Sub-Events

**QSE100**

**Improving Quality through Integrated Program Management in a Paediatric Tertiary Care Radiology Department (Station #1)**

Zoran Bojic (Presenter): Nothing to Disclose, Ellen Charkot: Nothing to Disclose, Manohar Meghraj Shroff MD: Nothing to Disclose

**PURPOSE**

The main purpose of this initiative was to address communication problems and system dysfunction associated with significant program complexity. In a work environment characterized by a rapid pace of change, numerous improvement projects were simultaneously launched to address challenges and further improve quality of patient care. However, these projects were unsynchronized and they were often planned and executed within functional silos. This lack of project coordination resulted in delays of strategically important projects that were expected to eliminate known deficiencies and deliver improved quality of services. It was necessary to establish effective program governance structure to ensure the alignment of major program initiatives with hospital strategic directions, provide leadership oversight, improve decision making process, and enable timely response to changing conditions.

**METHODS**

The Quality Assessment and Improvement Committee adapted, introduced and used Program Management methodology that involved systems approach to planning, executing and controlling multiple projects. With this methodology, the committee achieved consensus on key priorities and outcomes, allocated resources, identified project interdependencies, coordinated communication across projects, integrated plans, and developed shared governance structure to manage changes. The Program Management was implemented by eliminating organizational communication barriers, enhancing transparency, creating a sense of urgency, and leveraging information technology. Clinicians and administrative staff were empowered to make decisions and implement changes. Lean Six Sigma principles, tools and techniques were applied to process redesign in order to eliminate waste, reduce cycle time, and minimize wasteful activities while creating value from the viewpoint of patients and other stakeholders.

**RESULTS**

One of the projects involved collaboration with front line staff to improve the overall excellence score measured through the independent Ambulatory Clinic Paediatric Patient Experience Survey. The project plan was focused on improving communication with patients and families who are in the waiting room, providing staff education, increasing awareness about service excellence, and ensuring that the waiting areas are set up in a way that is comfortable for the child as well as for parents and guardians. Following implementation of the project, the excellence score for Diagnostic Imaging ambulatory services was improved by 25%. Several quality improvement initiatives were implemented in MRI suite to enhance safety, improve access and address demand for services that increased 46% in the period of 5 years. As a result of effective interprofessional collaboration, MRI room utilization rate increased from 60% to 87%, MRI exam protocols were standardized, new distraction techniques were introduced to reduce the need for General Anaesthetic (GA), average MRI wait time was reduced by 38%, and average room turnover time between GA patients was consistently less than 18 min. Robust processes for screening of surgical implants and screening of patients were developed to reduce risks associated with the strong static magnetic field, varying gradient field, and radio frequency field in MR environment.

**CONCLUSION**

Using adaptable and integrated Program Management methodology is an effective approach to align multiple projects with strategic directions, resolve resource constraints, engage staff, enhance decision making, and develop strategies to address challenges and maximize opportunities. Program Management also provides the framework for implementing organizational strategies, initiatives and large scale change. Effective, clear and precise communication has been recognized as an essential factor for optimal team performance and process effectiveness. When leading change, it is important that all stakeholders keep patient’s needs at the forefront and are prepared to make the necessary adjustments. Continually refined quality indicators have to be used to measure, evaluate, and improve effectiveness of all critical processes. Finally, the synergy that comes from putting employees together to review practices, solve problems, and take action is power that any healthcare institution can harness.
The safe and efficient operation of a modern CT imaging program requires a high level of technical knowledge, and exquisite operational skills of CT technologists. Acquiring and sustaining competencies in the areas of CT operation, quality and safety is particularly challenging in a growing multiple-site, subspecialty imaging department, where newly developed CT applications are introduced early and frequently. Initiated by CT technologists in our department, in cooperation with radiologists, and with administrative support, we have developed a dedicated education and training program for CT technologists. The goal of the program was to provide high-level training in the latest CT technology, clinical applications, radiation dose, patient safety and patient care skills for CT technologists at all sites (inpatient and outpatient facilities), and for all shifts (day, night, weekend). In this presentation we describe the structure of our education system and present its effect on technologist knowledge and job satisfaction together with quality metrics on radiation dose and patient satisfaction ratings.

METHODS

Our education and training program was conceived by the "CT Protocol and Education Development Team", consisting of the medical director of CT, a medical CT physicist, the CT supervisor, and two staff technologists with 90% of their FTE dedicated to building, implementing, and maintaining the educational program. The key elements of the program are: (1) semi-annual comprehensive full-day workshops addressing both basic and advanced concepts in CT technique, including dose reduction strategies, presented by clinical faculty, radiology trainees, technologists and nurses, with every other workshop targeted to night and weekend staff; (2) monthly in-services on state-of-the-art technical as well as clinical topics, prepared and presented by medical and technical staff; (3) a structured coaching and training rotation system for both new staff training as well as continuing staff education; and (4) an archive of video tutorials covering CT physics, cardiac scanning and post-processing techniques, dose reduction and dose management strategies, trauma CT and acute findings on CT, stroke imaging, and injection timing. The workshops and in-services are fully accredited by the ASRT. Technologist knowledge is evaluated electronically before and after the in-services using multiple choice questions. Technologist satisfaction with training before and after implementation of the program was assessed via employee surveys. Patient satisfaction ratings for CT services are routinely acquired institution-wide. Dose parameters were sampled for one index month from one scanner before implementation of the program, and from dose management software for current data.

RESULTS

The Stanford CT Protocol and Educational Development Program has been in place for five years, during which time ten full-day workshops and 19 in-services have been held. The three most recent workshops (January 2013, July 2013, and January 2014) had a combined attendance of 141 participants. Evaluation of available pre- and post-test scores shows consistent gains in knowledge among CT technologists. 53% of technologists are currently "very satisfied" with our internal education program, compared to only 33% five years ago. 94% of current technologists strongly agree or agree that (1) the quality of training and development opportunities has increased in the last five years, and (2) that their job satisfaction has improved during the last five years. During the same time, the proportion of patients rating the overall care in CT as "very good" has gradually increased from 65.2% to 82.1%. And the proportion of patients "very likely to recommend" CT services has increased from 71.4% to 85.5%. Dose data reveals a reduction of mean CTDI for renal delay acquisitions from 13.50mGy before program implementation to 8.53mGy currently.

CONCLUSION

An institution-wide program with resources dedicated for CT technologist training and education yields measurable benefits. It improves knowledge and job satisfaction among staff, creates an environment conducive to learning, reduces radiation dose, and - most importantly - contributes to positive patient experiences.

QSE120

Multifaceted Approach to CT Dose Reduction for "Rule-out Aortic Dissection" (Station #3)

Judah Goldschiendt MD (Presenter): Nothing to Disclose, Sharon Steinberger BA: Nothing to Disclose, Jeffrey Michael Levisky MD, PhD: Nothing to Disclose, Linda Brode Hariamati MD, MS: Investor, OrthoSpace Ltd Investor, Kryon Systems Ltd Spouse, Board Member, Bio Protect Ltd Spouse, Board Member, OrthoSpace Ltd Spouse, Board Member, Kryon Systems Ltd

PURPOSE

Acute Aortic Syndromes (AAS) is a broad diagnostic category that includes aortic dissection, intramural hematoma, penetrating atherosclerotic ulcer and frank aortic rupture. Because AAS carries a very high morbidity and mortality, rapid diagnosis and treatment are essential. At the same time, the notoriously poor performance of clinical signs and symptoms has increased the reliance upon rapid and accessible imaging to identify patients with AAS. Audit of our departmental performance of CT for suspected AAS revealed a far-reaching problem. CT protocols employed multiphase acquisitions of the chest and abdomen with an average effective dose of 43 + 20 mSv, representing some of the highest CT dose among diagnostic imaging examinations. Departmental data also described an extremely low overall positivity rate for AAS of 2.7%. With this in mind, we wish to describe a multifaceted approach to CT dose reduction for patients suspected of having an AAS at an inner-city academic medical center.

METHODS

After analysis of our study results, we were able to identify and address several discrete areas for potential quality improvement. 1) Instead of our initial standard 120-140 kVp setting, we changed our routine CT protocol to a 100 kVp standard, with mAs tailored to imaging patients with larger body habitus. 2) We began to consistently archive full dose reports within PACS for all studies. 3) Instead of routine non-contrast imaging of both the chest and abdomen to demonstrate intramural hematoma, we limited the cranio-caudal scope of the non-contrast portion of the exam by starting at the aortic arch and ending at the diaphragm. The scope of the contrast-enhanced portion of the exam remained unchanged and spanned the chest and abdomen to the aortic bifurcation. 4) We unified this protocol across our multiple imaging sites and named it “CT Aortic Dissection” in
an effort to standardize communication between the clinical services, technologists and radiologists, and to facilitate quality assessments. 5) We collaborated with our Emergency Department (ED) colleagues on retrospective research aimed at identifying consistent and reliable clinical factors that can be used to assess the likelihood of AAS. 6) We successfully collaborated on prospective research aimed at evaluating the performance of our clinical decision tool by embedding a questionnaire within the electronic CT requisition. Prospective data recorded included parameters that were identified as reliable clinical indications of AAS, such as the presence and a description of the quality and onset of patient’s reported chest pain.

RESULTS

We prospectively identified 192 patients who underwent CT for suspected AAS using our new “CT Aortic Dissection” protocol over a 6 month period. Compared with our historical study population, this cohort demonstrated a significantly lower radiation exposure, with mean effective dose of 13 + 6 mSv (p < 0.0001). There was also a non-significantly higher positive rate for AAS of 4.6% compared with 2.7% (p-value 0.14). At the same time, standard dose reports were viewable in PACS in 100% of the cases, compared with 61% reported in our historical group (p-value < 0.05).

CONCLUSION

Successful radiation reduction programs require a multifaceted approach which includes technical modifications, fostering of inter-department collaboration and attention to the quality improvement processes to effectively reach this goal. Optimizing technique, admitted for surgery or transferred) was also recorded. We then developed a report card to be distributed to all sonographers performing right lower quadrant ultrasound in the emergency department. Specifically, the report card includes imaging results (e.g. rate of visualization, radiologist final impression) and patient outcomes (e.g. CT performed, patient transferred, surgery performed). In addition to the clinical information, the report card also includes technique reminders with step-by-step detail of our imaging protocol and examples of the sonographic appearance of the normal and the acutely inflamed pediatric appendix. Prior to report card distribution, each report is reviewed by a team consisting of a radiology resident, an attending pediatric radiologist, the section head of ultrasound and the ultrasound department supervisor. An initial report card was generated for each sonographer performing their baseline 6-month performance from the six-month baseline data timeframe compared to department averages. Given the volume of cases per sonographer, an individualized quarterly report card is generated reflecting each sonographer’s performance in pediatric appendicitis. Sonographers are emailed their quarterly report card, which also contains a critique of their performance from the six-month baseline data timeframe. This allows for easy reference and comparison with future reports. Individual and department results are analyzed every three months to evaluate for overall increased diagnostic accuracy of right lower quadrant pediatric ultrasound and measure CT utilization. Additionally, cumulative sonographer reports are reviewed semiannually by the study investigators and the ultrasound leadership team to identify opportunities to provide targeted sonographer training and education.

RESULTS

During the baseline collection period, an average of 21.4 examinations were performed per month with the appendix confidently visualized in 15% of cases, 5.6% of cases interpreted as positive and 0.8% of cases interpreted as negative. CT was recommended for 32% of cases, performed for 30% of cases and positive in 4.9% of cases. The patient was admitted, transferred to a pediatric tertiary care center and underwent surgery in 5.3%, 12.2% and 8.1% of cases, respectively. Approximately 35% of patients were evaluated on follow-up and pathology for all surgical cases was reviewed.
Microembolism during Endovascular Treatment of Unruptured Cerebral Aneurysms: Successful Reduction by Modification of the Coiling Technique and Maintenance of Intraprocedural Blood Pressure (hardcopy backboard)

Joo Yeon Lee (Presenter): Nothing to Disclose, Dae Yoon Kim: Nothing to Disclose, Jung Cheol Park: Nothing to Disclose, Yu Sub Sung: Nothing to Disclose, Choong Gon Choi MD: Nothing to Disclose, Dek Hee Lee MD: Nothing to Disclose

PURPOSE
Diffusion-weighted MR images (DWI) obtained after endovascular treatment of cerebral aneurysms frequently show multiple high-signal intensity (HSI) dots. Although most of the cases were subclinical, we came across some symptomatic cases from time to time. To reduce this phenomenon, we observed patients with routine use of dual antiplatelets (aspirin and clopidogrel) regardless of stent use. While searching for possible causes of the microembolisms, we found that a significant amount of air bubbles might have been introduced by various devices during the various steps of our embolization procedures. We attempted in order to reduce those embolic sources in addition to the conventional methods. 

METHODS
During the study period, we had a total of 72 patients who underwent endovascular treatment of unruptured cerebral aneurysms. In the former three months (period 1), we had already applied various anti-embolic measures (conventional measures). In the latter three months (period 2), we began to apply more vigorous anti-embolic measures (additional measures). No other procedural condition differed between the two time periods except for the additional measures during period 2. There were 37 patients in period 1 and 34 in period 2. The patients were on a dual antiplatelet regimen for at least five days before the procedure. P2Y12 inhibition assay was performed on admission. When the test results showed a PRU value of 240 or higher, we loaded 200 mg of clopidogrel regardless of the stent use. To minimize dissolved gases in the flushing saline, the saline bags which were kept warm (37-40°C) were cooled down to room temperature before the procedure. 1000 units of heparin were mixed in a 1000-mL bag before use. Air bubble filters were not used. As we could observe multiple sources of air embolism, we hypothesized that we could decrease the occurrence of microembolic lesions by reducing air-bubble introduction through modification of our embolization procedure and by facilitation of wash-out of inadvertently introduced air bubbles through maintenance of the patient’s blood pressure above a certain level during general anesthesia.

RESULTS
The incidence of the DWI HSI lesions differed significantly at 89.2% (33/37) during period 1 and 26.5% (9/34) during period 2 (P < 0.0001). The incidence of symptomatic lesions differed between the two periods (29.7% during period 1 vs. 2.9% during period 2, P < 0.003).

CONCLUSION
By modifying our microcatheter handling technique with intentional active manipulation of a patient's blood pressure during coiling of unruptured cerebral aneurysms, we could successfully reduce the incidence of microembolic lesions on post-procedural DWI.
ICD-10-based Coding (hardcopy backboard)

Alex Towbin MD (Presenter): Author, Amirsys Inc Shareholder, Merge Healthcare Incorporated Consultant, Guerbet SA, Lisa Ulland: Nothing to Disclose, Rebecca Masters Pryor BS, RT: Nothing to Disclose, Emily Fiehrer BS, RT: Nothing to Disclose, Judy Hardin: Nothing to Disclose, Morgan P. McBee MD: Nothing to Disclose, Christopher N. Alsip BS, RT: Nothing to Disclose, Sally Hutchinson May: Nothing to Disclose

PURPOSE

In 2009, the US Department of Health and Human Services announced that the currently used International Classification of Diseases, Ninth Revision code set (ICD-9) will be replaced with the tenth revision (ICD-10) code set. The change is currently set to take effect on October 1, 2015. The new code set greatly increases the specificity of coding and expands the total number of diagnosis codes from approximately 13,000 to more than 60,000. The transition to ICD-10 will affect every medical practice in the US, although the degree of the effect will partially depend on the specialty and patient mix. Radiology practices, like other specialties, have unique challenges that must be overcome in order to code their studies accurately. The purpose of this project is to describe one academic radiology department's strategy to convert the department from using an ICD-9-based coding schema to an ICD-10-based schema.

METHODS

Initially, a risk assessment was performed. All final radiology reports signed by one of ten faculty radiologists over a three-month period were coded using a commercial ICD-10 automated coding system (CodeKyte CodeAssist; 3M Health Information Systems, Salt Lake City, UT). The resultant codes were then assessed to identify specific procedures in which generic codes were frequently used. After performing the risk assessment, two major patterns emerged in deficient reports: reports were either missing detailed historical or diagnostic information. Each deficiency was addressed in a different manner. In order to improve clinical history in final radiology reports, all technologists were asked to collect a detailed clinical history from the patient or their family and to document the history in the electronic medical record. This work expanded on a previously implemented improvement project. To assess the technologists' effectiveness in obtaining the clinical history, audits were performed for each modality division and compared to baseline performance. Each history was scored by one project team member and was considered complete if it was able to answer the following questions: What happened? Where is the problem? When did the problem start? The percentage of complete histories was plotted on a run chart with a goal of 90% of studies having complete histories. The department has a history of using standardized, structured reports for nearly every study performed throughout the department. Because many of the final radiology reports still lacked the detailed clinical history obtained by the technologist, the standard, structured reports were altered to populate this information automatically. In order, to improve the diagnostic information in the final dictated reports, procedures with the most commonly deficient reports were identified and the corresponding structured reports were edited so that the required information could be consistently obtained.

RESULTS

A total of 11,792 final reports were initially assessed using the commercial ICD-10 coding engine. Of these, 44% were judged to be deficient, yielding an unspecified code. The vast majority of these deficient reports were for extremity radiographs (63% of total). Initially, radiography technologists worked to document a complete clinical history. At baseline, the radiography technologists obtained a complete history for 65.5% of radiographs performed in the department. One month after implementation, the percentage of complete histories improved to 94%. In February 2014, the history project was expanded to include all modalities. At baseline, technologists obtained a complete history for 48.5% of CTs, 44.0% of ultrasounds, 81.6% of MRIs, 17.0% of interventional radiology cases, and 30% of nuclear medicine studies. Because the vast majority of reports deficient in diagnostic information were extremity radiographs, these structured reports were the most heavily edited. An ICD-10 code book was used to ensure that the required information was obtained for accurate ICD-10 coding. For every extremity radiograph, the radiologist is now asked to report on a series of findings relating to fractures such as the location and type of fracture, the presence of physeal involvement or displacement, and the presence of healing. These reports are currently in the approval process and, once implemented, will be used to report on all extremity radiographs.

CONCLUSION

We believe that a coordinated and comprehensive process is required to convert a radiology department from ICD-9-based coding to ICD-10-based coding. Through this project, we have performed a risk assessment and identified and implemented strategies to mitigate these risks. As we approach the October, 2015 deadline to convert to ICD-10 coding, we plan to begin dual coding and use this data to further refine our reports.
In recent years the growth of medical imaging as a national driver of healthcare costs has minimally decreased, however, spending continues to rise, despite a prolonged economic recession and reform legislation. Radiology utilization management, a concept implemented over the last fifteen years as a strategy to curtail costs, has become a reality of modern practice and thus far has developed in two major forms, active management through radiology benefits management (RBM) versus computerized decision support (CDS) at the point of order entry. Both methods have their advantages and disadvantages, with the radiologist playing an overall minor or behind the scenes role in each. We suggest a different approach in which the radiologist partners with colleagues from different clinical specialties to lead an 'action team' tasked with gathering and analyzing data pertaining to imaging exams and presenting this data to referring physicians in a manner that allows for the development of appropriate ordering trends. With this approach, the radiologist is an active and visible partner in the process.

METHODS

A radiology utilization action team (RUAT) was established at our institutions consisting of physicians and other allied health professionals from different specialties but including at least one radiologist, often as the chair or co-chair of the team. Team members serve voluntarily. The team meets monthly to review ordering trends from across the institutions, identifying specific 'initiatives' on which to focus attention. Initiatives typically deal with high cost or complex examinations such as breast MRI, but could be applicable to plain film or ultrasound. The goal of the team is to develop initiatives that incorporate best practices based on proven scientific or clinical evidence. Data regarding the chosen initiatives is culled from the electronic medical record and is acquired for all individual physicians who order the examination. The data is analyzed for outliers, i.e. physicians whose ordering practices differ significantly from those of their peers. Action team members then meet with clinical departments to present ordering data and provide information regarding available best practice standards as well as suggested guidelines developed by the team. The action team also meets with specific physicians determined to fall into an outlier category to discuss their ordering practices, their personal rationale behind requesting examinations, and further communicate standards and guidelines. These physicians are shown the data sets pertaining to their department, providing a concrete way to visualize the general ordering practices of fellow practitioners. The process is dynamic, with physicians able to engage members of the action team at any time for direct consultation or advice and with the action team members checking in with clinicians to be sure they have the information they require to make informed decisions regarding diagnostic imaging orders. In contrast to RBMs, the teams do not prohibit individual physicians from ordering examinations.

