Canadian Association of Radiologists

Position Statement on Structured Reporting

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Introduction and purpose

The Canadian Association of Radiologists (CAR) established the Structured Reporting Working Group to inform a national position statement on structured reporting, including its use and implementation in radiology departments, and to facilitate the wider adoption of structured reporting for diagnostic imaging in Canada. The working group was comprised of academic and community radiologists from across the country, representing a variety of sub-specialties and practice environments.

The following document provides background on the development of structured reporting in radiology, defines relevant terms (**Appendix 1**), details the advantages of structured reporting, and provides recommendations for departments and clinics adopting or expanding structured reporting in their centres. Where possible, this primer cites the relevant evidence; otherwise, it represents the consensus expertise of the working group.

Imaging societies around the world support the development of dedicated lexicons and the adoption of reporting templates.[1–4] Standardized terminology and structured reporting enhance clarity and improve communication of radiological findings.[5] Structured reporting can reduce the incidence of errors in reporting and communication, and improve the uptake of clinical practice guidelines.[6] Use of structured templates and common data elements also makes it easier for referring health professionals, billing and coding specialists, medicolegal representatives, and researchers to extract and compare information from reports.[7] The use of computerized voice transcription software offers tools that facilitate template versatility, uniform formatting, clinical decision support for imaging reporting systems, training modules for learners, and information transfer from the radiology information system (RIS).

Key Point: The Canadian Association of Radiologists supports the development and implementation of policies and reporting tools that increase the use of structured reporting for medical imaging.

The Evolution of structured reporting

Paper-based reporting

Structured reporting in radiology has evolved due to several factors, including advances in technology, recognition of the importance of standardization, regulatory requirements, and the need for improved communication. In the early days of radiology, reports were handwritten or dictated and transcribed onto paper. These reports varied in format and content, leading to inconsistencies. They often lacked standardized sections and templates, but communication between radiologists and clinical colleagues about a particular case ensured that even in the absence of uniform reports, all the information and impressions necessary to inform patient management could be conveyed between providers.

Digitization and standardized templates

With the advent of digital imaging and electronic health records (EHRs), radiologists transitioned from paper-based to digital reporting. Dictation systems emerged, enabling radiologists to dictate their reports, which were then transcribed and stored digitally. Although digital, these reports still lacked structured templates and standardized formats. Simultaneously, the increased demand for imaging and technology-driven streamlining of the radiology workflow and changes to the radiologist's role within the patient care team, led to the unexpected consequence of eroding consultative communication with clinical colleagues. Recognizing the need for improved consistency and completeness in radiology reports, various organizations and societies began developing standardized reporting templates. These templates provided predefined sections, checkboxes, and structured data elements to guide radiologists in reporting essential information. The templates aimed to ensure that critical findings, measurements, and clinical details were consistently documented.

Integration with reporting systems

As radiology reporting systems and PACS (Picture Archiving and Communication Systems) have become more advanced, integration with structured reporting templates has become possible within many systems. Radiologists could select the appropriate template for a specific study and populate the sections with relevant data, leveraging the advantages of digital reporting and structured data capture. Radiology societies have played a crucial role in advancing structured reporting to promote consistency, improve communication, and facilitate data analysis.[1–4]

Providing value for patient care

Across Canada, there remains considerable variability among free-text imaging reports (FTR) depending on personal and institutional preferences, as well as available tools. Research and practice have demonstrated that structured report templates provide clear, concise, consistent, and actionable reports that can assist in triaging the patient to appropriate treatment, improving quality of care.[8–12] Though some radiologists fear commodification due to the loss of individuality and freedom of expression in FTR,[13,14] clinicians are increasingly aware of the value and importance of imaging data to their work and the challenges associated with interpreting the unstructured presentation of data, including wasted time and effort.

Emphasizing interoperability and data exchange

As health networks connect clinics and hospitals across jurisdictions, reporting standards that facilitate uniformity of health data should be adopted to improve inter-institutional communication and patient care. Systematic data collection, mining and auditing processes across the healthcare system can provide critical insight and justification for expenditures associated with medical imaging. These reports, and their contributions to patient outcomes, must be linked to objective standards and be accessible to those making decisions about healthcare spending and policy.

