action in the room. In 4/2011, DICOM-Structured Reports of radiation use became available and these files include 32 time stamped variables describing the details of each radiation exposure. Possible failures to optimize radiation use were detected by examining the DICOM-SR files and confirmed by video review. 

**Results:** DICOM-SR files from 220 procedures were available for analysis. These files included 6,814 radiation events and 218,048 data elements. The combination of video recordings and detailed radiation use allowed analysis of possible failure modes including lack of collimation, failure to lower the detector, inadvertent activation of the fluoroscope, and failure to center the region of interest. For example, when DICOM-SR data revealed a larger than normal gap between the table and detector, video review demonstrated an opportunity to lower patient exposure by lowering the detector. In one case, lowering the detector 6.7cm led to a 24% decrease in reference point air kerma.

**Conclusion:** Detailed data on radiation events and video recording provides a powerful combination for detection and analysis of defined failure modes. A catalog of objectively defined failure modes is being developed. This along with the software tools used to detect different failure modes will be shared will be shared as open source content.


The website: Improving Fluoroscopy procedures can be found at https://sites.google.com/site/improvingfluoroscopyprocedures/

**Educational Exhibit**

**Abstract No. 315**

**Design and implementation of IR-specific features in an electronic medical records system**

**S.D. Samuelson, L. Hofmann, N. Kothary, S. Loh, J.D. Louie, W.T. Kuo, D. Hovsepian, D.Y. Sze, G.L. Hwang:** Stanford University, Stanford, CA

**Learning Objectives:** To demonstrate customization of a hospital-wide electronic medical records system (EMR) in order to address the unique needs of an academic interventional radiology (IR) practice.

**Background:** No hospital-wide electronic medical records system (EMR) system has been specifically tailored for the unique need of an IR practice. We sought to develop a team-oriented approach to address this design shortcoming at our institution. The purpose of this abstract is to share our modifications to Epic (Epic Systems Corporation, Verona, WI), which can serve as a template for other IR practices transitioning to EMR.

**Clinical Findings/Procedure Details:** Over an 18-month period a team composed of three IR faculty, one IR business manager, one information technology manager, and one programmer met initially weekly, then monthly to determine the features needed for the platform.

Our modifications included the following:

1. **Consult Request:** Referring physicians can only order an IR consult. Only the IR physicians can order an IR procedure.
2. **IR Navigator:** This directs members of our service through the appropriate workflow for consults, preoperative patients, and postoperative patients.
3. **IR Consult Worklist:** This easily viewed spreadsheet shows the outstanding consult requests so that patients can be quickly triaged for evaluation.
4. **IR Ordersets:** IR-specific pre-procedure and post-procedure orders were created to improve efficiency and patient safety.
5. **IR Rounds List:** A shared inpatient rounds list was created that displays the procedure, operators, and procedure date. This list is projected during morning rounds, allowing the entire team to quickly view relevant patient information, such as labs and outputs, without entering the patient’s chart.
6. **Electronic Follow-up Form:** This facilitates team communication and tracking of individual patient follow-up.
7. **Customized Greaseboard:** This allows important patient or procedure room information to be tracked real-time anywhere Epic can be accessed.

**Conclusion and/or Teaching Points:** A hospital-wide EMR can be customized to the unique needs of an IR service.

---

**Abstract No. 316**

**Automated e-mail notification of important incidental non-vascular findings in computed tomographic angiography (CTA) studies for evaluation of the aorta: how often are radiological recommendations followed by the ordering physician?**

**K.A. Spearman, C. Campe, G. Walker, G.R. Oliveira, S.P. Kalva, A. Waltman, B. Ghoshhajra, S. Wicky, G.M. Salazar:** Radiology, Massachusetts General Hospital, Boston, MA

**Purpose:** To determine the clinical compliance by an ordering physician in response to recommendations associated with automated email notification of non-vascular important findings.

**Materials and Methods:** In our institution an automated email notification of any important radiological findings is sent to the ordering physician at the time of image interpretation. In this retrospective study we reviewed all such notifications associated with CTA reports performed for evaluation of the thoracoabdominal aorta, between 1/2008 and 6/2008. The radiological reports were categorized into either vascular or non-vascular findings, based upon the impression content. The data collected included: type of finding, any suggested recommendations for additional evaluation, and the ordering physician’s compliance with the recommendation. Results are given in absolute numbers and percentages.

**Results:** 113 studies with e-mail notification of important radiological findings were identified during this time period. The majority of the e-mails sent to the ordering physicians involved non-vascular (n=79/70%) findings. A smaller percentage of emails were sent for vascular (n=34/30%) findings. The non-vascular findings consisted of: lung nodule 48.9% (n=24), lung nodule with other findings (e.g., thyroid, renal, breast) 14.2% (n=7), adrenal nodule 10% (n=5), renal 10% (n=5) and miscellaneous lesions (liver/bowel/breast lesions, n=6). In 61 of the 79 non-vascular findings emails, specific recommendations were made for additional radiological evaluation (77%). Of the 61 studies with recommendations for additional imaging, 80.3% were not performed by the ordering physician (n=49). Compliance of recommendation was 19.6%.

