Quality control in radiology: a telemedicine approach to peer-review

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PEER-REVIEW IN RADIOLOGY

Currently, the increasing requirement of quality control in modern radiology means that this vital aspect of the profession is becoming ever-more time-consuming and expensive. Peer review is a widely accepted approach that enables quality measurements to be carried out in routine practice, with the goal of improving overall performance through the recognition of initially unnoticed findings in diagnostic studies and the identification of appropriate corrective measures. In fact, peer review is an obligatory component of many radiological services. For example, in the USA, the Joint Commission (JCI) requires departmental peer-review systems to be in place as a pre-condition for the accreditation of the hospital radiology departments. As a result, almost all radiology departments, — certainly those in academic institutions — are involved in some form of peer-review process or another. However, each radiology department or the parent health system is free to define exactly how in practice this peer-review is carried out [1]. A recent paper on peer-review has identified important opportunities to create a non-punitive peer-review system, truly focused on learning from the errors we all make [2]. Thus, it is openly acknowledged that the radiologists' reporting performances cannot be perfect and some errors are inevitable, so a peer-review system should not only give rise to strategies to minimize errors but also to enable learning from any errors that do occur [3]. Quality control systems in radiology should thus get beyond the mere counting of errors and move on to a group learning and error prevention [4].

However, a major problem in current peer-review in radiology is that, more often than not, it is a purely internal departmental procedure. This affects not only the objectivity of quality control, but also its accessibility, especially in primary level hospitals with limited personnel. In short, current peer-review models usually focus on simply "scoring" errors and not on their elimination. In addition, the "scoring" approach may create tension between radiologists [3,5].

The rapid development of communication and diagnostic technologies, collectively well-known as tele-radiology, has enabled the acquisition of images in one place, their transmission over a distance via protected digital lines, and remote viewing for diagnostic or consultative purposes in another place.

Many observers consider that the real potential of tele-radiology lies in such distant peer-review processes which are perfect tools for health care improvement and allow not only increases in quality control but also the objectivity of the review. However to optimize the overall telemedicine peer-review approach, a system of linked actions for quality assurance in radiology also needs to be developed. Such a system has to replace the traditional "scoring" approach by more advanced and effective strategies.

We have developed such a concept and system for quality assurance in radiology Set up in 2016, the system involves an interlocking set of strategies, actions and tools [6].

The theoretical concept behind telemedicine-based peer-review is a cycle of actions: "*discrepancies evaluation - routine support - quality improvement activity - discrepancies evaluation*", reflecting the quality improvement PDCA (plan-do-check-act) cycle. Each of these steps can be described as :

- *Discrepancy evaluation is based on independent blinded peer-review methods and a formal classification of discrepancies.*
- *Routine support includes teleconsultations by subspecialized radiologists and technical support.*
- *Quality improvement activity involves various types of eLearning such as web-courses, webinars, online workshops, etc. with personal learning strategies. It can also include some administrative actions, but only in especially difficult and unclear clinical cases.*

The combination of the system described above with a telemedicine network gives rise to a brand new tool for quality management in radiology. The authors have succeeded in turning this theory into practice [6].

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DEVELOPMENT OF THE SYSTEM

In 2015, a so-called Unified Radiological Information Service (URIS) was set up to link 75 outpatient municipal hospitals in the Moscow area, as well as an Expert and eLearning center, that was established at the Research and Practical Center of Medical Radiology, in the Department of Health Care of Moscow. The URIS brings together 62 CT, 40 MRI and 30 digital mammography units, involving approximately 400 radiologists and technicians. As of July 2018 more than 1 000 000 studies

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and associated reports have been uploaded to the system.

However it is important to note that URIS is not just an archive of medical images; rather, it is a true telemedicine network, with a distributed archive, an established workflow and a defined cyclical quality improvement process

Every CT, MRI or digital mammography examination arrives at the URIS from which approximately 7% of all studies are randomly selected and sent for peer-review. If systemic discrepancies are detected, a personalized learning program is developed to address the issue and can be focused either on a departmental management team or on an individual physician or technician.

