

An International Survey of Quality and Safety Programs in Radiology

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Abstract

Purpose: The aim of this study was to determine the status of radiology quality improvement programs in a variety of selected nations worldwide. **Methods:** A survey was developed by select members of the International Economics Committee of the American College of Radiology on quality programs and was distributed to committee members. Members responded on behalf of their country. The 51-question survey asked about 12 different quality initiatives which were grouped into 4 themes: departments, users, equipment, and outcomes. Respondents reported whether a designated type of quality initiative was used in their country and answered subsequent questions further characterizing it. **Results:** The response rate was 100% and represented Australia, Canada, China, England, France, Germany, India, Israel, Japan, the Netherlands, Russia, and the United States. The most frequently reported quality initiatives were imaging appropriateness (91.7%) and disease registries (91.7%), followed by key performance indicators (83.3%) and morbidity and mortality rounds (83.3%). Peer review, equipment accreditation, radiation dose monitoring, and structured reporting were reported by 75.0% of respondents, followed by 58.3% of respondents for quality audits and critical incident reporting. The least frequently reported initiatives included Lean/Kaizen exercises and physician performance assessments, implemented by 25.0% of respondents. **Conclusion:** There is considerable diversity in the quality programs used throughout the world, despite some influence by national and international organizations, from whom further guidance could increase uniformity and optimize patient care in radiology.

Résumé

Objectif : L'objectif de cette étude était de déterminer le statut des programmes d'amélioration de la qualité en radiologie dans plusieurs pays du monde entier. **Méthodes :** Un sondage a été élaboré par des membres désignés de l'International Economics

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Committee du American College of Radiology sur des programmes axés sur la qualité et a été distribué aux membres de comités. Les membres ont répondu au nom de leur pays. Les 51 questions du sondage portaient sur 12 programmes d'amélioration de la qualité distincts et étaient regroupées en quatre thèmes : les départements, les utilisateurs, l'équipement et les résultats. Les personnes interrogées devaient indiquer si un type précis de programme sur la qualité était utilisé dans leur pays puis répondre à des questions subséquentes visant à mieux caractériser ce programme. **Résultats** : Le taux de réponse était de 100 % et représentait l'Australie, le Canada, la Chine, l'Angleterre, la France, l'Allemagne, l'Inde, l'Israël, le Japon, les Pays-Bas, la Russie et les États-Unis. Les initiatives sur la qualité les plus fréquemment mentionnées étaient la pertinence de l'imagerie (91,7 %) et les registres de maladies (91,7 %), suivies par les principaux indicateurs d'efficacité (83,3 %) et les tables rondes sur la morbidité et la mortalité (83,3 %). Les personnes interrogées ont mentionné à 75,0 % l'examen par les pairs, la certification des équipements, le contrôle des doses de rayonnement et la rédaction structurée de rapports, et à 58,3 % les audits sur la qualité et la déclaration des incidents importants. Les programmes les moins cités incluaient l'utilisation des méthodes Lean/Kaizen et les évaluations des performances des médecins (instaurés par 25,0 % des personnes interrogées). **Conclusion** : Les programmes axés sur la qualité et utilisés mondialement présentent une forte diversité, malgré une certaine influence des organisations nationales et internationales qui, par l'émission de davantage de recommandations, pourraient augmenter l'uniformité des soins prodigués aux patients en radiologie et les optimiser.

Keywords

quality improvement, safety, international survey, global, peer-review, value-added

Introduction

The widespread implementation of quality and safety programs in radiology departments around the world indicates global belief in their value toward reducing error and improving outcomes. But what can guide the improvement, beyond speculation and trial and error, of quality programs themselves? In other words, relative to what baseline can we evaluate the improvement of quality programs or of the international collective of quality programs? Evidently, the status quo needs to be well characterized, which could be helped by a thorough comparative analysis of international quality program implementation. Unfortunately, there is currently a paucity of literature to guide radiologists in this regard. Indeed, one can learn from successes and failures of others only if the preceding attempts are known.

