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A Measurement of Readiness for Tennessee Hospitals to Implement "Meaningful Use" Criteria Resulting from the American Recovery and Reinvestment Act, 2009

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ABSTRACT

A Measurement of Readiness for Tennessee Hospitals to Implement "Meaningful Use" Criteria Resulting from the American Recovery and Reinvestment Act, 2009

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In 2009, the American Recovery and Reinvestment Act was signed into law. This legislation provided for monetary rewards for those acute-care hospitals that meet "meaningful use" computerization and reporting criteria.

The study used a descriptive, nonexperimental design to answer three research questions (1) What is the level of readiness to meet "meaningful use" criteria in the Tennessee Hospital Association (THA) member hospitals; (2) What is the level of readiness to meet "meaningful use" criteria in the rural THA member hospitals; and (3) Is there a difference in the readiness to meet "meaningful use" criteria between rural and urban THA member hospitals?.

A survey was sent to 115 THA member hospital, with a return rate of 83% (N=95). The inclusion criteria focused on acute-care hospitals, with rehabilitation, psychiatric and long-term care hospitals falling into the exclusion criteria.

The Readiness Score was determined for the total survey respondents (N=95), as well as for the rural (N=41) hospitals and urban (N=54) hospitals in the Tennessee Hospital Association

member hospitals meeting the inclusion criteria. Z-scores of the readiness score were examined and indicated that there was one outlier with z>3.0. Therefore, that case was removed from the comparison in the t-test (N=94). The t-test comparison of rural and urban hospital found a significant difference at (p=.002), two tailed.

To ensure that the slightly nonnormal distribution of the readiness scores did not explain the difference found with the t-test, an additional nonparametric test was also conducted. The Mann Whitney U-test showed that even with the assumption of a normal distribution is not made, the difference in readiness between urban and rural hospitals is still statistically significant at p=0.026.

DEDICATION

This work is dedicated to my mother Mildred G. Wallin who always encouraged me that I could do anything and that education could never be taken away from me. She is correct! To my husband Dean Wilhoit who has never wavered in his support of my quests, without his support, I would never have achieved many successes.

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CHAPTER 1

INTRODUCTION

Borrowing from the philosopher Goethe, the Institute of Medicine's July 2001 *Crossing the Quality Chasm, a new health system for the 21st Century*, opened with very applicable words for our nation's healthcare systems: "Knowing is not enough; we must apply. Willingness is not enough; we must do."(p.iii) That same report proclaimed the current United States's healthcare situation as "flawed" and offered suggestions for a remedy, which included computerized charting and order entry as well as seamless communication across healthcare entities. A decade later, the 2011 Institute of Medicine's Report (IOM), "The Future of Nursing," reported that healthcare system-wide changes were needed that capture the full economic value of nurses and take into account the growing body of evidence that links nursing practice to the latest technology and improvements in the safety and quality of care. The IOM report again outlined the advantages of the computerization of the health record.

Since the beginning of organized healthcare, the accuracy of patient care delivery has been directed by handwritten orders and communications, and for well over 15 years, computers in healthcare have been believed to add improved safety options and clarify handwriting. Yet, 2009 research by Jha et al. reported that in the hospitals of the United States little adoption of the electronic order entry and documentation as well as decision support had occurred (Jha et al., 2009).

Such alarming inaction sparked legislation. In February 2009 President Barack Obama signed into law the American Recovery and Reinvestment Act (ARRA) (42 U.S.C. 201), included in the healthcare reform bill and stimulus funding. As part of the ARRA, the Health Information Technology for Economic and Clinical Health Act (HITECH) signed by the

President in 2009 provided for the implementation of the certified electronic health record (EHR) designed to address recommendations from three previously published reports, *To Err is Human: Building a Safer Health System*, (1999, 2001, and 2011). The HITECH Act specifies that each citizen should have his or her health information electronically available, accessible from anywhere, and in legible form. Also, a personal benefit from EHR systems is clear communication regarding provider orders and plans of care for healthcare team members. Perhaps the largest benefit is increased safety to consumers who need medication administration in the hospital, an area identified in the IOM report as in critical need of attention (IOM, 2001). The HITECH Act addressed the need, through electronic checking, to decrease medication administration errors (ARRA, 42 U.S.C. 201).

The HITECH ACT rewards providers that implement EHR and report identified measures of compliance beginning in 2011. More specifically, the HITECH Act allocated over $19 billion to accelerate the adoption of EHR and build a national infrastructure for health information exchanges (HIE) to improve the quality, communication, and coordination of care among healthcare providers. The majority of the funding was made available in the form of Medicare and Medicaid incentives, which commenced in January 2011, to eligible hospitals, physicians, and nurse practitioners in clinics that demonstrate "meaningful use". While the definition of "meaningful use" for measurement and reporting is still evolving, the first definitions were released in July 2010 and appear as a series of reportable measures listed as objectives in appendix A and B. Hospitals began to report compliance with EHR functionality in 2011 (Blumenthal & Tavenner, 2010). With monetary incentives now in place, there has been accelerated attention to implement, measure, and report. The criteria require demographic information on 50% of patients, maintenance of active medication lists and allergies for 80% of

the patients, computer provider order entry for medication orders for over 30% of patients, reporting clinical quality measures to CMS or states by 2012, and use of EHR technology to identify and provide patient-specific education resources (ARRA, 42 U.S.C. 201).

The Problem

In 1996 the healthcare industry in the United States ranked 38th for investment in information technology out of the 53 industries surveyed (US Department of Commerce, 1999). Alternatively, computerization of the medical record has been common practice in Europe, Australia, and Asia. In addition, German health policy regulators adopted a requirement in 1985 for the (six) steps of nursing process to be documented and has implemented computerized medical records including nurses' and physicians' documentation for the past 20 years. (Ammenwerth, Mansmann, Iller, & Eichstadter, 2003).

Three published studies reflect the readiness of hospitals in general and none are published related to Tennessee hospitals' readiness to meet and report meaningful use criteria (AHA, 2011; Jha et al., 2009; NRHA, 2010).

In September 1999 the Committee on the Quality of Health Care in America gathered national experts to list areas in which information technology could contribute to improved patient care. These areas included access to medical knowledge through the World Wide Web, computer-aided decision support systems, collection and sharing of clinical information, reduction in errors, and enhanced patient communication through direct communication with a care provider (IOM, Quality Chasm, 01).

In response, a coalition among the Department of Health Policy and Management, Harvard School of Public Health, the Division of General Medicine, Brigham and Women's Hospital, the Veterans Affairs Boston Healthcare System, the Institute for Health Policy, the

Biostatistics Center, Massachusetts General Hospital, and the Department of Health Policy at George Washington University in Washington, DC deployed a plan to study all the hospitals in the United States to measure the amount of progress that had been made in bringing EHR to life in healthcare facilities.

The coalition employed the help of American Hospital Association (AHA), a stakeholder to the research, and disseminated a survey of U. S. hospitals to measure their levels of computerization, ability to show information outside of "silos" (interdepartmental focus) and across the care continuum, and document the implementation of physician order entry.

The results of the study by Jha et al. (2009) revealed that only 1.6% to 2.2% of urban acute care hospitals had a comprehensive electronic-records system, and 0.3% to 0.9% of rural hospitals had fully implemented computer systems. Computerized provider order entry (CPOE) for medications had been implemented in only 17% of hospitals (Jha et al., 2009). Hospitals that reported having an electronic health record were more often larger, major teaching hospitals that were a part of a larger hospital system or classified as urban hospitals with a dedicated coronary care unit (Jha et al., 2009). In addition, the reporting requirements of "meaningful use" mandate integrated information systems: information systems that can share and synthesize information across departments and have physicians' order entry and information sharing among facilities. These findings are important in that they illustrate the wide gap between the current status of EHR implementation in U. S. hospitals and the "meaningful use" mandate.

In addition, the findings revealed rural hospitals reported remarkably fewer fully implemented computer systems within their facilities and listed financial resources as the top barrier to implementation (Jha et al., 2009). Tennessee has 64 rural hospitals of a total of 155

hospitals in the state. Rurality exacerbates the "meaningful use" problem as many rural hospitals lack the resources to implement EHR, including clinical documentation and CPOE.

In January 2011 the AHA surveyed 1,297 nonfederal, short-term acute care member hospitals. These hospitals were asked to identify if their hospital could meet the individual components of "meaningful use" and also to indicate if their EHRs used currently were certified for each of these individual component objectives. Findings demonstrated that 0.8% of rural hospitals (7 out of 598 responding rural hospitals in the United States) currently met all of the 'meaningful use' and EHR certification requirements (AHA, 2011).

Rural Hospitals

The obstacles faced by healthcare providers and patients in rural areas are vastly different from those in urban areas. Rural Americans face a unique combination of factors that create disparities in healthcare not found in urban areas. Economic factors, cultural and social differences, educational shortcomings, lack of recognition by legislators, and the sheer isolation of living in remote rural areas all converge to form a context where rural Americans struggle to lead normal, healthy lives.

