UNDERSTANDING HOW RADIOLOGISTS WORK: A CASE STUDY

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ABSTRACT
Radiology doctors are under pressure to lower costs, improve efficiencies, and integrate better into managed care information systems. This study watched six selected radiologists at work in an effort to better understand how they work and to suggest improvements in individual workflow that might increase sagging reimbursements. We found that individual doctors while following standard methodologies in diagnostic reporting tend to individualize workflow and personalize the flow of documents to their work stations to reduce boredom, optimize the use of templates in diagnostic reporting, and manage the potential reimbursements of imaging’s to be consistent with other doctors in their group medical practice. Radiology doctors can diagnose a wide array of imaging’s but tend to specialize and have favorite procedures they choose to select to work on from the Information System (IS) that reports patient test results needing evaluation.

Key Words
Radiology, Case Study, Healthcare, Direct Observation

INTRODUCTION
Healthcare has changed significantly with the signing of the Affordable Care Act in March of 2010. The implementation of Electronic Healthcare Records (EHRs) and the political will to reduce healthcare costs is creating market dynamics whereby patients expect quality care, and the government, like healthcare insurers, is looking for ways to reduce costs. Further, patients want easily defined services with excellent quality at a reasonable price, referring physicians require quality services that are easy to access, and payers such as Medicare, Medicaid, and private insurance companies are more focused on price than anything else. Proponents of a market-driven healthcare system suggest that healthcare should be self-regulating in terms of pricing, availability, and distribution of services in order to reduce costs and improve quality. The alternative is for government to determine pricing, availability, and the availability of services. Radiologists suggest an easy target because of their automated, assembly line methodology process of work they practice.
At risk is the personal relationship between the provider, the patient, and/or referrer without sacrificing quality. An important question is whether the role of the radiologist becomes more primary to the patient management system than it is now or will the increasing clarity of images make him or her less useful, allowing the images to speak for themselves (Sethi, 2009). Understanding the nature of how Radiologists work is essential to making the argument for managed commoditization. Radiologists rarely work directly with patients; work in darkened rooms writing reports for referring physicians where each report has a specific price associated with it. Thus, Radiologists are incentivized to write as many reports as possible to maximize their return on investment. Complicating the issue is the fact that, in healthcare, the customer is generally not the price driver, but rather patients/consumers want top quality care at virtually any cost (until it starts coming directly out of their pockets), but the payer wants low cost and reasonable quality (Myrice, 2012). This study sought to better understand the dynamics between cost and quality by directly observing radiology doctors at work. There is evidence to suggest that organizational performance and actual financial reimbursement are uncorrelated (Minnis & Elmuti, 2008). Thus, our research question asks to what extent payers and patients can be educated to understand the trade-offs between the time (cost) it takes to write a quality radiological report and the perceived quality of that report to the patient, referring physician, and payer.

Next, we will discuss the background and a summary of individual radiology doctor cases. This will be followed by a summary of results, conclusions, and future research plans.

**How Radiology Doctors Work**

Radiology is a medical specialty that evaluates the results of imaging technology to both diagnose and treat diseases. Radiologists work with, but apart from other doctors and patients, working in darkened rooms staring at computer screens analyzing images from x-rays, ultrasounds, computed tomography (CT), nuclear medicine, and magnetic resonance imaging (MRI) to assist referring doctors in diagnosing patient diseases and conditions. They use highly formalized workflows to evaluate qualitative data where they are concerned that the information they provide to referring doctors is complete, accurate, and sufficient (Hackbarth, Cata, & Brandser, 2011). Referring Physicians request some kind of imaging technology be used to evaluate a patient’s condition. This request must be approved by the payer and then scheduled. A trained technician, nurse or doctor then conducts the approved procedure. The completed procedure is then entered into the Hospital or Clinic Information System (IS) where it is directed to the Radiology IS. A radiologist sitting in a darkened room then selects from a menu that lists completed procedures needing evaluation. The menu lists procedures by data and time, urgency, and type of procedure. A radiologist chooses a procedure to evaluate, selects an appropriate template, then studies the image, formulates an interpretation, writes the report, and then uploads the report back to the Hospital IS for dissemination to the referring physician and the Radiology Group IS.

