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AN INTEGRATED DELIVERY MODEL FOR PROVIDING ON-SITE AND REMOTE RADIOLOGY SERVICES TO RURAL MIDWEST HOSPITALS

By

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A DISSERTATION

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Abstract

The purpose of this scholarly leadership project was to evaluate a model of integrated healthcare delivery for providing radiology services to rural Midwest hospitals. A key priority was to investigate a model of delivery that ensured radiology services were available to rural Midwest hospital patients, similar to the level of quality and value patients could receive by traveling to larger hospitals in more urban settings. This is important due to the impacts and demands of the healthcare marketplace, which is challenging leaders to improve the delivery of services. The model of delivery included radiology coverage for hospitals utilizing teleradiology to send images off-site to sub-specialist radiologists. These enhancements were intended to improve the quality and consistency of radiology interpretations without negatively impacting the necessary turnaround time of results provided to referring clinicians treating patients. This coverage was supplemented by having radiologists travel on-site for scheduled radiology procedures to ensure hospitals could offer necessary levels service for the convenience and satisfaction of local patients and their families. The intended objective of the model was to improve healthcare delivery to patients and to provide a competitive edge for rural hospitals. The study was accomplished by researching current literature, and collecting data from 5 rural hospital CEOs who represented the stakeholders at each facility. The CEOs were chosen because they were considered the key decision makers when contracting for healthcare services at their hospitals. A confidential qualitative on-line survey was conducted to gauge the satisfaction of the implementation and delivery of the new model. In addition, data was collected to investigate the success of the new model
before and after implementation, by evaluating the quality measures of result turnaround
times and the accuracy rates of the radiologists interpreting radiology findings. My
research found that a newly implemented model of radiology service delivery had a
positive impact on rural Midwest hospitals, improved their effectiveness in competing
with larger hospitals, and improved the overall quality and value of services being
accessed by their patients.

*Keywords*: Teleradiology, radiology services, radiologists, integrated delivery, quality
Completing my doctoral degree has been a lifelong dream of mine for some time now. When I embarked on this journey, there were several life issues that developed in the lives of my immediate family. There were many times when I thought there would be no way I could take the time away from my other personal and work responsibilities, to complete a doctoral degree, particularly in a program with the academic rigor that Creighton University is known for.

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CHAPTER ONE: INTRODUCTION

The delivery of professional radiology services to hospitals has long been the role and responsibility of radiology groups. One aspect of healthcare delivery is making sure that necessary radiology services are available for patients when they are needed. Wilson (2013) discusses the need to provide healthcare services at reasonable price points, given the significance and impact of national healthcare reforms. With healthcare reform measures now critically impacting the nation, the availability of services will be even more of a challenge, as reimbursement and access to healthcare services will become more controlled. The challenges providers have in rendering cost effective healthcare services along with the increasing complexities of the healthcare delivery system itself, will put continuous pressure on providers to develop new models of delivery to achieve their business objectives and to provide value rich services for their patients (Prenestini & Lega, 2013).

Throughout the Midwest, physician providers of radiology services continue to be in high demand. Historically physician radiologists would locate their practices in small and large communities, based on their geographic preferences. The American Hospital Association (2011) indicated that 72 million Americans reside in rural communities. These individuals often rely on their local hospitals as their only source of healthcare. Today, it is often difficult to find physicians willing to relocate to rural areas, particularly in the Midwest (Rosenblatt & Hart, 2000). A solo general radiologist or a small group of physicians was once capable of performing most, if not all of the radiology service requirements necessary to meet the demands of a rural hospital. This was not particularly
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challenging up through the 1980’s, until imaging technology began to expand and evolve, as new equipment and techniques in imaging were developed. Plain x-rays and ultrasound studies were the predominant imaging studies performed in most hospitals, until 1975 when the first Computerized Axial Tomography (CAT Scan) was introduced at a U.S. hospital, in St. Louis, Missouri (Beckmann, 2006).

This scholarly leadership project will outline the components and steps necessary for a physician group to develop a comprehensive integrated delivery model for the radiology services necessary to support rural hospitals in the Midwest. The model will focus on meeting the needs of all healthcare stakeholders in today’s complex healthcare marketplace. This scholarly leadership project includes a historical account and description of previous models for the delivery of radiology services. Qualitative research data will be included and descriptions given of the previous methodologies, and why a new delivery model may be desired in the marketplace. As I have been a part of the development and evolution of a new model of delivery in my own healthcare organization, this project will describe, in useful terms, how others could employ the same model, as they search for ways to improve or enhance their own systems of delivery. In addition to the method of delivery, contributions will be offered within the scope of the project regarding the trials and errors that may be experienced along the way. This model will provide a stepping-stone for other project implementations to utilize or build on the methods described, which one organization has proven to be successful.
**Information about the Author**

The researcher has 31 years of experience in the healthcare industry, specifically focused on radiology. As a hospital administrator, the researcher spent 7 years working in the hospital setting, 8 years in the outpatient imaging center environment, and has spent over 16 years in the practice management side of the radiology industry. The researcher serves on the nationally recognized Radiology Business Management Association Board of Directors and is board certified by The American College of Healthcare Executives. The researcher also holds certification in Radiology and Nuclear Medicine Technology from the American Registry of Radiologic Technologists (ARRT) and the Nuclear Medicine Technology Certification Board (NMTCB).

**The Problem**

Providers of healthcare services are under significant pressure to continuously make improvements to how their services are being delivered to the marketplace. At the same time the demands are high for improvement to healthcare delivery, and consumers and regulators alike are expecting healthcare reform to repair a broken healthcare system. To provide additional challenges, those consumers demanding improved service delivery are also insisting that the price for the services will be reduced (Wilson, 2013). Providers concerned about competing in this new healthcare environment will certainly have to improve their services if they expect to retain or increase their business market share. At the same time the medical specialty of radiology itself has been a target for payers like Medicare, having had reimbursement reduced 12 times in the past 7 years (Matthews, 2013). Jackson (2013) conveys the impacts of the Affordable Care Act have targeted
radiology because of added costs related to specialty medical providers. This does not discount the difficulty of the task at-hand, as the delivery of healthcare is more complex and challenging than ever before (Prenestini & Lega, 2013).

**Purpose of the Study**

The purpose of this scholarly leadership project was to outline a model for improving radiology service delivery to rural Midwest hospitals. This model of delivery has the flexibility to be scaled based on the size of the facility; however, the focus of this study was on the enhancement of service delivery to small, rural Midwest hospitals where service delivery may be compromised due to size and geographical presence. In addition, it is often challenging to obtain radiology specialists due to the number of specialists available. Often such specialists prefer to locate their practices in larger hospitals, where they can have the opportunity to focus more of their practice on their sub-specialty.

**Rationale for the Study**

The 1980’s and 1990’s saw the evolution of imaging continue to expand with newly developed techniques in CT scanning, MRI (Magnetic Resonance Imaging), and PET (Positron Emission Tomography). These new modalities expanded the education and training requirements for the practicing radiologist, and the radiology field began to challenge radiologists to begin sub-specializing in specific areas of interest. The field was evolving beyond what a general radiologist with general diagnostic training could provide with an expertise that most stakeholders in medicine would require. In other words, the field of radiology was expanding such that a general radiologist cannot provide a level of specificity sufficient to meet the needs of referring physicians.
The practice of medical imaging has undergone momentous changes over the last several years due to advances in teleradiology (Lau, 2007). Radiologists are no longer limited by having to be onsite at a given hospital, in order to read and interpret images. With the improvement of computer systems and the availability of high-speed Internet bandwidth throughout most parts of the country, radiology is now becoming virtual. Rapid changes in healthcare have required radiology groups to adapt to the changing landscape (Narang, 2013).

Teleradiology is defined simply as the use of electronic means to distribute images from one place to another (Burute & Jankharia, 2009). Based on my own knowledge, training, and experience in the healthcare industry, I believe there are three primary components in creating a teleradiology network. The first component is a computer workstation that can receive the images sent from an imaging modality such as a computerized axial tomography (CAT) scanner. The second component is a high-speed Internet connection, to transmit the images from one place to another. The final component is a receiving computer workstation, which receives and displays the images sent from the originating location. This workstation is equipped with the software tools necessary for the radiologist to interpret the imaging study. Historically, teleradiology has been utilized for after-hours services such as when the radiologist working a daytime shift has gone home for the day. Teleradiology has a broad range of applications and its primary purpose is to accelerate communication and dialogue among healthcare specialists (Matusitz & Breen, 2007).
The work environment is evolving and the availability of these technological improvements is becoming more widespread. Picture Archive and Communication Systems (PACS) along with high-speed Internet bandwidth through secure virtual private networks, are more readily available to healthcare consumers (Lau, 2007). As the demands on healthcare providers continue to increase, radiology practices are making comprehensive efforts to define their roles within the healthcare delivery system (Allen, Levin, Brant-Zawadzki, Lexa, & Duszak, 2011). At the same time, medical imaging continues to become more complex and the demand for qualified radiologists has historically surpassed the supply of professionals available.

Today teleradiology is utilized for a variety of reasons, including primary or secondary support for a hospital that may not have the availability of a local radiologist. Although many radiology imaging studies can be effectively performed in one location and interpreted in another location, many radiology studies require a radiologist to be on-site, as a participant in the imaging study or performing a needed procedure. This makes a teleradiology-only solution ineffective in most circumstances, given radiologists often must assist other physicians in solving complex problems (Heller, 2014). This often requires the physical presence of the radiologist, who may provide face-to-face consultations, or perform a radiology procedure.

Remote Telemammography

By example, breast imaging has historically required a radiologist sub-specializing in that specific area of radiology to be physically present to supervise the technical component of the imaging studies performed by radiology technologists. When
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performing breast-imaging studies, the images of the breast are taken, and once those images are available they are immediately reviewed by an on-site radiologist who assesses whether or not additional images are required. If a screening study is performed and it is determined an area in the images needs further evaluation, a diagnostic mammogram is then performed. These images must be reviewed by the radiologist, to determine if the study is normal or requires a biopsy to obtain tissue for pathologic evaluation. The decision to biopsy the patient is most commonly made after the radiologist has conferred with the patients referring physician or surgeon.

In the past, rural hospitals had to limit the number of days per week patients could access these types of radiology services or possibly not offer them at all. With a model of delivery that takes every advantage of remote capabilities off-site, radiologists can provide access to specialists using teleradiology daily. Prior to this service model, general radiologists would interpret mammograms a few days per week and if follow-up was needed, the patient would have to be scheduled to return to the hospital, which is often considered less satisfying to patients. Howell (2012) comments that one of the significant advantages of telemammography is that breast imaging studies are interpreted by radiologists with a higher level of expertise and competence.

Telemammography is one example of how a remote delivery model can be applied to a specific radiology service. A telemammography model of delivery could expand the number of days each week a screening or diagnostic mammogram could be scheduled locally, as those images could be interpreted remotely. Paredes et al. (2007) concluded that telemammography models of delivery had the potential to increase the
number of patients provided access to quality breast imaging services. Breast procedures can be scheduled and performed on-site by qualified radiologists specializing in delivering breast imaging services, expending that resource on-site for that facility, only when necessary. This would include ultrasound-guided procedures, as well as stereotactic biopsy procedures, if that equipment were available at the local rural hospital.

Remote radiology delivery models in the area of breast imaging are fairly new, and require several components to be successful as part of the on-site and off-site delivery of radiology services. This new model of delivery includes telemammography, which requires a skilled breast imager to be available and accessible during the daytime, as screening and diagnostic mammograms are being performed at small rural hospitals. The radiologist reviews the breast images remotely through digital transmission of the images, and then communicates directly with the technologist performing the study at the local hospital. This is done by telephonic means, as well as video communication at those facilities that have the necessary equipment and high-speed Internet bandwidth. Once the images have been reviewed, the radiologist can obtain additional views or have an ultrasound study performed to further distinguish the makeup of a detected lesion. If a lesion is identified, a biopsy can then be scheduled on-site within a few days.

Telemammography approaches also allow a provider group to make the most of its valuable physician specialists who train in this area of breast imaging. One breast imager may be able to read cases from 13-14 rural hospitals in a single workday, allowing access to the necessary services in each of those small communities. The quality of mammography interpretation may improve by having specialized interpreting
radiologists reading cases. Having the same small group of specialists traveling to rural hospitals a few days each week, allows continuity and access to services comparable to what patients might expect at a bigger hospital staffed with larger numbers of specialists. Having access to radiology specialists at a local level also assists the rural hospital by keeping those patients in the community for follow-up, surgical, or oncologic care. Local surgeons may be able to adequately treat breast patients who need tissue removed, radiation or chemotherapy, or just routine follow-up.