The National Rural Health Association (NRHA) recommends that definitions of rural providers be specific to the purposes of the programs in which they are applied and the NRHA accepts the definition of the Tennessee Hospital Association (THA). For the purpose of this research, the rural hospitals of Tennessee will include those hospitals so categorized by the THA. The THA uses the criteria of being outside the metropolitan statistical area, as designated by the U. S. Census Bureau (2009), to define the status of a hospital as rural. According to THA criteria, Tennessee has 64 rural hospitals.

Purpose of Study

The purposes of this study are to: 1) describe the readiness of THA member hospitals and 2) compare the readiness of the rural and urban THA member hospitals. The study uses data collected by the THA that measured the level of readiness to meet "meaningful use" criteria. Data are analyzed to answer the following research questions: 1) what is the level of readiness to meet "meaningful use" criteria by THA member hospitals; 2) what is the level of readiness to meet "meaningful use" criteria by the THA member rural hospitals; and 3) is there a difference between the readiness for THA member urban hospitals and THA member rural hospitals?

The HITECH Act (2009) mandated the implementation of electronic health records, computerized physician order entry and closed loop medication administration, and documentation (see Appendix A). Reimbursement for EHR implementation began in 2011 and by 2015, 100% compliance is required to qualify for Medicare or Medicaid payments.

Conceptual Framework

The conceptual framework for the study is based on the theory of organizational readiness for change developed by Weiner (2009). Weiner's construct of readiness reveals that it is multi-level and multi-faceted. As an organization-level construct, readiness for change is described as the "shared resolve" of the members of the organization to implement the change and a "shared belief" in their ability to accomplish the change, according to Weiner. Organizational readiness for change varies related to how much value the team members of the organization place on the change and how positively the team members perceive three key determinants of implementation ability: "task demands," "resource availability," and "situational factors" (Weiner, 2009). When the team members of an organization have begun to implement the change, are generating increased energy, demonstrate increased focus on their efforts to make

changes, and exhibit increased team work and collaboration, a higher level of readiness and successful, though, effective implementation of change can be predicted (Weiner, 2009).

Readiness in each hospital is achieved through organizational culture, institutional policies and procedures, past experience with change implementation, as well as resource availability. Of specific relevance to this study, resource availability refers to both human resources and monetary resources. Therefore, the collective readiness of Tennessee hospitals was affected by multiple variables. Rural hospitals with fewer resources, both human and monetary, most likely experience additional challenges that decrease the level of readiness. In the Weiner Theory there is also consideration for the influence of the initiator of the change. Because the federal government was the initiator of this change, the readiness of the organization has been affected. The initiator influence is a direct influence on implementation effectiveness. Figure 1 depicts the concepts of the theory of organizational readiness for change appropriate to the hospital readiness for the implementation of the Electronic Health Record.

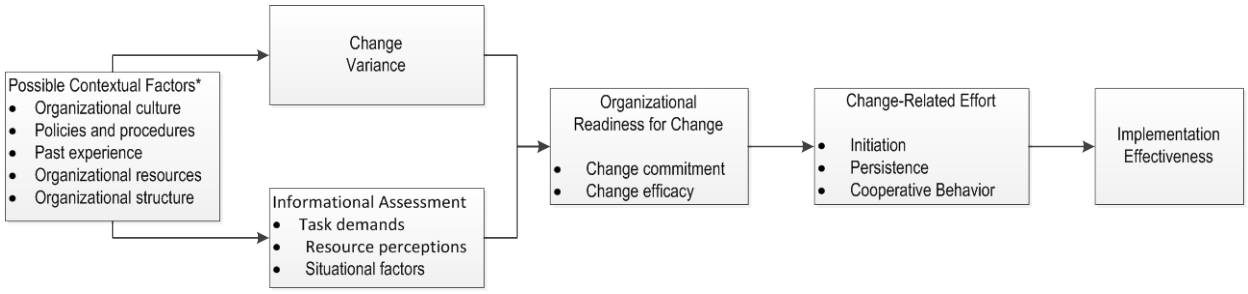

Figure 1. A theory of organizational readiness for change (Weiner, 2009).

Summary

The basis for this research is the application of the constitutive definitions of “readiness” and “meaningful use” criteria. These factors frame this study on the readiness of rural and urban hospitals in Tennessee to implement the electronic health record and to meet the “meaningful use” reporting criteria.

CHAPTER 2

LITERATURE REVIEW

The review of the literature addresses the implementation of electronic health records (EHR) in international countries and the United States, the concept of "readiness", the most recent research related to legislation that supports the implementation of "meaningful use" criteria, as well as the potential impact on rural hospitals. Findings from the literature related to the implementation of EHRs indicate that most hospitals in the United States are not ready for implementation due to a variety of factors including lack of information technology (IT) infrastructure, caregiver reluctance, EHR vendor issues, and financial restrictions (AHA, 2010; Jha et al., 2009; Rural Health Association, 2008). Rural hospitals face special challenges because sources of funding are different for them, and they often have no access to financial support or lines of credit needed to implement EHRs.

The literature related to the implementation of EHR spans more than 40 years. Four major areas are identified in the literature and are: (a) description of readiness as a concept with the very limited research or analysis of the readiness to implement the EHR; (b) international implementation experiences; (c) early U.S. implementation of systems developed "in-house" and implemented by very few hospitals or the Veteran's Administration; and (d) recent investigation related to the urgent need to implement EHR to impact quality and safety and to reduce the cost of healthcare.

Changes in the workflow of health professionals who provide patient care – such as concurrent documentation on personal computers and hand-held devices and entering orders into the computer – have happened slowly, and readiness for implementation has been noted as a major issue. In addition to required technology for EHR implementation, readiness requires high

levels of initiator persistence, as well as cooperation between information technology (IT) staff, clinical informatics professionals, and healthcare providers (Stablein et al., 2003). Staff is integral to readiness because, according to Bandura (1997), the readiness of an organization is "based more on what they believe than on what is objectively true" (p.34). In other words, all staff members and physicians need to work together and have confidence in their skills and in the EHR if implementation is to be achieved in the clinical setting.

Readiness

Defining Readiness

In his 2009 research, Weiner, an organizational psychologist, defined organizational readiness and developed a theory of its determination and outcomes. Rooted in the work of Bandura (1997) and related to self-efficacy beliefs, Weiner (2009) determined that readiness is determined by "levels of motivation, affective status, and actions," and is "based more on what they believe than on what is objectively true" (p.2). Simply described, Weiner's research found that people's behaviors can often be better predicted by the beliefs they hold about their capabilities than by what they are actually capable of accomplishing. Thus, self-efficacy perceptions help to determine what individuals do with their knowledge (p. 4).

The theory of organizational readiness described by Weiner (2009) is defined as a shared psychological state in which organizational members feel committed to implementing an organizational change and are confident in their collective abilities to do so. This description allows for examination of organizational changes where collective behavior change is necessary in order to effectively implement the change and, in some instances, for the change to bring about the anticipated benefits. As Weiner (2009) noted, organizational readiness for change is

not only a multi-level construct, but a multi-faceted one. Organizational readiness is very dynamic, fluid, and situational (pp. 1-2).

If all of the essential factors identified for a change (Figure 1) such as organizational culture, policies, and procedures, past experiences, organizational resources, and organizational structure (Weiner, 2009) are present in appropriate levels, organizational readiness for change emerges, reflecting the change commitment and, thus, the change efficacy level. Related efforts to the change readiness level are the actual initiation of the change plan, the follow-up, and persistence to follow the plan, along with cooperative behavior from all staff to accomplish the change. The final construct of the theory is the measure of implementation effectiveness. The implementation effectiveness is the measure of not only the breadth of the implementation but also of the ability of the implementation to meet the project goals and the sustainability of the implementation (Weiner, 2009). For this study collective behavior, as described by Weiner (2009), was not a part of the organizational process, as legislative mandates drove the necessity and pace of change. One area that Weiner (2009) describes, organizational resources, figures prominently in the change process required for EHR implementation especially for hospitals that are rural and small and have fewer resources than larger, urban counterparts (Weiner, 2009).

Assessing Readiness for User Acceptance

Several researchers – Sister Mary Jean Ryan and Stablein et al. – investigated the concept of readiness in 1993. Sister Mary Jean Ryan, FSM, president of SSM Health Care, led her system to analyze readiness for integrated care delivery. Her planning efforts identified that integrated information systems (i.e., connected information systems that could communicate with one another) would be needed to connect all sites of care as an element of readiness for the coming change (Ryan, 1993).

Ryan's suggestions included identifying the size of the population to be served, the network's service area, the type of network organization, the potential partners (hospital, physician, and payer), and services to be provided by the ministry, the financing mechanisms, the capital requirements, the probability of the network coming together, and the probability of its success. While her analysis was based upon her research within the SSM health system, she identified essential elements for consideration in readiness. The external reporting requirements and the measurement of outcomes were obviously omitted (Ryan, 1993).

