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Structured Head and Neck CT Angiography Reporting Reduces Resident Revision Rates

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Purpose: This resident-driven quality improvement project was undertaken to assess the effectiveness of structured reporting to reduce revision rates for afterhours reports dictated by residents.

Methods: The first part of the study assessed baseline revision rates for head and neck CT angiography (CTA) examinations dictated by residents during afterhours call. A structured report was subsequently created based on templates on the RSNA informatics reporting website and critical findings that should be assessed for on all CTA examinations. The template was made available to residents through the speech recognition software for all head and neck CTA examinations for a duration of 2 months. Report revision rates were then compared with and without use of the structured template.

Results: The structured template was found to reduce revision rates by approximately 50% with 10/41 unstructured reports revised and 2/17 structured reports revised.

Conclusions: We believe that structured reporting can help reduce reporting errors, particularly in term of typographical errors, train residents to evaluate complex examinations in a systematic fashion, and assist them in recalling critical findings on these examinations.

Description of the Problem

The radiologist's product is the report he or she creates to convey the findings present in a diagnostic imaging or procedural examination.[1] For a large portion of radiology's history the appearance and organization of these reports has been as variable as the individual patients they describe.[2] Today, an increasing portion of radiology reports are created using templates. A large body of literature has been produced describing structured reporting and the process of implementing these reports in practice.[3-7] Previous research has shown structured reports to be more effective in answering clinical questions and guiding patient care as compared to unstructured reports.[8] Despite this, there remains some reluctance to embrace this style of reporting. At our institution, a large portion of examinations remain dictated in an unstructured fashion by both residents and staff.

Our residency program provided the opportunity to choose a quality improvement project during the third year of training and encouraged these projects to focus on the 6 improvement aims of the Institute of Medicine including safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity.[9] The projects use multiple iterations of the Plan-Do-Study-Act (PDSA) cycle to identify an area requiring improvement, implement a change, and then assess the results of that intervention. Often, these quality improvement projects focus on reducing diagnostic, treatment, and preventative type errors. These errors arise in various ways in radiology including delays in diagnosis, inadequate follow-up, and failure of communication as a few examples. This particular project focused on reducing errors in resident reports through creation of a standardized reporting template.

At our institution, senior residents working overnight provide final reads for all diagnostic imaging. These reports are then reviewed the following morning by staff with attention to corrections that would alter patient care. We identified CT angiography (CTA) head and neck examinations as potentially benefiting from a standardized report as they are particularly complex examinations with numerous emergent findings that may be present. In addition, the somewhat infrequent performance may contribute to overall resident inexperience with the examination, possible reporting errors, and subsequent report revisions by staff.

Institutional Approach Employed to Address the Problem

In order to improve accuracy and reduce revision rates on resident dictated head and neck CTA examinations, a quality improvement project was created to implement a structured reporting template for these examinations. This was accomplished by reviewing templates on the RSNA informatics reporting website[10] and through consultation with neuroradiology staff (Fig). The template was structured based on critical findings that should be assessed on all emergent head and neck CTA examinations. Examples of these findings included vessel occlusion, dissection,

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EXAM: CTA head and neck

COMPARISON: []

IMPRESSION:
1. [positive/negative] for significant intracranial/neck vascular abnormality.
2. []

FINDINGS:
VASCULAR:
HEAD:
Occlusion/stenosis: [positive/negative].
Aneurysm: [positive/negative].
Vertebrobasilar system: [comment on dominance].
Normal vascular anatomic variants: []

[Head discussion]

NECK:
Dissection: [positive/negative].
Occlusion: [positive/negative].
Stenosis: [positive/negative] for significant stenosis.
Vascular calcification: [comment on carotid bulb and proximal ICA].