Before discussing the current state of international quality and safety programs in radiology, some definitions should be provided. To facilitate organization, quality programs may be classified into a framework by their shared targets: radiology departments, users (ie, radiologists), equipment, and outcomes, with the concession that each target is not mutually exclusive. Regarding programs targeting *radiology departments*, the quality audit compares local performance against published benchmarks¹ and may follow with "Plan, Do, Study, Act", or Deming, cycles until the desired target is met.² In other programs such as Lean management and Kaizen exercises, stakeholders define "value" and "waste," identify a problem, implement an intervention, and assess whether "value" is increased and "waste" reduced.² Progress toward departmental goals can also be tracked with metrics called key performance indicators (KPIs),³ although presumably KPIs could apply to *users* (ie, radiologists) as well. Peer review and peer learning are quality programs which aim to improve the performance of *users*; radiologists review image interpretations of other radiologists to identify discrepancies. Physician performance

assessments are another tool to assess how an individual radiologist's performance aligns with that of a larger group, according to a set of metrics predefined as indicators of quality care. Regarding programs which target *equipment*, imaging appropriateness describes guidelines that aim to reduce waste and limit exposure of patients to unnecessary risk, such as radiation exposure. Such guidelines are frequently proposed by radiological organizations such as the American College of Radiology's (ACR) Appropriateness Criteria⁴ and the UK Royal College of Radiologists' (RCR) iRefer guidelines.⁵ Equipment accreditation is another quality program ensuring that imaging equipment is performed in accordance with acceptable standards. Quality initiatives that target immediate *outcomes* of imaging include structured/synoptic reporting, which standardizes imaging report templates to ensure their completeness and consistency. Another initiative is critical results reporting, which focuses on the process of efficiently communicating "critical results" to referring physicians to ensure timely and appropriate follow-up. Other initiatives include disease registries, which are databases compiled of case-specific information for a given disease, and morbidity and mortality (M&M) rounds, which are meetings to address unexpected patient outcomes and identify remediable sources of error.

Previous authors⁶ have conducted an international survey of quality program implementation and have found imaging appropriateness (defined as "referral guidelines") and radiation dose monitoring (defined as "national quality and safety programs") to be the most commonly implemented programs. With so many different approaches to quality improvement, there are many program types which, to our knowledge, have yet to be comparatively assessed, namely, these include the structured/synoptic reporting, disease registry implementation, M&M rounds, Lean/Kaizen exercises, KPIs, and physician performance assessments. In this article, we discuss the results of an international survey which includes these remaining program types, and in doing so, we build upon the groundwork

Table I. Radiology Quality Programs.

Quality Aspect	%Respondents Reporting Use	Fraction of Respondents Reporting Use	#Respondents Reporting Mandatory	#Respondents for National:Local
Quality audits	58.3	7/12	4	3:3
Lean/Kaizen exercises	25.0	3/12	0	1:3
KPIs	83.3	10/12	2	2:8
Peer review	75.0	9/12	-	1:7
Physician performance assessment	25.0	3/12	2	2:2
Imaging appropriateness	91.7	11/12	0	1:9
Equipment accreditation	75.0	9/12	9	7:3
Radiation dose	75.0	9/12	8	8:2
Structured (synoptic) reporting	75.0	9/12	0	1:7
Critical results reporting	58.3	7/12	-	2:5
Disease registry	91.7	11/12	-	10:0
M&M/critical incident rounds	83.3	10/12	10	0:8

Abbreviations: KPI, key performance indicator; M&M, morbidity and mortality; -, question not asked.

set out by Mutch et al⁶ to further characterize the status quo of quality programs in radiology. From this new baseline, we can begin to assess the improvement of international quality programs and eventually assess whether the change is warranted to improve programs around the world.

Methods

A subset of members of the International Economics Committee of the ACR developed a survey in a focus group format based on the current literature. The 51-question survey categorized 12 different categories of quality programs and included 4 major themes: departments, users, equipment, and outcomes. The 12 quality programs addressed were quality audits, Lean/Kaizen exercises, KPIs, peer review/learning, physician performance assessments, imaging appropriateness, equipment accreditation, radiation dose monitoring, structured/synoptic reporting, critical results reporting, disease registries, and M&M rounds. Each member of the ACR International Economics Committee responded to the survey on behalf of their country. For each quality program, they indicated whether the initiative was used in their country, and if it was used, they answered questions that further characterized the details of the initiative. Most questions were limited to yes/no options (24 questions) or multiple choice (22 questions) and only a few were free-text responses (5 questions) (Online Appendix 1). The survey was administered online and was sent to participants by e-mail and remained open for 4 weeks. Data were tabulated using the aforementioned thematic framework adapted from the literature (department, users, equipment, and outcomes) and were qualitatively analyzed.