Stablein et al. (2003) assessed the readiness of hospitals for computerized physician order entry (CPOE). The introduction of CPOE brings the physician into the process of entering their orders and eventually their progress notes on computers. A readiness assessment tool was developed that included the external environment; organizational leadership, structure, and culture; care standardization; order management; access to information; information technology composition; and infrastructure. The assessments for readiness in the first 17 hospitals (bed sizes ranged from 75 to 906 beds) indicated that the lowest average component score was in care standardization, while the highest average component score was in organizational structure and function. Interestingly, organizational culture and the order management process had very low average scores.

The researchers identified significant gaps of readiness in 17 hospitals they examined. As they described, the major contributive finding of the study was that assessment of readiness and identification of the gaps are helpful so that those gaps may be addressed prior to implementation, therefore reducing risks to the organization. Perhaps a more important summary assertion made by Steblein et al. (2003) was that readiness components are designed to achieve a balance between the people, the structure, the process, and the technology indicators

for CPOE implementation. Regrettably, Stablein et al. (2003) failed to mention or recognize the financial readiness for such an implementation. They assert that implementation successes and failures depend more on organizational and personnel factors than technology factors (Stablein et al., 2003).

The research evaluation tool for assessing readiness had only two of the nine components described by Blumenthal and Tavenner (2010) to evaluate technology readiness. It is interesting to contrast Stablein et al. (2003) to the current situation to measure readiness. The federal ARRA, HITECH and DHHS guidelines have defined the technology functionality that must be accomplished, but the reality is that very few, if any, of today's technology vendors have all of the described functionalities required to meet meaningful use criteria. Certainly, the people and organizational readiness components should not be minimized; however, the technology's functionality is emerging as very important in the current implementation to meet the meaningful use criteria.

Stablein et al. (2003) further identified that hospitals with a history of success with multidisciplinary collaboration had the necessary accountabilities and structures in place, and physicians had a direct voice in shaping the future clinical direction for the organization. Readiness was greater because CPOE was basically a performance improvement project or a clinical project (rather than a technology project). Hospitals at lower levels of readiness in these components can be expected to have a much harder time building the necessary leadership, decision making, collaboration, and medical staff participation needed for CPOE (Stablein et al., 2003)

Other indicators of readiness included a track record of meeting clinician user demands, a stable and robust technology infrastructure, and a strong skill mix in the IT department (i.e.,

experience with large-scale clinical implementations, remote access, and mobile devices). Prior physician experience with clinical systems also translated into less training of physicians in system basics and a higher state of readiness (Stablein et al., 2003).

For every hospital in this study, at least one external factor was pushing CPOE as an important agenda, and a number of the hospitals experienced multiple factors, such as The Leapfrog Group and Joint Commission on Accreditation of Healthcare Organizations' patient safety requirements and local market competition. This is a particularly pertinent factor as the HITECH Act is a very strong external force influencing from both a financial payment position and patient safety position (ARRA, 42 U.S.C. 201).

Hospitals that scored high in organizational leadership had internalized patient safety as a top priority, with clear executive-level accountabilities and organizational structures to support a dedicated patient safety program. Gaining value from CPOE requires designing the new processes and tools within the framework provided by the organization's safety and quality program. Hence, those hospitals that have clear accountabilities, structures, and processes regarding patient safety are ahead of the game in leveraging CPOE clinical decision support tools, (Stablein et al., 2003).

Because CPOE requires physicians and their assistants to change, it is undoubtedly the largest-scale clinical performance improvement effort a hospital can undertake, at least in terms of the direct involvement of every physician, nurse, other clinical staff, and staff on every patient care unit. Thus, project structures for performance improvement and the hospital's track record in making changes in physician practice (regardless of how small) are among the indicators of readiness. The good news for the hospitals in this research is that a majority had pre-existing multidisciplinary approaches to problem solving that included medical staff, nursing, and

pharmacy. Having leadership and the perspectives of these clinicians at the table has been noted as critical (Stablein et al., 2003) and it is better if a previous track record of working together exists. Many of the 17 hospitals had histories of improvement projects (with and without information systems) that exceeded time and/or budget and had mixed success in achieving the desired outcomes (Stablein et al., 2003).

The hospital's culture and history, with respect to change, sets the stage for common purpose and trust that CPOE implementation is not only feasible but it will also deliver the desired outcomes. Culture matters for any change effort but is particularly important for CPOE because so many individuals and processes within the hospital are affected and because success requires a multi-year effort. The cultural backdrop and readiness for CPOE are also influenced by the organization's basic approach to innovation (Stablein et al., 2003).

In Stablein et al. 2003 research to assess hospitals (N=17) readiness for CPOE implementation there were two groups of hospitals: 1) those with demonstrated success in large scale implementation, which were the majority, and 2) those with mixed success. Research findings included 1) a history of collaboration between clinical services and Information Technology (IT) departments was a key factor in reported readiness; 2) those hospitals that reported an established remote access for physicians and increased amounts of clinical data, reference information, and other computer functionality had the highest reported readiness; 3) the lower the reported readiness in the experience of implementation and support and maintaining functionality the lower the reported readiness and less success with computerization implementation; 4) noted as a most important factor finding, while no specific numbers were provided by the researchers, all of the hospitals reported gaps identified in the CPOE implementation and identifying these gaps were key in driving increased computer system

functionality and increased readiness for future implementation; and 5) the higher the collaborative relationship between medical staff and the leadership team the higher the level of readiness for CPOE implementations. There were no levels of significance reported; however, the identification of current computer system gaps was reported as key in driving the plan for future implementations and increasing readiness for implementation. The researchers suggested that their findings could be related to any CPOE implementation. The issues examined in this research study should be addressed for the maximum readiness for improvements to achieve quality and safety to be fully realized (Stablein et al., 2003).

None of the hospitals in this research study were referred to as rural, with the smallest hospital having 75 beds, but the overall organizational assessment and findings are very consistent with the Weiner theoretical model, which considers the same components of readiness. An obvious omission from the findings of this readiness survey results is the financial availability and finance support for the implementation of CPOE (Stablein et al., 2003; Weiner 2009).

While the Stablein et al. (2003) research offers valuable findings related to the concept of readiness, the survey instrument did not contain the elements of the current "meaningful use" criteria and could not be included as the tool for this research proposal.

International Implementation Experiences

In 1998 Ammenwerth reported on a 2-month randomized controlled trial based on 60 patients on a ward in the Department of Psychiatry at Heidelberg University Medical Center in Germany. The study investigated the influence of computer-based nursing documentation on time investment for documentation, quality of documentation, and user readiness. Time measurements, questionnaires, documentation analyses, and interviews were used to compare

patients' care documented with the computer-based system (PIK group – PIK was the name of the computer software used) with the control group which were patient's care documented with the paper-based system.

The results of the study revealed both advantages and disadvantages of computer-based nursing documentation. Advantages seen in the PIK group included lower time needed for nursing care planning and that some formal aspects of quality – such as decision support with computerized lab values – were considerably better. The major disadvantage in the PIK group was that greater amounts of time were required for documentation of tasks and for report writing. User acceptance among nurses increased significantly during the study, and interviews indicated that PIK had a positive influence on the cooperation between nurses and physicians (Ammenwerth, 1998).

A study by Chan (2006) investigated knowledge, attitudes, and skill patterns of nurses toward EHRs in three hospitals in Hong Kong (N=242). The findings described nurse-users' specific needs with the EHR system and preferences for modification of the clinical documentation system. In this study, needs and attitudes were correlated with the age of the nurses. Researchers found that older, more experienced nurses had more positive attitudes toward EHRs, but self-reported as less skillful using the EHR.

A Taiwanese research study (Lee, Lee, Lin, & Chang, 2005) investigated the factors related to clinical nurses' use of a computerized nursing care plan in their daily practice. Of the nurse respondents (N=738), 84% were clinical nurses and the remainder shared some management responsibilities. The results indicated that younger nurses with more education spent less time using the computerized nursing care plan. Nursing experience (length of time as a nurse) had no effect on system use. Additionally, nurses who reported that wider use of

computers benefitted nursing efficiency, education and training capabilities, and system usability spent less time using the electronic care plan system. The researchers found that the more education the nurses received and the more they perceived the system as user-friendly, the less time they spent using it. These findings are not an indication that the nurses used the system to achieve greater efficiency in actual direct patient care or patient care outcomes. The nurses perceived the system as beneficial for uses other than direct care, such as nursing research, nursing content, and checking patient data. This effect was not initially significant in the findings, but was revealed after the other variables were controlled in the regression model. This unexpected finding contradicted the researchers' model by indicating that once nurses understand the benefit of using a computer system, they might spend more time maximizing its use. The system being evaluated was a documentation tool, used frequently prior to current integrated systems; therefore, the impact related to this study centered on compliance with documentation standards, efficiency (time saving), and user acceptance and satisfaction rather than patient safety and improved patient outcomes.