**Conclusion:** In this preliminary data analysis, incidental non-vascular findings were frequently encountered when interpreting cross-sectional thoracoabdominal aortic imaging studies. However, recommendations for additional imaging were not commonly performed by the ordering physicians. While notification of non-
vascular findings may be very important in patient management, further studies are still needed to determine the clinical impact of such findings and the need for notification of other clinicians involved.

### Educational Exhibit Abstract No. 317

**The utility of a dedicated interventional radiology fellow website**

R. Srinivasa, W. Stavropoulos; University of Pennsylvania Medical Center, Philadelphia, PA

**Learning Objectives:** While many radiology residencies have their own personalized resident websites for keeping track of schedules, gathering helpful documents, tracking conference attendance and making announcements, fellows are often left to hunt for the information they need. IR fellows in particular have a strong need for easy hospital wide access to relevant paperwork and information. Our purpose is to demonstrate the utility of having a dedicated and independent interventional radiology fellowship website to simplify and centralize information necessary for functioning efficiently and productively on the IR service.

**Background:** HTML, Javascript and PHP scripting languages were utilized to set up a secure, password-protected website that contains information necessary for functioning on our institution’s service.

**Clinical Findings/Procedure Details:** A number of relevant documents including the basics of how to use the hospital electronic records systems, patient care related information such as consent forms, a method for managing anonymous and secure patient lists, pre-procedure workups, basic IR relevant management algorithms, and hospital phone numbers were compiled into a centralized, easy to remember website accessible throughout the hospital. Information on the day-to-day runnings of the fellowship such as fellow and resident rotation schedules, conference schedules, journal clubs, attendance records, and contact numbers were also integrated. An RSS feed from the Journal of Vascular and Interventional Radiology containing abstracts from the most recent articles was also included to give fellows a quick glimpse at new research whenever they log in.

**Conclusion and/or Teaching Points:** A large part of being an interventional radiology fellow or a resident rotating on the interventional radiology service is taking care of patients before and after their procedures. In order to simplify obtaining and keeping track of patient information and having consents and workup forms readily available on the floors, an easy to remember secure website accessible throughout the hospital facilitates this greatly.

### Educational Exhibit Abstract No. 318

**Radiation use during fluoroscopic procedures as a quality measure**

M. Strother, M. Street, J. Duncan; Mallinckrodt Institute of Radiology, St Louis, MO

**Purpose:** Fluoroscopic procedures require physicians to optimally balance the risks and benefits of each x-ray exposure. As part of our Ongoing Professional Practice Evaluation (OPPE), we created and tested software that analyzes and plots large scale trends in procedure specific radiation use over time.

**Materials and Methods:** Since June 2008, fluoroscopy time (FT) for interventional radiology (IR) procedures has been entered into the Radiology Information System. This database also includes procedural codes (CPT), date and the attending interventional radiologist. CPT coding patterns were used to identify various procedures and the mean fluoroscopy time for every procedure with more than 100 instances in the database were calculated. The differences between these predicted values and the observed result was calculated. The rolling differences for 400 consecutive procedures were then summed for each attending and displayed as a performance index versus time. The resulting software was written using Python 2.7.1 and posted online at http://code.google.com/p/dicom-sr-qi/. Simulated datasets with embedded patterns were created to test the software.

**Results:** The initial dataset included 65,428 procedures that were described by 4,567 unique CPT code combinations. After excluding procedures with less than 100 repetitions and instances where fluoroscopy time was unavailable, 43,082 procedures remained and represented 78 unique procedure types. Software testing confirmed its ability to identify the embedded patterns. The analysis demonstrated two features that indicate experience correlates with decreased fluoroscopy time. First less experienced attendings tended to have longer fluoroscopy times than their more experienced counterparts. Second, fluoroscopy times tended to decrease during the study.

**Conclusion:** Analysis of radiation use during fluoroscopic procedure has utility as a physician specific performance measure for the Joint Commission’s OPPE program. The software calculates a performance index that tracks performance over time for a wide variety of common procedures. The number of procedures with greater than 100 repetitions will continue to grow and we expect this will make trends easier to discern.

### Educational Exhibit Abstract No. 319

**Increased efficiency with an electronic room scheduling system in interventional radiology: an educational exhibit**

S. Stutzman, S. Langford, A. Herr, L. Keating, M. Englander, K. Mandato, H. Barrows, I. Ramaswamy, G. Siskin; Radiology, Albany Medical Center, Albany, NY

**Learning Objectives:** To review the efficiency advantages of utilizing an electronic room scheduling system in a busy interventional radiology practice.

**Background:** A hospital-based interventional radiology department typically treats many patients during the course of a single day. Each room in an IR procedure suite often sees more patients than a typical operating room in a single day. As a result, an electronic scheduling system that can improve efficiency and potentially serve as a continuously updated database for quality improvement purposes can bring about significant benefits to a busy practice.

**Clinical Findings/Procedure Details:** The Electronic White Board (CardioPulse, Inc., Winston-Salem, NC) was instituted in our practice. Transition to its full use occurred instantly and was felt to be intuitive by all end users. Communication among all