Results

The response rate was 100% (12/12) with the following countries represented: Australia, Canada, China, England, France, Germany, India, Israel, Japan, the Netherlands, Russia, and the

United States. A summary of the results of the 10 surveyed quality initiatives is provided in Table 1.

Departments

Regarding quality audits, 58.3% (7/12) of respondents reported their use; 4 of which reported them to be mandatory. The majority reported trainees to be involved in the audits, and there was no apparent preference for quality audits to be nationally or regionally/locally organized. A 25.0% (3/12) of respondents reported utilization of Lean/Kaizen exercises, and when used, they were not mandatory and were primarily organized at the regional/local level. Key performance indicators were typically not mandatory and most respondents, 83.3% (10/12), reported their use. Key performance indicators were primarily organized at the regional/local level and frequently included wait times and report turnaround times (11 respondents each) and productivity and patient satisfaction (8 respondents each).

Users

Peer review/learning was another commonly reported quality initiative, with 75.0% (9/12) of respondents confirming its use; it was primarily organized at the regional/local level by 87.5% (7/8) of respondents. Computed tomography (CT) scans, plain radiography, and magnetic resonance imaging were the most frequently reviewed imaging modalities by 7, 6, and 6 respondents, respectively. Twenty-five percent (3/12) of respondents reported the physician performance assessment, or "Balanced Scorecard"; 2 of the 3 reported it to be mandatory.

Equipment

A total of 91.7% (11/12) of respondents reported use of imaging appropriateness initiatives, and 90% (9/10) of respondents reported regional/local organization of these initiatives. The primary methods used for optimization were education and communication to physicians about inappropriate usage.

Mandatory equipment accreditation was reported by 75.0% (9/12) of respondents, which was mostly regulated at the national level by 70% (7/10) of respondents; 9.1% (1/11) of respondents reported usage of the ACR accreditation standards, specifically. Accreditors were often hospitals (4 respondents) or contracted physicists (3 respondents). Radiation dose monitoring was also reported by 75.0% (9/12) of respondents, and 80% (8/10) of respondents confirmed national regulation. Doses were typically monitored by safety agencies (7 respondents) and/or radiology departments (5 respondents).

Outcomes

Seventy-five percent (9/12) of respondents reported utilizing structured/synoptic reporting, which was never reported to be mandatory, and 87.5% (7/8) of respondents reported regional/local organization. Templates were typically provided by radiologists (9 respondents) or radiology organizations like the Radiological Society of North America (RSNA; 6 respondents). Critical results reporting through a software solution was reported by 58.3% (7/12) of respondents and was reported to be determined regionally/locally by 71.4% (5/7) of respondents. Without software solutions, critical results were primarily communicated via telephone (10 respondents) or e-mail communication (7 respondents). Seventy-five percent (9/12) of respondents confirmed a report policy advising on the nature of critical findings, and this was reported to be nationally determined by 66.7% (6/9) of respondents; 91.7% (11/12) of respondents reported using a disease registry. No respondents reported regional/local organization of registries; cancer (9 respondents), infectious disease (8 respondents), and cardiovascular disease and stroke (7 respondents each) were the most frequently reported conditions reported. Morbidity and mortality rounds were reported by 83.3% (10/12) of respondents. They were always reported to be mandatory (10 respondents) and regionally/locally organized (8 respondents). They were most frequently reported to occur monthly (4 respondents), and residents and fellows were invited by 83.3% (10/12) of respondents.