A case study of three healthcare institutions in Japan conducted by Ochieng and Hosoi (2005), examined the effects of three factors: 1) information technology skills of healthcare workers; 2) present status of computerization in their organizations; and 3) worker attitudes on the diffusion of EHR in the healthcare environment. Healthcare workers, including administrative nurses and clerical staff, participated in the research (N=390). Significant findings included that at least 50% (N=195) of the respondents agreed with the statements that: 1) EHR is a necessity in clinical practice; 2) EHR can significantly improve the quality of patient care; 3) computers are more beneficial for administrative than clinical functions; and 4) training staff is too much effort. Healthcare workers interviewed in the study had positive attitudes toward

computerization in healthcare, and contrary to some previous research the healthcare workers did not believe that the use of computers interfered with the doctor-patient relationship. All respondents agreed that the cost of computerization in healthcare was prohibitive, a finding that is evident in current research. As in the previously described studies, the focus of this study was on the healthcare user and not the patient or the benefit of improved care outcomes that computerization could bring. Overall, the Ochieng and Hosoi (2005) study did not focus on individual use, the impact of organizational support systems, implementation, or patient care benefits.

In summary, international researchers have attempted to demonstrate the importance of computer experience to acceptance of the computer as part of the nursing process and to display the need to fit the documentation system to the workflow and the functionality of a clinical nursing documentation system (Ammenwerth, 1998; Chan, 2006; Lee et al., 2005). Published studies did not measure change in work processes as they relate to quality improvement or outcomes but instead focused on the ability of the computer system to conform or match the workflow patterns of doctors and nurses. Overall, computerization was not widely accepted due to the inability of the EHR documentation format and flow to fit the workflow norm of the current practitioners.

Early US Implementation of Systems

A majority of research related to implementation of computerized documentation systems in the U.S. measured physician use, knowledge, and attitudes toward computers. Cork, Detmer, and Friedman (1998) in a study of physicians (N=777) reported a strong correlation between computer use time and computer optimism as well as a very high demand for the computerization to fit the functionality of physicians' workflow. In other words, the more

computer savvy the physician, the more he or she felt EHRs were beneficial – as long as the systems fit his or her workflow.

Gardner and Lundsgaarde (1994) studied nurses' and physicians' computer access to patient information including laboratory results, demographic information, EKG data with electronic interpretation, nurse care plans, and computerized nurse charting versus handwritten charting. The respondents were asked to rate the importance of the components in the functionality of the EHR and items listed above – the ability to look at lab results, demographic information, EKG data with electronic interpretation, nurse care plans, and computerized nurse charting – rated as statistically significant.

Schoenbaum and Barnett (1992) listed six factors that impeded acceptance of a computerized medical record. Two of these factors involved changes that affect healthcare professionals: 1) that physicians needed to change their processes for documentation; and 2) connectivity with the care providers' systems and the hospital's systems required addressing system interface issues.

McDonald, Tierney, Overhage, Martin, and Wilson (1992) found that getting the data into the system was the difficult part of the electronic medical record implementation. In response to this problem, McDonald and the Regenstrief Group developed a strategy for collecting data and building their EHR in stages (McDonald et al., 1992; Tierney, Miller, Overhage, & McDonald, 1993).

Anderson, Aydin, and Jay (1994) identified many technical and organizational factors associated with implementation and adaptation of medical information systems that leave a disillusioned consumer with unmet expectations and additional system costs that were never presented or discussed by the vendor prior to implementation. In addition, the limited diffusion

and underuse of these systems relate to a wide variety of psychological, social, organizational, and management factors that characterize the contemporary healthcare setting (Anderson & Jay, 1987).

Several research studies focused on nurse attitudes, time in use, or perceived usefulness. A study by Sultana (1990) revealed nurses had largely unfavorable attitudes toward computers. Sultana's study measured the amount of time the nurses spent using a computer daily and weekly and examined the nurses' perceived usefulness of the computer system. Later, in 1994 InterMountain Health, a healthcare corporation, had a growing reputation for shifting to healthcare outcome measurement related to best practice care bundles and, in some cases, evidence-based care. In Gardner and Lundsgaarde's 1994 research of InterMountain Health, they focused on comparing perceptions of usefulness and measuring familiarity with computers and time spent using computers with user attitudes and acceptance, as well as supported decision making. Significant findings from this research included the inability to predict satisfaction with the computerized system by age, specialty, and general computer experience. Instead, satisfaction was correlated with duration of use and frequency of use of the system. They concluded that multiple users and data use factors must be considered as the EHR is further developed (Gardner & Lundsgaarde, 1994).

A variety of researchers have looked into user acceptance (Chan, 2006; Getty, Ryan, & Ekins, 1999; McNeil, Elfrink, & Pierce, 2004; Sultana, 1990). Getty, Ryan, and Ekins (1999) compared the attitudes of nurses who had little or no experience with computerized documentation of care to those with increased computer use times and measured participant computer literacy. Both nonusers and users had favorable attitudes toward computerized care plans; however, nonusers with previous computer experience had more favorable attitudes

toward the introduction of computerized care planning than those with no previous computer experience.

In one nurse focused study, Ammenwerth, Kutscha, Eichstadter and Haux (2001) investigated the factors that influenced computer-based documentation of the nursing process related to time, nursing care quality, and user acceptance. Ammenwerth, Mansmann, Iller, and Eichstadter (2003) investigated improving the nursing process documentation in an electronic system. Nurses reported acceptance of the electronic record and reported it was time consuming. There were no measurements of perceived usefulness in improving patient care outcomes, but there was perceived improved impacts on research and data collection related to patient care.

In 2005 Lee et al. presented a study analyzing the factors related to clinical nurses' use of a computerized nursing care plan and nursing documentation in their daily practice that found that nurses reported the documentation as time consuming and not necessarily beneficial to the patient care process.

In summary, integrated functionality for EHR has only begun to emerge in recent years (2004 through 2011). Most studies measured user attitudes about computers rather than the impact of EHRs on patient outcome quality, safety, or the cost of healthcare.

The Urgent Need to Implement EHR

Background Information

In order to draw informative conclusions from the results of the most recent research, it is important to understand that the Diagnostic Image transfer is the PACS system that is used in radiology and an EKG/Cardiac Ultra Sound Digital technology that can be transmitted across sites. This is a technology that has led the way in actual implementation; however, the reports

from the readings of these mediums may still be dictated and transcribed and scanned into the EHR, which does not meet the meaningful use criteria.

The Master Patient Index refers to an admitting system and the progress in that implementation is due to the billing systems and financial systems being the most advanced of all hospital computerization (AHA, 2011). Computerized appointment systems are also fairly prevalent; however, most of these systems do not integrate or communicate with each other or with physician offices. Integration and communication across sites is part of the comprehensive computerized technology that the meaningful use criteria require.

The ARRA and "Meaningful Use"

The advent of the ARRA legislation in 2009 brought a radical change to the healthcare environment related to EHR implementation and research opportunities. The question of user acceptance and EHR system usability were no longer relevant because with the new legislation came financial incentives for implementation on a prescribed timeline. The focus of research opportunities shifted to explore hospitals' timelines for implementation and the ability to implement the EHR. EHR implementation, according to the legislation, relates to a fully integrated EHR that can pass patient information across sites on the continuum of care, capture and store key indicators of quality outcomes of care, as well as report externally the outcome measures from an electronic database with fully electronic transmission of the data. Further, there are elements of meaningful use that address patients' ability to access their health information electronically if they desire to do so. The "meaningful use" criteria (appendix A and B) are specifically described, along with the reporting time table in developing rules and regulations related to the ARRA legislation implementation. In order to benefit from the stimulus dollars (through the HITECH Act), each participating hospital and office practice must meet a

specific reporting timeline. Due to the current financial burdens faced by hospitals, the funding to support the implementation of the EHR is beneficial and in great demand. As a result, there is great interest in the ability of hospitals to implement and EHR or refine their current systems and to meet the "meaningful use" reporting requirements and timeline.

The law to measure patient outcomes and encourage EHR implementation has been signed and financial incentive payments are in place, (ARRA, 2009; HITECH, 2009). The most important part of this regulation is what it says hospitals and clinicians must do with EHR to be considered meaningful users in 2011 and 2012 and then fully implemented by 2014.

The ARRA and HITECH legislation and subsequent rules and regulations issued by the Secretary of Health and Human Services (HHS) specify 14 core elements to meet in order to achieve meaningful use (Appendix A). There are some public reporting elements that allow choice by providers. Five of the following may be chosen: 1) implement drug formulary; 2) incorporate clinical laboratory test results into the EHRs as structured data; 3) generate lists of patients by specific conditions to use for quality improvement, reduction of disparities, research, or outreach; 4) technology to identify patient-specific education resources and provide those to the patient as appropriate; 5) perform medication reconciliation between care settings; 6) provide summary of care records for patients referred or transitioned to another provider or setting; 7) submit electronic immunization data to immunization registries or immunization information systems; and 8) submit electronic syndrome surveillance data to public health agencies. Therefore, it is important to measure the level of readiness of each hospital so they can achieve the incentive payment and avoid the penalty of decreased payment (Blumenthal & Tavenner, 2010).