Advantages of structured reporting

Consistency and standardization

Structured reporting helps to establish a minimum standard for the type of information that must be included in a report to make it complete and relevant. By using structured reporting templates, radiologists can ensure that their reports follow a consistent format and includes all the necessary information. This standardization reduces

variability among radiologists, leading to better understanding among healthcare professionals. A template report also provides confidence for the referring physician and the patient, that all major areas were reviewed: this sets both a professional standard and a quality brand for the radiology department.

Dedicated "disease-specific" templates ensure that all clinically relevant information is included in the radiology report.[15,16] This approach has been adopted for rectal cancer staging, where very specific fields have been created based on the input of surgeons, oncologists and radiologists.[17–19] Similar templates can be created for other conditions or malignancies such as pancreatic cancer staging,[20,21] prostate cancer staging,[22] lung cancer staging,[23] and musculoskeletal MRI joint evaluations.[24,25] The incorporation of various -RADS (Reporting and Data Systems), lexicons and classifications into the structured reporting template can also improve the inclusion of pertinent positive and negative findings and convey more definitive conclusions than with FTR.[16]

In cases where a disease process is not limited to one structure or organ (e.g., mass invading lungs, mediastinum and esophagus, or pancreatitis with pseudoaneurysms and other complications in the surrounding area), there can be challenges to using a template report. However, there are ways to overcome these obstacles. For example, the epicentre of the mass/abnormality can be dictated for the organ of concern followed by all the pertinent details related to the involvement of adjacent structures. A focused description can be included in the other sections, or a note referring readers to the epicentre discussion for full details.

For patients with malignancy or other chronic conditions that require interval imaging, a prior report that uses the same template allows the radiologist to quickly compare the prior findings (including prior measurements of previously identified abnormalities) more efficiently. There are also software programs that can import relevant measurements from a previous template into the current report.

Communication and collaboration

Standardized templates facilitate effective communication and collaboration among healthcare professionals. Radiology reports serve as an essential source of information for referring physicians, surgeons, and other specialists involved in patient care. By using structured templates, radiologists can ensure that the reports are comprehensive, easily interpreted, and readily accessible to the entire healthcare team, promoting better patient management and coordinated care. Structured, itemized formats are preferred by clinicians,[5,15,26] who may also benefit from improved efficiency of reading and interpreting structured reports compared to FTR.

Radiology reporting systems facilitate the linking of imaging findings to clinical outcomes, and data mining for radiomics. Reliance on these systems for quality assurance and data collection is growing, with standardization contributing to improved patient management.[27,28] Structured reporting templates can be designed to support image reporting and data systems (BI-RADS, LI-RADS, etc.) that are well-accepted by clinical colleagues.

Potential reduction of errors or omissions

Structured reporting templates encourage radiologists to provide clear and concise information. The predefined sections prompt radiologists to include key details relevant to the study, such as specific imaging techniques, findings, and impressions. The checklist function of itemized templates can reduce errors arising from satisfaction of search and help trainees navigate novel imaging events while increasing diagnostic accuracy.[29] This improves the

reports' accuracy and completeness, reducing the possibility of misinterpretation and omission of critical information.

Imaging with CT/MRI and ultrasound frequently involves the evaluation of hundreds or thousands of images. If a radiologist does not regularly review a specific type of study, there is a risk of missing important structures (e.g., wrist MRI, evaluation of various compartments in the pelvis for possible endometriosis on MRI). Distinct template fields for each major organ or structure of the imaged body part serve as a clinical cue for radiologists and trainees to review each one. Interruptions (e.g., phone calls, pages, in-person consultations by technologists, clinicians and other health care team members) during the reporting of cross-sectional images are common, and incorporating a mechanism to ensure that all relevant structures have been evaluated is important.

Efficiency and time savings

Templates can be set up to provide pre-defined sections and prompts that guide radiologists through the reporting process. This streamlines the workflow, reducing the time required to complete a report. Radiologists can quickly select options or fill in specific fields, saving valuable time and enabling them to provide reports for more patients or focus more time on complex cases. Studies have demonstrated that the use of structured reports can improve the efficiency of reporting, with no adverse effect on report quality.[30,31] These efficiency gains and high inter-rater reliability of structured reports are especially helpful when staff or residents are dictating full reports during on-call shifts or after hours and for emergency cases.

