The Pros and Cons of Structured Reports

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Abstract

Purpose of Review Structured radiology reporting has emerged as a necessary tool to achieve value-based medicine and to improve teaching of radiology residents. The pros and cons of structured reporting are compared to shed more light on its uses and aid in its further utilization.

Recent Finding Structured reporting is a promising tool that when used in conjunction with artificial intelligence will help boost research, and facilitate extraction of data and integration of decision support tools.

Summary This article will provide a review of the pros and cons of structured reporting.

Keywords Structured reports · Pros · Cons · Radiology reports · Standardized reports

Introduction

In the decade after Roentgen discovered X-rays in 1895 and as the technique expanded all over the world, the need for radiology reporting emerged. One of the first pioneers of standardized reporting and documentation was Preston Hickey, the early editor of the American Journal of Roentgenology. Hickey noted the importance of a

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standardized approach to reporting in radiology as early as 1899 [1]. Charles Enfield was another pioneering radiologist who, in the 1920s, criticized radiologists who describe the radiographic findings without drawing conclusions and giving their clinical impression [1].

Despite these early efforts, radiology reports still vary significantly between institutions and even amongst radiologists themselves. In 2006 Michael Porter introduced the concept of moving from volume-based medicine to value-based medicine which dictated the necessity of adding value to patient care in radiology. Only then did structured reporting emerge as an important tool to achieve this goal. In the following years, the American College of Radiology, European Society of Radiology, and Association of University Radiologists all started to voice concerns about the variability of radiology reports and convened to summarize the current and future state of structured reporting [2••, 3••].

It is suggested that up to 80% of malpractice suits in radiology are related to lack of communication. In this era of digitalized radiology, reports are considered a true medico-legal document providing an essential and, in many cases, the sole tool of communication between radiologists and clinicians [1].

The benefits of structured reporting include making data easily retrievable for both clinicians and research purposes, improving quality of care on the basis of standardized language used among all patients and clinicians, and reducing the misses of incidental findings on studies done for other purposes by having checklists. It is also suggested that structured reporting reduces typographical errors and improves reimbursement by ensuring completeness. On the other hand, the disadvantages of structured reporting include interference with workflow in busy practices and distraction from the interpretation process. It is also

difficult to apply in complex cases, may be faced with resistance by radiologists and may increase error if normal auto-populated templates are not corrected accordingly [2••, 3••, 4, 5]. A summary of pros and cons is provided in Table 1.

Recent studies suggest that structured reporting is essential for artificial intelligence and machine learning which require large sets of data. Unfortunately, the huge variability in current radiology reporting limits prompt advancement of this research [6•].

It is also suggested that radiology residents, who are the future of radiology, significantly benefit from structured reporting. This is evident in their improved reporting skills and in having an objective assessment tool to gauge the progress of their reporting performance [7•].

Discussion

Weiss et al. defines structured reporting in three levels. The first level includes basic headings. Most radiology departments use this level as most radiology reports include sections for clinical history, radiology protocol, findings, and impression. The second level refers to a consistent order in describing the findings, i.e., a CT abdomen report should include subheadings for each organ or organ system in a consistent order. The third level includes using a uniform lexicon to describe findings which allows the radiology reports data to be organized, standardized and easy to extract and use for research and teaching purposes [2••].

One of the most important initiatives in standardizing radiology reports is collaboration between RSNA (Radiological Society of North America) and ESR (European Society of Radiology) to create the radiology template library which is available on the website www.radreport. org. This website was established in 2008 and contains templates for a variety of radiology exams developed by subspecialty societies and contain RADLEX terms (a project launched by RSNA to provide a unified radiology lexicon). These provide certain codes and wording that allow a connection between different languages [2••].

The implementation stage will be challenging. A structured report for a certain disease entity should be approved by all radiologists and referring physicians involved in the management of this disease. Implementation of standardized reporting with a pilot group of radiologists or trainees, which would allow for serial process feedback, has been suggested prior to general use. However, wide-scale use of structured reporting still faces multiple challenges such as acceptance by radiologists and finding a proper supportive technique that connects structured reports with PACS [2••].

Pros

1. Enhances teaching experience: Even though residents are evaluated for the clarity and accuracy in their reports throughout their training, there is no formal structured curriculum that teaches residents the art of reporting. Most residents learn by observing faculty, fellows, or simply reading prior reports. Structured report offers a method to standardize this process and facilitate more accurate reporting skills evaluations [8].

2. Ensures completeness of reports and reduces misses: "Satisfaction of search" is a very well-known concept in Radiology which happens when the radiologist is satisfied with one important finding that might answer the clinical question and stops searching for additional findings. Structured reports offer solution for this by inherently providing checklists and ensuring all organs/details are mentioned. The following are two examples illustrating this point:
    Quattrocchi et al. reported 28.5% increase in important extra spinal findings upon analysis of 3000 lumbar spine magnetic resonance imaging when using structured reports compared to unstructured reports [9].
    Another successful example of implementing structured reporting is the American college of radiology lung CT screening reporting and data system which showed increased positive predictive value of 17.3 compared to 6.9 in diagnosing lung cancer upon analysis of 1603 patients [10].