Discussion

The aim of this study was to characterize the state of quality programs in radiology in select countries around the world. The most frequently reported quality initiatives were disease registries and imaging appropriateness (referral guidelines). The use of disease registries in radiology has not previously been examined, although our findings of widespread adoption are perhaps unsurprising given their use in other disciplines internationally.⁷ Disease registries have been shown to be associated with improved health outcomes as well as lowered health-care costs,⁷ and the frequent implementation of disease registries in radiology suggests a step in the right direction toward quality improvement. The frequent use of imaging appropriateness guidelines reported in our study is in concordance with a prior survey⁶ and is supported by the abundance of well-publicized

initiatives such as the ACR Appropriateness criteria,⁴ the RCR iRefer guidelines,⁵ and the "Guide du Bon Usage des examens d'imagerie médicale."⁸ The most regional/local implementation of these guidelines reflects previous international consensus, which acknowledged the importance of allowing for regional differences in their implementation.⁹ Post hoc interpretation of the available literature suggests that not all quality programs focused on imaging appropriateness have been shown to change ordering patterns. For example, a didactic lecture outlining appropriate usage of computed tomography pulmonary angiography (CTPA) for workup of pulmonary embolism had no apparent effect on promoting appropriate CTPA utilization,¹⁰ whereas integrating the guidelines into electronic order sets with clinical decision support was effective in reducing the use of chest X-rays in patients with bronchiolitis.¹¹

Most countries reported the use of KPIs, which highlights the progress toward quantification in quality improvement programs. A recent article by Harvey et al¹² suggested that radiology organizations openly publish semi-anonymized KPI data to allow for comparison of these metrics and establishment of performance benchmarks. Indeed, there is a seeming lack of data which renders it difficult to compare KPIs between countries; nevertheless, the top KPIs in our survey were wait times, report turnaround times, productivity, and patient satisfaction. Of note are radiology-specific KPIs that have been outlined,³ which may serve departments unfamiliar with their use. Regarding M&M rounds, it is encouraging that they were frequently (and locally) implemented; in addressing local recent adverse events, M&M rounds provide familiar examples from which physicians can and are mandated to (according to all countries) learn. These rounds were frequently reported to occur monthly with faculty, residents, and fellows in attendance. A literature review¹³ of M&M rounds suggests there is no consensus on the optimal frequency of M&M rounds, and attendees are typically multidisciplinary.

In considering the frequent reporting of peer review/peer learning in our survey, it is worth recalling the difference between the two. In general, peer review is focused more on identifying imaging misinterpretations by an individual, whereas peer learning utilizes misinterpretations as learning opportunities for a group. Recently, there has been a tendency to move away from peer review to peer learning, with a shift in emphasis to quality improvement from quality assurance.¹⁴ It has been found that such a shift tends to decrease the number of discrepancies in imaging interpretations.¹⁵ Some well-known solutions have been established for peer review/learning, such as RADPEER.¹⁶ Similarly, the RCR has published at least 2 documents of note on this topic—one highlighting the importance of peer feedback/review¹⁷ and another discussing the logistics of formal "Learning from Discrepancies Meetings."¹⁸ The Medical Council of New Zealand has even implemented mandatory peer review components to its recertification/continuing professional development program.^{19,20} Interestingly, in Norway, "double reading" (peer review) was found to be associated with the teaching status of the hospital²¹ and was

less common in private centers.²² Evidently, differences in institution type may affect the implementation of such quality initiatives around the world. It may also be that reimbursement models influence the perception of individual physicians with respect to the value of quality programs like peer learning. Nevertheless, quality of patient care should be considered important regardless of payment models. This importance is acknowledged in the recent attention toward reimbursement for *value* of services as opposed to for *quantity* of services, as in payment models called Pay for Performance (P4P).²³

We found that most countries reported nationally organized radiation dose monitoring programs, as well as mandatory national equipment accreditation programs. Regarding equipment accreditation, our findings are consistent with previous findings,⁶ in programs being largely mandatory and unique to each national entity. While only 1 country reported using the ACR accreditation standards,²⁴ they have been used as a model for other accreditation initiatives in other countries.²⁵ Regarding radiation dose monitoring, our results are in keeping with a previous study in which participants⁶ endorsed a national radiology quality and safety program. This is unsurprising given that international radiation safety has been in the spotlight for some time now. In 2012 and 2017, the International Atomic Energy Agency (IAEA) held large conferences to address the international status of radiation protection in medicine.²⁶ Several international organizations, including the United Nations Scientific Committee on the Effects of Atomic Radiation, monitor trends in radiation doses from national authorities, to identify potential radiation safety problems.²⁷ In Europe, the European Directive 2013/59/Euratom is binding on European member states²⁸ and regulates medical radiation protection, including recording of doses for CT examinations and angiograms.^{29,28} These international radiation protection efforts likely make it easier for individual countries to develop their own quality programs and ensure their sustainability.