RESULTS

Many initiatives exist simultaneously at our institution, dealing with examinations ranging from radiographs of the lumbar spine to PET/CT to shoulder MRI. An example of one such initiative involves abdominal ultrasounds. A steady increase in the volume of abdominal ultrasound studies performed at our institution was noticed. The radiologists members of the action team pointed out that an alternative "limited" abdominal ultrasound study was available and seemed to be underutilized. The radiology utilization action team developed an initiative to educate and inform ordering physicians of the availability of an order for limited abdominal ultrasound studies which could be used in certain specific clinical situations instead of the full abdominal ultrasound order. Following the dissemination of this information, ultrasound volume continued its increasing trend, but limited examinations were performed more frequently, absorbing some of the growth in ordering, while full abdominal exams remained relatively steady. Results of various other initiatives would be included in the presentation.

CONCLUSION

Utilization management is a general trend in healthcare that is now well entrenched and likely to be a fixture in the long term. Radiologists have an opportunity to actively participate that should not be ignored. We describe a multidisciplinary approach to utilization management that incorporates and values the expertise of the radiologist. The method advocated is a dynamic, physician-controlled process that allows for incorporation of best practice standards developed at the national level, such as ACR appropriateness criteria, as well the establishment of local or regional institutional guidelines based on collaboration among physicians of different specialties.

QSE130

Interdepartmental Process for Improving Intravenous (IV) Access and Turnaround Times in CT (Station #2)

Christoph Zoerch : Nothing to Disclose , Daisha Marsh ARRT (Presenter) : Nothing to Disclose , Dominik Fleischmann MD : Research support, Siemens AG

PURPOSE

Inadequate IV access in patients referred from the emergency department (ED) and inpatient units for contrast medium (CM) enhanced CT examinations increases the risk of CM extravasation, the need for repeat examinations, and contributes to extended procedural wait times by decreasing patient throughput—put resulting in emergency department (ED) crowding. The goal of this project was to implement measures that would substantially reduce the IV defect rate for ED and inpatients, by creating a mechanism that (1) provides consistently safe IV contrast administrations; (2) reduces the patient turn-around time by avoiding unnecessary interventions by CT staff technologists or nurses to correct IV defects; and (3) shortens patients’ time away from primary care staff and resources.

METHODS

We assembled a team of CT technologists, radiology nurses, nurses from the ED and inpatient units, as well as patient transport staff, to develop a “CT Patient Preparation Communication Process” with the goal of reducing the IV defect rate. The team categorized problems with peripheral IV's as the following types of "IV defects": (1) incompatible IV gauge; (2) incompatible IV site; (3) incompatible IV tubing; (4) loose IV connection; (5) non-working IV; and (6) painful/sore/infiltrated IV site. Any single IV defect, or any combination thereof can delay, complicate, or preclude safe power injections of intravenous CM. Next, we designed and implemented the "CT Handover and Preparation Sheet" consisting of a checklist and photographs, delineating correct patient preparation as well as IV placement standards required for safe and successful CT examinations. The "CT Handover and Preparation Sheet" was uploaded to the institutional directory of forms and its use has become required for every ED and inpatient. Actual IV defects are recorded by CT staff using an online form which records encounter and defect details. Unit nurse managers receive a weekly report of IV defect statistics and
imaging of the carotids. Technical issues remain. This same process is being mimicked by the other sections for application in MR and CT.

The next steps are to continue to monitor success rates for ultrasound exams to determine if any other addition, the rigor of such evaluations can identify improvements in other areas, here in that by altering the non-use of the templates indicating such a method as a successful management option.

After instituting standardized reporting templates, no PQRS coding failure was due to radiologist standardizing report templates using approved language can improve success rates for quality measures such as PQRS. The billing office, their process was reviewed and determined to be automated through a coding engine (CodeRyte) assessing for key language. Individual radiologist practice was reviewed to determine what standards for carotid duplex imaging were being utilized.

The group practice was standardized to use the Society of Radiologists in Ultrasound 2003 Consensus Conference statement velocities, modified slightly at one of the facilities with internal angiogram validated measurement data. The PDSA cycle was employed to effect rounds of change, beginning with optimizing the system level standard report templates, we sought to improve our success rate for this measure specifically on carotid duplex ultrasound exams.

A project group was organized with radiologists who read carotid duplex ultrasound and championed by the radiology medical director for one of the hospital practices. As the application of the CPT Category II code 3100F for this PQRS measure was performed by the billing office, their process was reviewed and determined to be automated through a coding engine (CodeRyte) assessing for key language. Individual radiologist practice was reviewed to determine what standards for carotid duplex imaging were being utilized.

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Measure #195 of the Centers for Medicare and Medicaid Services (CMS) Physician Quality Reporting System (PQRS) seeks to improve quality by standardizing the usage of direct or indirect reference to measurements of distal internal carotid diameter as the denominator for stenosis on carotid imaging exams. Through the use of system level standard report templates, we sought to improve our success rate for this measure specifically on carotid duplex ultrasound exams.

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The PQRS code can only be applied to Medicare patients, so non-Medicare patients were excluded. The billing engine was queried for exams billed under CPT 93880 (bilateral carotid duplex ultrasound) to Medicare with an associated 3100F code. The 2 year pre-change period tallied 536 qualifying ultrasound exams with 340 (63.43%) successfully receiving the PQRS code. 4 months of post change data showed an immediate improvement with 110 qualifying exams and 95 (86.36%) successfully receiving the PQRS code. On review of those that failed to receive the PQRS code, all had utilized the approved system template. A technical assessment was then performed with identification of a few previously unknown issues. First, patient’s insurer can change and if a person’s insurer changed to Medicare, the billing engine was not retrospectively assessing for whether the PQRS code should be added. The billing engine settings were adjusted to apply the PQRS code for qualifying language on all qualifying exams regardless of the payor, which would facilitate future resubmission if the patient’s payor changed to Medicare. In addition, several issues with the manner of insurer naming and storage within the billing reporting engine caused error with original and ongoing data assessments. The data reports were redesigned and rerun for evaluation, specifically limiting to those with Medicare at the time of the original exam. The pre-change tallied as 148 qualifying ultrasound exams with 124 (83.78%) receiving the PQRS code. The 6 month post-change tallied as 114 qualifying ultrasound exams with 104 (91.23%) receiving the PQRS code. The remaining failures in the post-change period were again confirmed to have used the approved report standard; the code had not been applied due to an internal process of routing the charges to hospital accounts for specific subpopulations of patients such as transplant recipients.

Standardizing report templates using approved language can improve success rates for quality measures such as PQRS. After instituting standardized reporting templates, no PQRS coding failure was due to radiologist non-use of the templates indicating such a method as a successful management option.

Going through these processes can uncover technical problems and data issues that would not have otherwise been recognized and corrected, likely otherwise attributed to variation in differing practitioner processes. In addition, the rigor of such evaluations can identify improvements in other areas, here in that by altering the methodology of the billing engine future resubmissions for changes in payors can be facilitated.

The next steps are to continue to monitor success rates for ultrasound exams to determine if any other technical issues remain. This same process is being mimicked by the other sections for application in MR and CT imaging of the carotids.
Lung Rapid Assessment and Management Program—Process Improvement Project (LungRAMP – PIP): Decreasing Wait Times for a Cancer Diagnosis (Station #4)

Daniel Toubassy BSC: Nothing to Disclose, Lilly Whitham: Nothing to Disclose, Alice Tsang (Presenter): Nothing to Disclose

PURPOSE

The Lung Rapid Assessment and Management Program (LungRAMP) was launched in 2010, as an outpatient diagnostic and treatment program which aims to quickly and appropriately assess and manage patients with presumed lung cancer.

The LungRAMP Process Improvement Project (LungRAMP PIP) was launched in an effort to:

- Ensure LungRAMP is consistently meeting provincial and hospital wait time targets from referral received to cancer diagnosis
- Identify opportunities for improving the quality of care provided to LungRAMP patients through the patient journey
- Reduce wait times for critical medical imaging tests because of the effect on diagnostic timelines of LungRAMP patients

METHODS

LungRAMP PIP leveraged Lean-Six Sigma methodology and involved 3 hospital departments, thoracic surgery, medical imaging and pathology to ensure the full patient journey was addressed. The project included 3 main phases: • Process Diagnostics: Staff interviews and process observations were conducted in order to develop an understanding of the complete patient journey. Following initial assessment a value stream mapping (VSM) event was facilitated to comprehensively map out the current state and identify areas of opportunity within the process. The VSM resulted in the prioritization of 2 main areas: Delays and inconsistencies in patient intake and care planning, Inefficiencies and miscommunication between clerical and clinical partners for CT guided lung biopsies, a critical diagnostic test. • Solution Development and Implementation: 2 approaches were used to create solutions for the VSM priorities: 2 cross-departmental working groups were established to address opportunities with patient intake and care planning and CT guided lung biopsy clerical workflow issues. A 2 day rapid improvement event (RIE) was held to tackle issues associated with day of exam processes for the CT guided lung biopsy procedure. By working closely with leadership and clinicians a project management team was able to guide staff through solution development and implementation. • Sustainability: Various Lean sustainability tools were implemented to ensure that any improvements would have a lasting effect, including: Leadership working group meetings to monitor progress of solution implementation Audits to monitor new processes and identify potential gaps Team huddles with frontline staff to discuss and resolve any issues Online dashboard to track weekly performance metrics for the CT guided lung biopsy

RESULTS

Various solutions were successfully implemented to improve the quality of the LungRAMP patient journey and decrease medical imaging wait times. Medical imaging improvements related to CT guided lung biopsies include:

1. 50% decrease in booking turnaround time from 10 to 5 days
2. 80% decrease in same day cancellations
3. Increased volumes of performed CT guided lung biopsies from 8 to 9 patients a week

Solutions:
- Implementation of an online consult review and approval process
- Implementation of new clerical workflow to streamline appointment bookings and notification
- Implementation of short call list of patients willing to accept last minute appointments

4. 25% increase in the number of exams that begin on time

Solution: Implementation of new day of exam workflow to ensure seamless patient care

5. 9% decrease in the length of time taken to complete a CT guided lung biopsy

Solution: Manual data tracking to ensure new workflow timelines are followed

Additional workflow improvements were made with the department of thoracic surgery to improve the patient intake and care planning process, specifically:

- Streamlined referral intake and booking processes for LungRAMP patients to decrease the wait for a surgeon consult
- Creation of customized care pathways to tailor the diagnostic assessment based on patient complexity

Overall, LungRAMP PIP enabled staff to create sustainable efficiencies in both LungRAMP patient management and CT guided lung biopsy processes. After implementing sustainable process changes and building a culture of continuous improvement the team is well on their way to reducing the wait time from LungRAMP referral to cancer diagnosis.

CONCLUSION

LungRAMP PIP successfully achieved its goals of decreasing the wait from referral to diagnosis and improved the quality of care provided to patients in their diagnostic journey. Specifically, significant gains were made in the medical imaging department, improving the efficiency of the CT guided lung biopsy procedure through Lean process improvement. Critical to the success of this project was cross-departmental collaboration, as it enabled improvements across the entire patient journey. LungRAMP PIP demonstrated that through process redesign and efficient use of existing resources it is possible to make high impact and sustainable improvements to patient care.
Reducing the Number of Changed Orders for Radiographs in a Radiology Department (hardcopy backboard)

**PURPOSE**

Incorrect orders are a common problem in many radiology departments and encompass errors such as ordering the wrong test for the indication, ordering a test on the wrong body part, or ordering a test on the wrong side of the body. If the error is not identified before the study is performed, the patient undergoes an unnecessary study and is subjected to the potential side effects of the examination such as excess radiation. Ideally, all errors are identified and corrected before reaching the patient. Once identified, the technologist must clarify each potential error with the ordering clinician and, if it is determined to be a true error, the technologist must either change the order or obtain a new order from the clinician. This process is inefficient for both the technologist and ordering clinician. To address this inefficiency, we sought to reduce the number of incorrect orders at the point of order entry.

**METHODS**

A quality improvement project was initiated in the radiology department of our large, tertiary care, academic children’s hospital. For the purposes of this project, we defined an incorrect order as any order changed by the technologist. We focused on orders changed by technologists as it is our typical practice to have the technologist make the order change rather than waiting for the ordering clinician to make the change. In addition, we decided to focus specifically on radiographs and fluoroscopy as they are the most common study performed and the most likely to be changed as a result of an order error. A weekly report was created in the radiology information system (Epic Radiant, Verona, WI) identifying the procedure type and originating department of each changed order. The number of changed orders was compared to the total number of radiography and fluoroscopy studies performed each week to calculate the percent of changed orders. Technologists were also asked to log the reason for each order they changed.

**RESULTS**

At baseline, 4.2% of all radiography and fluoroscopy were changed. When analyzing the data, we identified a number of issues resulting in incorrect orders. First, there were a small number of studies that were always incorrect. There were a number of reasons why these studies were not performed: the orders were outdated (i.e. Barium Enema), the orders were changed per departmental protocol (3-4 view radiograph of the Pelvis), or the orders were confused with a more common order (Fluoro >1 hour). In each of these cases, the order was removed and a new order was uploaded with the correct medical order from the radiology information system (Epic Radiant, Verona, WI), which led to changes in the radiology department preference list. We found that the order set for PICC placement had two problems. First, it contained the incorrect order for fluoroscopy guidance and second, it did not contain the abdominal radiographs order needed when a lower extremity PICC was placed. Each of these errors was corrected in the order set. No further order set errors were identified. We then looked at the specialty/department where each incorrect order originated. We found that changed orders were most likely to originate from inpatient floors (30.2%), the emergency department (24.7%), community pediatricians (21%), and orthopedics (5.8%). In order to decrease the number of incorrect orders from each of these divisions, we examined their radiology preference list and suggested several changes to each list. These changes were designed to simplify the preference list by removing orders that were either incorrect or rarely used (i.e. 3-view hand radiograph for arthritis was removed from the emergency department preference list); grouping similar studies together (i.e. all upper extremity radiographs are in the same section); or grouping different imaging studies of the same body part next to each other (i.e. single view chest x-ray and two-view chest x-ray). In addition, the orders were renamed to include the common indications for each imaging test (i.e. 1V abdomen - constipation). Because many incorrect orders from community pediatricians were obtained via a paper order form, we simplified our paper order form and provided updated protocols for the front desk staff who transcribe the paper orders into an electronic order. In order to make the number of changed orders, a run chart was created. While this project is still ongoing and many of the preference list changes have yet to be implemented, the percentage of radiography orders being changed has decreased from 4.2% to 3.7%.

**CONCLUSION**

Quality improvement techniques can be used to decrease the number of radiography orders changed in a radiology department. We believe that the changes we have made help to make our department safer by decreasing the chance that an incorrect study will be performed.

Improving CPT Coding Accuracy for Common Musculoskeletal Interventions (hardcopy backboard)

**PURPOSE**

Knowledge of Current Procedural Terminology (CPT) codes is essential for physicians for appropriate documentation and reimbursement as well as prevention of fraudulent claims. One of the most common types of fraud/abuse are misrepresentation of services with incorrect CPT codes, which can lead to billing for services that were not performed or billing the incorrect number of services that were performed. In addition, medical coding/operations departments have the responsibility of coding and arranging a practice, the ultimate responsibility for coding accuracy rests on the clinician. We identified common CPT coding errors for interventional musculoskeletal procedures at our institution, and sought to increase coding accuracy.

**METHODS**

At our institution a medical coding/operations department provides oversight for correct CPT coding for all procedures performed. Monthly reports of departmental CPT coding errors for musculoskeletal procedures for the preceding ten months were analyzed with coding errors recorded and categorized according to
Density team will continue to monitor the patient's lead time on a monthly basis and identify opportunities to need to be short and the importance of not jumping to solutions at the beginning of the project. The Bone testing successful process changes, small changes can have a big impact on other stakeholders, PDSA cycles

In conclusion, the Bone Density team successfully improved their patient's flow through the process, reduced flow better and they are less stressed. During this project, the team questioned their standard process for breast imaging patients needing a Bone Density exam, pulling the patients from the lobby five minutes prior to their scan time, reducing the travel and wait time for wheelchair patients and eliminating the practice of batching exams prior to analysis. A future state VSM was developed to reflect the changes to the process steps batching exams prior to analysis. A future state VSM was developed to reflect the changes to the process steps

PURPOSE

As part of a Value Stream Mapping initiative in the Radiology Department, our team identified that patients needing a Bone Density study had a total lead time of 94.3 minutes with approximately 75% of that time being non-value added wait time. The goal of this project was to decrease the patient's lead time, from patient arrival or report time through study completion, by 10% from a baseline of 94.3 minutes, in September 2013, to 84.9 minutes by December 31, 2013.

METHODS

The team was formed in July of 2013 and was led by the Assistant Supervisor and guided by a Process Improvement coach. The five Bone Density Technologists were all involved in the project and alternated their attendance at the project meetings. The team also included key stakeholders from the registration desk and breast imaging. The project team utilized several process improvement tools which included the DMAIC methodology, a project charter, current and future state Value Stream Maps (VSM), a Pareto diagram and analysis, Plan Do Study Act (PDSA) cycles, observation, pull systems, visual cues and a control plan. By visualizing the patient flow on the current state VSM, the team was able to accurately measure the duration and first time quality rate at each step of the process. A Pareto diagram allowed the team to determine the most time consuming steps and largest sources of opportunity. From that analysis, the team decided to focus their efforts on improving the Bone Density analysis step and the patient waiting steps of the process. The team brainstormed ideas, tested changes via PDSA cycles and ultimately implemented five key process changes. These changes consisted of improving the patient's process for locking their belongings, reducing process steps for breast imaging patients needing a Bone Density exam, pulling the patients from the lobby five minutes prior to their scan time, reducing the travel and wait time for wheelchair patients and eliminating the practice of batching exams prior to analysis. A future state VSM was developed to reflect the changes to the process steps and times.

RESULTS

When the project closed on December 31, 2013, the total lead time for Bone Density patients had decreased from 94.3 to 50.5 minutes which equated to a 46% reduction and easily exceeded the goal of 10%. Since then, the team has continued to sustain the efforts and decrease the lead time to 35.3 minutes in January, 41.2 minutes in February, and 27.7 minutes in March of 2014. Staff have anecdotally shared that their day seems to flow better and they are less stressed. During this project, the team questioned their standard process for obtaining two images for hip and spine studies. As a result, the leadership team acquired the necessary data to analyze the impact of the dual studies and concluded that the second set of images were indeed non-value added. In March 2014, after this project had closed, the process changed so that the technologists will only analyze the impact of the dual studies and concluded that the second set of images were indeed non-value added. In March 2014, the leadership team acquired the necessary data to address additional intradepartmental coding changes that have arisen. Additionally, we have continued offering regular group assessment and feedback which reinforces the importance of correct CPT coding and encourages continued physician and technologist coding awareness and communication. Our project demonstrates these improvements can take place even in a departmental setting with multiple rotating fellows and residents.

CONCLUSION

In conclusion, the Bone Density team successfully improved their patient's flow through the process, reduced patient lead time and it led them to a satisfied morning huddles are key to testing successful process changes, small changes can have a big impact on other stakeholders, PDSA cycles need to be short and the importance of not jumping to solutions at the beginning of the project. The Bone Density team will continue to monitor the patient's lead time on a monthly basis and identify opportunities to
Reducing Breast MRI Cancellations and No Shows (Station #1)

Neil Shah MD (Presenter): Nothing to Disclose, Anna Irene Holbrook MD: Nothing to Disclose, Michael R. Aho MD: Nothing to Disclose, Nathan Spell: Nothing to Disclose, Mary S. Newell MD: Nothing to Disclose

PURPOSE

The efficient and appropriate scheduling of imaging studies is a vital part of any radiology practice. This is especially true for higher cost, more time-consuming modalities such as MRI; where empty slots are more difficult to fill, improperly vetted patients are more difficult to reschedule, and potential for revenue loss is greater. Our institution currently schedules up to five breast MRIs per day. The cancellation rate (which includes no-shows) for scheduled patients is up to 15-25%, with these slots oftentimes going unfilled due to lack of prior notice. The purpose of this project is to: Determine the reasons for breast MRI cancellations and no shows, Reduce the percentage of cancellations and no shows for breast MRIs to 10%. Decrease the percentage of unused breast MRI slots to 5%

METHODS

Data Gathering: First, we created a flowchart outlining the steps involved in getting a breast MRI, from our institution scheduling the study to the patient arriving for the study. We identified steps in the process that might potentially lead to an MRI being cancelled or a patient not showing and MRI slots consequently being left unfilled. Then, we called all of our institution’s breast MRI no-shows from the past 6.5 months and asked them their reason for not showing. We created a Pareto chart to highlight the most common reasons for cancelling. We also checked the old schedules to see if these cancellations and no show slots were filled. Finally, using the flowchart and patient survey, we created a fishbone diagram to help guide our intervention methodology. Intervention: For our intervention, we called patients three days before their appointment to remind them of their MRI. Statistical Analysis: We used univariate analysis and statistical process control data and charts.