A local concern is that patients, who exit a rural community for a service, may decide to continue leaving the community for other healthcare services. Patients, who have to drive an hour or more for a medical service, may find it more effective to return to that larger facility when other comprehensive care is needed. Studies have also shown that the mother in the family typically drives healthcare decisions for the rest of the family (U.S. Department of Labor, 2013). Antwerp (2012) conveys that women are making healthcare decisions for their family a significant percentage of the time. Therefore services such as telemammography that are typically provided to women, may weigh heavily on the migration of patients outside the rural community hospital. Preventing this outmigration may also create value for the hospital and community. This may further solidify the value the organization places on the relationship with the provider radiology group.
Definition of Terms

Operationally defined key terms and concepts of this scholarly leadership project are as follows:

*Medical Imaging* is defined as those images typically provided to patients when they are being evaluated diagnostically, such as x-rays, CAT scans, and ultrasound exams.

*Outmigration* is defined as the movement of services outside the originating hospital.

*Picture Archival Computer Systems* are computer systems designed for storing, receiving, and sending images through electronic means.

*Radiologists* are medical doctors who have completed four years of medical school, a 4-5 year residency in radiology, and commonly a fellowship that includes 1-2 years of additional training in a branch of radiology.

*Radiology marketplace* is the community of healthcare facilities, hospitals, providers and patients, requiring the purchase and delivery of radiology services by radiologists.

*Radiology practice* is a group of individual radiologists who practice together under the same corporate entity.

*Telehealth* is the delivery of various types of health services utilizing telecommunication technology.

*Telemammography* is the transmission of mammography images using electronic means with the interpretation of the images provided as the end product of the service.
Telemedicine is the practice of medicine when the doctor and patient are in different locations. Communication between the doctor and patient is typically done by telephone or videoconference.

Teleradiology is the transmission of medical images using electronic means with the interpretation of the images provided as the end product of the service.

Work environment is the location and methodologies used to provide healthcare services.

The Leader’s Role Today

Leaders in healthcare today are challenged to deliver high quality and safe care to the patients they serve (Calayag, 2014). Patients and other healthcare stakeholders, have equally high expectations that those in leadership roles will implement strategies to insure that appropriate levels of services will be available. For those leaders responsible for providing healthcare services in rural hospitals, competition for scope and depth services can present additional challenges.

Rural hospitals are often situated a long distance from larger healthcare institutions, which most likely have a broader spectrum of healthcare services to offer their patients. The challenge for rural healthcare leaders is to provide as many services as possible, so they can maintain an attractive place for patients to receive care; and offer an alternative to the added expense that it would take for patients to travel long distances (Schulte, 2014). The Patient Protection and Affordable Care Act passed into law by Congress, has the overarching goal to reduce disparities in regard to healthcare accessibility within our society. Leaders must also make every effort to develop
strategies and methodologies to improve service delivery, within their own healthcare environments. Medical practice leaders play a pivotal role in healthcare delivery; and are responsible for the management of many stakeholder interests (Dickens, 2014).

When considering radiology service delivery to their hospitals, leaders must be open to new strategies within the radiology marketplace. In the past, rural hospitals either maintained the status quo by settling for limited radiology coverage, or employed teleradiology companies to provide a broader spectrum of off-site reads, but may have given up the broader range of radiology procedures that patients need access to from time to time. Those companies are now struggling, as even rural hospitals are demanding more to be competitive (Proval, 2014). Leaders must be considerate of the value proposition that radiology service delivery models can offer patients and referring medical staff members, so hospitals can position themselves to deliver value-based care (Wiley, 2013).

**Significance of the Project**

This project is significant for several reasons, as the improvements to radiology service delivery are paramount to ensure radiologists continue to play a vital role as members of the rural healthcare community. In order to compete in this dynamic healthcare marketplace, radiologists will have to continue to improve their radiology delivery by creating services that offer consumers in the rural healthcare marketplace added value. As physician providers compete for contracts to provide services to hospitals offering healthcare services to patients in various sized communities, they must find ways to offer comparable services to those offered in larger cities. Preventing the
outmigration of patients outside of their home communities, further improves the economic advantages necessary for hospitals to compete for patients. This will require a culture change in the minds of many physicians.

Physician groups and doctors practicing in almost every field of medicine are being impacted by the challenges of healthcare reform, directly attributable to the effects of the Affordable Care Act. As reimbursements to providers are reduced, physicians who do not want their incomes to go down will be forced to make some significant decisions about their work lives. Many will choose to work harder which could potentially be defined as doing more work per hour, working longer hours, or working more days. Physicians have historically worked long hours, have hectic schedules, and often have requirements to take after-hours call. In return for that work schedule, many physician specialists have the luxury of taking several weeks of vacation each year, while still receiving large salaries. Those who have grown accustomed to that lifestyle often do not mind the work life balancing required.

Newer generations of physician radiologists are not as accustomed to the long hours or high incomes. Glicksman (2013) conveys that newer generations of doctors may value quality of life over fast paced practices focused on high salaries. Therefore, in many cases it is easier for them to consider reduced work schedules from the beginning of their careers, in return for what they believe is a better quality of life. Those contrasting differences between generations have also had a significant impact on how care and radiology services have been delivered.
At the same time that radiology physician practices are looking at the impacts of the changing healthcare environment on the way they deliver their services, hospitals are strongly looking at the impact of this new healthcare environment on their businesses. Community hospitals in the Midwest face particular challenges that may be different from others throughout the country. Many smaller hospitals are being significantly impacted by reduced federal and state reimbursement. Those who have converted their facility status and reduced their bed sizes may have additional latitudes regarding reimbursement from government sources, but they still face the same difficulties that other smaller community healthcare facilities encounter. As the hospitals are being challenged, they are in turn challenging providers they contract with to provide more deliverable value to their customers. In smaller hospitals, they often feel they have to exceed the customer’s expectation, not just meet it. If hospital administrative leaders are going to keep the patient from driving to obtain services from a larger facility, they are going to have to provide a comparable level of service. Telemedicine approaches can assist rural hospitals in cutting costs while still providing necessary specialty services (Advisory Board, 2012).

At a time when healthcare is changing at a rapid pace, radiology groups must consider their role in this new healthcare industry. They must work with hospitals of all sizes to provide services that meet customer expectations, so patients will remain loyal to those facilities. If patients are satisfied with the services they receive, they may be inclined to utilize the hospital facilities for other needs. Since radiology services are one of the most widely used entry points into the healthcare system, they are considered a
pivotal player regarding patient satisfaction. Competing groups dynamic enough to meet those demands will likely replace radiologist groups that are unable to meet the needs of patients.

Technology has significantly advanced in the healthcare industry and many of those advances have narrowed the gap on competition among physician providers. Since many radiology services can now be provided remotely through the use of teleradiology, the market competition for radiology groups is no longer a local matter. Competitive radiology groups may now compete for radiology contracts, regardless of the geography between the hospitals. Although some radiology services require a radiologist on-site, competitive groups will be looking at ways to address those limitations, as they look to increase their own market share. In addition, Wall Street has now infiltrated medicine and radiology groups across the country are now bought and sold on the stock exchange. White (2005) reported that radiology groups would be migrating to become privately held, similar to what other professionals such as lawyers and accountants have found to be beneficial to control their costs. As larger groups are forming into this type of business model, their success may now be completely tied to profitability and stock price. This means there could be a new level of competition for hospital based radiology groups at a time when market demands are at all-time highs. Although these competitive threats are to be taken seriously, new models of delivery may be able to address these evolving market threats. New approaches to delivery must be capable of building on previous achievements within the healthcare delivery system, as there may be little tolerance for models of delivery that are perceived to diminish patient services.
Limitations and Delimitations

This scholarly leadership project takes an in-depth look at how a radiology physician practice deployed a new healthcare delivery model for the provision of radiology services to several Midwest hospitals. The success of the delivery model will be investigated by qualitative surveys, which are included as a part of this project from rural Midwest hospital Chief Executive Officers who participated. Hospital CEO’s are responsible for the evaluation of these outsourced services and therefore are considered the key evaluators and decision-makers for rural hospitals.

Based on the experience and expertise the researcher has in the radiology field, there may be unintended bias. However, the success of the model being described is further substantiated based on specific successful implementations of the proposed model occurring to date; and the direct impact the deployment of the models have had on the business growth of the practice involved.

Project Questions

Project questions were identified to investigate the success of the new model of radiology services delivery: Will access to a new model of radiology services delivery, including remote and on-site procedural coverage, benefit rural Midwest hospitals? Will improvements in radiology service delivery allow rural Midwest hospitals to improve services while controlling the healthcare costs for provider radiology groups?

Assumptions

It is assumed that healthcare leaders and providers most interested in this project are those most knowledgeable within the healthcare industry, and have a working
familiarity with radiology practices, particularly in private practice radiology environments. The model described will give readers the opportunity to further understand the strategies employed by physician practices in radiology and the potential impacts if the new model is implemented in a hospital setting. The survey questions are designed to provide supporting information about the satisfaction of CEOs in rural Midwest hospitals and effectiveness of the delivery model, as experienced by healthcare consumers and providers. The satisfaction and success attributed to the model presented can objectively be compared to traditional models of service delivery employed by radiology providers throughout the industry.

Summary

How a radiology physician practice approaches the delivery of its services has a significant impact on the business solutions and capabilities the group has to offer within the healthcare marketplace. Radiology providers that expect to meet the growing demands imposed within the healthcare marketplace will have to create added value and improve the delivery of their services. As consumers in the market for healthcare services are being challenged to pay more out of pocket for their personal healthcare needs, there will be greater pressure on all providers as competition for services and customer demands escalate.
CHAPTER TWO: LITERATURE REVIEW

Introduction

The impact on an organization’s strategic business model is shaped by the scope and capacity a provider group has in delivering desired services. If radiology groups are going to succeed, they may have to create effective ways to meet both on-site and off-site demands of hospitals and medical staffs, while utilizing technology to leverage their remote capabilities to maintain internal efficiencies. Godt (2014) conveyed that healthcare costs are approaching 18% of the nation’s gross domestic product (GDP). To attempt to combat rising healthcare costs, since 2005, providers of radiology services have been impacted by at least a dozen cuts to their reimbursement by payers, such as Medicare (CMS). These cuts have provided strong incentives to make sure any modifications to radiology delivery systems are cost effective for patients, as well as the providers of the services.

Vasko (2013) conveys that the future success of radiology groups will be tied to their ability to turn inaction into action. The ability of a physician group to control costs while increasing the level of quality and depth of their services, will determine its success and attractiveness in the marketplace. Teleradiology and telehealth solutions show great potential to improve patient care while lowering patient costs (Murphy, 2013). A new or enhanced model of delivery can be integrated into an organization’s strategic plan, as it may drive current and future business decisions, as well as be a contributing factor in the success of the organization. In return, radiology providers can have a significant impact by providing a service delivery model that can assist the rural hospital in providing
needed services, and at the same time preventing unnecessary costs for patients seeking care. Since radiology services are provided for almost every medical discipline to assist in the diagnosis of their patients, the stakeholder group impacted in a rural Midwest hospital is not insignificant. Rural hospital physicians have the ability to manage a wide range of medical conditions when teleradiology and telemedicine, is available. Rural hospitals and the physicians, who practice within those settings, are often isolated. This is why more than 50% of U.S. hospitals utilize telemedicine to supplement on-site care for their patients (Fromson, 2013).

Radiology Service Delivery and Change

Maru et al. (2010) suggests that diagnostic imaging is a major part of the growing healthcare industry worldwide. While 96% of the emergency departments in the U.S. are fortunate to have access to a CT scanner, many hospitals in rural areas have limited access to higher end imaging devices. Providing clinical care without the aide of critical diagnostic imaging technologies can result in an inconclusive or delayed diagnosis. This is equally true in countries outside of the United States, wherein the rural nature of medicine is even more pronounced. Bohacs (2013) stated that according to an examination of medical malpractice experiences over the last 25 years, death in patients was most often attributable to incorrect diagnosis, therefore pointing out the significance of getting accurate and timely interpretations of diagnostic test results.

Fratt (2013) conveys that the shortage of primary care doctors in rural settings will continue to worsen for decades. Therefore, it is imperative that provider groups delivering healthcare services consider new and innovative ways to leverage technology
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in order to enhance the availability of necessary medical treatment in rural settings. Rural hospitals often struggle satisfying their patients due to the lack of resources local providers have at their disposal to treat patients (American Hospital Association, 2011). Remote coverage capabilities connect doctors to other physician specialists by remote means, and releases patients from the geographical constraints that may impact their care (McLean & Richards, 2014).