Consistent with the frequently reported adoption of structured/synoptic reporting, a North American study³⁰ showed that most academic radiology departments surveyed were trialing structured reporting and many were satisfied with their use. There is, however, a lack of international surveys on the implementation of structured/synoptic reporting. The European Society of Radiology has published a paper advocating collaboration at the international level to develop templates for structured reporting.³¹ Organizations such as the ACR and the RSNA have established standardized templates for reporting imaging findings,^{32,33} and accordingly, 6 countries in our survey reported using templates established by the RSNA or some other organization. Several studies³⁴⁻³⁶ have examined the utility of structured reporting, particularly in its benefit to referring physicians. While structured reporting may lose some of the nuances of free-form reporting, it is less likely to use ambiguous terminology, relative to free-form reports,³⁶ and may avoid misinterpretation by referring physicians.³⁵ Moreover, structured reporting may facilitate machine learning in its formatting, as free-text reports have been difficult for machine learning to interpret.³⁷

More than half of the survey countries reported software solutions for critical results reporting programs; secondary methods of critical results reporting were most commonly phone calls and e-mails. Implementing an electronic alert system for critical findings has been shown to reduce the proportion of critical findings among those without documentation of care provider communication, suggesting it facilitated closed-loop communication.³⁸ There is currently no data to directly compare our results, but a study of North American neuroradiology fellowship directors found that approximately 40% of their respondents had lists of critical findings.³⁹

For quality audits, most were mandatory and involved trainees, and there was no preference as to national or regional/local organization. The international status of quality audit implementation in radiology has been previously surveyed⁶ and found to be reported by nearly half of the respondents; however, it was coupled with accreditation programs, limiting a direct comparison to the present study. The IAEA has created a useful tool outlining the details of establishing audit programmes.⁴⁰ The Joint Commission is another organization that accredits health-care programs and has also created diagnostic imaging standards.⁴¹

The least frequently reported initiatives included Lean management/Kaizen exercises and physician performance assessments. The relatively infrequent adoption of Lean methodologies is consistent with its controversial status within the field of radiology, as there are very few high-quality studies assessing its effectiveness.^{42,43} Regarding physician performance assessments, they are ideally intended to be nonpunitive⁴⁴ and focused on improvement.⁴⁵ However, there have been arguments against the analogous concept in the business world, forced ranking, which has received considerable criticism⁴⁶ for potentially decreasing morale and deterring teamwork. Perhaps such critiques are relevant to the infrequent implementation of performance assessments for radiologists. To our knowledge, the international implementation of Lean methodologies and physician performance assessments has not previously been surveyed.

The primary limitation of this study is that given the study design, the proposed findings are subject to self-reporting bias. However, the respondents were all senior experienced members of their national radiology community, so should have been well informed about quality programs in their countries. Another limitation is that the respondents were largely from urban academic centers, so the results cannot be generalized beyond such settings. Another limitation concerns the differing logistics surrounding health information handling and policy between and within countries, as quality initiatives often utilize protected health information. Lastly, another limitation concerns the choice to utilize binary (eg, yes or no) options for some survey questions, which is not ideal as quality programs may have a heterogenous spread within countries.

In this study, we have outlined the state of radiology quality programs around the world through the lens of the ACR International Economics Committee. International usage of radiology quality programs varies considerably, with imaging

appropriateness, disease registries, KPIs, and M&M rounds being most used, and Lean/Kaizen exercises and physician performance assessments being the least. Our survey indicates a relative lack of national/international programs to direct such activity. Such directives could help make more uniform the quality and safety activities that optimize patient care in radiology. The nature of quality improvement is that it is perpetual, and accordingly, we have much to work toward.

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Declaration of Conflicting Interests

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Supplemental Material

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