Current Research

Jha et al. (2009) surveyed all acute care, general medical, and surgical nonfederal hospitals (N=3,049) that are members of the American Hospital Association for the presence of specific electronic record functionalities. Their working definition for the comprehensive EHR, which was based on a consensus panel of experts, was defined to include clinical documentation of demographic patient characteristics, physician's notes, nursing assessments, problem lists, medication lists, discharge summaries, and advanced directives; test and imaging results that include laboratory, radiologic, and consultant reports, radiologic images, diagnostic-test results and images; computer provider-order entry that includes laboratory and radiology tests, medications, consultation requests, and nursing orders; decision support that includes clinical guidelines, clinical reminders, drug-allergy alerts, drug-drug interaction alerts, drug-laboratory interaction alerts, and drug-dose support. The researchers measured the number of hospitals that had systems that fit their working definition of EHRs in their clinical areas. They examined the relationship of adoption of EHRs to specific hospital characteristics and factors that were reported to be barriers to or facilitators of adoption (Jha et al., 2009).

On the basis of responses from 63.1% (N=1,924) of hospitals surveyed, only 1.5% (N=46) of U.S. hospitals had a comprehensive electronic records system (i.e., present in all clinical units), and an additional 7.6% (N=232) had a basic system (i.e., present in at least one clinical unit). Computerized provider-order entry for medications had been implemented in only 17% (N=518) of the hospitals that responded. Larger hospitals, those located in urban areas, and teaching hospitals were more likely to have an electronic records system than smaller, more rural hospitals. Respondents cited capital requirements and high maintenance costs as the primary

barriers to implementation, although hospitals with electronic-records systems were less likely to cite these barriers than hospitals without such systems (Jha et al., 2009).

The very low levels of adoption of electronic health records in U.S. hospitals identified in the Jha et al. (2009) research were confirmed in 2011 in research by the American Hospital Association (AHA). Together, the AHA (2011) and Jha et al. (2009) research suggests that policymakers face substantial obstacles to the achievement of healthcare performance goals that depend on health information technology. As Jha et al. (2009) point out, a policy strategy focused on financial support, interoperability, and training of technical support staff may be necessary to spur adoption of electronic-records systems in U.S. hospitals. The AHA (2011) and Jha et al. (2009) research reveals that the level of readiness and complete implementation for EHR is low for the United States as a whole.

American Hospital Association 2011 Research

In 2011 the AHA built upon the 2009 research by Jha et al. The AHA wanted to provide a snapshot of the current capacity of hospitals in the United States to meet the meaningful use requirements. To do so, they conducted a survey of all community hospitals. Data were collected between January 6 and January 20, 2011, with approximately 25% of all hospitals responding to the survey. Respondents (N=1,297) were broadly representative of all community hospitals.

The survey found great commitment to qualifying for the “meaningful use” payment program (HITECH), with 95% (N=1,235) of respondents reporting that they planned to pursue “meaningful use” funding. However, the survey also found that only 1.6% (N=21) of the total number of respondents (N=1297) currently met the meaningful use and certification requirements. Only 8% (N=55) of the 693 rural hospitals responding reported the ability to meet the “meaningful use” criteria in time to qualify for the HITECH funding (AHA, 2011).

In order to meet specific requirements of reporting required by the "meaningful use" criteria (Appendix B), the survey results indicated hospitals were far from proficient. Sixty-one percent of the reporting hospitals in the 2011 AHA study (N= 791) indicated they possessed the ability to perform drug-drug and drug-allergy checks, yet only 42% of the hospitals (N=545) reported having an EHR certified for this function, which is a meaningful use criteria requirement (AHA, 2011).

In looking at the 14 core objectives (Appendix C), hospitals reported the most progress in using their EHRs to ensure medication safety. For example, hospitals reported success in implementing drug-drug and drug-allergy checks, with 61% (N=791) reporting drug-drug and drug-allergy checking; however, but only 43% of the 791 (N=340) hospitals used a certified EHR. Fifty-four percent of respondents (N=700) reported having other capabilities, but only 39% (N=273) of the 700 indicated these capabilities could currently be carried out using certified EHRs. The majority of hospitals also reported using their EHRs to record demographic and clinical data (AHA, 2011).

Hospitals' abilities to meet each core objective using certified EHR technology was lower, ranging from 54% (N=700) total – with 38% (N=266) of the 700 that could record standardized patient demographics with a certified EHR – to 11% (N=143) with the ability to report clinical quality measures generated directly from the EHR to CMS or states, with only 7% (N=10) of those that could do so using a certified EHR (AHA, 2011).

Several of the core objectives posed significant challenges to hospitals. Some of the meaningful use objectives center on reporting information, such as quality measures or electronic copies of records, rather than on using technology to improve care. Hospitals have not generally

used their EHRs for the purpose of reporting externally and will need time to transition (AHA, 2011).

According to the survey respondents (N=1,297), the core measure requiring hospitals to report quality measures generated directly from the EHR was among the most difficult to meet. Hospitals have a strong commitment to quality reporting, and 97% of hospitals that responded to the AHA survey currently report data manually on more than 50 different quality measures to CMS, with data on 43 of those measures then made available to the public. EHRs have the potential to reduce the burden of quality reporting by automating the process; however, EHR products have not historically had the technical capacity for the quality reporting currently required for meaningful use. Vendors have only recently built this function into their products, with very little testing. In fact, the CMS certification process does not even check to see if the calculations are performed accurately. Thus, it will take time and effort for hospitals to understand whether the EHRs they deploy can actually generate valid quality metrics (AHA, 2011).

Hospitals reported variable progress in meeting the menu set requirements. As with the core objectives, hospitals were more likely to be able to meet the performance standards for "meaningful use" than to have upgraded or replaced their systems to possess certified EHR technology. For example, while 55% (N=713) of hospitals that responded reported implementing drug formulary checks, only 38% of the 713 hospitals (N=271) reported doing so with an EHR certified for that functionality (AHA, 2011).

Among the questions related to each "meaningful use" criteria menu set objectives, hospitals reported the greatest progress on those objectives tied to the clinical care process, such as incorporating lab results into the EHR as structured data. Fifty-eight percent (N=752) of

responding hospitals reported they had the ability, but only 316 (42%) of those hospitals have the ability to do so with a certified EHR system. Fifty-five percent (N=713) of respondents reported the ability to accomplish drug formula checks for drug orders entered, but only 271 (38%) of the 713 hospitals report the ability to perform this function with a certified EHR. Similarly, 713 respondents reported the ability to record advance directives for patients 65 years of age and older, but only 278 (39%) of those respondents could perform this function on a certified EHR (AHA, 2011).

Providing standardized electronic summary of care records for patients referred or transitioned to another provider could be accomplished by only 220 respondents (17%), while only 26 reported the ability to report on a certified EHR. The menu set objective with the lowest reported capability was the submission of standardized electronic immunization data to immunization registries or immunization information with 17% (N=220) reporting this capability and only 22 reporting the ability to accomplish this task on a certified EHR (AHA, 2010, Chart 4, Appendix D).

The menu set objectives posing the greatest challenge to hospitals generally focused on sending data to others using the vocabulary and data transmission standards specified by CMS, including all three of the public health reporting objectives. Note that to meet the "meaningful use" requirements, hospitals must successfully meet at least one of the public health objectives (Blumenthal & Tavenner, 2010).

Hospitals engage broadly in public health reporting. However, the "meaningful use" requirements include use of specific vocabulary and data transmission standards for submitting data that are not in common universal use today and were not historically supported by EHR

vendors. Indeed, most public health departments are not yet able to receive data in the required formats (AHA, 2011).

As with quality reporting, "meaningful use" criteria are setting out new ways to share data that hospitals are, in many cases, already providing through other means – mainly manual or stand-alone computer systems. The transition to these new approaches will take time, effort, and, in the case of public health reporting, advances in the IT systems of public health departments, physician's offices, and clinics – not just hospitals (AHA, 2011).

The 2011 AHA survey also asked hospitals about barriers to achieving meaningful use in a timely manner. The majority of respondents indicated that lack of clarity 53% (N=687) and complexity 52.3 % (N=678) of the regulatory requirements were barriers. These issues were cited slightly more often than up-front capital costs, which were also seen as a barrier by the 677 respondents and ongoing costs of maintaining and upgrades by 663 of the respondents (AHA, 2011).

There is reason to believe that rural hospitals face even more challenges. In a study echoed by the AHA's research, Slabach (2010) concluded that evidence is growing that small, rural hospitals are not prepared for the implementation and reporting outlined in the "meaningful use" criteria and necessary to receive the EHR funding support (Slabach, 2010).

National Rural Health Association Survey

Brock Slabach led the National Rural Health Association (NRHA) to survey its membership of rural hospitals about their readiness to implement the EHR (Slabach, 2010). Only 12% (N=30) of the responding rural hospitals (N=251) reported medium-to-high or stage-4 levels of readiness.

Rural hospitals reported a desire to advance the EHR, but the smaller the hospital, the greater the risk that they had not researched the "meaningful use" reporting and reward thresholds. Rural hospitals reported that they experienced significant problems with adequate health information technology. Deployment of the EHR in rural hospitals takes an average of 3 to 10 years, and 49% (N=123) of the responding hospitals reported low or low-medium readiness levels for implementation of a certified EHR. Slabach (2010) concluded that evidence is growing: small, rural hospitals are *not* prepared for meaningful use (Slabach, 2010).