RESULTS

The flowchart we created outlining the steps involved in successfully getting an MRI shows several events that potentially lead to cancellations: Not getting a precertification in time Insurance company denying the MRI Insurance company recommending a cheaper MRI elsewhere When one of these events occurs and the appointment is cancelled, our scheduler attempts to fill the timeslot with another MRI. If the cancellation occurs three or more days prior to the MRI, the scheduler has enough time to fill the slot. However, if the cancellation comes within three days of the appointment, the slot remains unfilled a vast majority of the time. When none of these events occur, our scheduler calls the patient one day prior to their appointment as a reminder. Sometimes the patients still do not show for various reasons (listed below), and the slot goes unfilled. Results of our survey of reasons for cancellations and no shows: Conflict: 44% Cancelled with clinician but not our department: 12% Insurance: 12% Forgot: 8% Medical concern with getting an MRI: 6% Clinician felt the MRI was unnecessary: 6% Claustrophobia: 3% Unable to get sedation: 3% MRI malfunction: 3% Too sedated: 3% Pregnant: 3% Our fishbone diagram, derived from the flowchart and patient survey, lists causes of cancellations and no shows from three sources: the patient, our institution, and the insurance company. Based on the flowchart, patient survey, and fishbone diagram; we decided to call patients three days in advance to remind them of their appointment, answer any questions, and resolve any conflicts. If there was an issue with scheduling, we referred them to our scheduler. Three days gave us enough time to fill the MRI slot if the patient notified us of a cancellation. Pre-Intervention: Cancellations and no shows: 15.7% Unfilled slots: 12.21% Post-Intervention: Cancellations and no shows: 9.8% Unfilled slots: 8.0% Preliminary data shows that both the percentage of cancellations and unfilled slots decreased, with the post-intervention cancellation rate of 9.8% meeting our goal (<10% cancellation rate.)

CONCLUSION

Our preliminary data is promising, showing a drop in both cancellation/no show and unfilled MRI slot rates. As we continue our study and the post-intervention sample size grows, we will be better able to determine whether the decreased rates are statistically significant. If deemed so, our plan is to change policy to call patients three days in advance and extend this recommendation to all MRI appointments, not just breast MRIs.

Improving Compliance with Screening Mammography Guidelines in an Insured Population by Initiating a Mobile Mammography Program to Increase Access to Screening Mammography in a Metropolitan Area (Station #2)

PURPOSE
To improve compliance with screening mammography guidelines in an insured population in a metropolitan area by increasing access to screening mammography with a new mobile mammography program.

METHODS
The American Cancer Society says lack of time is the number one reason that women do not undergo annual mammograms. Ontillo et al. showed that "Time to the nearest mammography center was predictive of missing mammograms." (Am J Roentgenol. 2013 Nov; 201(5):1057-63). We established our mobile mammography program in December 2012 with a mission to improve access to screening mammography by minimizing travel time for women who may not undergo screening mammography as frequently as is recommended. Our full-field digital mammography coach operates in an urban metropolitan area, with no differences in insurance requirements from our hospital's breast imaging center. This approach to improving compliance and access to breast cancer screening is in contrast to mobile mammography programs created to service women in rural communities or the uninsured. The coach employs a mammographic technologist and a driver who serves as the registrar. For 3 months, the coach visited 4 outpatient primary care clinics in the metropolitan area that are owned by our hospital. We made informational visits to providers at these clinics. On days when the coach was at each clinic, a sign indicating that the coach was on site, and that walk-ins were welcome, was displayed in the clinic. Then we initiated visits of the mobile mammography coach to grocery stores, local businesses and special events. The number of patient visits at each outpatient clinic and special event were tracked. Based upon utilization, the number of coach visits to each site in the upcoming month was adjusted. IRB approval was obtained for electronic medical record review. Date of last mammogram was obtained from the electronic medical record if the prior mammogram was performed at our institution. If performed at an outside institution, its date was obtained from outside institution images received for comparison during the interpretation process. Otherwise, the patient's recollection of the date of her last mammogram was used. Review of the electronic medical record revealed which mammograms on the coach led to a diagnosis of breast cancer.

RESULTS
In 13 months, 1253 women underwent screening mammography on the mobile coach. Seven breast cancers were found: 5 invasive ductal carcinomas, 1 invasive lobular carcinoma, and 1 ductal carcinoma-in-situ. The frequency of screening mammography continues to be debated. Annual screening mammography is endorsed by the American Cancer Society, the American College of Radiology, the Society of Breast Imaging, and the American College of Obstetricians and Gynecologists. The United States Preventative Services Task Force recommends screening mammography every two years. Our coach successfully increased compliance with all of these screening mammography guidelines. Of 1253 women screened on the coach, 1175 (97.5%) had not undergone mammography in the past year and 657 (54.6%) had not undergone mammography in the last two years. The longest time since prior mammogram was 24 years and the median time since prior mammogram was 1.9 years. 163 (13%) of mammograms performed on the coach were baseline mammograms. 277 (22.1%) of the screens on the coach were performed at special events; the remainder were performed at the primary care clinics. 372 (29.7%) of the mammography patients on the coach were women who saw the coach and "walked-in" without an appointment. All of the completed patient satisfaction surveys scored 4 or higher (on a 5 point scale, where 1 is the lowest and 5 is the highest level of satisfaction). Many women wrote on the surveys that ease of access provided by the coach inspired them to obtain their overdue mammogram. In its first 13 months, our mobile program required 960 patients to cover program costs and 1253 patients were examined (131% of break-even number). 8816 women underwent screening mammography at our hospital's breast imaging center during that time. The addition of the mobile coach increased our screening mammography volume by 14.2%.

CONCLUSION
The mobile mammography program achieved its mission of increasing compliance with screening mammography guidelines, while meeting program costs, and led to the diagnosis of 7 breast cancers. Because of the program's success, we are upgrading the coach to perform digital breast tomosynthesis.

QSE122
Excellence in Transcription Accuracy: Taming Voice-Recognition Errors with Radiologists as Editors
(Station #3)
Frederick A. Mann MD (Presenter): Nothing to Disclose, Sarah M. Russell: Nothing to Disclose, Linley Armiger: Nothing to Disclose, Jayson Scott Brower MD: Nothing to Disclose, Steve Duvoisin: Nothing to Disclose

PURPOSE
Re-establish transcription error-free diagnostic radiology reports historically obtained using transcriptionists with a web-based computerized continuous speech (voice) recognition program [VR] with editing performed real time by dictating radiologists.

METHODS
Beginning in 2009 (baseline), we have had a Quality Assurance Editor [QAE] review 30 reports per month per radiologist in our Eastern Division. The QAE, using a standard data extraction form, classified each report as error-free or not. Word error rates were calculated. Our Western Division began using a web-based computerized continuous speech (voice) recognition program [VR] with editing performed real time by dictating radiologists. Our Western Division continued to use routine random peer-review feedback, supplemented by regular audits (~10 examinations per radiologist). Data was entered by report institution of origin, accession number and radiologist into a MySQL database (Oracle, Redwood, CA). Data exported to Excel (Microsoft Corporation, Redmond WA) for analyses: mean, median, minimum, maximum, & skew by radiologist by year. As part of root cause analysis, transcription errors were assigned to one of the 9 Regenstreif VR error classes: (1) Annunciation; (2) Dictionary absence; (3) Suffix (wrong tense); (4) Added words; (5) Missing words; (6) Homonyms; (7) Spelling; (8) Unclassifiable based on context; and, (9) Critical errors, in which reader might confuse meaning of report. Summary and case-specific data were used to assign human-system integration: (1) Tasks compatible with human capabilities and characteristics (dictating and editing); (2) System design and implementation capable of eliminating or reducing human error; and, (3) System implementation made to take advantage of unique human capabilities. Per report program costs were calculated.

RESULTS

The number of reports scored by the QAE for years 2009-2013 was: 8500, 9246, 17886, 17946, and 19699, for a total of 73277. Based on baseline and follow-up analyses, system design and implementation contributed to most of VR transcription errors, although individual radiologists showed significant differential performance. Approximately 20% of radiologists were “repeat offenders” (eg, late adopters serially in bottom decile for error-free report proportions). Negative skew reflects the long tail towards low proportion of error-free reports in this group, and changes in skew over time show initial narrowing of variance in the “adopting” radiologists towards higher proportions of error-free reports and convergence as late adopters caught up. The implemented interventions include: (1) Introduction of standardized report templates and subroutine macros; (2) Monthly feedback to individual radiologists containing anonymized histograms showing their error-free report percentage relative to peers, and specific transcription errors receiving addendum to original reports; (3) System dictionary and radiologist phrase training, as part of enhanced user education; and, (4) Both group leadership and peer-to-peer encouragement for all radiologists to be vigilant in reducing transcription errors (eg, “Good radiologists do not sign bad reports.”). The combination of system design and radiologist education initiatives resulted in substantive improvements in word error rates, and in proportion of transcription error-free radiology reports: 2009 0.51 0.55 2010 0.82 0.81 2011 0.39 Minimum 0.03 0.03 0.09 Maximum 0.97 0.97 0.97 Minimum 0.03 0.39 0.71 0.92 Maximum 1.00 0.97 0.97 1.00 Skew -1.62 -1.00 -1.43 -2.79 -0.63 Small only a change proportion of error-free reports from baseline data was appreciated in the Western Division (median 2009-2013: 0.75, 0.78, 0.77, 0.80, and 0.82). The program cost varied with total volume between $0.04 and $0.08 per examination performed.

CONCLUSION

Using data-driven system design changes and (non-punitive) radiologist education, considerable improvements in transcription quality can be achieved without sacrifices in radiologists’ productivity. We are currently extending the existing process to our Western Division. We plan a more intensive case review during implementation of a new VR vendor, as algorithms for error reduction (eg, minimum classification error [MCE], large margin minimum classification error [LMMCE], hidden Markov model [HMM], etc.) vary by vendor - as do vendor-installed dictionaries, noise-reduction strategies, etc.

QSE132

MRI Rapid Diagnostic Pilot (Station #4)

Bradley Lang: Nothing to Disclose, Gabriela Penaloza (Presenter): Nothing to Disclose, Jeffrey Zon: Nothing to Disclose

PURPOSE

The region has experienced increasing demand for MRI services and unprecedented fiscal pressure within the health care system as a whole. The MRI Rapid Diagnostic Pilot aimed to develop a shorter MRI scan without significantly reducing the quality of the imaging or the reliability of the diagnoses. Shorter scans would improve access to MRIs for the population by allowing for higher patient throughput per unit of time. Also key to the pilot’s purpose were keeping costs at or below historical levels, and delivering a patient experience that is at or above that of the existing MRI service.

METHODS

To achieve shorter scans, the medical imaging department set a target for a ‘rapid exam’ of 20 minutes or less, which would be offered to a select group of patient populations. This 20 minute offering replaced the 30 or 45 minute exams which were otherwise available to the same patients for the same imaging purposes. For each of these patient populations, new sets of imaging protocols were custom designed to reduce exam times while maintaining diagnostic image quality. Development of the protocols was executed by a multi-disciplinary team of radiologists, technologists, booking staff, and administrators. Seven distinct patient populations were identified where trials of rapid exams were expected to have minimal risk to diagnostic quality and safety. Following the development of the protocols, rapid exams were conducted during a six month period where performance was closely monitored. Both booking staff and clinical staff collected additional data during the pilot, detailing exam delays, various risks, and other process data that contributed to performance measurement for the new protocols. Technologists were also trained on techniques to scan effectively using the new protocols to keep exam times down and image quality up. Regular audits were conducted to monitor variability in exam times, reduce risks related to the new protocols, and to ensure high data quality for the manually entered process data. The team also met regularly as a working group to share successes, escalate issues, and work together on process/system improvements to ensure pilot goals were met.

RESULTS

At the completion of the six month pilot, more than 1,200 rapid exams had been completed. Rapid protocols reduced exam duration on average by 39%. Projecting these results on an annualized basis for the department, the shorter patient scans free up a potential 766 MRI hours annually. With these efficiencies, a potential 2,522 additional patients could receive imaging annually using rapid MRI scans, thereby increasing access and decreasing wait times. Not only did the MRI Rapid Pilot achieve its throughput, but this success was achieved without any material detriment to diagnostic quality. Image quality remained high, and only one pilot patient in over 1,200 required a repeat MRI due to sub-par images. Furthermore, a physician-led quality assurance review of over 200 cases did not identify a single case where a physician review of the diagnosis differed from the original diagnosis. The success in diagnostic quality can be attributed to requisite diagnostic image quality produced by the new protocols. Data collected during the pilot show no correlation between the pilot protocols and any safety or risk incidents.

CONCLUSION

Regardless of the pilot’s success, there were still challenges experienced by the team. Of note, there was perceived increase to staff workload which impacted staff satisfaction during the course of the pilot. As a result, the project team conducted focus groups following the pilot to determine the best way to operationalize the rapid protocols without causing stress to the workforce. In the end, compromises were made to ensure that workload was manageable without eliminating the benefits of the rapid exams, such as limiting the number of consecutive hours of rapid patients booked on schedule as well as a re-evaluation of operations within six months of implementation. At the conclusion of the pilot, despite challenges in managing data quality and staff workload, there was substantial evidence to conclude that the MRI Rapid Diagnostic Pilot would lead to greater efficiency and access at the pilot sites. Overall, the recommendations the pilot team included implementing the MRI Rapid Diagnostic model at other MRI centres with confidence that the same results would be attained. A 2-3 day focused engagement, inclusive of implementation program, is currently under development to deliver...
improvement. From the affinity diagram a cause and effect diagram using the “5-why” exercise was completed.

The team started with a brainstorming activity using an affinity diagram to categorize their opportunities for improvement. In the “Analyze Phase,” after reviewing the baseline metrics, the team developed a stakeholder analysis to confirm team representation and developed a communication plan to assist with change management. During the “Measure Phase,” process metrics were collected to identify the on-time start rate by exam type (contrast, no contrast, with sedation), the on-time start rate for the subsequent four appointments following the first appointments of the day along with the collected to identify the on-time start rate by exam type (contrast, no contrast, with sedation), the on-time start rate for the subsequent four appointments following the first appointments of the day along with the overall on-time start rate. In review of our MQSA data, our practice noticed a trend toward increasing screening recall rates which prior to this project, had peaked at 16% for the group. Call back rates for individual radiologists varied from 20% to 12%. A Practice Quality Improvement Project (PQI) was created to improve performance.

METHODS
Following the ABR guidelines for PQI projects, a Plan-Do-Study-Act (PDSA) process was created. Our group identified screening mammography recall rates as an area for practice improvement. An initial target goal of reducing recall rates to 10- 12% was established. Recall rates and cancer detection rates were collected from our mammography reporting system. Data for individual radiologists and the group were made available to all breast imagers. This information was distributed at our monthly staff meeting. Root cause analysis was performed to identify factors leading to increased screening recall rates among individual radiologists. Our improvement plan consisted of “double reading” all of our screening call backs. All BI-RADS 0 screening examinations, underwent a second, independent review by a different radiologist. The second reviewer agreed or disagreed with the call back. If there was disagreement, a discussion of the case ensued. The primary reader was left to decide the final impression and BI-RADS assessment category for each case. If the patient’s screening mammogram was deemed a BI-RADS 1 or 2, both radiologists’ names were issued on the final report; with the primary reader as the “reader” and the secondary reviewer as an “agreer”. A total of four PDSA cycles were performed. Call back rates and cancer detection rates were recorded and reviewed monthly. Participants discussed data and recommended adjustments in the improvement plan. Recall rates and cancer detection rates were recorded and reviewed monthly. Comparison was made at the end of each cycle to determine if there had been improvement.

RESULTS
During the initial study period, the combined screening recall rate was 17.34% for the group (range 15.47 - 20.80%). This number decreased considerably during the first PDSA cycle to 10.97% (range 10.37 - 11.35%). These rates were maintained on subsequent cycles at 11.19% and 11.86%. Cancer detection rate was 6.5/1000 during the initial study period and was maintained at 4.3/1000, 5.2/1000 and 6.1/1000 during each of the four cycles. Radiologists expressed value in discussing difficult cases and appreciated advice and differences in approach gained from peer review.

CONCLUSION
Screening recall rates were reduced and maintained to the desired level by implementation of this PQI initiative. Although recall rates were reduced, we did not experience a negative impact on the cancer detection rates for the group. Individual case feedback from peer review was deemed a crucial component. By following current ABR guidelines, our project had the added benefit of meeting requirements for the ABR’s Maintenance of Certification (MOC). PDSA design is translatable to other practice settings.

Improving Early Morning On-Time Start Rates at a Large Outpatient MRI Facility

PURPOSE
The ability to start on time with the first patients of the day impacts not only the patients’ experience but also the efficiency of the MRI practice for the remainder of the day. We describe quality improvements efforts made to increase the on-time start rate from a baseline of 17% in March 2013 to 78% in March 2014.

METHODS
This project took place in a large 12 scanner outpatient MRI facility. In early 2013, front-line staff recognized that the first patients of the day were frequently not starting their exams at their scheduled appointment times. A quality improvement project was initiated after baseline data collection. A multidisciplinary team of front-line staff (desk personnel, imaging assistants, nurses, and technologists) was formed, guided by a quality improvement advisor using the IHI Model for Improvement along with Six Sigma DMAIC framework, and supported by administrative and physician leadership. The “Define Phase” started with a kick-off meeting where project structure and expectations were reviewed. The team studied the components of the charter, specifically discussing project elements that were in and out of scope. After final charter agreement was achieved, the team developed a stakeholder analysis to confirm team representation and developed a communication plan to assist with change management. During the “Measure Phase,” process metrics were collected to identify the on-time start rate by exam type (contrast, no contrast, with sedation), the on-time start rate for the subsequent four appointments following the first appointments of the day along with the outcome metric of overall on-time start rate. In the “Analyze Phase,” after reviewing the baseline metrics, the team started with a brainstorming activity using an affinity diagram to categorize their opportunities for improvement. From the affinity diagram a cause and effect diagram using the “5-why” exercise was completed.
This exercise was followed by an impact/effort grid to prioritize tests of change. During the “Improve Phase,” successive PDSA cycles were executed until a final recommendation for standard operating procedure was achieved. The “Control Phase” consisted of developing a process flow diagram, closure document, and collecting data to ensure process changes were being followed.

RESULTS

During the period between initial data gathering to project initiation, the on-time start rate increased from 17% to 36% but remained stable until project improvements were tested. Workgroup assumptions to the near 20% improvement were attributed to staff awareness and a few minor process changes. With the first two PDSA cycles, the on-time start rate increased significantly but then returned to baseline with the next two iterations. Final PDSA cycle showed the greatest improvement at 77%. This included staffing a technologist and patient coordinator along with a nurse 45 minutes prior to the first appointment of the day. In addition to the staffing change, a morning huddle to identify and ameliorate patient-specific obstacles impacting start times was key to our success. The huddle included review of the number of patients, whether the patients required contrast and/or sedation, and process workflow. Since implementation and through the control phase the on-time start rate has improved to 78% with expectations to achieve greater than 85% by year end. In addition, team satisfaction with the project was measured and showed that 100% either agreed or strongly agreed to all questions including "our team developed better solutions and was more successful because we used the DMAIC framework and process improvement tools."

CONCLUSION

A multidisciplinary team composed of MRI frontline personnel and a quality advisor were able to significantly improve on-time start rates for the first patients of the day using IHI and Six Sigma methodology. This process identified the need for earlier arrival times for key personnel as well as the importance of an early morning employee huddle to identify and mitigate operational obstacles. This resulted in both improved patient care and increased employee satisfaction.
**CONCLUSION**

Physicians taking care of patients presenting to the hospital with symptoms worrisome for acute stroke have a narrow window for treatment decisions. Implementing several practice quality improvement measures has streamlined the ability of the clinical services in our hospital system to order head CT examinations in patients presenting with acute stroke and for the radiology department to review these studies and communicate relevant findings in an expeditious manner that ultimately affects the delivery of patient care. We are now working with the referring clinicians to optimize best ordering practices for “Stroke Code Head CT” examinations.

**METHODS**

To use a survey of referring physicians to direct department-wide Radiology quality improvement efforts.

**RESULTS**

The pre implementation survey was completed by 65 people (22 attendings, 30 residents) and the post survey by 55 people (20 attendings, 1 fellow, 24 residents). Survey participants did not report significant changes in their opinions pre relative to post implementation. Regarding resident education, positive expectations prior to implementation were: immediate report feedback to residents, more attending availability for resident education, decreased anxiety for new residents taking call, and quicker turn around time for finalized reports. Common negatives included decreased resident independence/autonomy, lack of resident directed learning, lack of subspecialty education, distraction of attending presence, and possibility of consulting clinicians bypassing residents. Regarding patient care, common positive expectations included quicker finalized reports, catching resident “misses” quicker to prevent adverse patient outcomes, decreased length of stay in the emergency department, decreased call back rate of discharged patients. Common negatives included lack of subspecialty read, increased use of more complex imaging, and possibly more unnecessary studies. Regarding location of the night shift attending in the same room as the residents, initially only 33% of residents preferred this idea, and post 24/7 implementation 46% preferred this idea. For attendings, initially 65% preferred this idea, and the number dropped to 50% after 24/7 implementation. Common reasons for wanting the attending in the same room were ease of communication, immediate feedback, and quicker changes to reports. The common reasons stated for separate rooms included decrease in resident autonomy with attending present, decreased consulting opportunities for residents, and the attendings felt they were a distraction to the residents. There was a decrease in the departmental average turn around time for reports. Prior to 24/7 implementation the time to finalize reports were as follows: CT scan 13.5 hours, diagnostic radiology 4 hours, MRI 11 hours, and ultrasound 8 hours. Post implementation the time to finalize reports are as follows: CT 3 hours, diagnostic radiology 1.5 hours and 25 minutes, MRI 10 hours, and ultrasound 2 hours.

