

SIIM 2017 Scientific Session Reporting & Communication Part 1

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Minimizing Barriers in Learning for On-Call Radiology Residents End-To-End Web-Based Resident Feedback System

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Background

The on-call experience of independently interpreting complex cases and forming clinically relevant conclusions is an essential part of radiology resident education [1]. Feedback from the attending radiologists is one of the most valuable methods for residents to maximize learning. Systemized feedback is also helpful to ensure high quality interpretations of imaging studies [1]. In the context of increasing clinical demands in imaging volume and rapid turn-around-times, as well as differences in scheduled work hours, the more traditional face-to-face read-out is rarely possible, certainly not for all exams [2]. In many institutions, including ours, trainees are responsible to manually check the finalized version of their preliminary reports to learn from their on-call cases. Even when attending radiologists take the initiative to provide feedback, their methods in providing feedback vary – some choose e-mail while others wait for in person conversation. Without an efficient way to view changes, grade discrepancies, provide case-specific teaching points, and easily access imaging studies, important teaching points in image interpretation and report construction are lost. Our goal is to establish an easy, visually appealing system to minimize barriers to asynchronous communication between attending radiologists and on-call residents as well as to document improvement subjectively through surveys and objectively through participation metrics.

Case Presentation

We developed a web-based system to facilitate both provision and receipt of case-specific feedback for on-call resident preliminary reports. The foundation of this system is our departmental server which receives real-time Health Level 7 (HL7) order and report data from our Radiology Information System (RIS) (Siemens). Data is filtered by a Mirth Connect HL7 engine (Mirth Corporation) and stored in a MySQL (Oracle) database with associated metadata. This server also includes an Apache web server (Apache Software Foundation) to receive feedback data and for display of a dashboard for feedback consumption as well as a lightweight access directory protocol (LDAP) server (OpenLDAP) for authentication and permissions purposes.

A C#/.NET (Microsoft, Inc) plugin is integrated into our radiology workflow application (Medicalis Corp.) to gather resident feedback. The plugin is displayed when the exam is from our local teaching institution, the user is an attending radiologist as determined by our LDAP server, and when a preliminary report from a resident exists for the exam (Fig. 1).

Figure 1

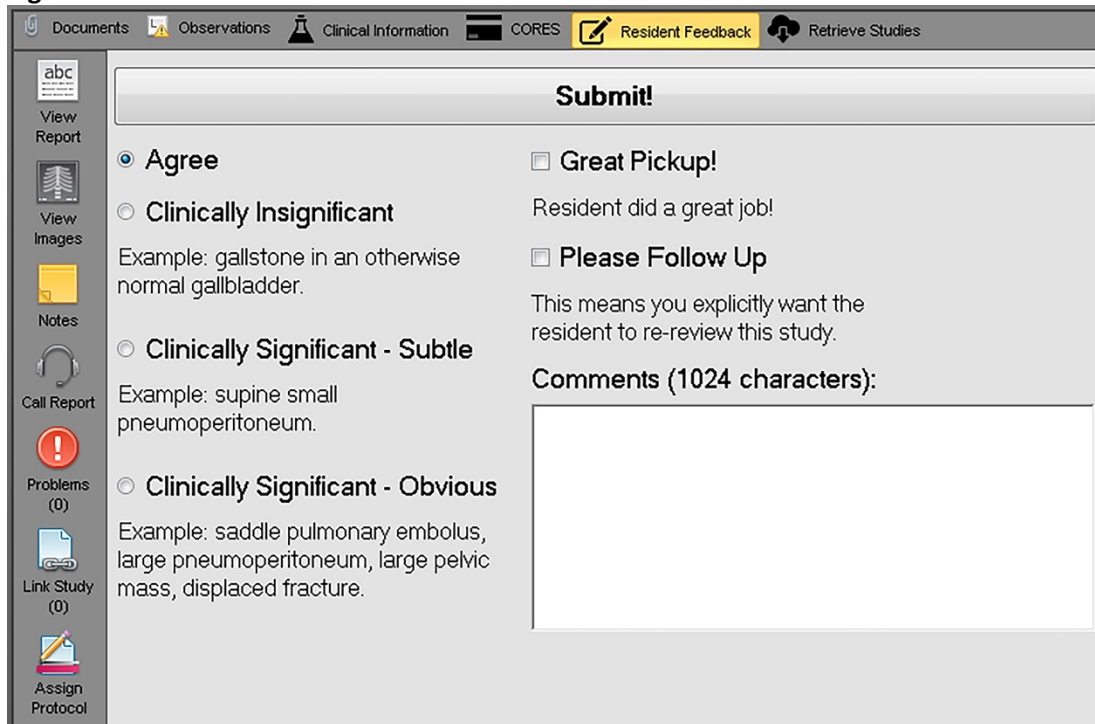


Figure 1. Resident feedback plug-in integrated in the radiology worklist application.