THE SYSTEM IN PRACTICE

Over a period of one year (August 2016 – September 2017), all CT and MRI examinations (n=380515) performed in municipal outpatient hospitals in Moscow were uploaded to the regional radiological system. From these exams, a sample set of studies (n=23199) was randomly selected and directed for peer-review. Prior to the peer-review process all personal data were removed, thus ensuring the anonymity of the patients. A group of experts, two or three for each record, carried out the remote peer-review which consisted of several iterations. If one of the experts considered the discrepancy to be significant, the system sends the study to another reviewer. If the second expert disagrees with the conclusions of his/her colleague, the study is re-directed for final evaluation to a third expert in the appropriate sub-specialty.

The quality control evaluation focussed on:

- Technical performance: artifacts, selection of the study region, patient's positioning, scanning technique, contrast enhancement timing and phases, pulse sequences, etc.,

- Diagnostic performance: detection of pathology, discrepancies in the interpretation, terminological errors, etc..

The peer-review system assigns a score from four grading levels, namely :

1. No discrepancy;

2. General remarks - comments on terminology, protocol design, etc.;

3. Discrepancy not significant from the clinical point of view, i.e. does not affect the patient's treatment and/or quality of life;

4. Discrepancy significant from the clinical point of view, i.e. could possibly affect the patient's treatment and/or quality of life.

The efficicny of the overall process was then assessed by comparing the levels of the significant/insignificant discrepancies during the first quarter of the study period versus those from the last quarter.

RESULTS

Clinically significant discrepancies were detected in 6% of all cases during the 12 months research period. Clinically insignificant discrepancies were found in 19% of the cases.

The most common discrepancies were identified in the reporting of pancreas (28%), lymph nodes and peritoneum (18%), anterior abdominal wall (18%). The frequency of discrepancies varied between different clinical areas: problems frequently appeared in oncology (46%), infections (32%), cardiovascular (24%). However by far the worst situation was in musculoskeletal imaging where almost 80% of studies had technical or diagnostic discrepancies. Specifically, the highest level of diagnostic imperfection was in cases of trauma MRI (70%) whereas there were discrepancies in only 26% of trauma CT.

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The identification by peer-review of any technical deficiency in the special support of technicians is particularly important, since such technical aspects during the examination can critically influence the radiologist's subsequent decision-making. A moderate correlation between discrepancies and inadequate technique or artifacts was identified in trauma cases. Technical problems were most often detected in pelvis MRI (55%), patient and slice positioning (43%), field-of-view selection (23%), pulse sequence selection (19%). In CT, the most problematic areas were the neck and the larynx where approximately 42% of studies were shown to have been carried out with technical deficiencies. Finally, we showed that 90% of studies with imperfections belonged to a limited group of specialists: 11% of radiologists and 17% of technicians. This result allowed us to personalize and focus corrective training strategies. The problems so detected and the means of their future prevention were translated into more than 220 eLearning activities (including 27 web-courses for 1955 radiologists, 98 webinars, 82 workshops, etc.). The regular broadcasting of our webinars and the free access to the records have made our webinars very popular in the professional environment. In 2017, 10200 students from 20 regions of Russia and CIS countries took part in the above eLearning activities

CONCLUSION

We have shown that the traditional "scoring" approach to the assessment of radiologists' performance can be successfully replaced by a more sophisticated one based on the application of a remote peer-review process for the detection of systemic imperfections. Specific quality improvement strategies can then be developed, combining several actions (learning, management, etc.) specially developed for the radiology department concerned. In this way, quality improvement procedures become more personal and more effective.

The new approach has resulted an improvement in diagnostics quality. Just one year after the implementation of our systematic telemedicine-based peer-review approach and associated eLearning system, a significant drop in imperfections has been observed, with the level of clinically significant discrepancies decreasing by 67%.

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