**CONCLUSION**

Regarding 24/7 attending coverage, the majority of residents and attendings perceive an improvement in patient care, as supported by documented decrease in report turn around times. There are mixed opinions on whether resident education is improved or harmed, both during the overnight call and during the day with a decrease in the amount of day time attendings on staff at a given time. There is a consensus that resident independence, confidence, self directed learning, and speed has decreased with the implementation of 24/7 attending coverage. It is unclear at this point, how these factors will affect resident performances in their further practice. In addition, while many thought the overnight attending should be in the same room with the resident on call prior to implementation, we noticed that post implementation, more attendings felt the on call attending should be in a different room, which may be a result of noticed decreased resident independence and moving the attending to a different room may be a reasonable solution. There was an increase in the percentage of junior residents who thought the attending should be in the same room, which may be related to anxiety associated with taking call, however, this may be at the cost of resident independence.

**Purpose**

To evaluate the resident and attending opinions regarding the effect of 24/7 in-house attending call coverage on resident education, as well as the effect on patient care in regards to report turn-around times.

**RESULTS**

The pre implementation survey was completed by 65 people (22 attendings, 30 residents) and the post survey by 55 people (20 attendings, 1 fellow, 24 residents). Survey participants did not report significant changes in their opinions pre relative to post implementation. Regarding resident education, positive expectations prior to implementation were: immediate report feedback to residents, more attending availability for resident education, decreased anxiety for new residents taking call, and quicker turn around time for finalized reports. Common negatives included decreased resident independence/autonomy, lack of resident directed learning, lack of subspecialty education, distraction of attending presence, and possibility of consulting clinicians bypassing residents. Regarding patient care, common positive expectations included quicker finalized reports, catching resident “misses” quicker to prevent adverse patient outcomes, decreased length of stay in the emergency department, decreased call back rate of discharged patients. Common negatives included lack of subspecialty read, increased use of more complex imaging, and possibly more unnecessary studies. Regarding location of the night shift attending in the same room as the residents, initially only 33% of residents preferred this idea, and post 24/7 implementation 46% preferred this idea. For attendings, initially 65% preferred this idea, and the number dropped to 50% after 24/7 implementation. Common reasons for wanting the attending in the same room were ease of communication, immediate feedback, and quicker changes to reports. The common reasons stated for separate rooms included decrease in resident autonomy with attending present, decreased consulting opportunities for residents, and the attendings felt they were a distraction to the residents. There was a decrease in the departmental average turn around time for reports. Prior to 24/7 implementation the time to finalize reports were as follows: CT scan 13.5 hours, diagnostic radiology 4 hours, MRI 11 hours, and ultrasound 8 hours. Post implementation the time to finalize reports are as follows: CT 3 hours, diagnostic radiology 1.5 hours and 25 minutes, MRI 10 hours, and ultrasound 2 hours.

**CONCLUSION**

Regarding 24/7 attending coverage, the majority of residents and attendings perceive an improvement in patient care, as supported by documented decrease in report turn around times. There are mixed opinions on whether resident education is improved or harmed, both during the overnight call and during the day with a decrease in the amount of day time attendings on staff at a given time. There is a consensus that resident independence, confidence, self directed learning, and speed has decreased with the implementation of 24/7 attending coverage. It is unclear at this point, how these factors will affect resident performances in their further practice. In addition, while many thought the overnight attending should be in the same room with the resident on call prior to implementation, we noticed that post implementation, more attendings felt the on call attending should be in a different room, which may be a result of noticed decreased resident independence and moving the attending to a different room may be a reasonable solution. There was an increase in the percentage of junior residents who thought the attending should be in the same room, which may be related to anxiety associated with taking call, however, this may be at the cost of resident independence.

**Purpose**

To use a survey of referring physicians to direct department-wide Radiology quality improvement efforts.

**METHODS**

Referring clinicians through a major academic medical center were solicited to complete a multiple-choice...
question anonymous survey pertaining to the quality of service provided by the medical center's Radiology department. Surveys could be completed by paper or electronically. Subsequently, a departmental Quality Improvement committee, comprising members from all subspecialties, implemented a number of departmental initiatives in response to survey results. After one year, the survey was repeated. Survey responses between the two time points were compared using the Mann-Whitney U test.

RESULTS

The survey was completed by 93 clinicians at baseline and by 85 clinicians at follow-up. Lowest reported quality at baseline related to the quality and consistency of reporting, including management of incidental findings, accessibility of the radiologist, and immediate notification of emergent results. In response, committee members worked with their respective subspecialty sections to implement several departmental initiatives: (1) Developed structured report templates to replace standard prose text for the most commonly reported examinations for each section; (2) Created a standardized lexicon for consistently communicating the level of confidence in a provided diagnosis between radiologists and examinations; (3) Provided education regarding ACR Appropriateness Criteria and existing societal guidelines regarding consistent and optimal management recommendations; (4) Established embedded radiology reading rooms in a variety of clinical areas; (5) Expanded evening and weekend coverage; (6) Implemented a new policy for more rapid interpretation of stat examinations; and (7) Crafted an enhanced policy for use of an electronic system for communicating and tracking important non-urgent findings. On follow-up survey, there were significant improvements regarding the extent to which radiologists: (1) "specifically answer the clinical question" (4.6±0.6 vs. 4.2±1.0, p<0.001); (2) "appropriately prioritize relevant and incidental findings in the report" (4.5±0.7 vs. 3.8±0.9, p=0.001) (3) "make relevant comparisons to prior examinations and correlations with other imaging examinations" (4.6±0.7 vs. 4.2±0.9, p<0.001) (4) "provide consistent imaging or management recommendations" (4.5±0.8 vs. 4.0±1.0, p<0.001) (5) "are accessible for consultations, examinations or procedures" (4.6±0.7 vs. 4.0±1.0, p<0.001) (6) "demonstrate professionalism in interactions" (4.8±0.4 vs. 4.6±0.7, p=0.024) and (7) "immediately provide notification of emergent findings" (4.6±0.7 vs. 4.3±1.0, p=0.007). However, clinicians expressed no difference in how willing they were "to recommend the center's Department of Radiology to others" (4.8±0.5 vs. 4.6±0.9, p=0.111).

CONCLUSION

A simple survey of a Radiology practice's referring physicians can serve as an effective means of identifying areas to target for the practice's quality improvement efforts by highlighting those items that are most important or needing improvement in the eyes of its physician customers. Following specific actions taken in response to the survey results over the course of a year, we successfully demonstrated significant improvements in numerous areas, as judged by our reference physicians at the time of follow-up survey. Future efforts can focus on the level of customer service provided to our patients and referring physicians in order to further improve clinicians' reported likelihood of referring our department to others. This survey-based initiative provides an easy and straightforward approach that other practices may apply to enhance their collaboration with referring physicians and improve the quality of care provided.

QSE133

No More Wait and Delays: Streamline Work Flow to Decrease Patient Time of Stay for Image Guided Musculoskeletal Procedures (Station #4)

Eric M. Goodman MD : Nothing to Disclose, Anuoluwatomiwa O. Osunkoya BENg, MENG : Nothing to Disclose, Yvonne Yee Cheung MD, MS (Presenter): Nothing to Disclose

PURPOSE

Providing the right care at the right place and right time is the new paradigm in healthcare. But patients in our facility frequently have to wait for appointments and are delayed to be seen for image guided musculoskeletal (MSK) procedures. In fact, waits and delays are significant barriers to achieving this goal of "perfect care". The purpose of this story board is to describe our project in streamlining the process of image guided musculoskeletal procedures leading to decrease wait, delays and patient length of stay at the department.

METHODS

A process improvement team composing of secretaries, technologists, fluoroscopy team leaders, resident and attending MSK radiologists was assembled with the purpose of decreasing time of stay for patients undergoing image guided MSK procedures. Our team employed the data driven Lean Six-Sigma (LSS) methodology and was coached by our departmental quality engineer with black belt certification. The LSS methodology combines Lean and Six Sigma approaches to improvement activities. This highly structured methodology is organized into 5 steps: Define, Measure, Analyze, Improve, Control (DMAIC).

RESULTS

This multi-step DMAIC process took 6 months to complete. Define step: We first developed a project charter and identified all stake holders. Using the Voice of the Customer tool, we agreed on the primary goal of decreasing patients' time of stay at the department. A high level process map using the mapping tool, Supply-Input-Process-Output-Customer (SIPOC) further categorized our needs. Measure step: Detailed process maps were created individually by the secretaries, technologists and radiologists. Combining these detailed process maps, we chose time stamps that reflected patients' experience from the time of their arrival to their discharge from the department. We gathered data for two weeks and calculated the following average time intervals: Check-in time, 4:24 minutes; waiting room time, 20:30 minutes; technologists pre-procedure work time, 7:24 minutes; consent time, 4:36 minutes; patient positioning time, 4:36 minutes; procedure time, 14:30 minutes; post procedure work time, 7:18 minutes. Analyze step: From the collected data, the team created a value stream map that linked work and information flow, incorporated metrics and exposed waste. This specialized flow diagram helped us visualize and manage flow and thereby provided the opportunity to offer same day add-ons. The resultant global reduction of all time intervals led to a drop of patient stay from 60 minutes to 40 minutes. Control step: We documented standard practices and trained all secretaries, technologists and radiologists to reduce variation. We then handed off the new process to section leaders who would be tracking key performance
CONCLUSION

Using lean six-sigma methodology, we streamlined and stabilized our workflow in image guided MSK procedures leading to a shorter time of stay and reduction of waits and delays for our patients.

Evaluating the Effectiveness of On-Site-Education for Improving Quality Assurance for Cancer Screening Imaging (hardcopy backboard)

Moon Hyung Choi MD: Nothing to Disclose, Seung Eun Jung MD (Presenter): Nothing to Disclose, Joon-II Choi: Nothing to Disclose, Hyun Cheol Kim: Nothing to Disclose, Woo Kyoun Jeong MD: Nothing to Disclose, Eun Hye Lee MD: Nothing to Disclose, Yongsoo Kim: Nothing to Disclose, Seong Sook Hong MD: Nothing to Disclose

PURPOSE

Early detection of malignant disease by screening is one of the most effective ways to prevent cancer death. Many countries run screening programs for early detection of common cancers. However, to obtain optimal results for these screening programs, it is essential to obtain and maintain the adequate quality of each imaging examination. In our country, the government performed quality assurance program of imaging examinations for cancer screening every year. However, some medical institutes repeatedly failed quality assurance tests of imaging examinations, even when separate lectures related to quality control were given. Therefore, the Society of Radiology and the National Cancer Control Institute planned on-site-education for quality assurance of imaging examinations for cancer screening. The purpose of this study was to evaluate the usefulness of the on-site-education program for the quality assurance of screening imaging examinations for early cancer detection in clinical images.

METHODS

Only selected medical institutes were included in this study due to the nature of the demonstration project. Medical institutions without the availability of the entire examination results of 2011, 2012, and 2013 were excluded. The study population consisted of a combination of thirty eight medical institutes which underwent on-site-education in 2012 for the quality assurance of screening ultrasound of HCC, twenty one medical institutes for screening mammography, and twenty one medical institutes for screening barium study for gastric cancer. Score systems for the clinical imaging evaluation were developed several years ago by a consensus of experts in the Society of Radiology. Failure of the clinical imaging evaluation was defined as 1) less than 60 points out of 100 points in the clinical images, 2) failure of fulfillment for the essential factors for screening examinations, which includes patient information, date of examinations, and name of medical institutes. After an annual survey in 2012, on-site-education was performed by expert. Then, repeated survey was done for evaluating the effect of on-site-education. Failure rates and mean scores of the clinical imaging evaluation for screening examinations of 2011 survey, 2012 survey before and after on-site-education, and 2013 survey were compared. Failure rates were compared using the Friedman test and the paired McNemar’s test, and means scores were compared using the one-way repeated measure analysis of variance (ANOVA). P-values less than 0.05 were considered as statistically significant results.

RESULTS

1) Ultrasound for screening HCC Failure rates of 2011 survey, 2012 survey before education, 2012 survey after education, and 2013 survey were 81.6%, 15.8%, 18.4%, and 21.1%, respectively. Pair-wise analyses using the paired McNemar's test showed that the failure rate of 2011 survey was significantly poorer than the results of other surveys. Mean scores of 2011 survey, 2012 survey before education, 2012 survey after education, and 2013 survey were 61.7, 72.8, 82.7, and 74.6, respectively. The one-way ANOVA revealed a p-value of less than 0.001. Posthoc analysis revealed that scores of 2012 survey after education was the best and that of 2011 survey were the worst. 2) Mammography for screening breast cancer Failure rates of 2011 survey, 2012 survey before education, 2012 survey after education, and 2013 survey were 85.7%, 19.0%, 0.0%, and 33.3%, respectively. Pair-wise analyses using the paired McNemar's test showed that the failure rate of 2011 survey was significantly poorer than the results of other surveys. Mean scores of 2011 survey, 2012 survey before education, 2012 survey after education, and 2013 survey were 49.8, 73.6, 85.9, and 75.8, respectively. The one-way ANOVA revealed a p-value of less than 0.001. Posthoc analysis revealed that the score of 2011 survey was the worst. The scores of 2012 survey after education was better than that of 2012 survey before education (p=0.006). 3) Fluoroscopic study for screening gastric cancer Failure rates of 2011 survey, 2012 survey before education, 2012 survey after education, and 2013 survey were 85.4%, 19.0%, 9.5%, and 23.8%, respectively. Pair-wise analyses using the paired McNemar's test showed that the failure rate of 2011 survey was significantly poorer than the results of other surveys. Mean scores of 2011 survey, 2012 survey before education, 2012 survey after education, and 2013 survey were 51.2, 78.6, 91.4, and 71.2, respectively. Posthoc analysis revealed that the score of 2011 survey was inferior to those of other surveys (p<0.001). Also, the score of 2012 survey after education was better than that of 2013 survey (p=0.008).

CONCLUSION

On-site-education positively impacts on the failure rate and scores of the clinical imaging evaluation of the screening imaging evaluation for early cancer detection. However, the impact may be reduced after time and repeated, annual education might be helpful to maintain the quality of screening imaging examinations.

Reducing Waste and Improving Compliance with Regulatory Standards in the Ordering Process for Ultrasound Examinations from the Emergency Department (hardcopy backboard)

Stacy R. Schultz BA (Presenter): Nothing to Disclose, Venkatesh R. Bellamkonda MD: Nothing to Disclose, Deepti G. Goyal MD: Nothing to Disclose, Nora J. Hare: Nothing to Disclose, Karen A. Koch RN: Nothing to Disclose, Elizabeth C. Walter MD: Nothing to Disclose, Christopher Phillip Wood MD: Nothing to Disclose

PURPOSE

The purpose of this study was to reduce waste and improve compliance with regulatory standards in the ordering process for ultrasound examinations from the emergency department. This was done through the implementation of a quality improvement initiative that included education, feedback, and process changes. The impact of this initiative was evaluated using various metrics, including the number of ultrasound examinations ordered, the time taken to complete each examination, and the compliance with regulatory standards. The results of this study showed that the quality improvement initiative was effective in reducing waste and improving compliance with regulatory standards in the ordering process for ultrasound examinations from the emergency department.
To describe a collaborative effort between the Departments of Radiology and Emergency Medicine at a tertiary care multispecialty medical facility that used a Define-Measure-Analyze-Improve-Control (DMAIC) framework to improve the ordering process for ultrasound examinations from the Emergency Department (ED). The primary objectives were twofold: (1) to make the process compliant with CMS meaningful use regulations and (2) to reduce all forms of waste and thereby improve the efficiency and staff satisfaction with the process. The secondary objective was to design an infrastructure that facilitated ongoing monitoring of the process and detect opportunities for further improvement.

METHODS
A team of front-line staff from both departments developed a project charter and used standard Quality Improvement tools including a stakeholder analysis and process flow mapping of the current state. Using Lean methodology, the diagrams were utilized to identify communication inefficiencies and failures, wasted staff resources, redundancies, opportunities for error, and other forms of waste in the system. To meet the CMS objective of migrating to an electronic process, the workgroup used the existing ED electronic medical record (Pulsecheck, Picis, Inc., Wakefield, MA) to be the foundation for the new process. By making small changes to the process through Plan-Do-Study-Act (PDSA) cycles and collecting qualitative and quantitative data, the team designed the future state for ordering US examinations for ED patients. The group also used the flow maps to develop metrics for process inefficiencies such as phone call interruptions and time to patient transport. These data were gathered pre- and post-implementation. An important counterbalance metric was maintaining or improving staff satisfaction as assessed by surveying all employees in the ED and US. Adherence to these changes after implementation was also monitored in the control phase. The group developed a communication plan to help with change management including educational materials including a tutorial program, a user’s guide, and tip cards delineating the changes. In addition, face-to-face instruction was conducted with staff members a several weeks prior to implementation of the new process. A continuous 0-100 sliding scale was used in surveying ED and US staff. These continuous variables were analyzed with descriptive statistics and the differences between means were analyzed with an unpaired T-Test to determine significance. By convention we estimate a p<0.05 as statistically significant.

RESULTS
Migration to the electronic process was successful. Implementation of the new process decreased phone call interruptions by 80% and four separate ordering processes were reduced to two. Results of our pre- and post-intervention staff assessments showed statistically significant improvement with overall satisfaction from (42.3 to 73.7, p-value<0.001), patient safety (51.8 to 74.3, p-value<0.001), interdepartmental communication (42.3 to 69.4, p-value<0.001), and perceived efficiency (39.6 to 70.9, p-value<0.001). The ED residents had the greatest improvement in satisfaction (24.4 to 90.4, p-value<0.0001) followed by the ED attending (42.3 to 73.7, p-value<0.0001). This enabled leadership to monitor individual compliance and efficiency of each step in the execution of the US orders with data not previously available in the old system.

CONCLUSION
This 100-day, interdepartmental, collaborative, quality improvement effort using the DMAIC framework allowed for a successful migration to an electronic process while reducing inefficiencies and improving staff satisfaction. Secondarily, the newly developed process allowed for documentation of key workflow metrics and improved situational awareness in both departments. Lastly, this project positively affected staff satisfaction as well as patient throughput, safety, and satisfaction.
Breast Imaging-Reporting and Data System (BI-RADS) is the most widely employed standardized reporting lexicon. BI-RADS has improved patient care through clear and consistent communication of breast imaging findings, while creating a system to identify and monitor patients requiring follow-up and to correlate BI-RADS scores to outcomes. There has been some movement towards the development of a standardized reporting nomenclature for other disease processes and organs (e.g. Bosniak classification, Liver Imaging-Reporting and Data System (LI-RADS)), but none of these have yet been as universally adopted as BI-RADS. Modeled after BI-RADS, we created a standardized assessment codes for reporting focal masses in the liver, pancreas, adrenal glands and kidneys at our institution. This system, called Code Abdomen, has been created to improve communication with referring physicians and other radiologists and to facilitate identification of patients in whom follow-up imaging is required.

METHODS

Radiologists use Code Abdomen to assign focal masses in the liver, kidney, pancreas and adrenals to one of eight categories/codes that summarize the overall level of concern for malignancy and the need for imaging or clinical follow-up. These four organs were selected due to the frequency with which masses are detected and followed in these organs as well as the impact on patient outcome. A significant strength of Code Abdomen is that it is applied to all cross sectional abdominal imaging examinations (CT, US, MRI) regardless of the indication or the examination or the setting (in or out patient, emergency department). An important feature of Code Abdomen is that it provides many codes to capture the clinical complexity of focal masses but can be easily classified into four categories including: benign (1, 2, and 7), indeterminate (0 and 3), suspicious (4 and 5) and known cancer (6) (see figure). For indeterminate and suspicious lesions, we require radiologists to specify the modality and timing of follow-up. We introduced and adapted Code Abdomen in a staged rollout that began in July 2013. The first phase consisted of a 4-week “warm-up phase”, which included dedicated educational orientation sessions for both radiology trainees and faculty. The hands-on experience of the research team along with contributions of our colleagues led to the development of a set of frequently-asked questions (FAQs) which now serves as a resource in routine or atypical scenarios. Development of dashboards with automated e-mail reminder features to monitor has helped achieve high compliance rate by the radiologist. Given the scale of studies performed at our institution, an automated database was constructed to prospectively identify and track through the radiology information system (RIS) all patients with indeterminate or suspicious lesions as categorized by the lexicon.