In the Picture Archiving and Communication System (PACS) environment, most of a radiologists time is spent in front of a workstation switching between the PACS, the Radiology Information System (RIS), and the Hospital Information system to access patient information, while also accessing the radiology groups billing system (Koff, 2005). The data being processed
is not quantitative but qualitative, often requiring judgment and experience to write an interpretation of the image rather than a diagnosis that is within the purview of the referring physician. Radiologists or rather the radiology group they belong to is paid for each report they write. Some reports, like an X-ray of a broken bone, can be quick and straightforward but more complex opinions may take time to evaluate and write. Radiologists, if available, will review previous images to detect changes in the patient’s conditions taking more time. Importantly, radiologists are not paid by the minute but rather piecemeal not unlike an assembly line. The issue is that if you are paid for each report, and then that report is reduced in cost, then revenue is reduced, and the radiology group and individual doctors suffer a loss of income. To recover that income, radiologists must read more images. To read more images, these doctors must work longer hours, shorten the time spent on writing reports, or accept a reduction in pay. This highlights the classic trade-offs between quality and quantity (Brady, 2011), and less pay for more work (Munk, 2012).

There are a number of complex issues at play in the above scenario. To a certain extent, the completeness, accuracy, and relevance of a radiological report is to cover the bases to avoid a law suit (Hackbart et al., 2011). Further, the desire for completeness must be weighed against the time and the cost it takes to write a complete report and the timeliness of moving a report along. For instance, emergency room doctors and nurses want only enough information to stabilize the patient, do no further harm, and then get the patient to the right doctors for follow-on care. Accuracy can be influenced by the initial information provided by the requesting doctor for a particular procedure or the availability of prior images making comparisons of a patient’s condition over time possible. Additionally, many hospitals are outsourcing their radiology works to radiology experts in other countries due to increasing demand for radiology services and a lack of specialists in the U.S. (Sethi, 2008).

Some doctors dictate their reports, and then have their reports transcribed which adds to the total cost. After the reports are transcribed, they are reviewed and sent off or never reviewed at all. More progressive systems use automated voice recognition systems that type the report as the physicians speak. They immediately review their report and then send it off. Typically, younger doctors or doctors are more inclined to use this technology, or driven by the profit motive, use speech technology to write faster reports. Given the greater clarity of images being produced as technology improves, it is the trend to use automation to speed report writing, and the use templates to describe standard conditions or legal precautions that is driving radiology towards commoditization.

The issue of tort reform and healthcare reduction of radiology costs is based on the notion that radiologists could write shorter opinions, be more to the point, allowing for more images to be read, more patients to be serviced, and costs reduced in the sense that doctor salaries would not go up. The reality is that radiologists are always included in lawsuits if radiology interpretations are available. Radiologists pay some of the lowest malpractice insurance premiums because they include an overabundance of boilerplate in their opinions, write opinions, and have their opinions reviewed randomly by other physicians in their radiology group reducing the opportunities for error. For instance, the Radiology Group we worked with conducts peer assessments which have been found to be a reasonable way to evaluate doctors (Augustine, McCoubrie, Wilkinson, & McKnight, 2010). This group randomly selects 10% of all opinions for review. Each review is
scored on a scale of 1-4. One means the reviewer completely agrees with the opinion. A two means agreement with slight modifications. A three means agreement with additional/major modifications while a four means disagreement. These reviews are not reimbursable but are required professionally to ensure standardization of report writing as well as to measure and maintain quality. Thus, lower performing doctors can be critiqued and potential problems avoided.

To ensure Information Quality (IQ) radiologists use templates to write standardized reports. Typically, a radiologist may have information displayed on multiple computer screens. One high-resolution screen will have the image being evaluated, another screen will have the report format, and another might have previous images from the patients’ medical history. These templates represent a subjective judgment by the radiologist and importantly, can vary among users and by uses of that information (Hackbarth & McQuade, 2009). That is, a radiologist may modify or write a template for their own use changing numbers or just a few words here and there. Overtime, these reports become very standardized and standardized between doctors within the same medical group. This is where the concept of commoditization becomes important. For many reports, standardization is so standard, that other doctors, not radiologists, can be taught to make a similar evaluation. Do you really need a radiologist to read an x-ray of a broken arm for an accident at home? Cardiologists are being taught in seminars to look at MRI’s and make their own assessments prior to making a diagnosis (Sethi, 2009). For “standard” reports, payers ask themselves; can we invent an automated process that writes the report and only refers the image to a radiologist if the image is non-standard? The response from a radiologist is that they look for more than the obvious, are more holistic, have been trained to see more, and that they provide a more complete opinion to the benefit of the patient. To better understand the dynamics between commoditization and the value added of a radiologist we observed six radiologists at work.