Modern Healthcare IT Check

The December 20, 2010, issue of *Modern Healthcare* reported a survey (N=245) of its American College of Healthcare Executives member CEOs regarding their plans for and implementation of IT systems. The following readiness states were surveyed: Implementation in Progress; Planned but Not Started; Implemented/Operational; Implementation Starts within 12 Months; and Not Contemplated. Categories measured included clinical decision making at the point of care, physician order entry, point of care data entry and retrieval, patient portal availability, and patient health record availability. The highest percentages were calculated in the Implemented/Operational category with Diagnostic Image/Transfer at 77%, Master Patient Index at 59.6%, Appointment/Resource Scheduling at 43.6%, Point of Care Data Entry/Retrieval at 29.9%, and Clinical Decision Making at 20.8% (Modern Healthcare, 2010).

The lowest percent of implementation was listed as decision-making (20.8% reported implementation to begin within 12 months). This finding is more consistent with meeting the "meaningful use" criteria (Modern Healthcare, 2010). However, this survey did not inquire as to the comprehensive nature or the certification of the systems that are implemented, both of which are important in the "meaningful use" implementation and measured outcomes reporting to

achieve "meaningful use." Despite a consensus throughout the literature that the use of health information technology should and could lead to more efficient, safer, and higher-quality care, the latest research demonstrates that the implementation of the comprehensive EHR is present in 1.5% in U.S. hospitals (AHA, 2011). To provide to the understanding of the research findings in the National Rural Health Association study of 2010, the research by Jha et al., (2009) and the AHA (2011), a comparison, Table 1 is presented below.

Table 1
Comparison of Three Major Studies Related to "Meaningful Use"

	9/28 - 10/1/2010 National Rural Health		Jha et al., 2009 Collaborative Study			AHA Survey of Members 2011	
	Currently Have	Expect to Not Meet	Currently Have in EHR	Expect to Meet	Expect to Not Meet	Can Meet Objective	Can Meet & Have Certified EHR
Drug Interaction Checks	19%	81%	1.2% - 2.0%	78%	22%	61%	42%
Active Medication Allergy List	40%	60%	1.1% - 2.0%	78%	22%	54%	39%
Standardized Patient Demographics	40%	60%	1.1 - 2.0%			54%	38%
Record vital signs and chart changes	40%	60%		76%	24%	52%	38%
Record smoking status	40%	60%				48%	34%
Maintain Active Medication List	19%	81%	1.1% - 2.0%	80%	20%	48%	34%
Privacy Protection						45%	32%
Implement decision support for priority condition	40%	60%				36%	25%
Implement CPOE	18%	82%	1.1% - 2.0%	55%	45%	32%	23%
Maintain list of current and active diagnoses	39%	61%	1.1% - 2.0%			31%	21%
Provide electronic d/c instructions upon request	38%	62%				27%	18%
Electronically exchange key clinical info among providers	39%	61%				27%	18%
Provide electronic copy of medical record upon request	38%	62%				22%	15%
Incorporate lab results into EHR	55%	45%	1.1% - 2.0%			58%	42%
Implement drug formulary checks			1.1% - 2.0%			55%	38%
Record Advance Directives (65 and older)			1.1% - 2.0%			55%	39%

Table 1 – continued on next page

Table 1 - continued

Generate lists of patients by specific conditions	39%	61%				52%	34%
Use EHR to identify patient-specific education resources	62%	38%				32%	22%
Electronic medication reconciliation between care settings	39%	61%				28%	18%
Submit standardized electronic syndromic surveillance data to public health agencies	16%	84%				19%	12%
Submit electronic reportable lab results to public health agencies	16%	84%				18%	12%
Provide electronic copy of medical record to another provider	39%	61%				17%	12%
Submit electronic immunization data to registries	16%	84%				17%	10%
Teaching			2.6±1.1	18.5±2.6	78.9±2.7		
Non-Teaching			1.3±0.2	5.2±0.1	93.5±1.2		
Profit Not for Profit	Did Not Measure		Reported that there was no significant difference in the owner status			Did Not Measure	
Urban who can meet MU and have certified EHR at time of survey							2.20%
Rural who can meet MU and have certified EHR							0.80%
Rural Hospital Participants	100%		38%			(N=693) 53%	
Urban Hospital Participants	0%		62%			(N=604) 47%	

Summary

The research conducted in European and Asian environments reflects strengths and weaknesses of the systems as evaluated by users most frequently framed in the concepts of acceptance. The systems implemented in the Ammenwerth (1998), Chan (2006), and Lee et al. (2005) and the Ochieng and Hosoi (2005) research settings were not comprehensive, integrated EHR systems like those specified in the current requirements for systems under "meaningful use." There is infrequent inclusion of readiness through mention of organizational education efforts and occasional inclusion of user involvement in design as a relevant factor in acceptance.

This research is not related to the current environment of measured outcomes and HITECH funding for computerized reporting of measured quality and safety outcomes.

All three of the research studies – the collaborative research by Jha et al. (2009), the 2011 AHA survey, and the 2010 NHRA survey research findings – are relevant to the current climate and report that rural hospitals are much less prepared to meet the meaningful use criteria when compared to their urban counterparts. The most recent findings from the AHA (2011) report that rural hospitals' ability to meet these criteria is half that of the responding urban hospitals, and both the NHRA and the AHA report that the time frame for effective and patient-safe deployment is too short for all hospitals but particularly for the rural hospitals. Slabach (2010) concluded in the NRHA research that evidence was growing that small, rural hospitals are not prepared for "meaningful use," and the AHA research seems to reinforce the accuracy of his conclusions.

More specifically, all three of these major research studies address the lack of clarity of the expectations related to what would actually and accurately meet the meaningful use criteria. While the AHA (2011) research was conducted 6 months after the publication of the reporting necessary to meet the meaningful use criteria, a lack of understanding and clarity was reported as a concern for 53% of the AHA respondents. The AHA research reported that the ability to generate the 15 quality reporting measures directly from a certified EHR is of particular concern. Reporting quality measures is a common practice in the hospital population, with 97% of hospitals currently reporting data on more than 50 different quality measures to CMS. Rural hospitals are included in the number reporting; however, the data reporting process may involve a manual process at the current time, particularly in smaller hospitals where manual tracking is common practice. Certainly, the EHRs have the potential to reduce the burden of quality

reporting; however, the products available currently do not have the full capability to achieve such data abstraction and technical reporting as a certified EHR, and this is a major concern.

Now that regulations are emerging related to the definitions of a certified EHR, the AHA (2011) research helps to point out that the vendor certification process does not even check to see if the calculations achieved by the data abstraction and the technical reporting are actually accurate. This brings to light the fact that more time is required of the hospital processes to ensure the accuracy of the vendor's product and more particularly the accuracy of the information reported to CMS or other federal and state bodies.

In addition, financial concerns related to the ability to meet the meaningful use criteria are evident in all three of these research studies. The financial concerns were listed as a major barrier in the Jha et al. (2009) research and that same theme carries through the other research studies, for example, 52.2% of the respondents in the AHA (2011) research expressed concerns about the upfront and ongoing maintenance costs of EHR systems. With the size and resources of the rural hospitals considered, rural hospitals are more at risk of not meeting the current implementation timeline. Financial grants have been made available to assist rural hospitals in their implementation; however, the impact of such grants on implementation remains to be described.

Support and financial availability to organizations reflect one key aspect of readiness, but the concept of readiness has not been presented in the research as important and affecting the overall implementation outcome.

This study examines factors reported by Tennessee hospitals as they relate to readiness and will report the level of readiness of all responding hospitals in Tennessee as compared to rural hospitals in Tennessee. Further, this research will open the door for additional research to

investigate achieved outcomes related to the level of readiness of hospitals at this point in time. No published research has been located in the literature and no focused research on Tennessee hospitals has been reported.

CHAPTER 3

METHODS

Research Design

The study used a descriptive, nonexperimental design to answer three research questions: (1) what is the level of readiness to meet "meaningful use" criteria in the THA member hospitals; (2) what is the level of readiness to meet "meaningful use" criteria in the rural THA member hospitals; and (3) is there a difference in the readiness to meet "meaningful use" criteria between rural and urban THA member hospitals? The THA Vice President, Mary Layne Van Cleeve, granted permission via email from her Chief Information Officer, Jean Young, to this researcher to use the data set for dissertation (Appendix G).

To investigate the readiness of THA member acute care hospitals for the implementation of "meaningful use criteria," data analysis was conducted on survey data collected from an electronic survey developed by Wenslow and Slabach for the NRHA and distributed by the THA to the member hospitals that met the inclusion criteria (acute care facilities both rural and urban excluding psychiatric, long-term care, rehabilitation and specialty hospitals). Survey research is an appropriate approach to address the research questions as it provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population. Survey research may include cross-sectional studies using questionnaires for data collection, with the intent of generalizing from a sample to a population (Babbie, 1990).