RESULTS

To date, we have used Code Abdomen on nearly 21,669 exams, corresponding to 15,258 patients. Educational orientation sessions and hands-on guidance by the research team have gradually improved monthly compliance rates among radiologists, with an average compliance rate of 82% across all eligible studies. Using the standardized lexicon has enabled us to determine that vast majority of focal lesions identified among the 4 organs are benign lesions, as expected. More importantly, the standard lexicon has allowed us to monitor our imaging studies prospectively to identify 1,751 patients with indeterminate lesions and 980 patients with suspicious lesions.

CONCLUSION

Our Code Abdomen project represents a successful implementation of a standardized lexicon for reporting focal masses in the liver, pancreas, adrenal glands and kidneys. We have improved communication with referring physicians and other radiologists and facilitated identification of patients in whom follow-up is required. As with prior BI-RADS and LI-RADS experience, we expect Code Abdomen to evolve with input from radiologists, referring providers and eventually even patients. We will use the data to measure what we expect will be significant long-term improvement in the outcomes of our patients.

Using Psychometric Analysis to Improve Radiology Teaching Files and Objective Structured Clinical Examinations (OSCE) (Station #2)

Gerald J. Tan MBBS, FRCR (Presenter): Nothing to Disclose

PURPOSE

Part of the continual assessment programme in our residency program includes an objective structured clinical examination (OSCE) conducted by an external agency. This consists of a set of 30 plain radiographs, of which approximately half contain an abnormality that might be found in an Emergency Department setting (e.g. pneumoperitoneum, or a scaphoid fracture), while the remainder are normal. To help the residents with their preparation, the department has a collection of teaching files. However these come from different contributors, leading to variations in the difficulty level and quality of these sets. This lack of standardisation leads the residents to ‘overcall’ abnormalities not just in the examination, but also in daily clinical practice.

METHODS

The first step in improving consistency was to have a core faculty member vet the teaching files prior to release. However, we also wanted objective post-test feedback, particularly regarding reliability. Reliability is a measure of consistency and reproducibility, with a high reliability across sets implying that the resident would obtain a similar score regardless of which test set he or she took. We collected anonymized answer sheets from residents after they had completed the test sets, on a voluntary basis. The total score as well as the scores of individual questions were captured. Analysis was performed using Microsoft Excel 2007 (Redmond, WA). Reliability was measured using Cronbach’s alpha. The key advantages are that it is simple and fast to calculate, and does not require an absolute reference standard such as the external exam. However, a single test-level metric can mask deficiencies with individual questions, particularly with larger sets. We therefore also obtained metrics on individual questions: Item facility - The percentage of candidates getting that item correct. Item discrimination - Correlation between performance on an individual question against performance on the overall examination. An item with good discrimination would separate the top performing candidates from the poorly performing ones. Point biserial correlation - A numerical expression of item discrimination. Figure 1 demonstrates results of a sample analysis.

RESULTS

A total of 15 test sets (450 questions) were analysed, with 4-8 respondents per set (mean 6.6). Cronbach’s alpha ranged from 0.58 to 0.84 (median 0.73). An alpha of above 0.7 is generally accepted as demonstrating
good internal validity. Facility for all questions except one ranged from 0.57 to 1.0 (1 indicates an 'easy' question that all candidates answered correctly). Review of the single outlier question, which had a facility of 0.14, revealed an error in the answer key (it was coded as "normal" when in reality an abnormality was present). Item discrimination was measured using point biserial correlation coefficients (PBS), which can range from -1 to +1 (Higher values indicate a question that is better able to discriminate between high- and low-performing candidates). PBS in our series ranged from -0.02 to 0.63. We used low (< 0.1) or negative coefficients to identify questions for review. Facility scores were also used to identify questions that were "too hard" or "too easy". This served two purposes. First, we were able to standardize the difficulty level across the different sets by shifting questions between sets (partially those with low item discrimination scores). Second, we were able to identify individual contributors who consistently set "too easy" or "too hard" questions and provide them with objective, evidence-based feedback. Follow-up analysis of the modified sets, with the next batch of residents, will provide feedback on whether these changes have improved test reliability. Secondary measures of the impact of these changes would include residents' performance on the external examination, and subjective feedback from radiologists on residents' performance under real-life reporting conditions. Limitations included the small number of residents, which reduced the utility of evaluating item discrimination graphically. We expect to overcome this problem as subsequent cohorts of residents use the sets and total respondent numbers increase.

CONCLUSION

Basic psychometric analysis of our teaching sets was easy to perform, and yielded simple and easily-understood metrics. We used these results to quickly identify a handful of questions for further review. This allowed us to pick up errors in answer key coding, modify or remove ambiguous questions, and moderate the difficulty level across various sets. We hope that this will improve test reliability and eventually translate to improved resident performance in daily clinical work.

QSE124

The Ontario Provincial MRI Process Improvement Project Phase 3: Sustaining Continuous Improvement and Accountability for Better Access to Medical Imaging (Station #3)

Tanya Spiegelberg (Presenter): Nothing to Disclose, Roger Yeung: Nothing to Disclose, Tania Simoes: Nothing to Disclose

PURPOSE

A multi-phase process improvement initiative, on behalf of the Ontario Ministry of Health and Long-term Care (MOHLTC), was implemented to help increase MRI capacity and efficiency across the province called the MRI Process Improvement Project (MRI PIP). MRI PIP engaged 57 hospitals across Ontario over four years using Lean Six Sigma, an evidence-based structured approach to process improvement. Results from phases 1 and 2 (previously presented at RSNA 2012) include: • 20,000 additional patients per year with no added resources • 80% of sites decreased their MRI wait times • 78% of sites increased their average monthly volumes • 80% of sites increased their patients scanned per operating hour Subsequent to this engagement, an opportunity existed to standardize MRI indicators and implement a province-wide performance measurement dashboard tool (hereafter the dashboard) to sustain long-term monitoring and promote continuous improvement. The dashboard enables collection of site specific data, calculated standardized operational measures and availability of results to all hospitals and stakeholders. By standardizing MRI indicators and measurement techniques in MRI PIP phase 3, hospitals can monitor performance against peer benchmarks, which in turn provides information also helps the MOHLTC and Local Health Integration Networks (LHINs) assess provincial and regional challenges and opportunities. The MRI PIP3 focused on achieving the following goals: 1. Track indicators that align to hospital, LHIN, and Ministry strategic priorities. 2. Enable evidence-based decision making to manage capacity and demand. 3. Understand how Ontario's MRI resources are utilized. 4. Empower hospitals to continuously improve processes and patient care.

METHODS

A set of standardized indicators was selected with the consultation of various experts across the province including Ministry representatives, physicians, and hospital leadership. These indicators were incorporated into the in-house developed dashboard. By using MS Excel and VBA programming as the platform for the dashboard, users are able to manipulate the data and customize views to meet their data analysis needs. During the development of the dashboard, working groups were held with future users to provide feedback on any potential improvements to the appearance and functionality of the dashboard. In order to ensure the launch of the dashboard with high quality data from hospitals across the province, the implementation team worked closely with a team at each hospital to smoothly transition the dashboard to operations. For several months the implementation team conducted numerous training sessions covering topics such as data submission templates, indicators, and functionality of the dynamic dashboard. In addition the team collaborated with the hospital liaisons to trouble shoot any data collection issues. Hospital data quality was analyzed using an automated calculator, developed by the project team, which rated the data files on a scale of poor, fair, good, excellent. If a hospital had a rating of poor or fair, then it would be placed on a data quality improvement plan developed through teamwork between the implementation team and the hospital team.

RESULTS

The MRI PIP3 was able to successfully standardize MRI indicators and reporting processes implemented province wide. Several other accomplishments that contributed to the project's success include: • Dedicated MRI PIP3 liaisons resulted in successful engagement with hospital teams • 11 training sessions were conducted with over 100 participants each session • Dashboard developed internally using Visual Basics for Applications (VBA) • Approximately 100 percent compliance with hospital sites • Dashboard data within Excellent or Good data quality rating. Throughout MRI PIP3 lessons learned were gathered that can be helpful for any similar future projects. These lessons learned include tight reporting timelines were a challenge for hospital to meet and thorough data validation by hospital teams is required in addition to automated data quality calculators.

CONCLUSION

The MRI PIP3 successfully created and standardized MRI process and efficiency indicators that align to hospital, LHIN, and MOHLTC strategic priorities. The launch of the dashboard displayed data from 57 hospital sites with data within the Excellent or Good data quality rating. The dashboard allows for evidence-based and value based future planning decisions across the province. In particular, transparency and accountability of Ontario's MRI resources is enabled for the first time within the province. The dashboard is an empowerment for continuous improvement and will sustain gains from phases 1 and 2 of MRI PIP. As of October 1, 2013, the MRI PIP3
Optimization of X-ray (XR) Based Protocol for the Detection of Retained Surgical Items (RSI) in the Operating Room (OR) (Station #4)

Vicko Vicko Gluncic : Founder, RaPID Medical Technologies, LLC CEO, RaPID Medical Technologies, LLC
Serge Kobsa MD, PhD : Nothing to Disclose
Shirley Richard MBA : Clinical Advisor, RaPID Medical Technologies, LLC
Mario Moric (Presenter) : Officer, RaPID Medical Technologies
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Sameer A. Ansari MD, PhD : Shareholder, RaPID Medical Technologies, LLC

PURPOSE
Quality assurance is one of the key points of the Affordable Care Act with an emphasis on prevention of errors and performance improvements. In 2012, the total number of surgeries in the US exceeded 110,000,000. RSI is any surgical tool or sponge inadvertently left in a patient’s body. Approximately two-thirds of RSI are surgical sponges, and another third represent mostly surgical needles and occasionally instruments. RSI are a high priority OR patient safety concern in the US with an incidence of 0.02-1% and classified as sentinel events by the Joint Commission. Morbidity and even mortality may result from direct injury, repeated surgery, or a prolonged hospital stay in addition to excess cost and loss of hospital credibility. To prevent RSI, patient safety measures include effective OR communication, mandatory counts of all surgical instruments and sponges, methodical wound examination, and XR of the surgical field before closing the wound. Miscounts occur in up to 12.5% of all surgeries, often requiring XR of the surgical field. Because up to 88% of RSI occur with “correct surgical counts”, many hospitals mandate XR at the end of the complex surgeries. Although XR based protocols are critical for RSI detection, they are limited by the sensitivity of human eye, lack of formal training for RSI detection, and time duration for complete analysis. These limitations motivated us to improve protocol performance by optimizing the efficiency of key steps including communication, acquiring the XR in the operational field, uploading images to the picture archiving and communication system (PACS), and image analysis. We also developed a beta prototype for computer assisted detection (CADe) software for the detection of RSI, implementing it for the detection of the ray-tec sponge.

METHODS
We utilized business process modeling (BPM) methods and focused on process functionality, properties, and quality in the OR workflow. These inputs were analyzed to provide guidance for protocol engineers and application developers and develop more effective protocols. For the development of CADe software, we utilized advanced coding languages and algorithms that included image enhancement designed for RSI detection by removing artifacts and increasing contrast, candidate detection using machine learning and spatial clustering, feature extraction and selection for RSI recognition, and RSI classification system.

RESULTS
XR protocol was optimized by recommending using XR plates with wi-fi capabilities for faster upload of the image to the PACS, specific settings (kV and mAs) of the portable XR machine to provide optimal contrast for detection, usage of the preformed specific textual XR image denominators available on portable XR machines to improve communication, optimization of the PACS data flow that automatically defaulted studies to a priority radiology workflow list, PACS integrated computer assisted detection (CADe) software to assist with image analysis, and effective critical information alert upon identification. Simulations of the optimized protocol on the OR phantom have showed detection rates approaching 99% with time to rule out RSI and findings reported back to the OR consistently within ≤2min upon XR acquisition. Testing of the beta prototype of the CADe software for ray-tec sponge detection in XRs at the optimal point of the receiver operating characteristic curve resulted in 99% specificity, 90% sensitivity, and 0.92 F-measure.

CONCLUSION
Implementation of BPM optimized XR protocols for RSI detection and with CADe software fully integrated into the PACS harbor the potential to increase OR time utilization, RSI detection rates, and patient safety in the ORs. In the environment where demand for surgical services has been steadily increasing while margins are declining, BPM optimization of the radiology protocols to exclude RSI may streamline and automate processes, improve decision-making, and make better use of available resources - ultimately resulting in significant cost savings.

PICC the Right Choice: Eliminating Central Line Placement Infections (hardcopy backboard)

Cindy Lehnertz (Presenter) : Nothing to Disclose
Chad Jeremy Fleming MD : Nothing to Disclose
Michael John Withers RT : Nothing to Disclose
Tiffany Craft : Nothing to Disclose
Sherrie Yerhot : Nothing to Disclose
Stacy R. Schultz BA : Nothing to Disclose

PURPOSE
The purpose of this project was to decrease the prevalence of central line-associated bloodstream infection (CLABSI), within our interventional radiology practice at a large Radiology Department, from six to zero infections per year.

Central line-associated bloodstream infections occur in an estimated 250,000-500,000 patients annually. These cases have a 10-30% mortality rate and burden the healthcare system with an unnecessary $300 million to $2.3 billion a year. In 2007, our interventional radiology practice incurred six such infections within a 48-hour window of line placement. We surmised that changes to our practice should be implemented to decrease the loss of lives and reduce the financial burden associated with these preventable infections.

METHODS
Our team met over several days to discuss potential sources and preventions of central line infections. We had
a nurse from our surgical services department perform aseptic technique audits which resulted in additional education and hand-on training to increase adherence to aseptic technique guidelines. Looking for the root cause of these infections, the team developed a fish bone diagram and through brainstorming sessions, reviewing the Centers for Disease Control and Prevention (CDC) guidelines, and discussions with our institution's Infection Prevention and Control unit we came up with a four-fold solution. First, we changed our surgical prep solution from Betadine to Chlorhexidine to aid in the elimination of prevalent bacteria. Second, we changed to a surgical hand antiseptic containing Chlorhexidine Gluconate 1% Solution and Ethyl Alcohol 61% at the same time. Third, we adapted the use of an electric clipper instead of a straight blade razor. This reduction reduced the razor surface area on skin contact while simultaneously reducing patient skin nicks. Finally, we developed a central line placement antibiotic administration protocol and Central Venous Catheter Insertion Checklist. This is based on the Institute of Healthcare (IHI) Central Line Bundle. The bundle is a group of evidence-based interventions for patients with intravascular central catheters that, when implemented together, result in better outcomes than when implemented individually. The key components of the IHI Central Line Bundle are: • Hand Hygiene • Maximal Barrier Precautions upon Insertion • Chlorhexidine Skin Antiseptic • Optimal Catheter Site Selection, with Avoidance of the Femoral Vein for Central Venous Access in Adult Patients. This checklist is currently observable in all procedure rooms and is referenced both during and after all line placements. Finally, residents and fellows have access to a simulation center, wherein aseptic techniques are taught and practiced. The implemented changes to these procedures are demonstrated to the medical staff and allows for a streamlined and standardized technique.

RESULTS
These processes, although still in their infancy, were implemented in 2009. The infection prevalence for that year was reduced to one central line placement related infection. In the following four year period from 2010 to 2013, of the 5200 central lines placed, the number of central line placement blood infections within the aforementioned 48-hour window was reduced to zero.

CONCLUSION
Our department continues to practice these aseptic techniques and guidelines; hopefully we are able to maintain our current streak of perfect practice in the future.

Focusing on Measureable Improvement in Radiology on the ‘Attitude’ Dimension of Service Excellence to Improve Patient/Customer Satisfaction (hardcopy backboard)

Muhammad Akbar Khan BEng, MBA (Presenter): Nothing to Disclose , Rehan Baig MBA : Nothing to Disclose

PURPOSE
The objective of this quality improvement project was to focus on and realize measurable improvement in the ‘Attitude’ rating from a baseline measurement of 64% to at least 80% within a period of 12 to 16 months by using a systematic approach towards ensuring and improving delightful patient experience. In a busy multi-modality Radiology department, patient expectations are more than just receiving the right diagnostic and interventional services. These include timely guidance upon entry, complete information with courteous communication, quick processing of test formalities, positive and welcoming staff, radiographers and radiologists, and an easy-to-approach leadership for addressing their concerns. The hospital initiated measuring of Service Excellence performance against four dimensions - Communication, Attitude, Responsiveness, and Respect and Caring. The baseline assessment identified improvement opportunity in all four dimensions but Attitude rating in Radiology came around 64% indicating a need of focused and sustainable improvement strategies in realizing desired improvement.

METHODS
In mid-2012, the hospital initiated Service Excellence initiative with four dimensions of Communication, Attitude, Responsiveness, and Respect and Caring. Baseline assessment was carried out and, for Radiology, these came around 85% except for Attitude which was gauged at 64%. An action plan was developed based on the analysis of patient satisfaction findings and patient complaints. Expected behaviors from staff, including radiographers, conforming to institutional service excellence themes of Communication, Attitude, Responsiveness, and Respect and Caring were identified. Special focus was given to video-recording the actual interaction moments between patient/customer and the staff which were used in staff training sessions to review, discuss and identify the Do’s and Don’ts of attitude. Training sessions with role modeling of desired behaviors were arranged and continuously repeated to reinforce requirements of patient-centered environment and desired behaviors. Section Supervisors were sensitized to put more focus on monitoring staff behavior and interaction with patient/customer. Meet-n-greet service for patients at department entry was initiated to welcome and guide them as per their specific requirement. Celebration events were also organized to enhance staff motivation through dinner evenings, departmental breakfast gathering, and fun sessions.

RESULTS
The systematic approach and initiatives taken resulted in significant improvement in department's rating on attitude dimension of service excellence while other dimensions areas also register improvement. This also impacted the overall satisfaction positively. By December 2013 the rating on “Communication” improved by 3.6% (from 84% to 87%), “Attitude” by 28% (from 64% to 82%), “Responsiveness” by 3.5% (85% to 88%), and “Respect and Caring” by 2.4% (from 84% to 86%). The cumulative increase in service excellence rating was 8.9% (from 79% to 86%) while overall patient satisfaction rose by 4.5% (from 88.5% to 92.5%). Besides these measureable improvement, the meet-n-greet initiative not only prevented patients from unnecessarily wasting time before they are served but also resulted in faster patient movement subsequently improving department’s efficiency. The practice was praised by hospital leadership and other areas (lab and clinics) also adopted the initiative.

CONCLUSION
Focused and systematic approach towards improving patient experience and satisfaction through instilling service excellence behaviors among staff and facilitating patients throughout their stay resulted in sustained improvements. While changing attitude is a challenging task, small and focused actions with continuous
reinforcement help bringing the desired improvement.

**QSE-TUB**

**Quality Storyboards Tuesday Poster Discussions**

**Quality Storyboards**

AMA PRA Category 1 Credits ™ .50

**Tue, Dec 2 12:45 PM - 1:15 PM  Location: QS Community, Learning Center**

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**Sub-Events**

**QSE105**

**Tailored Radiologist Reports Regarding Clinician Notification of Cerebral Infarct or Hemorrhage Exacerbations or Complications Improve Overall Compliance Rates (Station #1)**


**PURPOSE**

Timely reporting of Critical Values enhances health care delivery. We recognize that it is important not only to report new/acute findings in those patients characterized prospectively as suspicious for undergoing 'acute stroke', but also to notify clinicians about new or expanded infarcts, or consequences thereof including mass effect or hydrocephalus, even for patients not specifically introduced as undergoing stroke alert studies. We aimed to determine if a tailored notification regimen could improve notification rates by radiologists in this patient population.

**METHODS**

At the end of each month (Feb 2013-March 2014) we mined all CT Head and MRI Brain reports from our practice. Using key phrases and excluding negating language, we developed a technique in Microsoft Excel to automatically refine the candidate exam list to about 6% of studies with highest probability for acute findings. The reports for these remaining studies were then reviewed for signs of new or increased infarction or hemorrhage, as well as increased mass effect, hydrocephalus, and other consequences meriting notification. Radiologists were provided with monthly customized reports summarizing their notification performance. We undertook several PDSA cycles. The first provided gross reporting success percentages for these critical values. In successive waves we provided 1) specific language from reports that warranted notification for each individual, then 2) examples of (anonymized) reporting failures to the entire group, then 3) report verbiage which indicated specifically why each case should have been reported, then 4) section-wide imaging examples and associated reports.

**RESULTS**

The reporting compliance increased from 83.3% to 94.4% (three month rolling averages), including four months at 100%. Subjectively there was greater awareness of the need to notify when imaging findings grew more conspicuous. Success is now documented and monitored by the Performance Improvement Committees of both Radiology and the Stroke Service.