**Data Collection**

We observed six radiologists at work in a hospital setting evaluating images and writing reports. The six radiologists were selected by the research team based on recommendations from another radiologist familiar with the entire radiological group we were working with. The going in idea was that all radiologists have their peculiar styles but they tended to group themselves into six differing groups. The advice of this radiologist was based on years of experience teaching radiology at a medical school and years of observing other radiologists at work, as well as his discussions held within the radiological group seeking ways to standardize the way the group worked and the preferences of individual doctors in the way they wanted to work. We undertook confidentiality agreements to comply with the Health Insurance Portability and Accountability Act of 1996 (HIPAA) to ensure Privacy and Security Rules. It is very important from a legal and ethical standpoint to protect the confidentially of patients and doctors since we might inadvertently see patient data as well as the actual reports being written. By giving permission to see reports written by doctors we may accidently discover something that could embarrass a doctor. Some doctors have a fear of litigation and rebuke from their peers if there was a perception their reports were lacking in some way. There is general agreement that our research might improve report templates, information accuracy, completeness and the sufficiency of reports.
INDIVIDUAL CASES

Two of the research team members watched 6 different doctors, all male, on six different days, for approximately 1 hour. We took notes and then compared opinions and comments to arrive at a general consensus never having ever seen radiologists at work. The cases were written as questions/issues occurred to us since we had never seen where or how radiologists worked and thus the cases also reflect a growth of understanding. We think written this way, the reader will get a sense of how much information people really know or wonder about in the way radiology doctors really work. We did ask a very few questions but were very mindful that these doctors were working and that what we wanted to do was watch, thus keeping questions to a minimum.

Doctor One

We entered a darkened room passing by a heavy curtain designed to block light from the outside hallway. There were several doctors at work in front of computer consoles with several monitors. We learned that one monitor held the image being evaluated; another was a special monitor for color PET scans, the report writer, and second image screen for comparing images. We wondered if their chairs were comfortable and found that they used high-end office chairs to stay comfortable and alert. They had had ergonomic training as how to sit and position their screens for optimum use. They took breaks to rest and stretch when needed. If they were being productive they kept working until they needed a break. There were other doctors in the room in their own cubicles. They would periodically use a cell phone to call referring physicians or receive calls. Calls were kept short but the doctors were never rude. As it turned out, each doctor had a separate office nearby and secretarial support to coordinate with the hospital staff, outside clinics, and miscellaneous activities.

Doctor One was very much to the point and wasted little time. He worked from 7 AM to 5 PM and described his day as very intense. Interpretations were stated plainly, written clearly, and made with few wasted words. Doctor One used a headset with voice recognition capability, using voice presets to call up templates. Templates were later transcribed with full sentences created by key words. Doctor One corrected his reports by highlighting words in the text document and overriding them with new voice messages, making corrections immediately and moving on to the next patient quickly. He would have preferred a larger screen for writing reports so he could make the text larger. Patients were always referred to in the third person.

Doctor Two

We observed Doctor Two consulting with another doctor. They were not shy about asking for assistance or another interpretation. Doctors would also consult about previous studies they saw on the menu on if they knew another doctor who was in the office had written a previous interpretation. There seemed to be effort to choose studies of patients they had evaluated before as online records of patients existed with completed studies. As it turned out, doctors would review other doctor’s interpretations for accuracy and evaluative purposes. There were several phone interruptions that were disruptive and it took time for the doctor to refocus. Doctor Two unlike Doctor One would record his comments and then edit the recording. He would rewind the tape, listen for several minutes reviewing what he said, making corrections by saying “scratch that” and restating his opinion. He used much shorter statements than Doctor One from what we
could tell. Doctor Two would also group similar studies together in order to stay in the same mindset and increase his productivity. Doctor Two would begin with a standard boiler plate description of what he was doing that went, talking very fast and then he would slow down to evaluate the specifics of the patient he has evaluating. He didn’t want to emphasize what looked normal on an X-ray but rather emphasizing what issues he was observing. He tended to pick easy studies, lots of X-rays. This might have been for our benefit. In evaluating patient images, Doctor Two would comment on only what was requested. If they saw something else, they would comment it but not go looking for trouble.

Doctor Two did a lot of short opinions (80-90%) with a quick sign-off. He didn’t review as much relative to the descriptions he was writing. On the longer diagnosis’s, he would tend to really double check himself before signing off. He didn’t batch much, maybe 2 or 3 things compared to Doctor One. Doctor Two also tended to fill in the menu gaps by selecting and grouping easy opinions looking for what was empty in the menu.