The attending radiologist then provides a graded evaluation for report discrepancy, free text comments, positive feedback and/or a request for follow-up or review by the resident. Discrepancy grading is based on RADPEER scoring [3] and is categorized as: agreement, clinically insignificant discrepancy, clinically significant discrepancy with subtle findings, and clinically significant discrepancy with not subtle findings. The feedback data is posted through our web server and then stored in our database along with our report and order data.

Our web-based dashboard is accessible via our institution’s intranet or virtual private network (VPN). Summary statistics are user-specific and can be customized to a desired date range (Fig. 2).

Figure 2

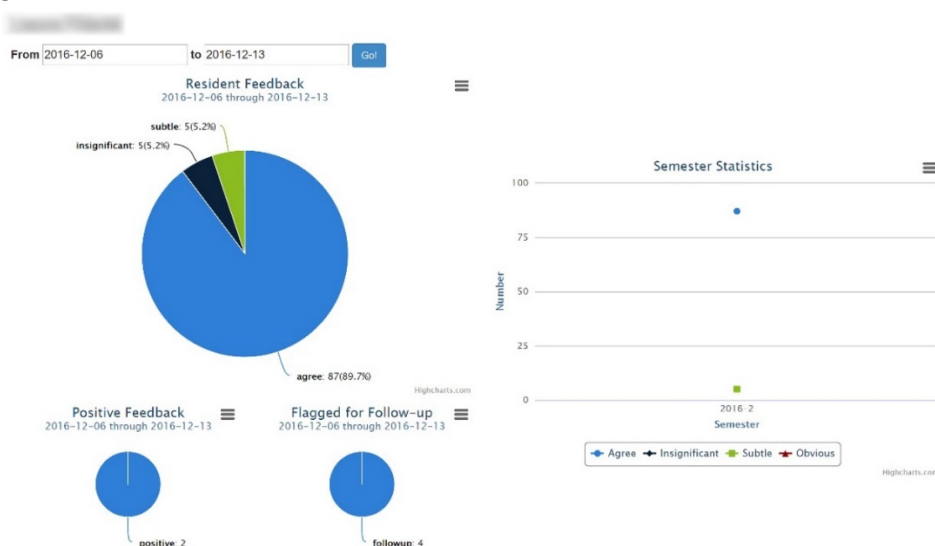


Figure 2. Screenshot of resident feedback dashboard interface, which includes customizable date range selection and distribution of reviewed reports by discrepancy grade. Reports with positive feedback and those flagged for follow-up are displayed separately. Bar chart on the right is intended to track resident’s progress over time.

Feedback categories and those exams flagged as positive feedback or for follow-up can be clicked interactively to display exam details as well as attending radiologist comments for each group. Each exam can then be expanded to see highlighted report differences using similar methods previously reported from our institution [2]. A direct link to immediately launch the associated images in context within the web-browser is also available (Fig. 3). Our residency program director has access to all resident dashboards for administrative and educational progress review.

Figure 3

Insignificant Cases

CT THORAX/ABD/PELVIS W/CON [] 2016-12-12 12:56:54 very tiny PE 7/193

MR ACUTE STRK BRN MRA HD\T\NK WOW [] 2016-12-12 12:56:54 small right parietal meningioma. left prox ICA is likely OK.

PROCEDURE: MRI 9414 MR ACUTE STRK BRN MRA HD\T\NK WOW Acc: []
 DATE OF EXAM: Dec 3 2016 6:45AM

CLINICAL INFORMATION: Dizziness, nausea, vomiting. Cerebellar stroke.

TECHNIQUE: MR images of the brain before and after intravenous contrast.
 Contrast-enhanced MR angiography of the neck and time-of-flight MR angiography of the head. Measurement of cervical carotid stenosis was performed using NASCET technique.

COMPARISON: CT head November 25, 2016

FINDINGS:
 The ventricles and subarachnoid spaces are normal in size and morphology for age.

T2/FLAIR-hyperintense signal with restricted diffusion in the medial and inferior left cerebellar hemisphere and vermis with gyriform enhancement, compatible with known subacute infarct in left PICA distribution. Associated susceptibility artifact and T1 hyperintense signal consistent with hemorrhage. Mild periventricular white matter T2 hyperintensity is **expected for age- nonspecific and likely reflect sequela of chronic microvascular ischemia.**
No significant mass effect. No hydrocephalus. Small 6 x 5 mm homogeneously enhancing extra-axial focus in the right parietal region likely reflects a small meningioma.

Brain MRA: No stenosis or aneurysm of the proximal intracranial vessels.
 Left PICA is patent. Bilateral AICAs, SCAs, and PCAs are patent.

Fig. 3 Display of cases. Exam information and reviewer's comments (arrows) are shown and can be expanded to view highlighted differences between preliminary and finalized versions of reports.