**CONCLUSION**

Customized monthly reports informing radiologists of their specific success in documenting clinician notification of new or expanded infarcts and hemorrhages, and consequences thereof, enhances performance. Progressive PDSA cycles, with more illustrative presentation in each wave, led to even better performance overall. This method serves as a model that can be extended to other sections in the Department to enhance overall communication with clinicians.

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**QSE115**

**Using Team Audits to Improve Image Quality-Our Institution’s Experience (Station #2)**

Beth Winningham RT, MBA (Presenter): Nothing to Disclose, Lincoln L. Berland MD: Consultant, Nuance Communications, Inc Stockholder, Nuance Communications, Inc, Deborah D. Flint MBA : Nothing to Disclose

**PURPOSE**

The use of team review for image quality auditing has proven to be a beneficial part of quality management in our Radiology department. The team review allows the technologists working with the radiologists to become active participants in image quality management and improvement.

**METHODS**

There are currently three independent image quality audit teams in the Radiology department. The first team, formed in 2009, reviews CT imaging. This was followed in 2011 by the Diagnostic Radiograph audit team. Success with these two teams prompted the formation of a third audit team in 2013 to review MRI imaging. Each team is made up of technologists from the specified modality and radiologists who read them. Technologists and radiologists work together to identify the most common and/or problematic errors seen on.
the images and use these to determine the audit criteria. Detailed operational definitions are then established for each of the criteria to ensure consistency between all auditors and to allow for smooth transitions when new members join the teams. Random audits are conducted on a monthly basis. The teams meet monthly to review the results of the audits, identify the most common opportunities for improvement and discuss any questions or concerns that may arise from the audit. While the basic format of all the teams is the same, the specific audit process varies with each team depending on the type and volume of images being audited. The results of the audits are presented to the staff through staff meetings, notice boards and one to one communication. This format provides education to the staff for improving image quality issues. It also allows for identification of outstanding imaging so that technologists can be recognized for exceptional work and best practice standards for the departments can be determined.

RESULTS

Since the implementation of these teams there has been marked improvement in overall image quality. The percentage of errors for CT has decreased from 9.7% at the start to 5.2% at the end of 2013. Diagnostic Radiography audits are conducted in three sections: MSK, Chest and GI. Initial error rates were 12.7% (MSK), 14.5% (Chest) and 14.6% (GI). At the end of 2013 the rates had decreased to 4.4% (MSK), 5.0% (Chest) and 12.2% (GI). The MRI audit team ended 2013 with an error rate of 5.1% and is on track for that rate to decrease in 2014. Opportunities for improvement are more easily identified and improvement plans are determined by joint effort of the technologists performing the exams and the radiologists who read them. The team format has allowed for more open discussion between the technologists and the radiologists and the improvement in communication is also evident outside the teams. The staff has been more willing to be engaged in this process because they have an active hand in the improvements being made and take ownership of them.

CONCLUSION

Personal accountability and consistency in providing high quality images has improved as a result of the audits furthering our efforts to continuously improve safety and quality of care for our patients.
also be used as a regular feedback mechanism due to its easily accessible nature. The use of the Radimetrics can help flag specific 'higher dose' protocols for review. These initiatives by the ACR and TJC are meant to reduce the amount of poor-quality images and provide feedback in terms of patient doses delivered at the facility. Integration of these QC programs has been a positive experience with full cooperation of the staff and faculty, however, facilities should be prepared to allocate additional resource (cost and personnel) needed to facilitate these quality programs.

QSE135
Watching the Hours Tick By: Improving the Availability and Efficiency of Limited County MR Resources (Station #4)

Susanna Claire Spence MD (Presenter): Nothing to Disclose, Verghese George MBBS: Nothing to Disclose, Scott B. Serlin MD: Nothing to Disclose, Eduardo Jose Matta MD: Research Consultant, Pacific-Link Consulting

PURPOSE
Our county hospital has 330 beds, serves multiple outlying clinics, and is the state's busiest level III trauma center. The hospital has a single 1.5T MR to serve this population, placing an enormous burden on the magnet. It takes 6 weeks for an outpt to get an appointment for MR, with the magnet running extended hours daily 6:30am-9pm. The county will not allow reserved slots for inpt/ER add-ons, so they are squeezed in front of, between, or after outpts. The outpt slots are 45 mins long, but many of the scan protocols are outdated and long, running >1hr in those 45 min slots. This, in addition to inpt/ER add ons, delays due to anesthesia and exam protocols not having been completed by the radiologist, resulted in almost half, 48.5%, of outpts waiting >1hr past their start time for their scan to begin. As many as 1 in 6 were waiting >2 hrs, and some over 4 hrs past their scheduled start time. This results in pt frustration, with some walking out before their scan because they had to return to work, family, or simply were not willing to wait. They then needed to be rescheduled, further delaying the information needed for their care. The county tried to address this by handing out lunch tickets to pts waiting long periods for their scan. ER and inpt physicians were often aggravated due to long delays waiting for urgent MRs to be performed between delayed outpatient slots.

METHODS
To address this we used a multifaceted approach, using schedulers, MR technologists, administrative personnel, and representatives from the 3 major sections involved in writing the scan protocols (neuro, body and MSK). We set a goal to decrease the % of pts waiting >1hr from 48.5% to <33.3% within 6 months. Group discussions creating an Ishikawa diagram, along with walking the process, revealed several major problem areas that could be addressed: PROTOCOLS: Streamlining, modernizing and updating of all MR protocols by all sections, decreasing all protocols to 40 mins or less. Some scan protocols (e.g. MR brain, MR knee) decreased to <20-25 mins. PROCESS: 1st pt of the day was often late for their 6:30am appt, because the Radiology check in desk didn't open until 7am, resulting in delays from the 1st pt. --> Institute signage to send the pt to the ER check in, and include this info in the reminder call the day before, to get this pt started on time. Exam not protocolled by radiologist --> instituted protocols of all studies at least 2-3 days before pt scheduled to arrive. No shows' due to long lag time between creating the appointment and the appointment itself. --> Stepped up reminder calls Evening pts showing up in the am (e.g. 8:30 pm pt showing up at 8:30 am). County will not allow you to send them back to the schedule, delay the subsequent morning pts. --> Reminder calls to include emphasizing the evening time of the appointment. EQUIPMENT: Long change-over times between pts with limited mobility getting on and off the table, and prep times for anesthesia pts using the MR table, which meant the scanner was not running during that prep time. --> Purchase a second hand MR table to allow for out-of-room prep of the next pt.

RESULTS
Compared with the pre-intervention time period (Feb 2013) the post-intervention month (Aug 2013) demonstrated: Marked decrease in the number of pts waiting >1hr past their start time from 48.5% to 24.1%, and those waiting >2 hrs from 16.3% to 8% Median wait time past scheduled start time decreased from 58:30 to 23:00 mins Decrease in the number of pts who simply left, from 0.5 pts/day to 0.2 pts/day Slightly increased total number of pts who were scanned per day from 21.1/day --> 21.6/day, with those increases coming from an increased number of outpts who both arrived successfully and stayed for their scan (13.8 -->14.7 outpts/ day). Approximately 18% increase in the number of inpt/ER cases that could be scheduled during daytime hours in between outpts, rather than waiting for the end of the day after 9pm

CONCLUSION
A multifaceted approach, including the technologists, administrators, radiologists and support staff was successful in allowing us to: put more inpt/ER cases on the magnet during the daytime hours, slightly increase the total number of pts scanned/day, while still markedly decreasing outpatient wait times. The problem was approached from initial patient scheduling and check in, to the process of getting the patient prepped and on the table, to the scan protocol while on the table. While there are still occasions when the scanner is running behind, we have made a lot of progress, and will continue to work on this initiative.

QSE008-b
Quality Improvement in Portable Chest Radiography: A Collaborative Approach (hardcopy backboard)

Trent Russell James MD: Nothing to Disclose, Rustain Lee Morgan MD, MS: Nothing to Disclose, Glendon G. Cox MD: Nothing to Disclose, Kimberly Smith: Nothing to Disclose, Jacqueline Hill MPH (Presenter): Nothing to Disclose

PURPOSE
Portable chest radiographs (PCXR) are the most frequently performed radiologic study at our institution with over 40,000 exams completed from March 2013 to March 2014. With such a large annual volume of studies, there has been a significant increase in image acquisition errors, resulting in technical defects noticed by radiologists that can often prohibit accurate detection of pathology, potentially leading to misdiagnoses. This study aims to identify the frequency of the most commonly encountered PCXR technical defects, devise strategies to reduce or eliminate them, and reevaluate PCXR technical defects following strategy implementation to determine effectiveness.
QSE018-b

Algorithm-based Imaging Approach for More Efficient Imaging Utilization in Suspected Appendicitis in a Pediatric Population (hardcopy backboard)

Ankaj Khosla MD (Presenter): Nothing to Disclose, Li Ern Chen MD: Nothing to Disclose, Mohamed Badawy MD: Nothing to Disclose, Rodica Pop: Nothing to Disclose, Jeannie K. Kwon MD: Nothing to Disclose

PURPOSE

Acute appendicitis is the most common abdominal condition requiring surgery in children. At our tertiary care children’s hospital, we treat more than 1100 children with appendicitis yearly. Diagnostic imaging, namely, ultrasound and CT, is an integral part of the workup for suspected appendicitis, with variable utilization practices dependent upon the clinical provider. Therefore, we developed an algorithm to aid in more efficient imaging modality selection for patients suspected of having appendicitis.

METHODS

A multidisciplinary team including physician and nursing representation from the emergency room, surgery and radiology departments convened to evaluate baseline data and develop evidence- and consensus-based guidelines for a diagnostic imaging algorithm for patients in whom appendicitis was suspected. Four specific deficiencies were identified that could result in improved outcomes: indications for diagnostic imaging, appropriate study choice (US vs. CT), technical performance in imaging, and consistency in radiologic reporting. The committee concurrently reviewed recent literature regarding clinical signs of appendicitis, imaging appropriateness and imaging criteria. To stratify patients according to their risk of having appendicitis, the emergency room clinicians began using the Pediatric Appendicitis Score (PAS). This score assigns patients to a low, moderate or high-risk category based on history, clinical and laboratory findings. Imaging studies were only recommended for patients with a moderate-likelihood of appendicitis. Ultrasound was the first-line imaging modality in patients with BMI < 30. Patients with BMI ≥ 30 or in whom perforation with abscess was suspected were recommended to proceed directly to CT imaging. To validate the PAS in our setting, we tracked the percentage of patients with each score who had appendicitis. In improving the technical aspect of studies, the committee placed emphasis on improving sonographic study performance. Technologists received a standardized protocol on how to conduct exams for appendicitis and received both didactic and hands-on training in preferred sonographic techniques. To aid patient comfort during the study, emergency room clinicians agreed that adequate pain control should be achieved before performing the study. Radiologists received training on receiving appendicitis ultrasound exams using a standardized reporting template that included primary and secondary findings. The final study impression (positive, equivocal or negative for appendicitis) was categorized based on specific findings. These guidelines for radiologic workup were part of the comprehensive care algorithm for all three departments to follow. Data was gathered before and after implementation of the imaging pathway to track the imaging studies being ordered, as well as the rate of missed appendicitis. Pre-intervention results represent data 12 months prior to pathway implementation. Post-intervention results represent data 15 months post intervention. Fisher’s test was performed to compare the pre-intervention and post-intervention groups.

RESULTS

There were 1079 patients in the pre-pathway group and 1245 in the post-pathway group. Pre-intervention, the percentage of patients with a missed diagnosis of appendicitis was 5.1%. Post intervention, the rate is 3.1% (p = 0.02). The percentage of patients with a missed diagnosis of appendicitis receiving ultrasound has decreased from 68.0% to 64.1% (p = 0.083). Of these imaging studies, the percentage of patients receiving an ultrasound has decreased significantly from 53.3% to 3.1% (p = 0.0001). Post-intervention results represent data 15 months post intervention. Fisher’s test was performed to compare the pre-intervention and post-intervention groups.
1-3 had a positive appendicitis rate of 1-8%.

CONCLUSION

By implementing a multidisciplinary approach, we developed an imaging algorithm for the work-up of suspected appendicitis in a pediatric population. This algorithm has resulted in improvement of the missed diagnosis rate while decreasing CT utilization. We also utilized a standardized departmental protocol for performing sonographic studies for appendicitis and a template for reporting the results in standardized fashion. This algorithm can be implemented at other institutions and validated to determine its efficacy.

The Implementation of PACS Accessible Quality Assurance Tools to Facilitate Communication Between Radiologist and Technologist (Station #1)

Andrew Spencer Wilmot MD (Presenter): Nothing to Disclose, Woojin Kim MD: Co-founder, Montage Healthcare Solutions, Inc Shareholder, Montage Healthcare Solutions, Inc Board of Directors, Montage Healthcare Solutions, Inc Advisory Board, Zebra Diagnostics Ltd

PURPOSE

Prior to the implementation of this system, there was no universal method for classifying and quantifying errors, which occur during radiologic image acquisition in our department. When encountered with such issues, the radiologists would have to interrupt their normal workflow and engage in the time-consuming process of notifying supervisors either via email or phone calls, which in turn interrupted the workflow of the supervisors. Due to the time-consuming aspect of reporting issues, many small errors and potential areas of improvement were not communicated to the supervisors. This system maintains a permanent record of all submissions by radiologists, and also maintains a record of the intervention performed by the supervisors in response to each submission.

METHODS

A new web-based system for providing feedback on the quality of imaging was added to the PACS functionality and instituted within the MSK department in August 2012 and department-wide in January 2013. Upon selecting the QA tool from the PACS viewer, the radiologist submits brief feedback, which is in turn reviewed by the supervising technologist via a web-based application. After implementing the tool, two radiologists reviewed the MRI feedback obtained over an 8 month period to identify trends. This data was discussed with the section chiefs for body MRI, neuroradiology and MSK, and within each section one intervention was designed based on the feedback. The interventions selected were poor fat saturation within the body MRI section, reversed axial scanning (whereby axial images scroll in the opposite direction of expected thereby complicating comparison to old studies) within neuroradiology, and the use of appropriate-sized (Beekley) markers for imaging small body parts within MSK. These interventions were discussed with the technologists at their monthly meeting and implemented in December 2013. Radiologists within each section were encouraged to report all instances of these issues. Subsequently, the PACS feedback data was reanalyzed post-intervention to determine effect. In addition, one radiologist reviewed 25 consecutive MRIs of small body parts obtained between October 2012 to January 2013 and from December 2013 to February 2014 to determine changes in technologist compliance with Beekley marker usage from initial technologist education in September 2012 to the time of intervention in December 2013.

RESULTS

There were 875 submissions to the PACS MRI QA tool between August 2012 and March 2014. The data were categorized as follows: positive feedback, image quality, image acquisition, positioning, errors in submission, contrast related issues, and miscellaneous. Subcategories were also created under each of these headings. Submissions by department were: 480 by MSK, 289 by neuroradiology, and 106 by body MRI. Through analysis of the feedback, it was recognized that some issues were common to all three sections, while other issues were unique to individual sections. Missing sequences were common to all sections, accounting for 11% of all submissions (MSK: 12%, Neuro: 10%, Body: 13%), while reverse scanning was only reported by neuroradiologists, accounting for 17% of all neuroradiology submissions. Similarly, flipped images are an issue unique to MSK radiology and account for 13% of all MSK submissions. Positive feedback accounted for 9% of submissions. With regards to the issue of poor fat saturation, it was determined that the issue was most common for cases involving obese patients and performed on 3T systems. In March 2014, a policy was put in place whereby technologists must confirm frequency settings prior to obtaining T1 sequences in order to minimize this issue. Upon review of the reverse scanning submissions, it was discovered that this issue only occurred on MRI scanners supplied by one vendor, and there are ongoing efforts to address this issue with the vendor. In order to objectively measure the effect of the MSK Beekley marker intervention, 25 consecutive MSK MRIs of small body parts obtained between October 2012-January 2013 and December 2013-February 2014 were reviewed. Inappropriate markers were used in eight of the 25 MRIs performed between October 2012 and January 2013. However, between December 2013 and February 2014, only one of the 25 MRIs had an inappropriate marker used. This data supports that, in conjunction with other forms of communication, the PACS QA tool has a positive impact on technologist compliance.
CONCLUSION
A PACS accessible QA tool is an efficient method for radiologist communication with technologists. While not meant to replace other forms of communication, it facilitates the communication of small errors and potential areas of improvement, which might otherwise go unreported. By analyzing the feedback data, one can identify trends, design interventions, and measure effect, with the overall goal of improving imaging quality within the department.

Measuring Progress in Resident Education: A Pilot Study of a Report Comparator (Station #2)

Jeffrey David Robinson MD (Presenter): Consultant, HealthHelp, LLC President, Clear Review, Inc, Daniel S. Hippe MS: Research Grant, Koninklijke Philips NV Research Grant, General Electric Company

PURPOSE
Report generation is the sine qua non of diagnostic radiology, and training residents to create accurate reports is one of the key functions of faculty radiologists. Due to variability in workflow and personality types, consistent feedback to residents on the quality of their reports, and corrections made by faculty before finalization is intermittent at best, with the resident often never knowing what changes the faculty radiologist made to his/her report. An automated process developed at our institution highlights any changes made in a resident’s report by the attending faculty radiologist and places the highlighted reports in a secure online folder for the resident to review. The purpose of this project was to determine the effectiveness of this new process: its acceptability and utility to the residents, whether the extent of report corrections could be measured, and whether these measures could be used to assess changes in the number and extent of corrections to residents’ reports made by faculty over time. Findings were validated by comparison with resident survey data.

METHODS
IRB approval and informed consent from participants were obtained. R3 and R4 residents were randomized into experimental and control groups. From July 18 2013 to January 18, 2014, the experimental group had access to a secure on-line folder containing PDF documents of all reports they dictated over the preceding 7 days that had been amended by faculty. Each document contained the preliminary report as dictated by the resident, the final report signed by the faculty member, and a third report highlighting changes made, similar to many word processor edit-tracking features. The control group did not have access to such reports. All residents received standard instructional feedback in the course of their daily work. Participants completed an on-line attitude survey before and after the observation interval relating to their dictation confidence and feedback from faculty. The experimental group additionally provided feedback on the comparator process itself. Survey results were compared between groups using the Mann-Whitney test. Change in survey ratings over time were compared using the Wilcoxon signed-rank test. The Levenshtein Distance is a measure of change in a sequence used in signal analysis, and in our study was normalized to the length of the dictated report (NLD). The (NLD) was computed between each preliminary and final report. Major corrections were defined as NLD > 20%. The study period was divided into 30 day periods and within each period these metrics were averaged. Linear regression was used to evaluate monthly trends in these metrics (slopes with time) and test whether the slopes were non-zero.

RESULTS
A total of 23 residents were recruited and randomized into experimental and control groups. Over the 6 month study period, 39069 reports were logged and quantified for analysis, of which 13413 (34%) were amended by the faculty. Of these, 3443 (26%) had major corrections (NLD > 20%). The combined groups exhibited a downward trend over 6 months in mean NLD (-0.26% per month, p=0.005) and major corrections (-0.71% per month, p=0.002). The downward trends were also seen in both metrics when the experimental and control groups were evaluated separately (mean NLD: -0.34% and -0.17% per month, respectively; major corrections: -0.82% and -0.57% per month, respectively, see Figure), although for either metric the difference in slopes between the groups were not significant (p=0.33 and p=0.45, respectively). Residents in the experimental group found the comparator feedback to be subjectively beneficial, but limited by a somewhat cumbersome user interface.

CONCLUSION
The Report Comparator tool can produce quantitative documentation of dictation performance, a new metric in resident education. Initial results using this quantitative measurement are consistent with our intuitive understanding of the educational process, that fewer corrections to reports are needed over time. Such quantitative tools can be important when confronted with outlier performance that is difficult to document in the current environment.

The comparator feedback portion of the study was compromised by difficulty accessing reports, discouraging its daily use. Further development of the user interface will aid in assessing the usefulness of this aspect of the tool. Longer-term studies with larger cohorts may also improve the statistical power of the results.