**Doctor Three**

Doctor Three left shortly after our arrival. Radiologists do leave the “Cave” to do biopsies for thyroid tests because they monitor the flow of dye needed to detect a blockage. They normally don’t schedule for these kinds of tests in advance, which made the radiologists unaware of what their schedule might be. They may also be assigned to attend Institutional Review Board (IRB) Meetings that break up their day but also slows productivity. Before he left, Doctor Three mentioned that they like the break to do these kinds of procedures but they received little reimbursement and it lowered their productivity.

**Doctor Four**

Doctor Four was very interested in the financial health of the Radiology Group and had been part of the group of doctors supporting and instituting a performance scorecard in 2008. Performance was measured based on the average performance of the group in writing numbers interpretations, their reimbursements, quality all of which were used to determine their twice a year bonus. Quality of Interpretation was measured on a scale of 1-4 where 1 represented an interpretation that another doctor would agree with while a 4 was an interpretation that another doctor would completely disagree with. There was clearly accuracy versus speed conflicts that worked against the performance metrics. Doctor egos were part of the problem as some doctors took criticisms badly. Cherry picking took place and there were conflicts with the quick doctors. There were defined volume metrics for the quick doctors with doctors often complaining to each other about how much work or lack of work some other doctors were performing. The review of interpretations was based on the four tier rating system but had problems because it was used to “pound” some doctors creating “silos” among the radiology group protecting different turf. Further, doctors with a lot of academic experience thought differently from doctors from private practice because they didn’t understand business.

To underscore the difference between private practice and academic experience we were told by the CEO of the radiology group in an early planning meeting that he had four levels of reimbursement to measure how much money each doctor needed to bring in. Level one brought in enough business to pay the doctors salaries. Level two brought in enough revenue to meet
salaries and benefits. Level three brought in enough revenue to cover salaries, benefits, and bonuses. And, level four brought in enough revenue to cover salaries, benefits, bonuses, and cover the overhead of the radiology group. When asked, doctors were content to bring enough revenue to cover level two not understanding the necessity or importance of business overhead and that business overhead is paid first and not last. The egos involved required salaries to be paid first in any conversation about how the business worked.

In a perfect world, hospitals would employ radiologists and align incentives with performance. Unfortunately, there are metrics to measure performance drops but nothing in place to raise metrics to provide greater rewards. Hospitals are employing a greater number of doctors who are agreeing to stronger performance metrics. But, bonuses are going away and there is no profit distribution. Radiologists working in hospitals report higher work stress, greater job dissatisfaction, and higher rates of burnout (Lim & Pinto, 2009). The government loves this healthcare model but it does result in bad PR since there is no incentive to work harder. The radiology group lost $825,000 to cardiologists because they learned to read images of the heart and make their own interpretations cutting into the group’s profit margin. Doctor Four felt the trend would be towards more boutique medicine and rogue doctors, as the trend toward accessibility without responsibility would not result in any changes in behavior.

Doctor Four worked very quickly when he was not talking to us and seemed to generally enjoy the distraction we provided. He did a thorough job on reading old reports/studies on the patient, writing the new report by dictating it with the voice recognition software.

Doctor Four emphasized the need for radiologists to have a relation with the physicians. According to this doctor, it is very important for a radiologist to know before hand, the area of specialty of the physician who requested the study and how he treats patients. Having such information will benefit all parties, because the radiologist would provide more information in the area that the physician is specialized in, therefore would increase the quality of the study, and help the patient with a better diagnose.

If you know the doctor who referred the patient of the interpretation you are writing, you read it differently. Relationships with other doctors matter whether they are in person or by phone. We were present for an example. Doctor Four said I know this doctor and all he really wants to know is do I need to operate or does the patient need to rest the injury. The referring doctor was making the decision to operate or not operate and accepting all the legal risk of making a wrong decision but wanted another opinion in reading an image. He also explained that it was important to identify unique films for legal purposes, look at any patient history, and to explain in your report which film was read in which order to avoid a lawyer asking “How do you know this was the patient’s condition at a particular time?”.

**Doctor Five**

Doctor Five used Power Scribe to dictate interpretations holding the microphone rather than wearing the headset. He talked very fast, worked very fast, and reviewed other interpretations from other doctors as he worked. Accurate readings/interpretations are assumed. You are fired for bad readings. He explained further that radiologist strengths were image understanding.
Patients might move, patients might have large bodies, the consideration of age factors, and that seeing relationships between body parts was an important part of their job.