Improving radiology service delivery within a healthcare system is a crucial part of any provider group’s business strategy. Delivery strategies such as the remote delivery of radiology services are a simple but well thought out concept. The new delivery model utilizes advancements in imaging technology to deliver radiology services to patients, as opposed to patients being inconvenienced by having to leave their community hospital for a larger facility. The unavailability of specialty care in some community hospitals creates a significant challenge for patients and referring physicians alike. Cost and convenience will weigh heavily on consumers and be the driving force behind many decisions made within the healthcare system (Nayak, 2013).

Kerzner (2013) discusses the impact of change and the need for leaders to find ways to overcome the associated resistance that may follow. As an example, Monge, Perez, and Rein (2013) state that the Mayo Clinic in Rochester, Minnesota, has utilized something it calls value stream mapping to identify variances in care delivery in order to reduce and improve the delivery of their services throughout the imaging enterprise. Since the Mayo Clinic composes imaging equipment replicated throughout their many locations, they have to continually find ways to overcome the need for providers to be on-
site versus off-site. Challenging leaders and providers that change must occur to improve healthcare delivery, is often unpopular but necessary. The need to improve radiology delivery service options challenges leaders and providers to improve healthcare delivery at their hospitals.

In proposing a new model of delivery in radiology, it is paramount that physician providers obtain buy-in within their organizations before making the proposal to external client hospitals. Communication and acceptance is key, and it is necessary that everyone within the organization understands the benefits of the new model of delivery. There must be a clear consistent message of support sent to customer stakeholders. Lauing (2013) comments that physician groups must demonstrate value in today’s healthcare economy. Part of that value can only be realized if there is a complete belief that traditional approaches to radiology service delivery are no longer meeting the needs of customers.

Hospital administrators and clinician providers responsible for ordering and providing imaging studies on their patients, may be apprehensive with changes in the delivery of the healthcare services they offer. Many rural hospitals have reached out to remote radiology service providers, to obtain some of the necessary services they need. However, Jones (2013) states that local radiology groups may provide better services by offering a combination of on-site and off-site service delivery. This allows local referring physicians to have active radiologists on their medical staffs to interact and assist in local decision-making. Although remote-only providers would argue that this interaction could effectively be done utilizing video technology, human interaction among colleagues
sitting across the table from one another still appears to be an important aspect of the relationship desired. Souness, Hughes, and Winzenberg (2008) conducted a descriptive research study that looked at the satisfaction of general practice physicians with the availability and quality of radiology services. The study noted the need for higher quality interpretations in a timely fashion, and availability after hours was noted as a consistent concern.

Stakeholders may be motivated by distinctly different sets of values, and each may have needs that are not readily recognized or appreciated by others. Wiley (2013) conveys that hospitals are looking for value, and that value presents itself in forms such as improved quality, better turnaround times of results, and cost containment. Models of delivery that show evidence of meeting the hospital’s objectives are commonly embraced by administrators and referring physicians alike and are considered an operational foundation of excellence (White & Griffith, 2010).

Healthcare systems are changing at a rapid pace as hospitals and physician providers are trying to drive value, at a time when the healthcare system is attempting to transform itself (Squazzo, 2014). At the same time, patient outcomes in the U.S. fall behind other countries despite the rising cost of delivering care. Rising healthcare cuts have been a long-standing concern of radiology providers participating in the continuum of healthcare. Tyson (2014) states that healthcare in the United States is at a critical point in time. He conveys that healthcare costs will soon reach 20% of the country’s gross domestic product (GDP), which he views as unsustainable. Within the last several years, the impact of those changes have had serious repercussions for radiologists and the role
they play in providing services in the healthcare system. There has been governmental criticism as to the impact that technological innovations and changes have had on the many aspects of healthcare, such as the increased use of MRI scans verses the benefits of not doing one. The American College of Radiology estimates that reductions to medical imaging payments would cost radiology providers as much as $6 billion dollars over a 5-year period (Knechtges & Carlos, 2007).

Objections to delivery model changes may occur more often at the departmental level. Bowman (2012) comments that teleradiology only models may take away from a hospital’s ability to provide patient-focused care. If radiologists no longer have personal interactions with staff providing the technical portion of the radiology service, or have the opportunity to talk with patients, Bowman indicates this may be problematic in delivering optimal patient care. Although productivity for the radiologist and department staff may improve, he fears the physical disconnect, particularly with patients needing procedures, will decrease overall value and completion of care.

In the delivery of radiology services, technologists performing the radiology exams often rely on radiologist physicians being physically present, particularly as healthcare paradigms have shifted to empower patients to become more active healthcare participants (Fortner, 2013). These needs can be adequately met in a delivery model that allows for greater remote coverage, but this takes cooperation and process changes from those caregivers involved in direct patient care (Grimshaw, 2013). Healthcare providers have a tremendous opportunity to improve service delivery to rural communities, by leveraging specialty radiology services that employ remote strategies in concert with
INTEGRATED DELIVERY MODEL

services provided on-site. Whitten et al. (2002) validates the effectiveness of systems of healthcare that employ telemedicine approaches. They state that telemedicine has been used effectively in the U.S., particularly in rural areas that need specialist advice, but do not have access to those physician providers locally.

**Project Impact**

The healthcare system is undergoing dramatic changes and methods of telehealth are being explored to mitigate rising healthcare costs, while at the same time improving outcomes (Irving, 2013). McCarthy (2013) offers that rural hospitals have different needs than their larger, urban counterparts. A combination of on-site and primary remote service may be beneficial for rural hospitals. Although radiologists are off-site primarily, distributed imaging networks will allow specialty exams to be routed electronically to sub-specialty readers, who will interpret the studies performed locally. In traditional on-site delivery models, a generalist radiologist may provide an adequate interpretation, but a sub-specialist trained in a particular area of the anatomy, may be able to provide greater specificity on a given case. For rural hospitals that often rely on less qualified, mid-level extenders for basic treatment and diagnosis, this specificity provided by highly trained, sub-specialty radiologists can provide real value for the patient and healthcare providers. Remote teleradiology may have a significant impact on a hospital’s ability to overcome staffing issues related to geography, as well as challenges in covering the hospital’s needs outside of normal business hours (Silva et al., 2013).

Rural hospitals are vital to the well-being of the communities they provide services to. Rural communities rely on their local community hospital to provide the
basic care and services they need (McCarthy, 2013). Rural hospitals often struggle with the satisfaction of their patients, as well as the satisfaction of medical providers that are utilizing diagnostic testing to evaluate patients. Hospitals often struggle to provide certain sub-specialty services, due to that fact that the specialty physician would have to be on-site to provide those services. The result is having a general radiologist attempt to provide all imaging interpretations, for which he or she may not have the same level of training in specific anatomical areas of the body, like a sub-specialty trained radiologist would. Whether there is substantial evidence or not as to whether sub-specialty trained radiologists make fewer errors than generalists, there is an undeniable trend toward sub specialization (Ross, 2010).

Cultures of rural hospital medical staffs are often times known to be results oriented. They are often focused on providing the highest quality of service they can, so patients will not be apprehensive to stay in the community for basic healthcare services. Providers who can help deliver better services for these patients may be preferred even if physicians who rarely set foot in the hospital provide those services. Hablutzel (2014) conveys that patient satisfaction and loyalty go hand-in-hand as long as the patient experience includes the quality delivery of healthcare services, similar to what he or she could receive in a more urban setting. If patients make the decision to leave for services like diagnostic testing, there is a chance they may redirect all of their care outside their community, particularly if their experience was positive. Access to quality services in a timeframe that is conducive to patient needs and expectations, will likely have a significant impact on this type of outmigration.
Limitations

Limiting factors tied to remote coverage are primarily related to technology, cost, and the coordination necessary for scheduling resources. Although it is suggested that those implementing this new model of delivery provide the majority of the hardware and software necessary, there are responsibilities that each hospital has in preparing its site. An example would be the necessary interfaces that are required to allow for the appropriate transmission of images, including prior images from previous patient visits if applicable. Interfaces are also required to allow a dictated interpretation to be uploaded electronically to the hospital’s electronic medical record (EMR) system. Additionally, rural hospitals must ensure they have adequate Internet bandwidth and technology so that images and reports can be transmitted expeditiously. The delivery model must ensure that turnaround times and services are not negatively impacted (Weisser, Ruggiero, & Walz, 2007).

Other obstacles with telemedicine solutions are tied to the costs and efforts associated with licensing, credentialing, and reimbursement for services. Although telemedicine approaches have the potential to decrease costs overall, there are still hurdles within this relatively new frontier of medicine (Herrick, 2007).

Barnes (2013) conveys that recent surveys conducted by the American College of Radiology show a gain of more than 1,500 jobs in 2013. Presently it would appear that there are enough radiology jobs out there for radiologists graduating from residency programs to fill them. However, Barnes goes on to say that the future is somewhat unstable and unpredictable, given there are 6,800 radiologists presently over age 56, and
2,100 of those are over the age of 65. Radiologists in both of these groups have the
to retire, which would drastically change the demographics of the workforce.
In addition, future reimbursement for radiology services will also have a significant
impact on the workforce, as some attending medical school may choose other disciplines
or more lucrative occupations. Radiology has long been one of the favored medical
specialties due to the high incomes, preferred work schedule, and highly technical
environment provided within the field. Madden (2014) states that radiologists ranked
number 7 out of the top 10 medical specialties for physicians receiving the highest
payments from Medicare (CMS), based on 2012 data.

Summary

If radiology groups are going to modify their model of delivery in the new
healthcare economy, they will need to have a planned approach to presenting and
implementing the process and procedure changes necessary. Radiologists must focus
their attentions on not only what is good for them as provider businesses, but must also
convince their hospitals as to how they might provide more value and a higher level of
service than they did previously. With technological innovations now available,
radiologists are forced to improve their delivery models to remain competitive in the
marketplace. As radiology service delivery advances toward a more virtual environment,
groups within a typical market area will have the opportunity to compete for providing
remote services. If radiology service delivery no longer requires radiologists to perform
procedures on-site, radiology could become an open commodity, contracted primarily
based on price.
CHAPTER THREE: METHODOLOGY

Introduction

Rubenstein and Pugh (2006) stated there is strong interest in developing and producing more effective methods of healthcare delivery and common understandings need to be appreciated by stakeholders involved in the delivery of healthcare services. Prior to implementation, acceptance of the radiology delivery plan and approach will need to be agreed upon by leaders representing the stakeholder group. In addition, practice leaders must assess the readiness of the organization and stakeholders to accept proposed changes, prior to investing the time and energy in developing an extensive delivery strategy (Weiner, 2009). These stakeholder groups range from those at the departmental level and at the mid and upper management levels, as well as the referring medical staff that may or may not be impacted directly. Acceptance of any changes attributed to a new healthcare delivery model will, therefore, have to be explained and sold a little at a time to each stakeholder group.

The Problem

Rural hospitals often have difficulty providing the scope and depth of healthcare services to maintain a strong patient base (Hall, Marsteller, & Owings, 2010). Providers of radiology services to rural hospitals are challenged with staffing due to the scarcity of physician resources. Inefficiencies in productivity due to low volumes of imaging exams make it challenging for radiology groups to have dedicated sub-specialty radiologists on-site, which often limits the services that are available to rural consumers.
Radiology providers marketing a product or service should be concerned with validating the quality of that service with stakeholders who will select the provider for the services provided to their organizations in the future. Coulter, Jones, and Carden (2012), on behalf of Blue Cross Blue Shield of Tennessee, concluded that approximately 50% of patients in rural areas were not taking advantage of the hospital services available in their own communities. Healthcare organizations must validate the effectiveness of the services they provide based on competitive data (Burke, 2011). Healthcare providers who deliver services to rural hospitals must show increased value and improvements of their services, otherwise they are vulnerable to market penetrations by competing radiology providers. Value may be improved services, improved quality or the enhanced scope of services provided to the rural hospital. Changes in a model of delivery may have a positive impact on the organization delivering the service, as well as the hospital receiving the provided service. However, the patient will give little credence to delivery changes that have a positive impact on the radiology provider. Patients will expect evidence of improvement for the services they themselves receive.

**Model Efficacy**

In the delivery of radiology services to rural hospitals, there are several opportunities to measure effectiveness. The first consideration will be to identify the true primary organizational stakeholders that will be impacted by the changes in the model of delivery being proposed. Bryson (2011) discusses the formal and informal requirements that are placed on a given organization. Organizations providing radiology services must understand the various needs and expectations of their patients; along with any
constraints those expectations may pose for a provider of radiology services. Providers must understand what they are expected to do, and recognize the mandates that may be imposed by all stakeholders throughout the healthcare system.