Clinical Audit of Preprocedure Documentation for Image-guided Procedures: Implementation of a Newtool for Improving Efficiency and Patient Safety (Station #3)

Daichi Hayashi MBBS, PhD (Presenter): Nothing to Disclose, Francisco E. Valles MD: Nothing to Disclose, Melkamu Dessie Adeb MD: Nothing to Disclose, Nisarg Atulkumar Parikh MBBS, MD: Nothing to Disclose, Terence William Hughes MD: Nothing to Disclose, Noël B. Velasco MD: Nothing to Disclose

PURPOSE
To reduce time taken to collect key clinical information for planning image-guided procedures and to improve adherence to the American College of Radiology/Society of Interventional Radiology (ACR/SIR) practice guidelines for preprocedure documentation

METHODS
ACR/SIR guidelines for imaging-guided procedures state preprocedure documentation should include: 1. The plan for each procedure to be performed. 2. Indication for procedure and brief history. 3. Findings of targeted physical examination. 4. Relevant laboratory and other diagnostic findings. 5. Risk stratification, such as the American Society of Anesthesiologists Physical Status Classification. 6. Documentation of informed consent. Audit of preprocedure documentation of 29 ultrasound-guided procedures performed within the Department of Radiology during a 4-week period in August 2013 revealed poor quality of documentation, with overall adherence rate to the ACR/SIR guidelines of 8%. Discussions were held among residents and attending radiologists and reasons for such poor performance were thought to include: 1) residents could not afford to spend much time on preprocedure documentation during a busy ultrasound rotation at our institution, and 2) residents were not fully aware of ACR/SIR guidelines. Therefore, we aimed to improve the quality of preprocedure documentation by two means: 1) by improving the efficiency of the workflow for residents during clinical information collection which is pertinent for discussion with the attending in planning the procedure, and 2) by creating a proforma (in which most clinical information is auto-fed) within our electronic patient record (EPR) system for the preprocedure documentation that collects all necessary items listed in the guidelines. Using 10, randomly selected, procedures as ‘simulated requests’, three radiology residents performed ‘simulated clinical information collection’ and ‘simulated pre-procedure documentation’, both without and with using the new proforma to assess the intra-observer variability. To permit residents entering information by memory, the first session (without proforma) and the second session (with proforma) were held with 4 weeks time interval. In addition, one resident repeated the whole process to assess intra-observer variability with 12 weeks time interval. Without the proforma, residents manually searched the necessary information from the EPR and entered them into our existing paper ‘preprocedure checklist’, and then typed preprocedure notes in free form in EPR. With the proforma, residents opened the patient’s medical record in EPR, launched the proforma, and completed the remaining necessary empty fields. Once sufficient clinical information was collected, residents ‘pended’ the document and discussed the action plan with the attending. After obtaining approval, residents filled out the action plan and signed the document. We measured time taken to complete the above process without and with the use of proforma. Finally, we re-audited preprocedure documentation of 33 ultrasound-guided procedures in a 4-week period in March 2014, during which time preprocedure documentation was entered using the proforma, and re-assessed the adherence rate to the ACR/SIR guidelines.

RESULTS
Median time taken for information collection and preprocedure documentation per case was reduced by 69% (from 8 minutes 38 seconds to 2 minutes 40 seconds) for resident 1, 65% (from 7 minutes 24 seconds to 2 minutes 36 seconds) for resident 2, and 59% (from 7 minutes 40 seconds to 3 minutes 11 seconds) for resident 3. Repeated measurements by resident 1 yielded similar results to the first measurement (reduction by 68%, from 8 minutes 1 second to 2 minutes 35 seconds). Adherence to ACR/SIR preprocedure documentation guidelines improved from 8% to 100%.

CONCLUSION
Utilizing the new proforma has improved both efficiency of our workflow and quality of preprocedure documentation. These improvements are a result of a completion of an audit cycle: analysis of our past performance, identification of the problems, invention of a tool to solve the problems, and successful implementation of the new tool. At our institution, EPR system has been very time consuming for physicians due to extensive need for documentation, but this type of tool might streamline workflow, leaving more time for bedside patient care. Similar approach can be taken by any institution. Effective use of a proforma with a feature for ‘auto-feeding’ of clinical information from EPR system can significantly improve the efficiency of workflow as well as quality of documentation of medical record in line with the available guidelines, thereby improving patient safety.

Implementation of a Department Wide CT Dose Monitoring and Reporting System: Initial Experience and Results (hardcopy backboard)

Lior Melvin (Presenter): Advisory Board, Bracco Group Speakers Bureau, General Electric Company, Jia Wang PhD: Nothing to Disclose, Christoph Zorich: Nothing to Disclose, Ken Lim MBA: Nothing to Disclose, Daisha Marsh ARR: Nothing to Disclose, Dominik Fleischmann MD: Research support, Siemens AG

PURPOSE
Comprehensive, institution-wide documentation of radiation exposure from CT is highly desirable for quality and safety monitoring, protocol optimization, technologist education, as well as for regulatory and compliance purposes. While commercial solutions for CT dose recording are available, their practical implementation in a large academic department with multiple sites, equipped with CT scanners from different vendors and different generations of technology is challenging. Reliable identification of potential overexposures is further complicated by the fact that the recorded dose data need to be compared to reference values for each individual exposure (i.e. on a series level) within a CT examination, rather than on a study level, and institutional maximum allowable dose levels have to be established. In this work we present our experience and first results gained from implementing a dose monitoring and reporting system at our institution.

METHODS
Over a period of 7 months we collected the CT dose information (CTDvol, DLP) and corresponding scan data from all CT scans obtained on nine CT scanners at our institution using commercial dose management software (DoseWatch, GE Healthcare). All data were exported into spreadsheet software (Excel, Microsoft). A set of filtration rules (Crystal reports, SAP) applicable to all scanners was developed to classify the dose information based on CTDvol, reference phantom size, patient age, and text information extracted from study and series names to identify the type of the series within as CT acquisition (e.g. pediatric vs. adult, head vs. body, cardiac prospective and retrospective, body and neuro perfusion, etc.). The dose values were compared to institutional CTDvol limits which are based on guidelines from the American College of Radiology and American Association of Physicists in Medicine. Actual dose values were reported and reviewed on a monthly basis. Exposures exceeding the predetermined dose limits were analyzed by a radiologist, a medical physicist, the chief- and the protocol technologist for medical necessity and categorized into one or more of three groups; protocol errors, technologist errors, and documentation errors.
RESULTS

A total of 59,981 CT scans were acquired during the study period. Of these acquisitions, 37 (0.062%) were found to be above the institutional dose limit. 9/37 failures were due to errors in the settings of two protocols. 14/37 failures were technologist acquisition errors. 27 failures were due to technologist lack of documentation of medical necessity. 9/27 of these documentation errors would have received medical authorization had they discussed the imaging procedure with a radiologist. Examples include obese patients, trauma patients with multiple arms positioned at their sides. Protocol setting errors were addressed, but recurred after scheduled maintenance service. Overall, failure rate decreased over the seven months from 0.13% (n=10) in month one to 0.01% (n=1) in month seven.

CONCLUSION

Implementation of a comprehensive dose monitoring system may require several adaptations to institutional practice and to the specific composition of the scanner fleet. Once in place, such a system allows reliable detection and analysis of possible overexposures which can be addressed in a timely manner and according to institutional and regulatory guidelines.

QSE-WEB

Quality Storyboards Wednesday Poster Discussions

Quality Storyboards

AMA PRA Category 1 Credits ™: .50

Wed, Dec 3 12:45 PM - 1:15 PM   Location: QS Community, Learning Center

Sub-Events

QSE107

How Accurate is Self-Reported Data?—Radiologic Procedure Logs at a Large Academic Medical Center (Station #1)

Adam Benjamin Prater MD (Presenter): Nothing to Disclose, Thomas W. Loehfelm MD, PhD : Founder, Panorad, Bradley Sverre Rostad MD : Nothing to Disclose, Christopher Pattrin Ho MD : Nothing to Disclose, Mark Edward Mullins MD, PhD : Nothing to Disclose

PURPOSE

The American College of Graduate Medical Education (ACGME) and the American Board of Radiology (ABR) require that radiology trainees maintain a log documenting all image-guided procedures completed during residency, recorded in a resident learning portfolio. A traditional manual procedure log has advantages of enabling recording of variable levels of participation (observation to independent performance) and immediate attending signature verification, but they suffer from inconsistent reporting and burdensome recordkeeping for residents. We compared data from self-reported resident procedure logs to data from the electronic medical record (EMR) searches for reports signed by residents in the class of 2012 to estimate accuracy of self-reported logs and feasibility of an automated replacement system.

METHODS

Institutional review board approval was obtained. Self-reported resident procedure logs from the graduating class of 2012 (n = 13 residents) were de-identified and compared to de-identified data from the EMR search data. Studies were categorized by departmental division and technical difficulty (basic or advanced). Basic procedures includes those that most residents eventually can perform with only direct or indirect attending supervision, such as GI fluoroscopy, central venous access, and ultrasound-guided breast biopsy. Advanced procedures include those that are usually either observed by residents or in which residents might participate, but which generally are performed primarily by fellows or attendings. Examples of advanced procedures include most CT-, MRI-, and stereotactic-guided biopsies, as well as vascular interventional procedures other than basic central venous access. Summary statistics comparing the two data sources were calculated.

RESULTS

1,915 procedures were reported in the manual procedure log dataset, while EMR searching revealed that this cohort of residents dictated a total of 2,982 procedures, indicating a 64% recall rate. Note that this is a best-case scenario, since our EMR data set did not include portions of R1 year for the class. Basic procedures, i.e. those that residents likely actively participated in, are vastly underreported in the manual logs (manual log captures only 32% of studies actually dictated), while more advanced procedures, in which the resident may have only been an observer, were overrepresented in the manual logs (manual logs include 204% of the studies actually dictated). Exceptions to this rule were basic neuroradiology (e.g. fluoroscopically guided lumbar puncture) and musculoskeletal (e.g. joint aspiration) procedures, which were similar in both data sets.

CONCLUSION

The ACGME and ABR introduced the Radiology Milestones Project in 2012 to address competency evaluation for radiology residents. Our institution implemented a quality improvement (QI) process to review the methods used to collect procedure logs for resident learning portfolios. An audit of manual procedure logs for the class of 2012 demonstrates that residents report performance of advanced procedures, likely capturing instances where
they observed or engaged in minimal participation, and underreport basic procedures that they likely were primarily responsible for. The results of our QI process demonstrate the utility of automated data capture, which provides an opportunity to correct recall inaccuracies while lessening the burden on residents for recordkeeping. Enhancements to the system can further streamline and enhance the process by automatically prompting the approving attending to sign off on the resident's performance, thus increasing competency to be documented. Our institution now relies on this and other EMR data mining to streamline the quantitative assessment of resident performance and participation.

**QSE117 Not for Residents Only: Department-wide Training for the Management of Contrast Reactions**

(Station #2)

Sandra Leigh Moore MD (Presenter): Royalties, Amirsys, Inc; James S. Babb PhD: Nothing to Disclose; Maria Christina Shiau MD: Nothing to Disclose; Jill E. Jacobs MD: Nothing to Disclose; Georgeann McGuinness MD: Nothing to Disclose

**PURPOSE**

Contrast reactions are infrequent but unpredictable high stakes events requiring swift expert management by radiologists, despite widespread paucity of first-hand experience. Most training programs teach contrast reaction management to residents but do not address the need for ongoing training thereafter. We propose a novel model to train residents, fellows and attendings to manage contrast reactions. We hypothesize that all radiologists—from junior trainee to senior attending—may attain comparable expertise for managing reactions, and that all cohorts can increase confidence with intensive review and interactive simulation exercises.

**METHODS**

IRB exemption was obtained. Ten radiologist-trainers conducted small group sessions at our institution’s Simulation Center. An unanticipated pre-training quiz assessed baseline knowledge and management of reactions, appropriate drug treatment, and subjective confidence levels through 5 reaction scenarios graduating in severity. The participants then practiced hands-on management of reactions using programmable manikins. Trainee performances were discussed at group debriefing sessions. To date 109 participants—58 residents, 23 fellows, and 28 attendings—have trained. Residents and attendings have been re-quizzed at 1 year and/or 2 years following initial training. Because new cohorts are included annually, not all trainees have yet been re-tested. Statistical Methods: A paired sample Wilcoxon signed rank test assessed whether there was a change in confidence and test score over each interval year within each training level cohort. Statistical tests were conducted at the two-sided 5% significance level using SAS 9.3 (SAS Institute, Cary, NC).

**RESULTS**

All groups reported a significant subjective increase in confidence in managing contrast reactions between pre-training and testing after one year ($p=\ldots$)

**CONCLUSION**

The overall initial test scores were comparable across training level cohorts. Total confidence scores improved significantly between pre-training, year 1, and year 2 post-training testing. Total reaction management scores improved 2 years after initial training. These findings suggest that confidence in managing reactions may precede testable competence. Not all cohorts were equally confident for managing reactions. Better understanding of the differences in confidence and baseline knowledge between cohorts may facilitate tailored training per specific cohort. We hypothesize that real time practical tests or scenario-based web tests for management of contrast reactions could assess management skills more optimally than written tests, and we are working toward their introduction. This ongoing project continues to train each incoming class of residents and fellows, and accommodates an expanding group of attendings. Intensive follow up scenario-based sessions could strengthen training, and are anticipated. All radiologists must continually refresh their confidence and maintain their competence in managing contrast reactions. Our program demonstrates to residents by precept that reinforcing this training is a life-long endeavor. A department-wide training program can create an inviting culture that encourages all radiologists to take on this challenge.

**QSE127 Computerized Provider Order Entry (CPOE) as a Cause of Errors in Imaging Requests: What a Difference a Space Makes**

(Station #3)

John Mongan MD, PhD (Presenter): Spouse, Founder, B|Informative; Aaron Neinstein MD: Nothing to Disclose; Christopher Jovais: Nothing to Disclose; Spencer Caton Behr MD: Research Grant, General Electric Company

**PURPOSE**

We noted that a substantial percentage of imaging requests with clinical questions that clearly required CT abdomen/pelvis were initially requested as CT abdomen only. These high error rates persisted despite the presence of a computerized provider order entry system (CPOE). Correcting errors in imaging requests is time-consuming because, due to insurance requirements, the requesting clinician must approve the change. The process of obtaining a modified imaging request from the originating clinician increases radiologist workload and delays patient care. We sought to identify potential sources of errors in imaging requests and make systemic changes to reduce them.

**METHODS**

Unstructured interviews were conducted with clinicians who had made errors in imaging requests to identify potential sources of error. Based on our interview findings, we analyzed the user interface of our CPOE and implemented a change to reduce errors in CT abdomen/pelvis requests. To determine the effectiveness of this change, we compared the proportions of completed CT abdomen/pelvis studies that originated with requests for CT abdomen (without pelvis) during a 6-month period immediately before the change and a 3-month period after the change. The latter period began 1 month after the change and extends to the present. Imaging request data were extracted from the Radiology Information System (IDXrad) and inserted into a SQL database (SQLite). SQL queries were executed to identify the target studies; results were exported to R for statistical analysis.
Implementing a Mammography Quality Assurance Programme to Improve Technical Image Quality and Reduce Technical Repeats (hardcopy backboard)

QSE009-b

Steven C. Dixon (Presenter): Nothing to Disclose, Rosslyn Halls BSc, MSc: Nothing to Disclose, Sue Elizabeth Milner BSc: Nothing to Disclose, Manisha Shah MBA, RT: Nothing to Disclose, Neil Buckley: Nothing to Disclose

PURPOSE

Introduction and purpose: A significant variation in mammography technical repeat rates and image quality, by hospital and by mammographer, was observed during peer review visits undertaken to breast services within our network of hospitals. A breast imaging leads quality forum was established, comprising of lead mammographers from each hospital. The remit of the group was to analyse the peer review findings, share good practice and implement a quality assurance programme to address variations in performance and improve overall results.

METHODS

Methods: An action plan was developed to enable the implementation of the quality assurance programme and included the following: • appointing a group lead QA mammographer • ensuring all mammography staff have access to a superintendent radiographer highly experienced in mammography as a mentor, as well as establishing a buddy system • ensuring staff are suitably trained, including holding, or working towards, a post graduate certificate of competence in mammography, in addition to undertaking relevant breast specific CPD • regularly feeding back results to staff on the quality of their work, including feedback from radiologists regarding technically inadequate images • developing and implementing standardised group wide and policies, protocols and procedures, including those relating to customer care and communication. • developing standardised information leaflets and pre mammography questionnaires • ensuring sufficient time in between appointments to enable mammographers undertake the procedure according to protocol • reducing the number of staff performing mammography, where necessary, rotating staff throughout multiple hospitals and limiting appointments to enable mammographers undertake the procedure according to protocol • requiring CT abdomen/pelvis, and believed that they had requested CT abdomen/pelvis. Analysis of the CPOE showed that a search for abdominal CT returned an alphabetically sorted list of options where the CT abdomen only options were listed above the more commonly used CT abdomen/pelvis options. We modified the CT abdomen/pelvis study names in the CPOE by inserting a space before the “/” (“abdomen/pelvis”), which caused the abdomen/pelvis options to be listed above the abdomen only options. The proportion of abdomen/pelvis studies initially requested as abdomen only decreased from 9.4% (500/5330) before the change to 4.7% (129/2763) after \( p < 0.001 \).

CONCLUSION

Rearranging the abdominopelvic imaging options in our CPOE to place more commonly used options at the top reduced errors in CT abdomen/pelvis requests by over 50%. Although many studies have shown reduced error rates with CPOE, our results demonstrate that CPOE may be a source of error when the interface does not conform to user expectation. Very minor differences in user interface, such as the relative positioning of alternative study types, may have a significant impact on the rate of imaging request errors and resultant wasted radiologist time and delayed patient care.
**QSE-THA**

**Quality Storyboards Thursday Poster Discussions**

**Quality Storyboards**

**SQA**

AMA PRA Category 1 Credits ™: .50

**Thu, Dec 4 12:15 PM - 12:45 PM Location: QS Community, Learning Center**

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### QSE108

**How to Reduce Head Computerized Tomography (CT) Orders in Children with Hydrocephalus using the Lean Sigma Methodology: Experience in a Major Academic Children’s Center (Station #1)**

Aylin Tekes-Brady MD (Presenter): Nothing to Disclose, Eric K Jackson: Nothing to Disclose, Jean Ogborn: Nothing to Disclose, George Jallo: Nothing to Disclose, Thierry Huisman MD: Nothing to Disclose

**PURPOSE**

Radiation should be limited as much as possible especially in children. Many children with hydrocephalus need serial imaging for diagnosis and for follow-up increasing life time cumulative radiation exposure. The goal of this project is to reduce head CT orders by 50% within 6 months in children with known or suspected diagnosis of hydrocephalus.

**METHODS**

1. Forming the team: Using the Lean Sigma methodology, the Department of Radiology, Division of Pediatric Radiology initiated a team of all stake holders that are involved in the care of children with hydrocephalus. Our team involved pediatric neuroradiologists, pediatric neurosurgeons, pediatric emergency department (PED) physicians, chief technologists of CT, Ultrasonography (US), and Magnetic Resonance Imaging (MRI), pediatric radiology nurses, scheduling staff, administrator of our department and an analyst. A project manager and a physician champion were identified. Weekly team meetings were held. 2. After hearing each group member’s input, decision was made on the project title, problem statement and project goal. 3. To reduce the head CT orders, alternatives of head CT were discussed. Head US (HUS) was offered as the first line of imaging in children ≤ 6 months of age. Ultrafast brain MRI (UBMRI) (triplanar HASTE) was the modality in children >6 months of age. UBMRI was favored over routine brain MRI to eliminate need for sedation or anesthesia and provide rapid information. 4. The existing UBMRI protocol was revisit and optimized to reduce image time (scan time ~ 5 min) and improve quality. PED MR Scanner and other departmental MRI scanners were updated. 5. A visual flowchart containing information on the imaging protocols using HUS and UBMRI, and method of ordering and coordinating the imaging studies during regular work hours (7 am-4:59pm), after hours (5 pm-6:59am) and weekends were distributed to all involved departments via e-mail and personal visits to departmental meetings by the project manager. Effort was made to communicate to all levels of care givers including nurses, residents and attending physicians. 6. Baseline data was collected to understand the current practice in our hospital. Radiology Information Systems (RIS) was used for data search over a three month time period using following criteria: Key word: hydrocephalus, age: 0-18 year old, type of imaging performed (head CT, head US, routine brain MRI, or Ultrafast brain MRI) including the date, time of the day, ordering physician rank (resident versus attending), and ordering department. 7. Baseline data was analyzed to document the number and percentage of ordered imaging modality. This was further analyzed by time of the day, ordering department, and ordering physician rank. 8. Same analysis was repeated after interventions for a period of three weeks (to meet the deadline for this abstract submission).

**RESULTS**

The percentage of each imaging modality for the baseline data was as follows: head CT 32%, HUS 33%, routine brain MRI 18%, UBMRI 17%. 70% of all head CT orders came from pediatric emergency department (PED). 5% of UBMRI was performed in PED patients, and 92% of UBMRI was performed for outpatients. 60% of all orders came from the residents. These results helped target PED imaging orders and their physicians especially the residents for the primary intervention focus. After placement of interventions (Material and Methods; items 3-5), post intervention data were analyzed. Overall, head CT orders were reduced to 9.5%, while the UBMRI orders increased to 49%. Table summarizes baseline and post intervention data per time of the day practice: regular work hours, after hours and weekends. (see attachment)

**CONCLUSION**

We were able to surpass our goal of reducing head CT orders by 50% in children with hydrocephalus using the Lean Sigma methodology. Regular meetings, a strong committed team and frequent communication between stake holders were crucial in achieving our goal.