In cases of CT scans of the head, pulmonary emboli CTs, radiographs, and other imaging studies where there are potentially higher rates of normal results, a template of a "normal" exam with all regularly reported pertinent negatives can be created and used with the click of a button. These prepopulated template reports can be edited and modified for each patient if an incidental finding or abnormality is identified. These templates can improve efficiency because most of the report is already complete.

Transitioning from FTR to structured reporting may require radiologists to learn new software interfaces, understand template structures, and adapt to a different reporting workflow. Initial implementation and training efforts may be necessary to ensure a smooth adoption process and avoid resistance to change among radiologists. When radiologists "take their eyes off" an image, their workflow and concentration are interrupted, potentially leading to missed findings. However, many dictation systems have built-in phrases that radiologists can say to bring them to another field without moving the cursor (e.g., "Go To [name of organ], or "Next field"). This allows them to continue looking at the patient's imaging study until they approve the final report and ensure there are no dictation or transcription errors by the voice recognition software.

Data and Informatics

Structured reporting templates generate structured data, which can be easily aggregated, searched, and analyzed. These structured data sets enable data mining and advanced analytics, providing opportunities for quality improvement (QI) initiatives, research studies, and the development of clinical decision support systems. Radiology departments can extract valuable insights from the accumulated aggregated data to identify trends, measure performance metrics, optimize processes, and conduct QI initiatives.

Evaluating standardized data sets can improve radiologists' ability to conduct QI projects. For example, templates that include synoptic information for LI-RADS or other -RADS allow radiologists to provide feedback on their accuracy in cases where pathology correlation can be obtained. In addition, the inter- and intra-observer agreement can be calculated for various imaging findings when synoptic template reports use standard lexicon terminology, which is an important way to allow future improvements and iterations of current -RADS system and other aspects of image interpretations.

Recent developments in structured reporting involve the integration of decision support tools within reporting systems. These tools leverage structured data to provide evidence-based recommendations, guidelines, and clinical decision support at the point of reporting. Radiologists can access relevant information, reference materials, and automated calculations to support their interpretation. Decision support can be integrated into report templates in the form of hyperlinks or summaries leading to the adoption of standardized lexicons. This information can guide more confident reporting of studies that are uncommon.

With the ongoing implementation of AI-powered tools in the radiology workflow, structured reporting will facilitate data mining from imaging reports,[32] which can be used to efficiently create data sets for training AI models for various purposes and indications.[27] The advent of ChatGPT and other generative tools based on large language models is likely to have a significant impact on radiology, but human oversight and validation remain critical. Similar tools can assist radiologists in generating structured reports by providing suggestions, auto-completing text, or offering relevant information based on the provided data. Radiologists can interact with the model, input key findings and impressions, and receive assistance in completing the remaining sections of the report. These tools could also be used to generate reports in different languages, improving accessibility and facilitating communication in diverse healthcare settings, or translating certain aspects of the report into patient-centered language.

Education and Training

One of the challenges when beginning radiology residency is knowing what is relevant for the report. With the use of disease-specific synoptic reports, residents learn the pertinent aspects of a disease process that can be communicated to the referring physician and help improve the quality of the patient's care. For teaching centres, the availability of structured report templates can be a key educational resource for residents throughout their training and for developing their search pattern for a specific study type or disease process, while producing high-quality reports.[33,34] Templates help residents increase their knowledge of the disease process, improve their communication skills, and increase efficiency.[33]

Structured reporting templates ensure that radiology trainees consistently include essential information in their reports. The predefined sections and checkboxes guide them in documenting key findings, measurements, and clinical details, minimizing the risk of omissions or incomplete reports. This consistency helps trainees develop good reporting habits and ensures that important information is effectively communicated. Preceptors and attending radiologists can quickly review trainee reports based on the structured template, ensuring that all necessary information is included. Structured reports also reduce the editing time of staff radiologists who approve the reports written by residents,[35] and can be a helpful training tool for both learners and their instructors. Feedback can be provided on completeness, accuracy, and appropriate use of terminology. Trainees benefit from specific feedback that helps refine their reporting skills, their key medical core competencies for a particular disease process, and the quality of their reports.