Population

The study population included all THA hospital members as of October 2010 (N=115). The hospital sizes ranged from 2 to 653 staffed beds; these hospitals were licensed for 2 to 766 beds, respectively. The survey was returned by 95 hospitals. Follow-up phone calls, emails,

and resending the cover letter and survey in December 2010 and January 2011 resulted in a response rate of 83%. Of the responding hospitals (N=95), 54 were urban hospitals and 41 were rural.

Sample

The sample for this study included 95 returned surveys that resulted in an 83% return rate. One hospital system was an outlier and was excluded from this sample when the parametric statistical tests were performed. For the parametric statistical tests, 41 hospitals were rural respondents and 53 were as urban respondents. On the basis that the sample size for each of these groups was greater than 30, the sample size was determined to be more than adequate to perform the statistical tests, both parametric and non-parametric, to answer the research questions.

There were 143 members in the THA at the time of the survey, but the psychiatric and rehabilitation hospitals and the long-term care facilities were excluded from the survey due to variations in the "meaningful use" requirements. The composition of the rural hospital group was defined by their membership in the THA rural hospital group and likewise the urban hospitals were considered urban hospitals by their THA membership grouping. Of the non-THA member excluded hospitals (N=12) three were from East Tennessee, two from Middle Tennessee, and seven from West Tennessee. Five of the non-THA member excluded hospitals were rural and seven were urban. Only fully completed questionnaires were included in the data analysis. None of the questionnaires had to be excluded, as all were complete.

Protection of Human Subjects

The East Tennessee State University Institutional Review Board (IRB) reviewed the study proposal and determined that this study met neither the Food Drug Administration nor the

Department of Health and Human Services definition of research involving human subjects. Therefore, the study was exempt (Appendix D). Hospital identifiers were not listed on any of the coding or written materials. Study data were provided by the THA chief information officer in the form of a spreadsheet. To protect confidentiality, the hospital names and actual bed size were not included in the data spreadsheet from THA.

Instrument

The questionnaire for the study was developed by the NRHA under the direction of Louis Wenzlow of the Wisconsin Rural Health Association and Brock Slabach, Sr. Vice President, NRHA, who provided background information on the development of the questionnaire.

The THA in collaboration with the Chief Medical Informatics Officer of Tennessee administered the survey titled, *Hospital HIE and HIT Survey 2010*, to the association membership meeting the inclusion criteria. The survey consists of 60 questions organized under 13 major headings that were respondent information, electronic health record, EHR product name and version number, health information exchange (HIE) and regional health information organization (RHIO), name of HIE/RHIO, EHR applications currently implemented, meaningful use, laboratory, immunizations, broadband, facility owned physician practices, facility owned ambulatory centers, and hospital medical staff. Five of the questions related to hospital and respondent demographics. Nine questions related to hospital physician practices, ambulatory care centers, and information system demographics. Twelve questions measured system implementation. The survey results were downloaded into an excel spread sheet by the THA Chief Information Officer.

Pilot Testing

The original questionnaire was pilot-tested by Wenslow and Slabach through administration to the executive leadership committee of the NRHA (N=25) for the purpose of evaluating clarity and readability. Questions that were difficult to understand were clarified or reworded. Next, the revised survey was sent to the member agencies of the NRHA (Slabach, 2010). The number of fully completed and returned pilot questionnaires was 251.

For this study, the elements of the questionnaire that most directly reflect the current "meaningful use" criteria were identified from research conducted by the American Hospital Association (AHA). These data from the questionnaire were abstracted from the data set and equally weighted and added together to compile a "readiness" score.

Reliability and Validity

Reliability is the consistency with which respondents answer questions and validity refers to whether an instrument actually measures what it is intended to measure (Hoskins & Mariano, 2004). Content validity for the instrument was determined by distributing the questionnaire to Rural Health Association Executive Committee which consisted of 25 executive leaders from rural hospitals (confirmed by phone conversation with Brock Slabach, October 2011), and incorporating their suggestions into the final version of the instrument. Further validity or reliability was not conducted for the instrument by the THA.

Data Collection

As previously described, the questionnaire was developed by the NRHA (Wenslow & Slabach, 2009) and modified slightly by the Chief Medical Informatics Officer of Tennessee collaborating with the Chief Information Officer of THA and the THA statistician to include a Tennessee survey title and all components from the published meaningful use criteria

(Blumenthal & Tavenner, 2010). Data were collected electronically via survey monkey from hospitals, rural and urban, that comprised the THA membership in October 2010. Follow-up reminder phone calls and emailed reminders were implemented by THA to enhance survey returns. Data were received by the information systems division of the THA and assimilated into an excel spread sheet. Hospital name identifications were removed and the data set sent to the researcher for data analysis. No data analysis has been conducted by THA or the Tennessee Chief Medical Information Officer.

Data Analysis Methods

The data were analyzed using the statistical software package SPSS v.19. The excel spreadsheet was imported into SPSS and the coding of all the survey items was completed. Data were checked for missing items, corrected, and verified.

The analysis included the descriptive evaluation of each of the 14 criteria responses using frequency distributions. The readiness score was calculated by summing the 14 individual criteria scores and converting these scores to a 100-point scale to aid the interpretation process. The first research question was answered by providing the mean, standard deviation, median, minimum and maximum values of the readiness score for the entire sample. The second research question was answered by providing the mean, standard deviation, median, minimum and maximum values of the readiness score for the rural and urban hospitals. When examining the frequency distribution of the readiness score and the self-perceived objectives met it was determined that there was a skewing to the right. A z-score was calculated and the one outlier had a $z>3.0$. Therefore for the parametric statistical tests, independent t-tests and the Anova, in Table 3, the outlier was omitted. Further it was determined that as there was a quasi-normal distribution (Figure 2), the non-parametric tests were appropriate and Mann-Whitney Test was

conducted to answer the third research question. An alpha level of 0.05 was used to determine the level of significance of the findings.

Sample Characteristics

Ninety-five hospitals surveyed were included in the study. The detailed characteristics are outlined in Table 2, below. Fifty-four of the respondents were urban hospitals and 41 were rural. Respondents include 15 in the less than $6,000,000 to $10,000,000 revenue group, 40 in the $10,000,001 to $50,000,000, and 40 in the $50,000,001 to greater than $150,000,000 range. The respondents were 34 from the East division of Tennessee, 37 were from Middle Tennessee, and 24 are from West Tennessee. Twenty-nine (30.5%) respondents reported no EHR and 66 (69.5%) hospitals reported they do have an EHR. Sixty-four percent reported being connected to an HIE/RHIO. Thirty-four reported having a central data repository (CDR). Seventy-four hospitals reported a fully implemented Laboratory Information system and 70 hospitals reported a fully implemented Pharmacy System. When asked if the hospital has electronic medication administration record, 52 (54.7%) of the respondents reported they have one fully implemented. Forty-one of the respondents indicated they have medication bedside verification systems fully implemented. Eighty-three responded as having a radiology system fully implemented. The same number reported having order entry and results reporting fully implemented. Forty-three of the responding hospitals reported having electronic in patient charting used by nurses, and seven respondents reported they have in patient charting used by physicians. Seven hospitals (7.4%) of the respondents reported having computer physician order entry (CPOE) fully implemented. Two hospitals reported having a patient-portal access fully implemented.

Table 2
THA Survey Results

1) Record standardized patient demographics					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	52	54.7	54.7	54.7
	Yes	43	45.3	45.3	100.0
	Total	95	100.0	100.0	
2) Record Vital Signs and Chart Changes					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	52	54.7	54.7	54.7
	Yes	43	45.3	45.3	100.0
	Total	95	100.0	100.0	
3) Maintain up to date, standardized problem list of current and active diagnosis					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	89	93.7	93.7	93.7
	Yes	6	6.3	6.3	100.0
	Total	95	100.0	100.0	
4) Maintain active medication list					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	51	53.7	53.7	53.7
	Yes	44	46.3	46.3	100.0
	Total	95	100.0	100.0	
5) Maintain active medication allergy list					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	65	68.4	68.4	68.4
	Yes	30	31.6	31.6	100.0
	Total	95	100.0	100.0	
6) Record standardized smoking status for patient's 13 years of age or older					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	52	54.7	54.7	54.7
	Yes	43	45.3	45.3	100.0
	Total	95	100.0	100.0	
7) Provide an electronic copy of hospital discharge instructions upon request					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	19	20.0	20.0	20.0
	Yes	76	80.0	80.0	100.0
	Total	95	100.0	100.0	
8) Upon request, provide patients with a standardized, electronic copy of their health					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	84	88.4	88.4	88.4
	Yes	11	11.6	11.6	100.0
	Total	95	100.0	100.0	