**Doctor Six**

Technicians can and do ask radiologists if pictures are good before setting a patient free to ensure good interpretations. Radiologists can have patient’s move to get better pictures because they take a more holistic approach and understand more of the factors affecting good imaging and interpretations of images. This is why they don’t recommend other doctors read images beyond very narrow interpretations. Another factor is that patients with pain should have delayed procedures because it may alter how they position themselves during a procedure. Radiologists use templates for normal views and are far easier to use for anatomical areas you know. They choose studies from the menu based on experiences during their residency, personal traits, and personal interests. They may feel uncomfortable with some studies because they had little practice or exposure with particular images during their residency as opposed to book learning.

Where other doctors would talk while looking at the images, Doctor Six would look at the pictures, decide what to say, and then say it rather than being more spontaneous. This doctor used templates for normal studies. He was taking advantage of the templates and information already filled in such as the date and other specific information. He liked to use the templates Cardiac CT scans and according to him the templates worked very well. He also worked more linearly and looked at the film one more time, as a double check to confirm he was not missing anything. He also referenced any doctors he talked to by phone in the readings.

**Limitations**

We observed the doctors working with no prior expectations. As such, we had no scripted questions to ask but rather asked, when we could, questions on our mind. This limited the discussions we might have had but allowed us to stay focused on observing. Future studies will allow us to ask more focused questions and chose a more appropriate venue and research methodology for looking at radiologists in their workplace.

**Results and Conclusions**

An important result is that we saw radiologists working in their workplace allowing us to better evaluate the radiology literature and the issues affecting their profession. We saw the workload and the pace at which they worked. We were able to get a sense of the workplace dynamic, saw the silos within the radiology group, and observed very different ways of processing patient interpretations. It was clear that different radiologists cherry picked cases to interpret, used the technology to varying degrees of effectiveness, and worked at very different speeds. Some doctors had a real fear of potential litigation while others considered it part of the job. Doctor Five mentioned he had been sued twice but had the lawsuits dropped quickly because his documentation was impeccable. He thought it was funny because the cases were not cases were he thought there was any kind of issue, his opinion was that they were pointless. Cases where he thought there might be an issue, and that he had documented more than usually, were never contested.
Radiologists are at the front of the medical technological curve in terms of using technology to save time and money (Johnson, Taira, Cardenas, & Aberle, 1997). They are interested in improving the accuracy, timeliness, sufficiency, and relevance of the information they provide to other medical users. After all, they are financially rewarded for a business model that rewards speed and efficiency. But, even with greater environmental controls, other researchers have found that perceived organizational effectiveness and actual financial performance has no significant relationship (Minnis & Elmuti, 2008) suggesting that we may not fully understand all that radiologists do and how they actually work. However, they can be legally penalized for inaccuracy and insufficiency of information. At the same time it easy to understand how they might be commoditized. They use templates extensively and follow a strict decision tree for normal images. This leads to a dependency on technology to help make decisions and provide standardized predictable reports. The idea would be to use computers to screen images and create standard reports for low risk procedures. Lesser-trained resources could be used to interpret basic images or doctors trained to interpret images without the need for a radiologist to confirm “obvious” diagnoses. We saw several images of very old people and saw pacemakers and the associated wiring. It was made clear as we listened to the interpretation that height, weight, fat, age issues, overall health, medical history, etc. all must be taken into account in creating an interpretation.

One interesting issue is that initial diagnostic scans of patient images take time to complete because there is no baseline to work from. The radiologist must cautiously look at everything. If there is a second, an earlier image, the interpretation goes faster because comparisons can be made and differences noted. Results were much better if there were additional images to work with. However, if you had too many images, it took additional time to review the patient’s record. We asked if everyone should then have an MRI. The answer is no. There would be an ethical obligation to review each image on the rare probability that they would spot a potential medical condition. Further, if an image existed and it had not been interpreted, they would be open to a lawsuit because a medical condition might have been detected early enough to prevent it from becoming more serious. Thus, the reason radiologists don’t go looking for trouble.

Radiologists have an image problem. They rarely interact with patients, tend to work an 8-5 schedule, have 11 weeks’ vacation a year, and are paid a lot of money. Working in a dark room day after day takes a different kind of personality than what you would expect from a doctor who needs to interact with patients. We left this experience better understanding both points of view. We see the advancement of technology allowing computers and laypersons to make rudimentary interpretations. We see the beginning of this in the literature and the workplace. On the other hand, the radiology profession is not going away any time soon. There is a real need for their expertise. The real observation from our study experience is that radiologists do work in silos, disagree between them selves and that the result is that they create cracks whereby the payers can exploit opportunities to lower costs. Radiologists should close ranks and better promote the expertise they bring to the healthcare system or they will be commoditized.

REFERENCES