Outcome

Attending radiologists and trainees were surveyed with regard to the ease or difficulty of providing or receiving feedback prior to the implementation of our system. 23 of 31 (74%) of attending radiologists and 14 of 14 (100%) of 2nd, 3rd, and 4th year residents taking call responded. While 91% of the attending radiologists felt feedback was useful for the on-call residents, 48% of them responded that it was cumbersome or difficult to provide feedback. 71% of residents felt it was easy to check for discrepancies from preliminary reports; however, 29% of them stated that the task was cumbersome. In addition, the majority of the residents (64%) did not want to receive feedback via e-mail, a method that was used by 35% of our attending radiologists who participated in the survey. Interestingly, while 92% of our faculty responded that they give commendation to residents at least a few times a year, only 50% of the residents agreed and all residents desired more positive feedback. A follow-up survey focused on our new system will be conducted in February, 2017, three months following the implementation of our feedback algorithm with a full comparison of user satisfaction from both faculty and trainee groups. Although complete survey data is not yet available, the new system has been well-received by both attending and resident radiologists.

We attempted to more objectively quantify attending radiologist participation prior to and after the implementation of our new system. This proved to be somewhat difficult, primarily because when using our old paper-based system attendings would commonly report the total number of reports in their queue in bulk as all "Agree" without individually reporting each exam. The new system does not currently assume that an exam is graded "Agree"; feedback must be given explicitly. Given these

differences, we chose to evaluate participation based on feedback that was not in the "Agree" category as this requires explicit feedback in both old and new systems.

During the final full three months of the old feedback system, there was an average of 48 exams (2%) where feedback other than "Agree" was given. During the time since the new system was fully implemented, there was an average of 124.5 exams (4.6%), when extrapolated for the full month of December, where feedback other than "Agree" was given (Table 1). We hypothesize that general and explicit participation will continue to increase as attending radiologists become more comfortable with this new feedback system.

Table 1

Before implementation			
Month	Total number of cases with feedback (%)*	Number of cases with non-agree feedback (%)	Total number of preliminary reports**
July, 2016	901 (45)	60 (3)	2019
August, 2016	683 (28)	51 (2.1)	2418
September, 2016	627 (25)	34 (1.4)	2499
After implementation			
Month	Total number of cases with feedback (%)	Number of cases with non-agree feedback (%)	Total number of preliminary reports
November, 2016	583 (24)	112 (4.5)	2463
December, 2016 (12/1 - 12/12)	243 (22)	53 (4.8)	2093

* = percentage relative to total number of preliminary reports, ** = total number of preliminary reports issued by a resident between 6pm – 7 am or on Saturday or Sunday was used as estimates for number of on-call cases.

Table 1. Objective quantification of attending radiologist participation before and after implementation of web-based feedback system.

Discussion

While several tools in resident preliminary report discrepancy tracking and report comparison have been described, our approach is focused on ease of use and completeness for both the attending radiologist and the trainee, with survey and objective compliance data to validate acceptance and improvement. This workflow is seamlessly integrated into the radiology worklist without taking up valuable real estate on diagnostic monitors. The attending radiologist can provide feedback in as little as two clicks of a mouse. Unlike some workflows, where discrepancy tracking is based on macros, our system also allows for case-specific instruction via free text comments from the faculty, which is only displayed on the specific resident's dashboard. Additional flags for positive feedback and specific follow-up are allowed and encouraged based on resident feedback.

The graphical format of the resident feedback dashboard is easy to view and less overwhelming for the trainee than previously described listed formats [4,5]. Customizable date ranges, summary visualizations, interactive drill-down capability, and integrated web-based image launch allows complete review of feedback along with report and imaging data in one easily accessible location. Many of previously described report reviewing tools have focused on the amount of words or characters changed as a measure of resident performance. However, we and others have found that many of the changes are stylistic and do not necessarily contribute to the pertinent findings or diagnoses that affect patient care [2,4]. While we still highlight these changes using previously reported methods [2] our emphasis for resident education is centered on the discrepancy grading and comments.

Areas for improvement include increasing faculty participation and standardizing feedback. While we believe the plug-in is relatively easy to use, further education or other workflow improvements may encourage higher participation rates. We have also found that some attendings grade resident reports using different internal scales; we have considered normalizing feedback based on particular attending historical average grades to try and account for this. In the future, we also hope to incorporate feedback data into our report search tool, create anonymized teaching files for missed case conference, and improve report comparison function by utilizing natural language processing.

Conclusion

Feedback is an essential method of instruction for the radiology resident on call. An efficient, streamlined web-based system which delivers end-to-end feedback including report and image viewing can minimize barriers in communication between the attending radiologist and on-call resident. Although complete user satisfaction and compliance assays are not yet compiled, we have received overwhelmingly positive input from both faculty and trainees.

References

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Keywords

radiology education, dashboard, resident-attending discrepancy