Tobey, Yamamoto, and Roberson (2014) discuss the necessity for all industries to enhance their efficiencies. In the medical field this is particularly challenging, given that at the same time providers are being asked to improve efficiencies in the delivery of their services, they are also being asked to reduce costs and improve the care provided to patients. Tripathi (2014) conveys that the healthcare industry will undergo changes that are likely to be disruptive in nature, and new methods will be expected to reduce errors in radiology reports and improve the value of the healthcare services provided. Since outcomes define the success of a delivered healthcare service such as radiology, assessment tools will be necessary to measure satisfaction and to gauge performance.

**Project Plan**

The scholarly leadership project, “An Integrated Delivery Model for Providing On-site and Remote Radiology Services for Rural Midwest Hospitals” was: The researcher investigated the need and efficacy for introducing and implementing a new model of radiology services delivery to rural Midwest hospitals. The model of delivery was implemented at several rural Midwest hospitals, most of them being designated as Critical Access Hospitals by the states they were in. This meant the hospitals for the most part are cost reimbursed for the care they provide patients, due to their rural locations and needs of the patients they serve. Sites were chosen who had previous experience with a prior model of radiology services delivery and utilized for comparison.
Project Assessment

This scholarly leadership project utilized a qualitative approach in collecting data. The data collected was intended to gauge the satisfaction and outcomes of the new model of delivery post implementation. Additional data was included to assess certain key performance measures before and after the implementation of the delivery model. The on-line survey was sent to five rural Midwest hospital CEOs to obtain their input regarding the implementation of the new model of radiology services delivery. Certain questions were designed to allow each participant to confidently convey their opinions in their own words, which added additional depth to the survey instrument. Prior to the survey, an Institutional Review Board (IRB) application was submitted by the researcher for authorization prior to sending the on-line survey to the five CEO participants. The purpose of the IRB is to ensure that study participants are protected.

The scholarly leadership project IRB proposal was approved and the application resulted in the researcher receiving an Exemption Status for a 3-year period. This included approval for the participant request letter, which was sent to all participants outlining their role and responsibilities regarding the survey, as well as the obligation the researcher had in protecting their confidentiality. The participation letter and access to the project survey questions were sent to each of the 5 survey participants. There was 100% participation by all 5 hospital CEOs.

Considerations for Assessment and Measurement

The following information was chosen for assessment by using a series of project questions provided to hospital CEOs to gauge the effectiveness, impact, and satisfaction
that the new model of radiology delivery has provided their rural hospitals and stakeholders utilizing radiology services. This information was obtained through an online survey of five rural Midwest hospital CEOs who are considered to be experts in understanding the needs and satisfaction levels tied to the delivery of hospital services. In smaller hospitals, CEOs are required to have more operational knowledge regarding their service lines as opposed to larger hospital CEOs who may have other administrative staff members to delegate these tasks to. The smaller the facility, the more likely the CEO interacts with staff members on the front lines of operations and services (Mayhew, 2014).

Specific project topics were analyzed through questions to assess the following information as perceived and validated by the rural hospital CEO:

1. Satisfaction with the new model of radiology delivery by the various stakeholder groups, such as hospital administration, the referring medical staff, emergency room physicians, and patients.
2. The benefits of the model implementation to their organization.
3. The satisfaction with report turnaround time and service impacts related to result turnaround times.
4. Has the ability to schedule patients for more radiology procedures on-site had a positive impact on patients?
5. Has the model of delivery increased revenue for the hospital?
6. What positive or negative impacts has the new model of radiology delivery yielded?
The Importance of the Survey

Rural hospitals often struggle for access to the same core hospital services as institutions located in larger cities. Rural hospitals struggle for survival while at the same time providing valuable services for local communities. Healthcare leaders report that when local hospitals close, the economic impact is significant for area citizens (Holmes, Slifkin, Randolph, & Poley, 2006). Providers who work with rural hospitals must continue to provide value added services that assist the hospital in meeting customer expectations. CEOs are often the decision makers when it comes to the purchasing and contracting of provider radiology groups. If a new model of healthcare delivery can improve the radiology services available to patients, then it is likely patients will utilize the hospital for a broader array of services. Understanding the patient satisfaction from the rural hospital CEOs perspective will be a key indicator in evaluating the success and value opportunities a new model of delivery may yield post implementation.

Nowicki (2008) discusses various approaches to assessing improvements in healthcare. Proactive strategies are more focused on defining quality and developing its measures. Measures can be presented in a qualitative or quantitative fashion, and each may give indications of specific successes or failures. A goal-oriented approach for quality assessment would focus more on the achievement of specific objectives that might be easier to measure through data collection, such as turnaround times that may improve, stay the same, or decrease. The on-line survey will assess customer satisfaction or opinions as to whether quality improved, stayed the same, or decreased, and may be a reliable way to gauge the impact of an effective implementation. Providers truly
concerned about this more subjective measurement will take added steps to ensure customers are not only satisfied, but feel the improvement is significant. Snow (2009) conveys that there are three steps for leaders in conveying this type of quality to customers:

1. **Wow through Know-How:** Leaders have to convince the customer you are the experts in your field and the delivery of your service is second to none.

2. **Take Notice; Take Action:** Leaders make sure customers are communicated with and that any problems or concerns are responded to without delay.

3. **Add Flair through Care:** Customers are attracted to delivery of care that is rendered by providers who show enthusiasm and passion. Customers must be made to feel important, and then understand the steps being taken to ensure their needs are being met.

**Methods of Measurement**

For the purpose of this scholarly leadership project the research was utilized to investigate the virtues of the new model of radiology service delivery to rural Midwest hospitals. The primary assessment tool was an on-line survey, which was distributed to five CEOs in rural hospitals where the new model of radiology delivery has been implemented. The purpose of this assessment survey was to gauge the satisfaction of rural hospital CEOs at Midwest hospitals and perceived impact that the new model of delivery had on the hospitals and stakeholders within the five organizations.

The CEO is seen by radiology providers as the key decision-maker for hospital services and is therefore seen as the most knowledgeable source of information for the
purposes of this research study. The viewpoint of the CEO is key as this individual
represents and interacts with all organizational stakeholders and makes key purchase and
contracting decisions for the rural hospital. The results of the assessment will be narrated
by the researcher, which will represent the actual experiences at each of the five rural
hospitals. This research will serve to validate the outcomes experienced at each location.

Data will also be presented, which will serve to investigate and assess whether or
not there was a measureable change in overall quality of the radiologist’s interpretations
before and after implementation of the remote delivery model. To gauge this the
researcher will review the overall discrepancy rates of the radiologist’s interpretations of
the radiology studies at each of the five rural hospitals in order to assess whether or not
there was an appreciable change in overall quality. This quality measure will be based on
data from the provider group’s internal peer review reports. National benchmark data
recognized within the radiology industry will also be used to validate and compare the
provider radiology group’s internal measurements to peers across the country that also
participate in the same peer review database. This data will be reviewed before and after
the implementation of the new model of delivery.

Lastly, we will review the internal turnaround time data the group provides to
each facility as another measure of quality of service delivery. The researcher will
investigate whether or not there was appreciable change in the amount of time
radiologists took to deliver a report of their findings to the rural hospital.
Project Survey Questions

The project survey questions listed below were sent to five hospital CEOs who represented rural hospitals located in the Midwest who had prior experience with the implementation of the remote model of radiology delivery. The purpose of the questions was to investigate stakeholder experiences at their facilities and how the change in delivery impacted their organizations.

1. Has remote radiology coverage, in combination with on-site radiology coverage provided by radiologists, been successfully implemented at your hospital? Yes or No? Please elaborate on the success or deficiencies of implementation that your organization experienced.

2. Has the implementation of remote services benefited your hospital? Yes or No? If so, please give examples of those benefits. If they did not benefit your hospital, what steps could have been taken to improve the implementation?

3. Have the turnaround times of results met your expectations? Yes or No? If no, what could have been done differently to achieve a better outcome?

4. Has access to remote services in conjunction with expanded on-site procedural services improved patient care at your hospital? Yes or No?

5. Has access to remote sub-specialty radiology interpretations, given your hospital a competitive edge, by leveling the playing field between your hospital and those situated in larger communities? Yes or No? If so, can you provide examples?
6. Were the costs and efforts necessary to implement remote radiology services at your hospital acceptable? Yes or No?

7. Would you recommend the remote radiology services delivery model implemented at your hospital to other healthcare providers? Yes or No?

8. Has the remote radiology services delivery model assisted your hospital and stakeholders by reducing costs of healthcare delivery? Yes or No? If yes, could you provide examples of how you believe cost containment was achieved?

Summary

Radiology groups must develop and educate healthcare stakeholders as to how the implementation of a new model of radiology delivery would benefit all parties involved. Once the processes are clearly communicated to each stakeholder group, hospital stakeholders must clearly understand what they can expect from a new model of delivery and what negative impacts this may have on a rural hospital. If rural hospitals are to remain competitive, they must offer an acceptable level of services as determined by patients. Telemedicine offers new opportunities for those in rural areas to ensure that appropriate levels of medical care are available to their patients and communities (Vivek, 2008). If those levels of care are received positively, retention or the potential to increase market share is possible. Stakeholders will have high expectations that radiology groups can deliver acceptable levels of radiology services. Qualitative assessment tools will be utilized to make sure there is a clear alignment of expectations and satisfaction with the actual implementation and delivery of services.
Implementation of a new model of radiology delivery should be a planned approach with a clear timeline developed. When changing a model of delivery, leaders should consider meeting with representatives from all stakeholder groups such as referring physicians, administrative and technical staff members, in order to communicate the plan. A clearly developed implementation schedule must be provided, and the provider group must clearly communicate expectations, roles, and responsibilities for all involved parties. In radiology, this means the group of stakeholders is fairly large, including staff members from the radiology department itself, the Information Technology (IT) department, medical records, medical staff services, and senior administration (Yee, 2013).

The Problem

Leaders implementing change, such as a new approach in radiology service delivery, should attempt to glean acceptance of the new model of delivery with the departmental manager or director, first. The departmental managers are the front-line administrators responsible for the operations of the entire radiology department. They are concerned with sources of revenue and costs associated with the delivery of services within the hospital. They are most commonly held to standard benchmarks within the industry related not only to the production of images, like x-rays or CAT Scans, but the time associated with providing the service to the patient as well. Once the images are technically produced, those images then make their way to a radiologist for interpretation.
Prior studies have to be retrieved and provided along with any pertinent medical history to explain why the test was ordered in the first place. Although the quality of the interpretation and speed with which that service is turned around is the responsibility of the assigned radiology group, the department manager is ultimately responsible for making sure the departmental services work smoothly and effectively. Any change in the model of professional radiology delivery needs to address the impacts the modifications may have on the departmental staff. Changes involving the communication and delivery of radiology results to those who rely on them for the treatment of patients will likely be scrutinized. Vasko (2013) conveys that radiology groups must be able to clearly communicate the added value any improvements in service delivery will provide the hospital in the way of efficiencies and better quality. Quality could be demonstrated by more accurate interpretations or improved result turnaround times. To be attractive to stakeholders, radiology providers must explain how changes in the delivery of their services will make hospital departments more efficient (Marshall & Blair, 2013).

Radiology group leadership should consider the best approach in communicating implementation strategies and timelines to the medical staff who refer their patients for imaging studies either as emergency room patients, or patients seeking inpatient or outpatient diagnostic services. The medical staff may be concerned with specific issues, such as turnaround times for results and more specific interpretations, provided by sub-specialist radiologists who focus their practice by way of training, on a limited portion of patient anatomy (Harvey, 2008).
Making the Sell

Presenting and selling organizational changes to hospitals and their associated stakeholders should not be taken lightly. As a vendor or provider of healthcare services, radiology providers are often minimized in their overall contribution to the medical staff. As physicians, radiology providers have a great deal of knowledge and expertise to share, which can bring significant value to any hospital or medical staff, as well as their patients (Fratt, 2011). However, as radiologists are often considered ancillary to other medical staff members, healthcare providers may not consistently treat them as full participants on the healthcare team. Radiology groups can minimize their risks and enhance their position in the local healthcare community, if they are able to provide innovative services that bring added value, which all stakeholders can appreciate (Vasko, 2011). If radiologists cannot be distinguished because of quality or the services they provide, they may soon be considered a commodity. As more and more radiology services can be performed on a remote basis, radiologists located anywhere in the U.S. can compete for services even in a rural area. Assuming the quality of the products and the depth of services offered are similar, purchasers of radiology services may begin making their contracting decisions by selecting the group offering the best price for their services, independent of the group’s geographic location (Muroff, 2010).

Radiology Delivery Model Plan Resources

Burke (2011) states that transformational organizational change requires leaders to take on specific roles with the implementation and allocation of resources. Leaders will be required to not only sell the model change ideas to stakeholders, but will also be
expected to clearly develop a planned approach to accomplish any changes necessary as well as identify needed resources. Although a change in the delivery model of radiology services is mostly process related, it would be remiss not to consider both direct and indirect costs, which may vary depending on the needs of a particular hospital.

