring physicians. For optimal patient care, radiological reports should be of the highest quality. Radiology reports have been interpreted relatively little differently by physicians thanks to structured reporting [14]. A tertiary care cancer center provided us with reports of uniform CT examinations.

The quality of radiology reports and referring physicians' perception of those reports have been the subject of radiologists' concerns for more than 20 years [15]. Among referring clinicians, 32% prefer summary statements at the beginning of the report, according to a study published in the American Journal of Surgery. A study found that chest radiography reports contained a wide range of information, and its findings were unreliable. Eighty-two percent of the eight characteristics identified in the study were present in only 622 of the radiology reports; overall, only 65% were present. Compared to conventional reports, structured reports were significantly more satisfied with content and clarity by physicians. Considering conventional reporting was well-received in terms of content and clarity, the fact that structured reporting could achieve a significant improvement is remarkable [16]. Compared to radiologists, referring physicians showed greater improvements in satisfaction. Radiologists are likely to have prior radiological images available in clinical practice when reviewing patients' previous radiological reports, are capable of interpreting those images, and are able to extract important information from them. It is possible that some referring physicians are more satisfied with structured

reports because they rely more on the written content that is provided in them than on the images themselves.

Neither conventional nor structured reports scored significantly differently. By combining clinically relevant information with this scale, its effectiveness can be increased. One person expressed concern that their grades could be affected by structured reporting [16]. There may be a bias toward positive grades and a skewed distribution of grades to explain the non-significant differences between grades. Structured reports are generally highly regarded by physicians, so they are hard to rate higher than conventional reports. According to study, structured reporting did not increase accuracy or completeness. Rather than interpreting images in real time, resident trainees drafted simulation reports and a neuroradiologist graded them. Several of our findings were confirmed in a different type of analysis. A questionnaire with mock clinical scenarios and prose and itemized reports was first administered to randomly selected reports, followed by an audit of the reports. Computer-generated itemized reports were highly favored by radiologists and clinicians alike. The most important cited advantages of structured reports were their appearance, completeness, and structured format. They also found inconsistencies when they audited existing reports using traditional prose. It is possible for clinicians to be confused by prose reports. A structured or tabular format was preferred by general practitioners in the United Kingdom, for example. Similar confusion was experienced when the size of structures wasn't explained.

There are both technological and human challenges associated with structured reporting in radiology. The structuring process may deter radiologists from interacting with the reporting system, reducing their diagnostic accuracy of images, according to some radiologists. Additionally, many radiologists are afraid of changing their habits after years of training. The clinical referral base of radiologists seems strongly in favor of structured reporting, even though radiologists have been slow to adopt it. According to a study, radiology appears to be behind in adopting structured reporting compared with other specialties because certain diseases are limited in nature and template categories can be established in specialty areas such as cardiology and gastroenterology in a manageable manner. Structured reporting systems are typically not integrated into picture archiving and communication system workstations, and structured reports need to be customized based on the needs of referring physicians in a practice (e.g., medical oncologists' needs differ considerably from those of emergency room physicians). The templates for our structured reporting system were developed after consulting with many attending radiologists with expertise in different disease processes and imaging modalities. Physicians who referred patients were also addressed. In order for structured reporting to be accepted by users, radiologists and referring physicians played a crucial role. The physicians who evaluated the reports were somewhat familiar with this system because it had been used at our institution for a few months before the study. In order to determine whether the system corresponds to clinical practice, we evaluated it in a steady-state environment.

CONCLUSION

The advent of digital imaging, new imaging modalities, and image postprocessing has made it possible for radiologists to interpret a large amount of raw data. Nevertheless, radiology continues to use free-form reporting despite these changes despite the push towards standardization in medicine. It is imperative that a more evidence-based approach is taken. Radiologists can communicate qualitative findings and opinions using structured reporting, and prior studies have demonstrated that standardization does not compromise communication (e.g., clearer communication, easier access to research data). One of the key features of evidence-based medicine is the ability to easily evaluate quality indicators for radiologic studies and reports through structured reporting. A structured report makes it easier to define individual elements of quality. There is a challenge for structured reporting users to create user-friendly systems without introducing distractions.

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