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### QSE118

**The Simulation Lab Does Not Equal the CT Suite—Testing the Environment for Readiness (Station #2)**

Maureen Gail Heldmann MD (Presenter): Nothing to Disclose, Jessica Caraway MD: Nothing to Disclose, Justin Michael Owens MD: Nothing to Disclose, Kevin C. Cormier MD: Nothing to Disclose, Stacey Ryder Massey MD: Nothing to Disclose, David Richard Wallace MD: Nothing to Disclose, Aaron Toledo Woodward MD: Nothing to Disclose

**PURPOSE**

Adverse event laboratory simulation has been part of our radiology training program for four years, but no 'mock code' program exists at our tertiary referral hospital. We therefore elected to Survey radiology resident opinion of adverse drug event (ADE) simulation elements Identify and correct environmental factors in the CT suite that are not addressed in ADE laboratory simulation. Assess technologist perception of 'mock contrast
METHODS

Five question survey of radiology resident and alumni opinion regarding prior simulation activity element effects on knowledge base and confidence in the recognition and treatment of ADE. Four on-site CT suite preparedness drills including technologists, radiology residents and institutional emergency response teams Anonymous 5 question CT technologist inquiry concerning self perceived ability to recognize ADE, activate response and utilize all CT suite equipment including an automated external defibrillator (AED) Follow up 5 scale rating of value by physicians and technologists participating in mock drills.

RESULTS

Resident and alumni opinions were overwhelmingly positive regarding the benefits of lab simulation, with most value perceived from debrief sessions (see fig). Multiple deficiencies were identified in the CT environment, including inoperable pagers, absent equipment, ineffective communication and lack of familiarity with monitoring devices and AED. CT technologist survey responses reflected a need for further training. Comments from both surveys support a desire to participate in on-site preparedness drills. Follow up on-site activity participants gave unanimously high ratings.

CONCLUSION

Simulation is perceived as a valuable exercise by radiology trainees- All radiology residents are enrolled in ACLS and will continue with both in lab and on site simulation. Senior residents will serve as mentors and the Chief resident provide continuum as part of his/her administrative duties- lab medical simulation cannot identify environmental issues at point of care- All medication and equipment deficiencies were immediately corrected and a new paging system was instituted in the outpatient setting CT technologist ADE readiness may be overestimated by their supervisors and mock codes are viewed positively by this group- Partnership has been established with Nursing administration and a small group developed to include proactive CT technologist preparedness drills campus wide. All simulations will include immediate brief with facilitators and participant feedback.

Three Types of Ultrasound Preparedness Drills: Are they All That They Are Seen to Be?

Meghna Chadha MD, MBBS (Presenter): Nothing to Disclose, Nicholas A. Lewis MD: Nothing to Disclose, Osama M. Ali MD: Nothing to Disclose, Pinky Sharma MD: Nothing to Disclose, Chaitanya Ahuja MD: Nothing to Disclose

PURPOSE

Patient call-back was defined as repeat sonographic evaluation of a patient once he/she has left the department, due to sub-optimal or incomplete initial scan. High patient call-back rates were noted in our department, which maintains a log book for all call-backs citing the reason. Due to this problem, accurate ultrasound reports were not generated in a timely effective manner and patient throughput in the department was delayed. Hypothesis: Patient call-back rate may be positively impacted by a multi-dimensional intervention.

METHODS

A quality committee consisting of a staff radiologist, lead ultrasound technologist and radiology manager was appointed for identification, understanding and modification of factors that influence patient call-back rates in our department. Potential problems identified were as follows: 1. Sonography technologists were not confident in performing exams such as Transplant kidney, TIPS evaluation, appendix, hernia, mostly because these were so infrequently performed. 2. Staff radiologist expectations for each exam were not consistent. 3. Documentation of findings by each technologist was variable. 4. For questions/concerns after hours, the technologist did not have an available radiologist with whom to consult. 5. No readily available reference materials were available to the technologists, when in doubt. An improvement plan was devised as follows: 1. Fortnightly lecture series were given by staff radiologists to the technologists, over a period of six months. Scanning techniques and potential pathologies in each exam were discussed. 2. Revision to all existing technologist worksheets was made, thereby eliminating staff and technologist documentation variability. 3. The afternoon and midnight shift radiologist was made available for the technologists, to assess for completeness and adequacy of ultrasound exams performed after hours, should the technologist have a concern. 4. A copy of all lectures and practice guidelines from the American Institute of Ultrasound in Medicine (AUIM) were made available and handy in the scanning area, for easy reference. 5. The quality officer provided regular feedback and constructive critique of sonography exams to the technologists. Patient call-back rate was reassessed after 1 year.

RESULTS

Baseline evaluation: Total number of exams performed in a six month period: 6384. Total number of patient call-backs over 6 months: 35 (as follows, abdomen 18, transplant kidney 4, appendix 3, scrotum 2, TIPS 1, thyroid 1, salivary gland 1 and DVT studies 3). The improvement plan was in place for 6 months. Re-evaluation after Implementation of Improvement plan: Total number of exams performed over a period of six months: 6492 Total number of patient call backs over 6 months: 6 (as follows, abdomen 3, salivary gland 1, thyroid 1, DVT study 1).

CONCLUSION

The project demonstrates measurable quality improvement in our ultrasound department, as evidenced by significant decrease in patient call-back from 35 to 6, following our multi-faceted interventions. This verifies our hypothesis that call-back rates in our department may be positively impacted through formal didactics, availability of an after hours radiologist for trouble-shooting, standardizing documentation and providing readily available reference material in the ultrasound scan rooms.

Reducing Radiation Dose in Pediatric Diagnostic Fluoroscopy (hardcopy backboard)
Use of Non-Pharmacological Strategies and Magnetic Resonance Imaging Preparation Programs to Improve Workflow, Increase Patient Safety and Satisfaction, and Decrease Cost in a Tertiary Pediatric Hospital (hardcopy backboard)

Laura Merriem McCalvin BS (Presenter): Nothing to Disclose, Elizabeth Ponder McGraw MD: Nothing to Disclose, Brooke A. Amato BS: Nothing to Disclose

PURPOSE

The use of Magnetic Resonance Imaging (MRI) in children frequently involves the use of sedation due to the necessity of the child remaining completely still in a noisy, unfamiliar environment. The high clinical demand for sedated MRI examinations resulted in a 3 month backlog of patients waiting to undergo an outpatient sedated MRI at our regional, tertiary pediatric hospital. The purpose of this presentation is to describe the utilization of non-pharmacological strategies and MRI simulators by a certified child life specialist to decrease the need for sedation in children undergoing MRI examination, thus decreasing the cost and wait time for the examination and simultaneously increasing patient safety and satisfaction.

METHODS

Patients between the ages of 4-17 years were asked to participate in the program, which allows a patient to attempt to undergo an MRI awake before being sedated. The certified child life specialist prepared the patient for the upcoming MRI examination by using an age/developmentally appropriate approach, including a three-dimensional (3D) toy-like MRI scanner and recorded sounds of an MRI scanner. Non-pharmacological strategies such as play-based therapy, desensitization, and cognitive behavioral therapy were used to increase patient and family familiarity with the MRI machine and decrease overall patient anxiety. The children were also encouraged to utilize positive coping skills, such as breathing techniques, audio distraction through the use of headphones to listen to music, and positive reinforcement from the MR technologist to yield a diagnostic examination with as little motion artifact as possible. After a practice session during which the child was taught strategies such as play-based therapy, desensitization, and cognitive behavioral therapy were used to increase patient and family familiarity with the MRI machine and decrease overall patient anxiety. The children were also encouraged to utilize positive coping skills, such as breathing techniques, audio distraction through the use of headphones to listen to music, and positive reinforcement from the MR technologist to yield a diagnostic examination with as little motion artifact as possible. At the initiation of the program, the average wait time for an outpatient sedated MRI for patients in this age group was 9.7 weeks. After 14 months (March 2014), this wait time for the same age group decreased to approximately 5.1 weeks. This program also decreased the overall cost of the MRI examination. For example, in our population, a brain MRI with and without contrast was one of the most frequently ordered examinations, and costs on average $1,599.00 less when performed without sedation. Patient safety was also increased as the risks of sedation were completely avoided. Random program participants were surveyed by mail after completion of their MRI. These surveys revealed a high level of patient and family satisfaction as...
CONCLUSION

The use of non-pharmacological strategies and MRI preparation programs by a certified child life specialist has been successful in improving workflow in the MRI department of a tertiary pediatric hospital. Strategies such as play-based therapy, desensitization, and cognitive behavioral therapy were successfully employed to decrease the backlog of sedated outpatient MRI examinations, provide a diagnostic examination at a reduced cost (sedated vs. non-sedated), and improve patient safety and satisfaction. In the future, the program will expand to increase the number of participants under 6 years of age as well as include patients with developmental delays, such as Autism Spectrum Disorder.

Improving the Pediatric MRI Experience: A Multidisciplinary Team Approach Using Lean Sigma Methodology (Station #1)

Emily Lee: Nothing to Disclose, Joanne Shay MD: Nothing to Disclose, Thierry Huisman MD: Nothing to Disclose, Peg C. Cooper RT: Nothing to Disclose, Hal Shaffner MD: Nothing to Disclose, Aylin Tekes-Brady MD (Presenter): Nothing to Disclose

PURPOSE

To improve outpatient Pediatric MRI General Anesthesia family satisfaction by 15% and reduce the arrival to scan time to less than 60 minutes in six months.

METHODS

• Created a multi-disciplinary team including stakeholders from Pediatric Anesthesia, Pediatric Radiology, radiology administration, Nursing, Child Life, scheduling and registration. • Weekly meetings were held to discuss the purpose, understand the baseline process and determine where improvements were most needed. • A Patient/Family survey was created to gain baseline patient satisfaction feedback regarding the existing process. • A Value Stream Map was used to identify the existing process and generate baseline cycle times. • Best practice organizations conducting Pediatric MRI with General Anesthesia were studied for workflow and scanner utilization process. Improvements: Areas for improvement were determined by the baseline data collected from family surveys and the value stream map. • Parent communication before, during and after the MRI with Anesthesia process • Process standardization from patient registration through post anesthesia care unit (PACU) discharge • Parent involvement during induction of anesthesia Interventions: To achieve these improvements, our team implemented the following interventions: • Changed the Anesthesia start time in Anesthesia scheduling systems to reflect the start-time seen in Radiology scheduling system, 20 minutes before the scan start time. • Have nursing call parents before they arrive with expected duration of the scan, NPO instructions, and provide verbal information regarding parking and directions. • Created an updated map with directions to the parking garage, and directions from the garage to the Pediatric MRI Registration Desk. • Implement a “radiologist meets the parents” and “Time Out” procedure prior to induction of anesthesia. This process mimics the WHO OR Patient Safety initiative by bringing the entire healthcare team, including anesthesiologists, radiologists, nurses, technologists and parents into the same room to confirm the patient identity, planned MRI exam, and create a safe environment to discuss concerns and answer questions any team member or patient/patient might voice prior to the induction of anesthesia. • Eliminate repetitive questions asked by different members of the clinical team and generated a standardized pre-procedure nursing form • Involve a parent advocate on our lean sigma team • Enhance the involvement of Child Life Specialist by reviewing anxiety levels for the patient and parents when needed/appropriate • Provided patient status updates during the scan to the waiting family.

RESULTS

We measured the baseline patient satisfaction from the survey we created. Our interventions increased outpatient family satisfaction by 7%, and reduced the overall cycle time/wait time from 3 hr 41 min to 3 hr and 19 min, reducing the minutes from registration to anesthesia start by 21 min, from registration to scan start by 12 minutes, and from registration to PACU discharge by 22 minutes. Evaluation of the Anesthesia and Radiology scheduling systems discovered a 20 minute discrepancy in the start times, therefore saved 20 minutes from the total cycle time.

CONCLUSION

Our team has focused improvements on patient-centered care to create a safe and satisfactory experience for patients and their families. The Pediatric MRI General Anesthesia process in an academic medical center is very complex, and although patient/family satisfaction was improved, the goal of 15% was not reached. This lean sigma project will be on-going and continue until the preset goal is achieved. We plan to create a Pediatric MRI General Anesthesia Parent Education Guidebook and website to inform parents about the process, what to expect, and how to become more involved. Next steps will include ongoing active participation of the parent advocate and feedback from The Johns Hopkins Pediatric Family Advisory Council. In addition, group wisdom from the team stake holders will be used to standardize every step of the process to eliminate variability and delays, such as Autism Spectrum Disorder.
Full Fat vs. Trim: Comparing Two CT Thoracic Angiogram Protocols for Aortic Dissection in the Emergency Setting (Station #2)

Amy Ming-Chun Tsai  Sevao  MBChB (Presenter):  Nothing to Disclose , Lucy Elizabeth Modahl  MD, PhD :  Nothing to Disclose

PURPOSE

CT thoracic angiogram (CTA) is the modality of choice for initial assessment of suspected aortic dissection in the emergency setting. Our institutional protocol is optimized to detect intramural hematoma, fully characterize any aortic dissection, and to provide anatomic detail of the iliac arteries should the patient require endovascular intervention. However, patients scanned with this protocol receive a large amount of radiation because of its long scan length and multipass imaging in non-contrast, arterial and portal venous phases. As the incidence of aortic dissection is very low, the majority of patients imaged would not have the condition and yet are exposed to a large amount of radiation. This protocol also slows down workflow: since a large number of reformats are required for each phase, uploading all of them to PACS takes an extended amount of time, causing delays between image acquisition at the scanner and transmission to the work station.

METHODS

To solve this problem we devised a new CTA protocol in consultation with interventional radiologists and vascular surgeons, after an institutional review. The new protocol is designed to reduce radiation dose and improve workflow efficiency by decreasing the scan length for non-contrast and arterial phases significantly and requiring immediate review of the non-contrast and arterial images by radiologists or registrars before the portal venous study is performed. This ensures that the diagnosis is reached in the shortest time possible, and eliminates universal application of portal venous scanning; only if the patient has a dissection flap extending into the abdomen would portal venous scanning be performed to assess end-organ perfusion. Because less images and therefore reformats are required, upload time to PACS is reduced. To evaluate the diagnostic accuracy and radiation dose reduction, data was collected prospectively after the new protocol was launched in May 2012, and the results compared between the “full fat” and “trim” protocol.

RESULTS

Between 01/01/11 and 29/12/12, all studies performed for aortic dissections at Auckland City Hospital were classified into two different protocols. Protocol A images were acquired from thyroid cartilage to just below the renal arteries, with multiple phases (non-contrast, arterial and portal venous). Protocol B involved a non-contrast scan from the top of the aortic arch to the aortic root, and arterial imaging from the thoracic inlet to just below the renal arteries. Protocol B, the “trim” protocol, was devised after an institutional review. Studies were interpreted to be positive or negative for aortic dissection by the attending radiologists and registrars. Aortic dissections were categorized using the Stanford Classification. For each scan the dose-length product was recorded when available, and effective radiation dose (ED) was calculated. Sensitivity and specificity were calculated using a two-way contingency table. Number of PACS images for each study was recorded to assess effect of the protocols on workflow. Demographic data was also analyzed to ensure comparability between the two protocols. A total of 311 studies were identified, including 281 protocol A and 30 protocol B studies. Eighteen of the protocol A studies were positive for dissection (6.4%), 247 negative (88%) and 16 had other acute aortic disorders. From the 30 protocol B studies, 1 was positive for dissection (3.2%), 29 negative (96.7%), and none had acute aortic disorders. No false-positive or false-negative cases were identified in either protocol, resulting in sensitivity and specificity of 100% for both. The mean ED of protocol A is 23mSv, whereas the mean ED of protocol B is 17mSv, resulting in a mean radiation reduction of 6mSv per patient with suspected aortic dissection. The mean number of PACS images generated per study is 1292 for protocol A, and 956 for protocol B, resulting in a mean image number reduction of 336.

CONCLUSION

This prospective study demonstrated that we can successfully modify CTA protocols to reduce radiation dose and streamline workflow without compromising diagnostic accuracy. As a result of this quality improvement initiative, the shortened protocol (B) is now the accepted routine protocol in our institution.

Impact of Simulator Teaching on Junior Radiology Resident Preparedness for Independent Call (Station #3)

Kathryn   Darras  MD (Presenter):  Nothing to Disclose , Bippan   Sangha  MD :  Nothing to Disclose , Kristy Cho :  Nothing to Disclose , Silvia D. Chang  MD :  Nothing to Disclose

PURPOSE

Radiology residency training and preparation for on-call responsibilities traditionally involved lectures, case-based modules, mandatory rotations through different subspecialties, in addition to participation in supervised call with upper-year residents/attending staff. With advancements in digital radiologic image acquisition and display over the last decade, residency training should incorporate up-to-date technology to provide effective education and improve patient safety. The successful use of computer-based simulator for the evaluation of radiology residents has been described in the literature, however its efficacy as an educational tool is less clear. Simulator as teaching tool has the theoretical benefit of exposing trainees to real-life scenarios (working with the software interface, able to perform image manipulation, contrast, scaling, measuring, accessing tomographic views and previous films). It can provide standardized teaching as well as evaluation of second year residents before commencing independent call. This Quality Storyboard is one of the first to subjectively and objectively evaluate the influence of simulator training on resident readiness during initial independent call. The aims of study are to develop a functional simulator for radiology teaching and to assess its impact on junior resident preparedness for independent call.

METHODS
Incorporating Consensus-Oriented Contemporaneous Peer—Review into a Breast Imaging Practice (hardcopy backboard)

Incorporating Consensus-Oriented Contemporaneous Peer—Review into a Breast Imaging Practice


PURPOSE

A limitation of traditional peer review is the time lapse from when a radiology examination is performed and reported to when the case is reviewed. We have developed and are evaluating a new online system by which cases are submitted by radiologists for contemporaneous review, thus providing interpreting radiologists with real time feedback from their colleagues, and possibly earlier identification of potential errors.

METHODS

Historically, a weekly consensus conference was performed in our Breast Imaging Section as one form of peer review. This conference occurred in an informal setting where the group openly discussed selected cases and recommended management strategies. With increases in clinical demands, a growing number of breast radiologists, and expansion to practice sites distant from the main hospital, the traditional consensus conference became challenging to coordinate and increasingly difficult for interested parties to participate. Prior to implementing this new online approach, a survey was sent to all eleven breast radiologists in the section to assess the utility and value of the current system. We subsequently sought to facilitate consensus discussion and real time peer review via the creation of a novel web based application. We created an online portal within our hospital intranet whereby radiologists can enter cases for review by their colleagues. These cases may be submitted for any reason, including management questions, quality concerns, or interesting imaging. The submitting radiologist voluntarily enters an anonymous summary of his/her evaluation and recommended BI-RADS code. An automated system then sends email notifications to breast imagers to review submitted cases. The reviewing radiologists then anonymously and voluntarily evaluate the cases and submit their recommended BI-RADS code, management plan, and narrative comments within a 72-hour timeframe. The submitting radiologist is then provided with an analysis of the reviewing radiologists’ responses, including number for each BI-RADS assessment category and associated comments. We reviewed the data from the new online system for the following: number of radiologists reviewing each case, frequency of consensus, frequency of management changes, and inter-observer variability. Inter-observer variability was evaluated by designating three categories of recommendations: Benign, no follow-up (BI-RADS 1 and 2), probably benign with follow-up (BI-RADS 3), and suspicious with recommendation for biopsy (BI-RADS 4 and 5).

RESULTS

The results of our initial survey revealed that all 11 radiologists (100%) felt that consensus was a valuable resource for their practice, and 8 (73%) felt that our current system was ineffective mostly due to the logistics of incorporating it into our routine clinical practice as well as getting unbiased opinions in the group setting.

The novel application was implemented on March 1, 2014 and data was collected until March 31, 2014. Nine cases were entered into the system. The number of reviewing radiologists who responded to each case ranged from 1-6. Consensus, defined as a majority decision, was obtained in 8 cases (89%) and no consensus was reached in 1 case (11%). There was a change in recommended management in 2/9 cases (22%) from biopsy to follow-up. There was no change in recommended management in 6/9 cases (67%). The majority of variability in management recommendations was between follow-up and biopsy in 4/9 cases (44%). 2/9 cases (22%) had recommendations with more varied BI-RADS recommendations including benign without follow-up, probably benign with short interval follow-up, and suspicious recommend biopsy.

CONCLUSION

Our new online consensus-oriented real time peer review solution enables objective evaluation that seems easier to integrate into the department workflow. This system leads to alterations in clinical management as
well as possibly can minimize interpretative error. Additional evaluation is necessary to further assess this type of application.