**Personnel Changes**

The personnel necessary to implement the proposed delivery model changes will vary depending on the resources and equipment needs of a particular hospital. Small hospitals often have much less infrastructure and therefore may contract out for services such as advanced information technology (IT). Changing the delivery of radiology services from a primary on-site service to a primary remote service requires several advanced technical changes. IT personnel will be necessary from both the hospital and within the radiology group to ensure that certain technical requirements on each end are met. Nester (2014) discusses the necessity for hospitals and providers to align together, so that variations in healthcare delivery and practice can be reduced.

Other personnel who will be involved in the changes are the departmental clinical and clerical staff. The processes for radiology scheduling will be modified, as well as the processes involved in receiving the clinical results from the radiologists. This will not require additional staffing for the hospital, but it will require the hospital to modify how it processes its work. In reality, the technical staff will have the opportunity to be more efficient, as they will no longer be batching their work and having it sit unprocessed until the radiologist arrives on-site.
Technical Considerations

There are several technical considerations that may come into play, depending on the particular hospital radiology providers are working with. Kash (2014) discusses the importance of accessing information using technology. Of all the issues of concern in implementing a remote model strategy, the technical issues are of paramount importance. Radiology practice computer systems must be fully integrated with the hospital’s network and connected utilizing high-speed Internet lines. This serves to achieve the following purposes:

1. Once images are taken at the healthcare facility, they must be transmitted in real-time to the radiology practice computer system.

2. Once images are received on the practice’s computer systems, they are now available for the help desk to evaluate and transmit to an interpreting radiologist.

3. The assigned radiologist receives the images and he or she reviews the images and dictates the results in the form of a written report.

4. Once the written report is transcribed using either a voice recognition software program or an on-site or off-site transcriptionist, it is then forwarded back to the originating hospital.

5. There must be an established interface between the practice’s dictation system and the hospital’s medical record system that allows the typed report to be uploaded into the hospital’s electronic medical records system.
6. Once uploaded into the hospital’s medical record system, the referring physician who ordered the test can view it, and treatment for the patient can begin.

Cost Factors

Labor issues for a radiology practice are considerable and any opportunity there is to maximize a radiologist’s productivity, may result in a reduction in costs overall. Halvorsen and Kristiansen (1996) discussed the financial advantages of having interfacility networks of hospitals connected to a central computer network for the interpretation of images in radiology, and this concept continues to be true today. They suggested that cost reductions from travel alone for specialty radiologist physicians traveling to rural hospitals would be considerable. For the hospital already utilizing teleradiology for off-site after-hours interpretations, there is little additional technology or costs incurred. If hospitals lack the specific interfaces to send images to the radiology practice and additional interfaces to allow uploading of the results back into their medical records system, this expense would be allocated to each hospital. For the rural hospitals included in this research, where the new model of implementation has occurred, those actual expenses ranged from $20,000-$25,000 per hospital. This would include any physical hardware and software that needs to be purchased, and the labor hours required by IT staff to program the interfaces. If any additional workstations are necessary, those could be purchased for an estimated $8,000 each. High-speed Internet lines should be in place already, but if additional speed through increased bandwidth is necessary, that was obtained by hospitals at an additional cost of $200-$400 per month.
In addition to costs incurred by a client hospital, there would be additional labor costs incurred by the practice. These costs would vary with the size of the hospital and would depend on the level of IT expertise the hospital would have in-house or outsourced. If the practice has to use additional time to write and implement both sides of the necessary interfaces, this could result in additional costs. In addition, if the practice has to incur any other related costs due to the negotiation or contracting with a particular hospital, this may also impact the specific costs expended by the radiology practice. The costs of the new model implementation should be carefully assessed and reviewed. The actual costs will be based on the specific technology already in place at the hospital, and what potential outlays of hardware, software, or increased bandwidth will be necessary to complete the implementation.

**Timeline for Implementation**

The time necessary to implement the radiology model change is approximately 30 days for an existing facility already receiving services. Most of the time required will be spent educating various stakeholder groups as to how the processes are changing, how the timing of services are changing, and what they can expect in regard to the turnaround times for the delivery of results to treat their patients. Gagnon, Duplantie, Fortin, and Landry (2006) discuss the purpose of telehealth and their belief that the value for rural regional healthcare facilities is evidenced in the enhanced services delivered, the improved consistency of care, and the retention of local healthcare delivery. The implementation and timeline should address the expectations for improved turnaround times and when improvements can be expected.
**Implementation Plan**

The implementation of a new model of radiology service delivery should begin by assessing the needs of the hospital and its stakeholders. This assessment starts with an initial discussion between representatives of the radiology group and the hospital’s radiology manager or director. The purpose of this discussion is to review the current delivery of services and to gauge the need for change. The discussion will need to explore the overall impacts of a new delivery model, and how the delivery of radiology services to the hospital's patients may be improved.

Although the hospital will not be motivated by the sole needs of the radiology group, it is good for each party to have a common understanding of the potential benefits for the radiology group. If this is not communicated up-front in the discussion, it may become an issue later in the acceptance process. A clear message should be conveyed that outlines the radiology group’s goal to improve services and quality, while at the same time utilizing their radiologist resources efficiently. The radiology group should clearly explain the benefits of a new model of delivery and how this will impact current departmental functions and improve patient service delivery. The department manager will likely be concerned with operations, and how model changes may impact scheduling radiology technical and nursing staff, the scheduling of procedures, and how access for patients will be impacted. The goal of this discussion is to glean the acceptance of the manager, as this support will be key in making the sell to the next level of administration.

Once the radiology department manager and radiology group administrators are in agreement, the next steps include the evaluation of any technical changes that may be
necessary. This includes an assessment by the technology experts from both the radiology group and the hospital, to review any necessary hardware, software, or high-speed Internet bandwidth changes required. More importantly, if there are any substantive technical changes needed, it will be necessary to determine who will be responsible for any associated costs needed to implement the new model of delivery. Once this assessment is complete, a cost summary and timeline can be developed for the implementation, which will need to be agreed upon by both parties.

Once the technical and operational assessments have been completed, it will be necessary to discuss the model changes with the next layer of hospital administration. In some instances there may be an administrator in between the radiology manager and the CEO, and in other settings the radiology manager may report directly to the CEO. In either case, the model plan components must be discussed and embraced by all necessary administrators including the CEO, prior to presenting the model of delivery to the local rural hospital medical staff.

Since the delivery of radiology results has a significant impact on the referring physician ordering the tests or procedures to evaluate a patient’s condition, there must be general buy-in from the clinicians on staff at the local hospital for most changes of significance. Radiology groups will need to include one or more of the radiologist leaders, for a presentation to the hospital medical staff at a regular or special medical staff meeting. The radiology manager and CEO will also be actively involved in the presentation, as they will need to validate their support for any proposed changes in the delivery of radiology services. The radiologist will be a key leader utilized in explaining
the impacts on patient care to the medical staff, and how changes in delivery will improve the services provided, even though they may not see a radiologist physically on-site as often. Specific benefits such as improved result turnaround times, higher quality reports due to the involvement of sub-specialty radiologists reading specific exams, will need to be clearly communicated. This buy-in is necessary so that the local referring physicians feel included and do not become obstacles in the approval and subsequent implementation. Although the final decision rests with the hospital CEO, this individual may be reluctant to make changes if the hospital medical staff is clearly opposed.

Once approval is agreed to by the hospital CEO, the radiology group and departmental manager can begin to finalize the implementation plan. This would include working with technical staff members to ensure all of the necessary technical issues are addressed and high-speed Internet connections are installed and properly tested. This is a key issue, given the new model of delivery relies significantly on the ability of the hospital to send images to radiologists reading from another geographic location. In addition, any workflow and scheduling changes for patients, hospital staff, and radiologists will need to be addressed and a timeline for testing the new model will need to be developed.

The radiology group and hospital then agree upon the implementation plan and the work begins to implement the new approach to delivering radiology services. Once the model is executed, it will be necessary to continue monitoring the outcomes of delivery by utilizing metrics which are likely already in place within the department, to ensure the model of delivery is meeting the expectations of the hospital and the radiology
It is extremely important the radiology group administrators and the radiology department manager communicate any concerns that occur with the new implementation, so that those issues can be addressed promptly. Typical start-up issues often occur with inadequate or inconsistent high-speed Internet connections, and the processes implemented to schedule new procedures on-site. Clear and consistent communication between the hospital and the radiology group can help to ensure the successful delivery of healthcare services through a new method of delivery. The process of implementation should include periodic reviews on a weekly basis, until it is determined that the new model is functioning smoothly.

**Summary**

The implementation strategy and execution of the proposed radiology delivery model changes is a key factor in whether or not the changes will be readily accepted by rural hospitals. There must be clear communication and deliverables, along with a carefully planned approach. The projections of costs and employee involvement from the hospital’s perspective will be extremely important. This may be one time when the radiology group wants to spend substantial time on planning and training, prior to start-up. Success or failure of any new process may be judged within the first few weeks of implementation. Missteps are to be expected until processes and technical issues are running smoothly. Timelines must be reasonable and should ensure that everyone involved is ready for the level of changes required, and that contingency plans are in place if initial successes are not achieved immediately. Technological contingencies become extremely important, as the success of remote coverage is tied to working
computers and access to high-speed Internet connections between the hospital and the location where the radiologist is working. Radiology groups should be prepared to dedicate the necessary IT personnel to assist the hospital in the initial phases of implementation.
CHAPTER FIVE: ASSESSING THE PROJECT, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

Healthcare has become a significant part of everyone’s lives. As healthcare represents one of our country’s largest expenditures of the gross domestic product produced, research projects related to healthcare may have a good chance of impacting others in a significant way (Pettypiece, 2013). The focus of this scholarly leadership project will be to outline a delivery model for radiology services for rural Midwest Hospitals to improve or maintain access to needed radiology services.

Project Purpose

The purpose of this scholarly leadership project Dissertation is to present a model of radiology delivery, which can be reviewed, refined, and implemented by other medical professionals and stakeholders within the healthcare industry. By presenting this project, those interested in this topic will be able to utilize this information as a resource to replicate or improve upon this proposed radiology delivery approach.

The project outlines a model of delivery that has been utilized effectively to provide needed radiology services to populations of patients that utilize rural Midwest hospitals to receive their care. The proposed model of delivery expands the availability of radiology services by outlining methods of delivery intended to provide radiology services both on-site and through remote (off-site) means, utilizing teleradiology and high-speed Internet connectivity. The risks associated with any change in a healthcare services delivery model are those same risks associated with any new organizational
process change. Anderson (2009) communicates that changes that are controlled are more likely to achieve the desired objectives of the change itself. Change that is narrowly focused, easily understood, and easily measured, may have a greater opportunity to succeed.

The Problem

Radiology services are needed by healthcare providers to diagnose disease so that a treatment plan can be developed for their patients. Rural hospitals have difficulties in obtaining healthcare providers within their communities, therefore creating a disparity between the value of a small hospital and those hospitals having more services located in larger cities. There is a need to supply specialty radiology services in a timely manner to rural hospitals, so that patients will continue to utilize those local services as opposed to seeking their healthcare in larger facilities. There is a need to improve the delivery of radiology services provided to rural hospitals and to create efficient models of delivery so that radiology physicians are available to provide these needed services in a cost effective manner.

If a radiology delivery model is going to be changed, it must be measured following implementation to gauge the impact of the change. In addition, it may be necessary to compare any delivery system with those utilized by other radiology providers in the radiology industry. Therefore there are risks in not delivering promised services. It may be beneficial to look for incremental improvements over a few months, as opposed to establishing hurried timelines in days or weeks for which immediate improvements are expected. Each stakeholder group may appreciate the positive impacts
of change differently. Referring physicians may experience faster turnaround times very quickly, but they may appreciate changes in quality over a much longer period of time (Fratt, 2011).

Basu (2014) states that organizations that do not continually change their business strategies to improve their products and services may be at risk. For a physician practice that provides radiology services to rural hospitals, there is significant risk if services are not improved over time. If a group fails to be innovative with its approaches to improving delivery of the services it provides, other physician groups may be more than willing to compete for that business. Physician groups providing services must be conscious of the risks and potential threats that a change in delivery process may present. In order to be competitive, radiology providers must offer innovative approaches and game-changing methods that improve quality and value, such as models of delivery that include remote sub-specialty interpretations (Moan, 2010). New healthcare delivery models are needed to sustain, improve, and control the costs associated with delivering necessary services to hospitals and their patients.