Table 1 Summary of pros and cons of structured reporting

Pros	Cons
Enhances teaching experience for residents	Resistance by radiologists
Ensures completeness of reports and reduces misses	Interruption of search pattern resulting in missed findings
Provides the link between radiology and clinical practice	Potential increase in errors due to failure to adjust prepopulated phrases
Reduces "typos"	May be limited in complex cases
Facilitates research and clinical data extraction	Reduces productivity

3. Provides a link between radiology and clinical practice to aid in implementation of a value-based model: In a pancreatic cancer study, structured reports have been advocated by clinicians who indicated increased utility in staging and guiding clinical management compared to unstructured reports [11].

4. Reduces "typos": Unstructured reports contain multiple grammatical and spelling mistakes due to speech recognition software errors. Structured reporting helps in alleviating this problem by populating proofed templates and checklists [12].

5. Facilitates research and clinical data extraction: Data could be mined and retrieved with very little effort using structured reporting and artificial intelligence. In addition, clinicians can easily retrieve information related to a patient's diagnosis and make clinical decisions accordingly with less effort [13].

Cons

1. Resistance by radiologists: Many radiologists believe in their dictation style and consider it their own art in practicing their careers. Some also consider structured reports a threat to subspecialty expertise by reducing the information that could be included in the reports [14].

2. Interruption of search pattern resulting in missed findings: Radiologists may voice concerns about interruption of their search pattern by focusing on the report template, a phenomenon known as "eye dwell" which will potentially result in missing of important findings because the attention of the radiologist is drawn to filling the template rather than focusing on the image [15].

3. Potential increase in errors: This may occur when auto-populated phrases are not adjusted on a case by case basis. A very common example is stating that the gallbladder is normal when it is actually surgically absent [16].

4. May be limited in complex cases: For structured reports to be inclusive, multiple dropdown menus and checklists should be added to ensure completeness of the report and adequate description of findings. Along the same line, it might be difficult to describe disease processes that involve more than one system, the interruption in the flow of description caused by headings for each organ separately may alter the comprehension of the reader and makes it difficult to put all the pieces together in one final diagnosis [15].

5. Reduced productivity: Application of structured reporting may not be feasible in busy practices as it

mandates longer detailed reports and extra commands and mouse clicks [5].

Future Including Relation to Artificial Intelligence

Structured reporting can boost research by using artificial intelligence tools to extract and retrieve relevant data. An example is the Annotation and Image markup (AIM) project of the National Institute of Health Cancer Biomedical Informatics Grid which allows the machine to store and read the information with no human effort. Applying structured reporting on the AIM allowed for numerical data to be easily extracted by both researchers and physicians for clinical use [13].

Structured reports can also use artificial intelligence to integrate decision support tools within the report. For example, when a radiologist describes a particular lesion, the report software can mandate that the radiologist describes certain parameters such as enhancement, size, and shape; so the software could then form a determination of lesion behavior. This could also be taken further and integrated into continuously updated evidence-based decision support tools to further guide recommendations for follow-up imaging or clinical management [17].

An additional benefit would be integration of report software with multimedia hyperlinks that can link to attached annotated images from the study itself or to web-based sources to further clarify the reported finding. These hyperlinks may also explain the finding in easier non-medical terminology to make it more understandable to the patient [18, 19].

Finally, many types of software that provide numerical coding for certain findings are available commercially. Coding the report with certain numbers will trigger certain messages in the electronic medical record or the hospital system to notify the clinician of critical results [20].

Conclusion

Structured reports are an emerging, promising tool in the practice of radiology as the field evolves with artificial intelligence and shifts from volume-based to value-based practice. The benefits of structured reporting include easy retrieval of necessary data to enhance research or relay information to physicians and patients, reduction in misses of incidental findings on studies done for other purposes by having checklists, improved completeness which potentially enhances reimbursement, and enhancement of resident education by standardizing their methods of reporting and the way it is evaluated. Conversely, the disadvantages

of structured reporting include opposition by radiologists due to decreased efficiency in busy practices, distraction from the interpretation process by focusing on the report template, challenges in its application to complex cases, and potential increase in errors by failure to adjust pre-populated phrases.

Implementation of structured reporting still requires multidisciplinary efforts with continuous feedback among radiologists, clinicians, and even technology teams to ensure a proper smooth transition for all parties involved in this process.

Compliance with Ethical Guidelines

Conflict of interest Reham Haroun, Maysoon Al-Hihi, and Hani Abujudeh declare no potential conflicts of interest.

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- Of importance and
- •• Of major importance

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