[Neck discussion]

NONVASCULAR:
[]

FIG. Structured report template for head and neck CTA examinations. The template allows for free text as necessary and helps guide evaluation of the examination.

stenosis, or aneurysms. The report was organized around the presence or absence of these findings, which were reported in a positive or negative fashion with subsequent elaboration using free-text as necessary. The template was made available to residents through the speech recognition software for all neuroradiology CTA examinations during a 2-month period. An e-mail was sent out to the residency program notifying them of the availability of the template and encouraging its use, however, on call residents retained the option of using the structured template or not when dictating afterhours CTA examinations. In order for the template to populate, it was necessary for the residents to select it from a list of relevant templates associated with the examination identifier. Reports were subsequently reviewed and assessed for revisions. Baseline revision rates with unstructured reporting were collected during a 2-month period before the quality improvement project. This was accomplished through a retrospective review of reports gathered from head and neck CTA-specific examination identifiers in the radiology information management system. A revision was defined as any change to the original report by the staff radiologist. Revision types were further subdivided into (1) material revisions: those that could potentially alter patient care, and (2) immaterial revisions: those that did not, ie, typographical errors such as a misspelling, missense, or punctuation error. Following completion of the testing period the residency class was sent a short survey about structured reporting.

Description of the Outcomes of the Institutional Practice or Change in Practice

During the 2-month period before the quality improvement project there were 54 afterhours head and neck CTAs finalized by residents using unstructured reporting (Table). The baseline revision rate during this time was 11/54 (20%). During the quality improvement project, while the structured template was available, there were 58 head and neck CTAs performed afterhours and finalized by residents. Of these examinations, 17 were finalized using the structured reporting template and 41 were finalized without the template. The revision rate with the template was 2/17 (12%) and the revision rate without the template was 10/41 (24%).

Table
Tabulated revisions for structured and unstructured head and neck CTA reporting

	Total reports	Material revision	Immaterial revision	Overall revision rate
Baseline period				
Unstructured reports	54	6	5	11/54 (20%)
Study period	58			
Unstructured reports	41	1	9	10/41 (24%)
Structured reports	17	0	2	2/17 (12%)

Following the testing period with the structured template, 25/29 (86%) surveyed residents stated they believed structured reporting could reduce revision rates and improve accuracy. The same number of residents thought structured reports were easier for clinicians to navigate and read. Of the surveyed residents, 14/30 (47%) residents were aware that a structured template had been made available for head and neck CTA examinations. Finally, all of the residents (6/6) working afterhours shifts during the study period reported using the template to dictate head and neck CTA examinations.

Discussion of Future Directions

In 1999 the Institute of Medicine published its landmark report "To Err is Human: Building a Safer Health System."[11] The report discussed quality and safety in the American health care system with a focus on the large impact of medical errors and ways to reduce them. Over the following decades quality and safety became a central focus of American medicine. One particular strategy advocated in the Institute of Medicine report to improve quality and safety emphasized action though professional societies with regard to licensing and certification. In response, the American Board of Radiology implemented a requirement that all diplomates participate in practice quality improvement during maintenance of certification. This was also applied to residents in training with the goal of introducing the concepts and practice of quality improvement. This resident quality improvement project created a structured reporting template for head and neck CTA examinations that was organized around critical findings potentially present on these examinations. The report was made available to residents dictating afterhours examinations independent of staff during a 2-month period. Structured examinations were then compared to those dictated in an unstructured fashion. Using a structured reporting template resulted in approximately 50% fewer revisions when the resident examinations were over read by staff neuroradiologists the following morning. The structured template reduced resident revision rates both in terms of immaterial revisions and those revisions that could potentially alter patient care. During the time period the template was available, the material revision rates were lower with only 1 material revision occurring with unstructured reporting. There was a large reduction in immaterial revisions noted with use of the structured report, which we attributed to a decrease in formatting and punctuation changes related to use of a standardized template for normal examinations.

Although only a small number of residents reported using the template, this was reflective of the small percentage of residents working afterhours. A report published by Larson et al[4] described the large scale implementation of structured templates throughout the department of radiology at Cincinnati Children's Hospital and

ways in which these changes were maintained. Factors critical to long term successful implementation included broad consensus, fiscal incentives for using templates, and direct intervention with those not using or deviating from the normal templates. In essence, successful long term adoption of large scale change such as implementation of department wide structured reporting requires both individual and institutional investment. We believe the results of our quality improvement project will help generate individual buy-in and increase use of the template in the future.