**Assessing Value**

When implementing a process change for a delivered health service, radiology groups must understand that what appears to be a good idea internally, may be challenged by various external stakeholders within the hospitals served. Various stakeholder groups will be impacted, so it is important to understand and outline the potential threats radiology groups might encounter. The project model changes must be clearly understood by rural hospital stakeholders and described, so that the radiology provider
involved in the process modifications can understand how those changes may impact them or the work they currently do. For small organizations, a new model of radiology delivery may be viewed as negative if hospital leaders believe changes will result in the necessity of adding or eliminating staff. Medicine tends to be local, so it should not be assumed that one size fits all or that one model of delivery will yield the exact results for one hospital versus another. Heathfield (2014) comments that the most successful change management efforts are the result of over-communicating to those customers asked to make necessary changes.

**Acceptance of Change**

Organizational stakeholders who put up roadblocks to the process changes before they are implemented, presents one of the most significant risks to a model change in the delivery of services to a hospital. Physician groups are involved as members of the medical staff once they begin providing services to a hospital. Physician groups providing radiology services may often be viewed by healthcare administrators as vendors, and therefore are challenged to provide services in ways that coincide with the needs and requirements of other local physician providers. This becomes a challenge if the medical staff has become accustomed to a certain model of delivery, even if the potential benefits of a new model enhances services provided to patients. Klein (2011) comments that radiologists will be judged on the value they bring to the overall delivery of care to patients.

Additional risks with a change process involving radiology delivery may involve the hospital departmental staff. The process changes will utilize technology, which will
INTEGRATED DELIVERY MODEL

replace manual processes and certain job functions now performed by in-house staff. An example of this would be the use of voice recognition software. In this proposed delivery model, radiologists interpreting exams will dictate into the voice recognition software, which the group will provide the site access to. This may impact the need for transcription at the hospital, which may be controversial.

Once the radiologist completes the interpretation, he or she will review and electronically sign the report. The report will be electronically uploaded into the hospital’s medical record system, and made available for review by the medical staff or other healthcare providers within minutes. These process changes alone may eliminate the need for transcriptionists to listen to dictated reports on a recording device, type the reports, and then print them for review and signature by the radiologist. Rogerson (1996) indicates that process-engineering changes must take into account the impact changes may have on people. Radiology groups implementing a new delivery model that has potentials to reduce or eliminate staff may want to treat this issue cautiously. Often staff can be reassigned to other duties within the department, as opposed to having their jobs eliminated.

Leaders must understand there may be political issues within each facility, particularly if the changes involve the reduction of staff members. For some, the economics may be a motivating factor in implementing a strategy that could potentially reduce the site’s internal costs attributed to labor. In other facilities, hospital administrators may be more reluctant to make changes in staffing, even if those changes may be in the interest of most stakeholders. Each stakeholder group may view changes
from a slightly different set of eyes, depending on how those changes it impact them
directly or indirectly. Given that most stakeholders will have significant training as
scientists, objective results may have a greater impact on their decision-making, than
perceptions or emotions.

**Project Opportunities**

When attempting to implement process changes from a provider to a client
hospital, there should be a clear and consistent message as to what impact the changes
will have on the overall delivery of healthcare services to the hospital and all of its
stakeholders. There may be an automatic assumption that the cost reductions sought by
the physician providers through the careful reduction of on-site services may be a self-
serving. To mitigate this assumption, the offsetting benefits for the hospital and patients
need to be clearly communicated. Since each stakeholder group may see process changes
from a different vantage point, it may be beneficial to target each group separately for the
explanations.

Studer (2014) conveys that organizations are facing tremendous changes and that
the execution of change processes may be a key indicator attributing to an organizations
success or failure. Leaders can facilitate necessary changes by communicating the
benefits of process and cultural improvements to select groups. Groups must realize that
process changes that reduce hospital staffing may be received positively by senior
leadership, but may be received negatively by the middle manager that may find it
difficult to eliminate someone’s position. On the other hand a hospital that is profitable
and experiencing market share penetration may have a higher likelihood of expanding or
maintaining services, resulting in the necessity of additional staffing. In the healthcare field, the patient should be a primary concern for all stakeholders. If a new model of delivery is ultimately good for patients, the opportunity for acceptance may be higher. As with any change hospitals may encounter, there will be many factors involved in the overall assessment of whether or not a change in delivery provides positive value for the organization as a whole.

**Project Strengths**

The strengths of the project begin with the overreaching purpose, which is to offer a model of radiology delivery that improves or sustains service delivery while utilizing a methodology that remains cost effective for both the rural hospital and the radiology group providing services. The project has been developed and tested within a rural Midwest marketplace, where the need and desire to improve delivery exists.

**Project Weaknesses**

The project has been implemented and tested in a relatively small number of hospitals, all of which are small in size and located in rural communities. In addition, the project utilizes pre- and post-implementation data offering both subjective and objective conclusions. Provider relations are strong between the implementing radiology group and the rural hospitals in the study, therefore acceptance may have been obtained more readily than in other settings where the groups history and reputation are not as established. Rural hospital CEO’s are the key decision-makers within their organizations, but other stakeholders may have variations of opinion as to the successes or failures of a healthcare delivery system utilized for hospital consumers.
**Literature Support**

Hall, Marstellar, and Owings (2010) states that the importance of having hospitals in rural areas is critical. Hospitals attract both healthcare providers and physicians, to take care of emergency room, outpatient, and inpatient healthcare needs. The success of the community hospital is critical to the rural community economy and often is an attraction to locating residents. Models of healthcare delivery such as radiology services are crucial to diagnosing disease, allowing referring physicians to develop effective treatment plans.

The healthcare delivery system is constantly under reform. Zuckerman (2014) discusses the need for solutions that address healthcare resources and those areas impacted by their geographical location. Furthermore, the impacts of the Affordable Care Act increase the need for new models of delivery that address challenges within the healthcare continuum. Exceptional services and innovative solutions can provide both short and long-term benefits for stakeholders involved in healthcare delivery.

**Data Collection Overview**

The data collected for this scholarly leadership project is divided into three parts. The first qualitative component included in this project presents the results of an on-line elective survey, which the researcher sent to CEOs in five rural hospitals where the new radiology model of delivery has been implemented. Since the radiology groups providing the model had pre and post model implementation experience with those same hospitals, this allowed for qualitative data comparison of result turnaround time pre- and post-implementation.
Lastly, the outcome data for interpretation discrepancies has been compared and contrasted to national peer review data. This data is provided to assess the impact on the quality of the interpreted report, comparing actual discrepancy rates before and after the implementation of the new model of delivery.

**On-line Survey**

Five rural Midwest hospital CEOs were selected by the researcher to participate in a 15 to 20 minute on-line survey. Each of them was provided the on-line survey using an electronic survey format, which was sent through secured email to each individual recipient, utilizing the Survey Monkey tool. Participants were chosen from rural Midwest hospitals that had pre- and post-experience with the provider radiology group, and had experienced two different models of delivery over a number of years. Participation was voluntary and followed the appropriate IRB requirements of the university. There were five surveys sent out to five rural Midwest hospital CEOs, and all five surveys were completed and returned.

Each recipient was given eight questions to answer. Four of the questions were structured to select only yes or no responses, and four of the questions utilized a yes or no question with probing requests for additional comments. Question one included in the survey (see Appendix E) was intended to assess the CEOs satisfaction with the new model of delivery and whether or not they believed the implementation was successful or not. One hundred percent of those participants surveyed responded that the implementations had been successful in their hospitals.
Question two was intended to gauge whether or not the respondents believed that the remote service model of delivery had benefited their hospital and if so, the question probed for specific examples. One hundred percent of the participants surveyed responded that the implementation of remote services had benefited their hospitals. Respondent A commented, “STAT reads for the Emergency Department (ED) patients in particular CT scans”. Respondent B commented that the “exceptional improvement in turn-around times for the ED, Mammography, and imaging studies,” noting a significant improvement of care. Also respondent B stated that “now specialists are reading and interpreting our imaging work”. Respondent C stated, “Improved turnaround time on reports was beneficial.” Respondent D communicated, “Staffing is no longer an issue. Turnaround times are excellent.” Respondent E stated “timely access to STAT interpretations and fellowship trained radiologists to serve our patients.”

Report turnaround times in healthcare are extremely important, particularly when it comes to radiology and imaging. Question three was intended to investigate whether or not the CEOs expectations were met in regard to turnaround times of radiology results. One hundred percent of the five respondents felt the turnaround times of results had met their expectations. The expectations of the CEOs were also compared to the actual performance data pre- and post-implementation, which showed that report turnaround times did not suffer with the new delivery model.

The qualitative data would indicate that there was no significant change either positive or negative in regard to turnaround times of results pre- and post-model change. Had a respondent answered no to question three, there was an additional probe that asked
what could have been done differently to achieve a better outcome. There were no comments from any respondent given there was 100% agreement that their expectations had been met.

Question four was a yes or no question intended to gauge whether or not the CEOs felt the remote service combined with expanded opportunities for radiology procedures to be performed and scheduled on-site, had improved patient care for their hospitals. One hundred percent of the respondents answered in the affirmative.

Question five was intended to broaden the scope of questioning, to assess the impact the new model of radiology delivery had on the overall competitive position of the rural hospitals as compared to those hospitals located in larger communities. The researcher was investigating specifically the impact of sub-specialty interpretations as compared to those provided by general radiologists. Sixty percent (60%), or three of the five respondents, believed that access to such specialty radiology interpretations had given their hospitals a competitive edge while 40%, or two of the five, said no. Although the probing questions were tied to the yes responses only, one of the respondents who answered no also made a comment.

Respondent A noted “Mammography by subspecialists applies also the ability for STAT CT reports.” Respondent B commented that “Installation of digital mammography transmitted to a breast center with immediate readings and consultation for specialist to both readings and consultation from specialist to both the primary care doctor and the very anxious patients; very positive response from patients.” Respondent C stated “not an issue that consumers use in making choices. Not sure how much of an issue it is for
our physicians.” Respondent D said “the availability of the interpreting radiologist on diagnostic mammograms to go over results with the patient before leaving our facility has been well received.” There was no comment by Respondent E.

Question six asked if the costs and efforts associated with implementation was acceptable at their hospital. In an era of rising healthcare costs, solutions that add significant cost to an already burdened healthcare system are often poorly received. Therefore it was important for this project to investigate the associated concerns regarding direct or indirect costs. One hundred percent of the respondents indicated the costs and implementation efforts were acceptable.

Question seven was intended to gauge the viability of future implementation of the new model of radiology services delivery. Rural hospitals in the Midwest are very committed to each other and meet often to compare experiences. It was deemed important to the researcher to further investigate whether or not the model would be recommended by the hospitals that have already experienced it. One hundred percent of the respondents agreed that they would recommend remote radiology services delivery to other healthcare providers considering implementation.

The final question, number eight, was specific to inquire as to whether or not the hospital CEOs believed the new model of delivery had an impact by reducing costs. Three, or 60%, of the respondents stated that yes; it had reduced costs at their hospital while 40%, or two of the five, respondents said they did not believe it reduced their hospitals costs. There was an additional probing question tied to the affirmative response, which asked for examples of how they believe costs were contained.
Respondent A stated “has allowed support to non-radiologists physicians with more accurate interpretations of images when need which allows the delivering of better patient at lower costs (less chance of misread).” Respondent B commented, “Rapid definitive readings result in appropriate treatment, rather than empiric treatment that some cases will be wasteful and unnecessary.” Respondent C stated “ability to schedule patients in a more timely fashion knowing each modality will be read by a radiologist with the necessary additional training to match the large faculties with on-site radiologists. We do not worry about coverage which would be an issue for us in a rural area with stand-alone radiologists.”

**Additional Data**

To further investigate the successful implementation of the new model of radiology delivery, comparative data was obtained from the radiology group involved. Data was assessed in two specific areas, which included report turnaround times pre- and post-implementation, and accuracy of radiology interpretations pre and post-delivery. To further validate the radiology group’s accuracy as compared to radiology groups across the United States, peer review data is also included to ensure validity of the group’s performance measures.

The data provided in Appendix F shows the pre- and post-implementation results for each of the five rural Midwest hospitals included in the survey. Although there was no appreciated significance in any of the pre- and post-results for turnaround time, one of the hospitals showed a slight decrease in turnaround time in the six results pre- and post-data used in the data comparison.
Appendix H shows the individual discrepancy rates for the interpretation of radiology results, pre- and post-implementation of the new model of radiology delivery for each hospital. The data also measures the period six months before and six months following implementation. Again, there is no evidence of any significant change in the discrepancy rates pre- and post-implementation. Appendix I provides discrepancy comparisons for the same period comparing the radiology group who completed the model as compared to the national peer radiology group database, using the RADPEER™ database. The RADPEER™ database was developed by the American College of Radiology to provide support in the assessment of quality and peer review (Abujudeh et al., 2014).