Structured reporting templates can also serve as educational resources for radiology trainees. The templates can be structured to embed guidelines, references, or links to relevant educational materials. Trainees can refer to these resources to enhance their understanding of specific diagnoses, imaging modalities, or reporting guidelines. The templates provide a structured framework for learning and reinforce the acquisition of essential knowledge.

Critical communication tools in structured reports

In addition to findings and conclusions, the imaging report can signal and record the communication of critical results. Policies requiring timely communication of results are universal among hospitals, radiological societies, and medical liability companies. Many institutions have existing reporting tools as part of their RIS platform, but structured templates can also be designed for these purposes, and can support reporter compliance, data mining and quality audits. Templates can be updated and modified over time based on peer learning in a radiology department.[36] Structured reporting templates often include features to highlight critical findings or results, such as colour coding, flags, or standardized symbols. These visual cues draw immediate attention to the urgent nature of the findings, enabling referring physicians to quickly identify and prioritize their review of the report. Radiologists can use consistent language and predefined phrases within the structured template to convey the urgency, severity, and recommended actions for critical findings. Referring physicians can easily understand and act upon the information provided. See Appendix 2 for examples.

Pearls for successful implementation and change management

Facilitating change management to increase the use of structured reporting templates in radiology departments requires a systematic and well-planned approach. Governance is key to successful implementation and to mitigate frustration among colleagues[37,38] while emphasizing positive change management.[39]

Leadership support

Obtain support from departmental and organizational leaders to emphasize the importance of structured reporting. Leaders should communicate the benefits of structured reporting, provide resources, and set expectations for adoption. At the outset, authoritative endorsement of the move to structured reporting, repeated as needed by the leaders at the department level, is essential.

Stakeholder engagement

Involve radiologists, technologists, and other key stakeholders early in the process. Seek their input, address concerns, and involve them in decision-making, template design/selection, and workflow implementation. Engaging stakeholders fosters ownership and promotes buy-in. Identify radiologists who are early adopters and advocates of structured reporting. These change champions can serve as mentors, share success stories, and motivate their peers. Their influence and positive experiences can help drive wider acceptance and adoption.

Uniformity of user-friendly templates

The goal of uniformity in level 1 structure (Appendix 1) is most easily within reach. Requiring all reports to have common titles, i.e., indication, comparison, findings, and conclusion creates a visible move to standardization that prepares reporters and referring physicians for evolution to more detailed structured reports.[40]

In the beginning, individual radiologists with an interest in the creation of useful templates should be given latitude to explore different options for level 2 structure. A wide selection of such templates is available from radiological societies and institutions. These may be downloaded, modified to suit local needs, and enriched with "pick list" selections that streamline their function for normal findings and common abnormalities. Once a template with level 2 structure is deemed functional, it should be subject to approval and possible modification by the intended users, bearing in mind that universal consensus is very unlikely.

The work of individual radiologists in designing and refining efficient structured reports that offer consistent, ordered presentation of data and conclusions is fundamental. The ultimate benefits of this effort may be limited unless a policy on uniform structure is promoted and adopted by the entire imaging department. Resources must be allocated to maintain template libraries, to train new users and solve practical problems at the individual and institution level. The uniformity of level 1 and level 2 reports is a key quality indicator that influences the perception of referring physicians and increases their confidence. The delivery of level 3 reports from trainees as well as senior staff demonstrates a commitment to patient quality by all members of the department.

Education and onboarding

Offer comprehensive education and onboarding programs to familiarize radiologists and other staff members with structured reporting templates. Provide training sessions, workshops, or online resources that cover template usage, system navigation, and any updates or modifications. Continuous education ensures confidence and proficiency. In a university-affiliated setting, it is often easier to require the radiology trainees to use the sanctioned level 2 templates, and to allow experienced reporters the option to continue freeform reporting within a level 1 structure. This will generate momentum toward the universal adoption of the level 2 format as its advantages become evident.