One limitation of our study was the need to manually select the template from a relevant list of templates. This was required as we did not want the template to auto-populate for daytime examinations since this was out of the scope of the project. Unfortunately, this resulted in low use during the first PDSA cycle. To improve use, additional emails were sent to the residency program notifying them of the template and direct communication was undertaken with the overnight residents encouraging its use. Following these interventions, use of the template rose. The majority of residents surveyed at the end of the study that had participated in afterhours call and had used the template had a positive view of structured reporting. During the initial PDSA cycle we did not have time for an outcomes survey of the ordering providers, which in the case of afterhours CTA examinations included emergency department physicians, neurologists, and neurosurgeons. Prior literature has, however, suggested a positive reaction from ordering providers. For example, a study by Naik et al[12] demonstrated itemized reports were more popular with both radiologists and referring clinicians.

As education is one of the driving missions of our institution, we believe structured reporting can benefit residents in terms of reinforcing concepts taught in the reading room. Residents continually find themselves rotating among vastly different areas of radiology throughout their training. Templates can be useful educational tools in allowing residents to develop search patterns and also to remind them of critical pathologies specific to certain examinations. It is important, however, that structured reporting strikes the right balance between being helpful and not overly burdensome. We stressed the use of our succinct template particularly in the case of negative examinations. When examinations were positive, we emphasized using the report to organize the findings on these complex studies so that scattered, stream of consciousness reports were avoided. Fundamentally, our aim with the structured report was to allow the residents to focus more time on the examination images, offer them a check list of critical pathologies to assess for, and to help them organize their final report.

In summary, creation of a structured template for reporting CTA head and neck examinations resulted in a reduction in reporting errors, particularly in terms of immaterial revisions for typographical errors. Based on these results and positive feedback received regarding the structured report, we plan to identify additional complex cross-sectional examinations that may benefit for structured templates at our institution.

References

1. Sistrom CL, Langlotz CP. A framework for improving radiology reporting. J Am Coll Radiol 2005;2:159–67.
2. Boland GW. From herding cats toward best practices: Standardizing the radiologic work process. AJR Am J Roentgenol 2009;193:1593–5.
3. Hawkins CM, Hall S, Hardin J, et al. Prepopulated radiology report templates: A prospective analysis of error rate and turnaround time. J Digit Imaging 2012;25:504–11.
4. Larson DB, Towbin AJ, Pryor RM, et al. Improving consistency in radiology reporting through the use of department-wide standardized structured reporting. Radiology 2013;267:240–50.
5. Reiner BI, Knight N, Siegel EL. Radiology reporting, past, present, and future: The radiologist's perspective. J Am Coll Radiol 2007;4:313–9.
6. Schwartz LH, Panicek DM, Berk AR, et al. Improving communication of diagnostic radiology findings through structured reporting. Radiology 2011;260:174–81.
7. Sistrom CL, Honeyman-Buck J. Free text versus structured format: Information transfer efficiency of radiology reports. AJR Am J Roentgenol 2005;185:804–12.
8. Marcovici PA, Taylor GA. Journal Club: Structured radiology reports are more complete and more effective than unstructured reports. AJR Am J Roentgenol 2014;203:1265–71.
9. Institute of Medicine (U.S.) Committee on Quality of Health Care in America. Crossing the quality chasm: A new health system for the 21st century. Washington, D.C. National Academy Press; 2001.
10. Radiographic Society of North America. RSNA Informatics Reporting. 2009.
11. Kohn LT, Corrigan J, Donaldson MS. To err is human: building a safer health system. Washington, D.C. National Academy Press; 2000.
12. Naik SS, Hanbidge A, Wilson SR. Radiology reports: Examining radiologist and clinician preferences regarding style and content. AJR Am J Roentgenol 2001;176:591–8.