The data provided would indicate the radiology group implementing the new model of delivery experienced overall discrepancy rates within acceptable standards as compared to the RADPEER™ group, showing both pre- and post-implementation accuracy rates at 99.96% and 99.97%. This compares to the 97.89% benchmark recognized by RADPEER™, which compares to results achieved by other radiology groups reporting in the RADPEER™ database across the country. Finally, Appendix G shows the number of additional procedures each of the five rural Midwest hospitals were able to schedule at their facility, as opposed to having patients transferred to other hospitals for these radiology procedures, which the new model of delivery provides. Overall the data shows that four out of five of the hospitals experienced an increase in the number of procedures they provided on-site at their hospitals, which was viewed as added value by the hospital CEOs.
Results Summary

One hundred percent of the surveyed CEOs said the costs and efforts related to the new model of delivery were acceptable. Only 60% of those surveyed felt that the new delivery model had helped their hospitals reduce their costs. Of those who said the model had assisted their hospitals in containing costs, they also pointed out the improvements associated with sub-specialty interpretations, improved turnaround times, and access to scheduling additional procedures at their institutions. The investigation conducted by the researcher would indicate that based on the on-line survey data, the five hospital CEOs were satisfied with the results of the new model of radiology service delivery at their hospitals. Each of the participants surveyed conveyed they believed their hospitals benefited from the new model and they would recommend the implementation to healthcare providers considering such an implementation.

Participants communicated that sub-specialty interpretations were important and the improved turnaround times of radiology results were viewed positively. Timely access to radiologists was also commented as an attribute of the new delivery model. All of the participants conveyed that the new model of delivery, which included access to more on-site procedures, had improved patient care at their hospitals. Sixty percent of the participants indicated that sub-specialty support had provided a competitive edge when comparing their rural Midwest hospitals to larger facilities.

Future Investigation

There is potential for additional investigation and research in the area of new models of healthcare delivery. As reimbursement continues to challenge healthcare
providers and rural hospitals, it will be necessary to continue to find ways of offering value added services in a cost effective manner. The model of radiology delivery investigated by this researcher has the potential to be further developed and expanded into other areas of healthcare. These would include the support of governmental healthcare facilities, college and university health centers, and long-term care facilities. Although providing remote radiology services is not unique in the marketplace, the further development of remote off-site and on-site service delivery models may have a significant impact on cost and quality if adapted to other situations.

**Conclusion**

Changing a delivery model will involve a significant amount of effort and present potential risks for those initiating or proposing the change. Change leaders who understand the needs and expectations of the stakeholders they work with before communicating a change concept, may have greater success in the implementation phases of a new model of healthcare delivery. Mitigation efforts need to occur proactively and be included as a part of the implementation design. Radiology groups desiring to improve services while minimizing their own costs, may be successful in this process if they clearly communicate to hospital leaders that the improvement will be of value so that patients will be served effectively. Measurement methods should be outlined up-front to give added security that the efforts are genuine.

The satisfaction level of hospital stakeholders will most likely be tied to outcomes of the new model of delivery, the improvement of radiology services, and the specific benefits they specifically experience with the new model. Each stakeholder involved will
have varying levels of appreciation for specific changes to the overall organization. Hospital administration and medical staff members are generally motivated by improvements that yield patient satisfaction and increased market share. The more satisfied the patient, the more likely he or she is to return to a hospital for services (Otani, 2009). Improved turnaround times are important for several stakeholders; especially those impacted and measured themselves, such as the emergency room physicians. Emergency room physicians may be measured individually on the time it takes for them to see patients in the emergency room, diagnose and treat them, then have the bed ready for the next patient. Radiology, like other hospital support services, has an impact on length of stay, so factors such as turnaround time and specificity of results play big roles in the overall delivery of healthcare delivery to patients (Khatib, 2009).

Radiology providers have a unique opportunity to improve their level of services to rural hospitals using cost-conscious models of delivery that enhance services and potentially improve quality of care for patients. By modifying the methods of delivery, radiologists have the ability to provide high quality services to remote hospitals that may otherwise have levels of services reduced due to their geographical location. Radiology groups in turn can capture or retain market share, while still providing an appropriate quality of life and attractive practice opportunity for radiologists.

Radiology practices that offer combined on-site and remote radiology models have the distinct opportunity to serve rural community hospitals by delivering high quality, cost effective services in a variety of ways. This model of delivery can assist hospitals in capitalizing on their local economy, expand overall radiology services
available to patients and providers, improve access to specialist radiologists for improved quality, and enhance the overall competitive advantage of the rural community hospital.
References


INTEGRATED DELIVERY MODEL


**Appendix A**

Application for Determination of Exempt Status (per 45CFR46.101 (b) 2/3):
Observation, Survey, Interview (IRB-02 Social-Behavioral)

For Office Use Only
IRB #: _______ (Assigned by IRB office at the time of submission)

Contact and Study Information

<table>
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<tr>
<th>Study Title:</th>
<th>AN INTEGRATED DELIVERY MODEL FOR PROVIDING ON-SITE AND REMOTE RADIOLOGY SERVICES TO RURAL MIDWEST HOSPITALS</th>
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<tbody>
<tr>
<td>Principal Investigator (include credentials):</td>
<td>THOMAS C. DICKERSON</td>
</tr>
<tr>
<td>Phone:</td>
<td>217-257-1902</td>
</tr>
<tr>
<td>Email:</td>
<td></td>
</tr>
<tr>
<td>Department and School:</td>
<td>EdD, Interdisciplinary Leadership – Graduate School</td>
</tr>
<tr>
<td>Person who could answer questions about this application and the proposed research if other than the Principal Investigator:</td>
<td>Dr. John Hudson – Dissertation Committee Chair</td>
</tr>
<tr>
<td>Phone (The number to best reach you if there are questions):</td>
<td>402.312.8551</td>
</tr>
<tr>
<td>E-mail:</td>
<td></td>
</tr>
</tbody>
</table>

All other study personnel and their credentials (please check status of the individual and their role in this project such as mentor, advisor, consultant, investigator, etc.)

<table>
<thead>
<tr>
<th>Dr. John G. Hudson II</th>
<th>Faculty ☐ Staff ☐ Student ☐ Graduate Student/Resident/Fellow ☐ Other ☐ Role in Study: Dissertation Committee Chair</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Jeff Ehrlich</td>
<td>Faculty ☐ Staff ☐ Student ☐ Graduate Student/Resident/Fellow ☐ Other ☐ Role in Study: Liaison for Project</td>
</tr>
</tbody>
</table>

Application for Determination of Exempt Status: Observation, Survey, Interview
February 2013
Project Sites

☐ Creighton University

☐ Alegent Creighton Health; specific hospital(s) ____

☐ Alegent Creighton Clinic; specific clinic(s) ____

☐ Other (please specify): ______

If the study is being conducted at a non-Creighton affiliated site that does not have IRB oversight, an agreement between that site and the Creighton IRB must be completed prior to starting the project. (See the letter of agreement template)

Check type(s) of measures to be used:

☐ Passive Observation of Public Behavior

☐ Survey

☐ Interview

☐ Other (Describe) _____

Will information be recorded anonymously (i.e., no subject identifiers or codes that can be used to re-identify subjects will be recorded)? No ☐ Yes X☐.

Will “sensitive information” be recorded that could damage subjects’ reputation, employability, or financial standing, or place them at risk for criminal or civil liability? No X☐ Yes ☐

If yes, explain:

Will any information from this project be submitted to the FDA? No X☐ Yes ☐ If Yes, STOP and contact the IRB at irb@creighton.edu if you have questions.

Subjects

1. Who will be enrolled? Midwest Hospital CEOs in Illinois.

2. How many subjects will be enrolled? Five (5)

3. Will subjects under 19 years of age be studied? No X☐ Yes ☐

   If yes, to what extent will researchers interact with subjects?

   Note: This exemption is limited to individuals 19 years of age or older. Subjects under 19 can be passively observed in public places, but only so long as researchers do not participate in the activities being observed.

4. If children (under age 19) will be observed, complete the following section (a through f):

   a. Provide a rationale for the specific age ranges of children to be included:
b. Describe the expertise of the investigative team in dealing with children of that age range:

c. Describe the adequacy of the research facilities to accommodate children of that age range:

d. Will sufficient numbers of children be studied to answer the scientific questions?  
   No ☐ Yes ☐  
   Please elaborate.

e. Will the investigators interact directly with the child subject?  No ☐ Yes ☐

Recruitment

1. How will potential subjects be identified and how and where will they be approached for participation?  
   Five (5) CEOs will be identified, out of a potential pool of 10.  Participation will be chosen by the researcher.  
   CEOs will be sent a letter (sample attached) by email, requesting their participation.  
   Follow-up calls will be made by the researcher if necessary to complete communication.

2. Describe the recruitment materials (ads, letters, recruitment script, e-mails etc.) to be used, if applicable, and attach a copy to this application:  
   Recruitment will be conducted by e-mail request and the interviews will take place utilizing a Survey-Monkey survey, which will also be sent to participants by email.

3. Attach the introductory script that describes the study and includes relevant elements of consent.  
   View the model information letter script on the IRB website.  
   Not Applicable ☐  
   If not applicable, why?  ____

Methods

1. How will information be obtained?  
   Via email through an Internet Survey.

2. How will anonymity of data be maintained?  
   Data collection form will not contain names of interviewees or other personally identifiable information and IP tracking will be disabled.

3. Who will collect data?  
   Researcher- Thomas C. Dickerson

4. How often will subjects be contacted, and why?  
   Subjects will only be consulted during the interview, unless they voluntarily contact the researcher to convey additional information.

5. How many attempts will be made to contact?  (A maximum of 3 times will be allowed):  
   Initial invitation only with follow-up for confirmation.

6. If subjects will be paid or otherwise compensated (e.g., extra credit), indicate how much they will receive, and how they will be compensated:  
   There is no compensation for participation offered or implied.
7. If recruiting students or employees, how will coercion of the participant be minimized? X
   N/A (not enrolling students or employees)

Submit your study design/protocol OR complete the following section

1. Background and significance: The research associated with this Scholarly Leadership Project will include assessments of hospital administrators to gauge satisfaction with service delivery utilizing the proposed model implemented at their hospitals.

2. Rationale behind the proposed research and potential benefits to participants and/or society: The research is in the form of a Scholarly Leadership Project, which will serve to measure and validate the impact and effectiveness of a new model of radiology services delivery to improve services to rural Midwest hospitals.

3. Specific aims (research objectives):

   The purpose of this Scholarly Leadership Project Dissertation is to present a model of radiology delivery, which can be reviewed, refined, and implemented by other medical professionals and stakeholders within the healthcare industry. By presenting this project, those interested in this topic will be able to utilize this information as a resource to replicate or improve upon this proposed radiology delivery approach.

   The project will outline a model of delivery that has been designed for implementation to provide desperately needed radiology services to populations of patients that utilize rural Midwest hospitals to receive their care. The proposed model of delivery serves to expand the availability of radiology services by outlining methods of delivery intended to provide radiology services both on-site and through remote (off-site) means, utilizing teleradiology and high-speed Internet connections.

4. Specify objectives and hypotheses to be tested in the research project: The objective is to validate or improve upon existing models of radiology delivery for rural Midwest hospitals.

5. Statistical analysis: This Scholarly Leadership Project will include both qualitative and quantitative data that will be analysed as appropriate.

6. Potential benefits:

   It is believed that a new model of radiology delivery, which includes both on-site and off-site coverage, may be implemented successfully without negatively impacting quality or the speed at which services are delivered.

   This model of delivery may offer the opportunity to actually improve quality and the breadth of services delivered, if appropriately implemented.

7. References: See attached document titled: References

Additional Information, Clarification, or Comments for the IRB Reviewer: ____

Application for Determination of Exempt Status: Observation, Survey, Intervents
February 2013
Principal Investigator’s Assurance

The following signature certifies that the Principal Investigator (PI) understands and accepts the following obligations to protect the rights of research subjects. It is the PI’s responsibility to:

a. Ensure that the submitted protocol provides a complete description of the proposed research (contains adequate information regarding subjects’ rights and welfare and ensures that all applicable laws and regulations will be followed).

b. Ensure that, throughout the course of the study, all research personnel involved in the project conform to the applicable federal regulations and Creighton University IRB policies when conducting the research.

c. Secure all research-related records on file and acknowledge that the IRB may review these records at any time.

d. Promptly report any proposed changes to the research project (e.g., amendments, modifications, updates) to the IRB. Changes shall not be initiated until such changes have been reviewed and approved by the IRB, except to eliminate immediate hazards to subjects.

e. Inform the IRB immediately of any information that may negatively influence the risk/benefit ratio for subjects enrolled in the study.