Seamless IT and workflow integration

Integrate structured reporting templates into the existing radiology reporting system and workflow. Ensure that templates are easily accessible, well-organized, and seamlessly incorporated into the reporting process. Minimize disruptions and aim for a smooth transition from FTR to structured reporting. Coordination with an IT service is essential as the library of sanctioned templates intended for all staff will increase in number and diversity. Template titles should be relatively intuitive and alphabetically ordered. Early on, many modifications of sanctioned templates may be needed. At this point a designated radiologist or team should coordinate all changes to sanctioned templates. From a regional perspective, reviewing and updating templates on a larger scale with a central repository may help ensure that best practices become updated to all radiology sites over time.

Ongoing support and continuous improvement

Have a dedicated team available to address questions, provide guidance, and troubleshoot issues. Continuously evaluate the impact of structured reporting on workflow efficiency, report quality, and patient outcomes. Foster a culture of continuous improvement by regularly reviewing and updating structured reporting templates. Incorporate feedback from radiologists, technologists, referring physicians, and other stakeholders to refine templates, ensure their relevance, and adapt to evolving clinical needs.

Conclusion and areas of future work

Structured reporting in radiology has focused on standardization, improved communication, efficiency, and integration with reporting systems. It has transformed radiology reporting from unstructured narratives to structured templates, enabling better documentation, data analysis, decision support, and ultimately, enhanced patient care. Going forward, the CAR will continue to provide suggested reporting templates to correspond with its library of clinical practice guidelines.

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Appendix 1: Glossary of Terms

Synoptic report	Electronic report using a discrete data field format (i.e., each piece of information has a specific place and format in the report) that allows for the standardized collection, transmission, storage, retrieval, and sharing of data between clinical information systems.
Structured report	Report details are presented in discrete fields in an organized format using a template or checklist.
SR Level 1	Basic. Including demographics, nature of examination, clinical history, technical information (technique and limitations), findings, conclusion, critical result communication record, addendum. This type of report can be produced without relying on computerized dictation software.
SR Level 2	Item headings within the findings providing an anatomic or pathologic checklist. Freeform alphanumeric reporting under the item headings. This level of organization can be easily built into most software application templates. In the absence of predetermined templates, a rough equivalent can be achieved by having reporters start a new paragraph for each new anatomic location.
SR Level 3	Relies on an electronic template with data fields filled from a predetermined lexicon, usually specific to the most relevant pathology.
Standardized report	Report that follows a specific format that is determined/dictated at the institutional level or in accordance with published standards.
Itemized report	Using headings to subdivide findings into relevant compartments often as an anatomic list. This promotes predictability in the order of information, uniformity between reporters and ease of comparison between successive studies. Itemization introduces a checklist function into the report that is helpful to trainees dictating and clinician readers.

Appendix 2: Options for communication of critical results

1) An ALERT banner can be deployed in a report to signal that an important finding is contained.

##########"""""""""" ATTENTION """""""""##########

######## SIGNIFICANT OR UNEXPECTED ########

###########_ RADIOLOGIC FINDING _###########

2) Record of timely communication of a critical result:

SIGNIFICANT FINDING: [ ]

Communicated by: Telephone ; From Dr __ To: Dr __

Date / time: [ ]

3) Record of an allergic reaction to contrast:

ALLERGY / REACTION TO RADIOLOGIC CONTRAST

During today's radiologic exam, the patient experienced a contrast reaction.

- Contrast used: [ ]

- Description of reaction: [## Mild, moderate, or severe. List symptoms. ##]

- Treatment / Outcome: [ ]

- Recommendation: The allergy status of the patient has been updated in the medical record (EMR). Use of iodinated radiographic contrast should be avoided, if possible, in the future. If iodinated contrast is required medically, consider premedication as follows:

Premedication regimen of 50 mg of oral prednisone 13 hours, 7 hours, and one hour before injection of contrast material, and 50 mg of oral diphenhydramine at one hours before iodinated contrast injection substantially reduces the rate of adverse reactions (Greenberger et al.)

4) Difference between final report and earlier interim report

Please note this final report has potentially clinically significant disagreement with the preliminary report provided earlier. Specifically, __

Reference

Greenberger PA, Patterson R, Radin RC. Two pretreatment regimens for high-risk patients receiving radiographic contrast media. J Allergy Clin Immunol 1984; 74 (4 Pt 1):540-3, PMID: 6491099.

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