I understand that failure to comply with applicable federal regulations and Creighton University IRB policies and procedures could result in suspension or termination of the research project.

[Signature]
Signature of Principal Investigator
(Must be signed by the PI, no designee)

Date
5-15-2014
May 19, 2014

Thomas C. Dickerson, EdDc
Graduate School
Interdisciplinary Leadership Program

RE: IRB #: 14-17092
TITLE: AN INTEGRATED DELIVERY MODEL FOR PROVIDING ON-SITE AND REMOTE RADIOLOGY SERVICES TO RURAL MIDWEST HOSPITALS

Dear Mr. Dickerson,

Thank you for submitting the above mentioned proposal to the Institutional Review Board office for review. This project has been determined to be exempt from Federal Policy for Protection of Human Subjects as per 45CFR46.101 (b) 2/3. All listed investigators have completed the required CITI HIPAA training. The project and exemption is approved is for a 3 year period.

2. Participation Request Letter
3. Project Survey Questions

Continued approval is conditional upon your compliance with the following requirements:

1. Compliance with the Creighton University IRB policies and procedures
2. Problems must be reported using the Reporting Form for Reportable New Information. Problems requiring report can be found in the IRB Policy 134 “Reportable New Information”
3. All protocol amendments and changes to approved research must be submitted to the IRB and not be implemented until approved by the IRB. Please use the modification form when submitting changes to protocol or consent documents.
4. This study cannot continue after the expiration date, which is xxx.
5. You are required to submit a renewal/termination prior to this date. If you wish to continue the project, the renewal must be in the IRB office on week prior to the expiration date.
If you should have questions during the course of this project, please call the IRB office at (402) 280-2126 and one of the administrators will assist you, or you may email the office at irb@creighton.edu.

Sincerely,

[Signature]

Christine Scheuring, B.S.
Administrator, Institutional Review Board

The Creighton University is fully accredited by the Association for the Accreditation of Human Research Protections Program, Inc.® (AAHRPP)

Creighton University has an Assurance on file with the Department of Health and Human Services: Assurance Identification No. FWA 00001078, the expiration date: July 6, 2016
IRB Registration Numbers: IRB #1Biomedical IRB # IRB00000155 (Expiration July 13, 2015); IRB #2 Social Behavioral IRB # TIRB20067 (Expiration July 13, 2015)

Creighton University has an Assurance on file with the Food and Drug Administration (FDA)
Assurance Identification No. FWA00001078, the expiration date July 6, 2016
IRB Registration Numbers: Registration/Identification No.IRB00000155
May 22, 2014

Dear Project Participant:

My name is Thomas Dickerson, and I am a doctoral student at Creighton University in the Interdisciplinary Ed. D. Program in Leadership, within the graduate school. In an effort to fulfill the necessary components of my scholarly leadership project dissertation, I am conducting a scholarly research project entitled, An Integrated Delivery Model for Providing On-Site and Remote Radiology Services to Rural Midwest Hospitals, regarding the delivery of radiology services to Midwest hospitals. I am therefore respectfully requesting your voluntary participation in my research, and would ask you to take a 15-20 minute on-line survey, to respond to a few specific questions related to your experience and expectations regarding the delivery of radiology services.

Your participation in this scholarly research project will remain confidential and your name and location will not be identified.

I would sincerely appreciate your participation in this study and should you have any questions related to your involvement, please contact me at (217)-257-1902, or email me at xxxxxxxxxxxxxxxxxxxxxxxxxxxxx.

Respectfully,

Thomas C. Dickerson
Appendix C

Participant Consent Form
Consent to Participate in a Scholarly Leadership Project
Creighton University

TITLE OF PROJECT: An Integrated Delivery Model for Providing On-Site and Remote Radiology Services to Rural Midwest Hospitals.

INVESTIGATOR: Thomas C. Dickerson

WHY AM I BEING INVITED TO TAKE PART IN THIS RESEARCH? The purpose of the research question will be to assess and gauge satisfaction with radiology service delivery utilizing the proposed and implemented model of delivery. This assessment will represent a measure of successful implementation and stakeholder satisfaction with the delivery of the new model proposed.

WHO IS DOING THE STUDY? Thomas C. Dickerson, a doctoral candidate at Creighton University, under the guidance of Dr. John G. Hudson, II.

WHAT IS THE PURPOSE OF THIS STUDY? The purpose of the project is to present a model of radiology delivery, which can be reviewed, refined, and implemented by other medical professionals and stakeholders within the healthcare industry. Those interested in the topic will be able to utilize the information to replicate or improve the approach.

WHERE IS THE STUDY GOING TO TAKE PLACE AND HOW LONG WILL IT LAST? The study will occur in the spring and summer of 2014 and participation will be limited to completing an on-line survey.

WHAT WILL I BE ASKED TO DO? Respond to a series of on-line survey questions and submit.

ARE THERE REASONS WHY I SHOULD NOT TAKE PART IN THIS STUDY? If you do not have access to the Internet, do not have the time to complete a short survey, or choose not to participate for any reason.

ARE THERE ANY BENEFITS FROM TAKING PART IN THIS STUDY? Providing valuable information, which may contribute to improvement of patient care in rural Midwest hospitals, as it relates to the delivery of professional radiology services.

DO I HAVE TO TAKE PART IN THE STUDY? Your participation is completely voluntary.
WHO WILL SEE THE INFORMATION THAT I GIVE? Your comments will be confidential and will not specifically identify you or the hospital you represent.

WHAT IF I HAVE QUESTIONS? Should you have any questions, contact xxxxxxxxxxxxxxxxxxxxxxxxxxxxx or phone me at (217) 257-1902. You may also contact my Dissertation Chair and Faculty Supervisor, Dr. John Hudson, II at xxxxxxxxxxxxxxxxxxxxx.

Please initial each activity and initial each step you agree to.

_____ To participate in the on-line survey.

_____ Yes, you may contact me if you have follow-up questions directly related to your survey responses.

Your signature acknowledges that you have read the information provided and agree to participate in this scholarly leadership project.

Signature of participant: _______________________________ Date: __________________

Printed name of participant: ____________________________

Signature of researcher: ________________________________ Date: __________________
Appendix D

Project Survey Questions

1. Has remote radiology coverage, in combination with on-site radiology coverage provided by radiologists, been successfully implemented at your hospital? Please elaborate on the success or deficiencies regarding implementation that your organization experienced.

2. How has the implementation of remote services benefited your hospital? If so, please give examples of those benefits. If they did not benefit your hospital, what steps could have been taken to improve the implementation?

3. Have the turnaround times of results met your expectations? If no, what could have been done differently to achieve a better outcome?

4. Has access to remote services in conjunction with expanded on-site procedural services improved patient care at your hospital?

5. Has access to remote sub-specialty radiology interpretations, given your hospital a competitive edge, by leveling the playing field between your hospital and those situated in larger communities? If so, can you provide examples?

6. Were the costs and efforts necessary to implement remote radiology services at your hospital acceptable?

7. Would you recommend the remote radiology services delivery model implemented at your hospital to other healthcare providers considering this?

8. Has the remote radiology services delivery model assisted your hospital and stakeholders by reducing costs of healthcare delivery? If yes, could you provide examples of how you believe cost containment was achieved?
Appendix E

Remote Radiology Services to Rural Hospitals Survey

Q1 Has remote radiology coverage, in combination with on-site radiology coverage provided by radiologists, been successfully implemented at your hospital?

Answered: 5   Skipped: 0

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<th>Responses</th>
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Remote Radiology Services to Rural Hospitals Survey

Q2 How has the implementation of remote services benefited your hospital?

Answered: 5  Skipped: 0

If so, please give example...

If they did not benefit...

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<td>If so, please give examples of those benefits.</td>
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<td>If they did not benefit your hospital, what steps could have been taken to improve the implementation?</td>
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<td>stat reads for the ED patients in particular CT scans</td>
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<td>Exceptional improvement in turn-around times for ED, mammography and imaging studies - significant improvement in care. New specialist are reading and interpreting our imaging work</td>
<td>5/23/2014 9:08 AM</td>
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<td>Improved turn around time on reports</td>
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<tr>
<td>4</td>
<td>Staffing is no longer an issue. Turn around times are excellent</td>
<td>5/22/2014 12:26 PM</td>
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<tr>
<td>5</td>
<td>Timely access to stat interpretations and fellowship trained radiologists to serve our patients</td>
<td>5/22/2014 12:25 PM</td>
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Remote Radiology Services to Rural Hospitals Survey

Q3 Have the turnaround times of results met your expectations?
Answered: 5  Skipped: 0

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<td>If no, what could have been done differently to achieve a better outcome?</td>
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# Type response here
Date

There are no responses.
**Remote Radiology Services to Rural Hospitals Survey**

Q4 Has access to remote services in conjunction with expanded on-site procedural services improved patient care at your hospital?

Answered: 5  Skipped: 0

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Remote Radiology Services to Rural Hospitals Survey

Q5 Has access to remote sub-specialty radiology interpretations given your hospital a competitive edge, by leveling the playing field between your hospital and those situated in larger communities?

Answered: 5  Skipped: 0

Answer Choices

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<td>mammography by subspecialists plus the ability for stat CT reports</td>
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<td>2</td>
<td>Installation of Digital Mammography transmitted to a bread center with immediate readings and consultation from specialist to both the primary care doctor and the very anxious patient - very positive response from patients.</td>
<td>5/23/2014 9:08 AM</td>
</tr>
<tr>
<td>3</td>
<td>Not an issue that consumers use in making choices. Not sure how much of an issue it is for our physicians.</td>
<td>5/22/2014 3:33 PM</td>
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<td>4</td>
<td>The availability of the interpreting radiologist on diagnostic mammograms to go over the results with the patient before leaving our facility has been well received.</td>
<td>5/22/2014 12:25 PM</td>
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Remote Radiology Services to Rural Hospitals Survey

**Q6 Were the costs and efforts necessary to implement remote radiology services at your hospital acceptable?**

Answered: 5  Skipped: 6

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Remote Radiology Services to Rural Hospitals Survey

Q7 Would you recommend the remote radiology services delivery model implemented at your hospital to other healthcare providers considering this?

Answered: 5  Skipped: 0

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Remote Radiology Services to Rural Hospitals Survey

Q8 Has the remote radiology services delivery model assisted your hospital and stakeholders by reducing costs of healthcare delivery?

Answered: 5  Skipped: 0

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<td>has allowed support to non-radiologists physician with more accurate interpretations of images when need which allowed the delivery of better patient at lower cost (less chance of a misread)</td>
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<td>Rapid definitive readings result in appropriate treatment, rather than empirical treatment that in some cases will be wasteful and unnecessary.</td>
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<td>3</td>
<td>Ability to schedule patients in a more timely fashion knowing each modality would be read by a radiologist with the necessary additional training to match the larger facilities with onsite radiologists. We do not worry about coverage which would be an issue for us in a rural area with stand alone radiologists.</td>
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### Pre Implementation Turnaround Time

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### Post Implementation Turnaround Time

**Data from period of 6/1/13-11/30/13**

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*Data from period of 11/1/12-4/30/13*

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*Data from period of 5/1/13-10/31/13*

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*Data from period of 4/1/11-9/30/11*

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## Post Implementation Turnaround Time

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### Pre Implementation Interventional Procedures

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### Post Implementation Interventional Procedures

*Data from period of 6/1/13-11/30/13*

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### Pre Implementation Interventional Procedures

**Data from period of 10/1/12 - 3/31/13**

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### Post Implementation Interventional Procedures

**Data from period of 4/1/13 - 9/30/13**

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### Pre Implementation Interventional Procedures

*Data from period of 12/1/12-5/31/13*

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### Post Implementation Interventional Procedures

*Data from period 6/1/13-11/30/13*

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### Pre Implementation Interventional Procedures

Data from period of 11/1/12-4/30/13

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### Post Implementation Interventional Procedures

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## Post Implementation Discrepancies

Data from period of 6/1/13-11/30/13

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## Pre Implementation Discrepancies

*Data from period of 10/1/12-3/31/13*

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## Post Implementation Discrepancies

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### Pre Implementation Discrepancies
*Data from period of 12/1/12-5/31/13*

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### Post Implementation Discrepancies
*Data from period of 6/1/13-11/30/13*

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### Pre Implementation Discrepancies

*Data from period of 11/1/12-4/30/13*

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### Post Implementation Discrepancies

*Data from period of 5/1/13-10/31/13*

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### Pre Implementation Discrepancies

*Data from period of 4/1/11-9/30/11*

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### Post Implementation Discrepancies

*Data from period of 10/1/11-3/31/12*

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### Appendix I

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*National Benchmark for Accuracy Rate: 97.89%*