Table 2 – continued on next page

Table 2 – continued

9) Computerized provider order entry (CPOE) for medication orders					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	92	96.8	96.8	96.8
	Yes	3	3.2	3.2	100.0
	Total	95	100.0	100.0	
10) Implement drug-drug and drug-allergy interaction checks					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	65	68.4	68.4	68.4
	Yes	30	31.6	31.6	100.0
	Total	95	100.0	100.0	
11) Implement standardized capability to electronically exchange key clinical info among providers					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	69	72.6	72.6	72.6
	Yes	26	27.4	27.4	100.0
	Total	95	100.0	100.0	
12) Implement one clinical decision support rule and track compliance					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	50	52.6	52.6	52.6
	Yes	45	47.4	47.4	100.0
	Total	95	100.0	100.0	
13) Implement systems to protect privacy and security of patient data in the EHR					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	84	88.4	88.4	88.4
	Yes	11	11.6	11.6	100.0
	Total	95	100.0	100.0	
14) Report clinical quality measures generated directly from the EHR to CMS or states					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	84	88.4	88.4	88.4
	Yes	11	11.6	11.6	100.0
	Total	95	100.0	100.0	

Another interesting characteristic of the sample came from the analysis of question 7.4 (specific question not shown), which asked each respondent his or her perceived readiness to report the 14 criteria that are required in the "meaningful use" reporting and the comparison of that perceived readiness to the actual readiness as measured by the reported system functionality of the respondents. The total number of respondents (N=95) answered that they perceived the capability to report 4.9 of the total 14 "meaningful use" criteria, while the functionality of their information systems indicated the actual ability to report 6.26 of the total 14 "meaningful use"

criteria. Using an independent t-test statistic the difference between the perceived and actual functionality was significant (p=.001). Therefore, the actual functionality readiness was higher than the perceived readiness.

Characteristics of the three main divisions of the state were also examined comparing the readiness scores of East, Middle, and West Tennessee. The East and West Tennessee scores were significantly different (p=.016), with the East division measuring a higher level of readiness than the West as shown in Table 3. The Middle division did not have a significant difference when compared to the East and the West divisions.

Table 3
Oneway ANOVA Comparing Readiness Score and Total Met Between Regions

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Readiness Score	East	33	75.7576	14.07588	2.45030	70.7665	80.7487	41.89	97.30
	Middle	37	69.2476	17.86082	2.93630	63.2925	75.2027	18.92	93.24
	West	24	62.8378	17.18142	3.50714	55.5828	70.0929	29.73	94.59
	Total	94	69.8965	17.02595	1.75609	66.4092	73.3837	18.92	97.30
Total_met	East	33	5.5758	4.14601	.72173	4.1056	7.0459	.00	12.00
	Middle	37	4.5405	3.20238	.52647	3.4728	5.6083	.00	12.00
	West	24	2.9167	3.06334	.62530	1.6231	4.2102	.00	12.00
	Total	94	4.4894	3.64189	.37563	3.7434	5.2353	.00	12.00

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Readiness Score	Between Groups	2344.994	2	1172.497	4.335	p=.016
	Within Groups	24614.115	91	270.485		
	Total	26959.110	93			
Total_met	Between Groups	98.406	2	49.203	3.945	p=.023
	Within Groups	1135.083	91	12.473		
	Total	1233.489	93			

CHAPTER 4

RESULTS

Ninety-five questionnaires were collected for inclusion in the study. During the analysis a biostatistician recommended omission of one outlier with z score >3.0 because it would skew the results; therefore, 94 questionnaires were included in the parametric statistical tests. Ninety-five were used in the non-parametric statistical tests because those tests correct for the abnormal distribution.

Demographic Survey

The frequency distributions of the demographic characteristics are presented in Table 4. All participants (100%) were THA members in October 2010. Forty-one of the respondents indicated they were rural hospitals and 54 were urban. Licensed beds ranges varied from 15 hospitals which reported annual revenues of less than $10,000,000, 40 hospitals reported annual revenues of in the range of $10,000,000 to $50,000,000, and 40 hospitals reported annual revenues of greater than $50,000,000 as shown in Tables 4 and 5.

Table 4
Frequency Distributions of the Reported Demographic Characteristics for Responding Hospitals (N=95)

Population Characteristics		N	Percentage
Hospitals:	<$10,000,000	15	16%
	$10,000,000 - $50,000,000	40	42%
	>$50,000,000	40	42%
Hospital Bed Numbers:	Minimum	2	
	Maximum	914	
	Mean	176.52	
Tennessee State Division:	East	34	35.8%
	Middle	37	38.9%
	West	24	25.3%
Demographic:	Rural	41	43.2%
	Urban	54	56.8%
Does your facility have electronic HR:	No	29	30.5%
	Yes	66	69.5%
Is your hospital connected to HIE	No	61	64.2%
	Yes	34	35.8%

Table 4 – continued on next page

Table 4 – continued

Do you have inpatient charting by RNs	No	50	52.6%
	Yes	45	47.4%
Do you have inpatient charting by MDs	No	88	92.6%
	Yes	7	7.4%
Does your lab have capacity for electronic lab results reporting	No	12	12.6%
	Yes	78	90.5%
	No Response	4	4.2%
Can your lab currently receive electronic lab reports	No	14	14.7%
	Yes	75	78.9%
	No Response	6	6.3%
Can MDs electronically order lab tests from your lab using their EHR	No	77	81.1%
	Yes	16	16.8%
	No Response	2	2.1%
Does your hospital lab data go into any HIE/RHIO	No	72	75.8%
	Yes	19	20.0%
	No Response	4	4.2%
Does your hospital currently electronically report immunizations to TN Immunization site registry	No	85	89.5%
	Yes	7	7.4%
	No Response	3	3.2%
Does your hospital have a network infrastructure capable of supporting robust EHR applications	No	12	12.6%
	Yes	76	80.0%
	No Response	7	7.4%
Does your hospital have access to broadband to meet your information needs	No	7	7.4%
	Yes	83	87.4%
	No Response	4	4.2%

	Not at All	Planning	Partially	Fully Implemented	No Response
Do you have CDR applications	3 (3.2%)	24 (25.3%)	34 (35.8%)	34 (35.8%)	
Do you have lab system	4 (4.2%)	3 (3.2%)	13 (13.7%)	74 (77.9%)	1 (1.1%)
Do you have pharmacy system	4 (4.2%)	5 (5.3%)	16 (16.8%)	70 (73.7%)	
Do you have eMAR	4 (4.2%)	26 (27.4%)	13 (13.7%)	52 (54.7%)	
Do you have bedside medication verification	4 (4.2%)	42 (44.2%)	7 (7.4%)	41 (43.2%)	1 (1.1%)
Do you have a radiology system	3 (3.2%)	7 (7.4%)	5 (5.3%)	79 (83.2%)	1 (1.1%)
Do you have order entry/results reporting	1 (1.1%)	8 (8.4%)	7 (7.4%)	79 (83.2%)	
Do you have electronic inpatient charting	3 (3.2%)	32 (33.7%)	16 (16.8%)	43 (45.3%)	1 (1.1%)
Do you have CPOE	4 (4.2%)	73 (76.8%)	11 (11.6%)	7 (7.4%)	
Do you have IT patient portal access	17 (17.9%)	73 (76.8%)	0 (0%)	2 (2.1%)	3 (3.2%)
Do you have interface engine expertise	5 (5.3%)	10 (10.5%)	23 (24.2%)	55 (57.9%)	2 (2.1%)

The mean, median, and standard deviation for the hospital bed size, how many of the 14 "meaningful use" criteria the respondents perceive they are meeting, and how many of the 10

reportable items from the “meaningful use” menu set that each respondent perceives it met are shown in Table 5.

Table 5
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Q1_3 Licensed Bed Number	95	2	914	176.32	194.355
Q7_4 How many of the 14 core set Obj you have currently	80 (84.2%) No Response: 15 (15.7%)	0	14	6.26	3.805
Q7_5 How many of the 10 menu sets obj do you currently meet	82 (86.3%) No Response: 13 (13.6%)	0	10	2.94	2.516

Research Questions

There were three research questions to be answered in this research: (1) what is the level of readiness to meet “meaningful use” criteria in the THA member hospitals, (2) what is the level of readiness to meet “meaningful use” criteria in the rural THA member hospitals, and (3) is there a difference in the readiness to meet “meaningful use” criteria between rural and urban THA member hospitals?

Statistical Tests

SPSS v.19 was used to enter and code the data and to perform the statistical analysis. Descriptive statistics first described the frequency, and percentage of each of the survey questions for the total population and for each survey question divided into rural and urban groups. The minimum, maximum, mean, and standard deviation were calculated for the bed number(Q_3), the perceived number of 14 “meaningful use” criteria each respondent reported they can meet currently(Q7_4), as well as the perceived number of the 10 menu set objectives they can meet currently for the total population (Q7_5). A closer analysis of the level of readiness for the respondents (Q7_4) was necessary to determine the answer of the first research

question. The self-reported mean level of readiness for the survey respondents was 6.26 of the 14 core set of the "meaningful use" criteria. However, earlier in the research plan a table was generated (Appendix C) that displays the 14 "meaningful use" criteria and the related EHR functionalities that are necessary to achieve them. Because the EHR functionalities are the focus of the survey questions, the next step was to calculate a sum for each criterion and convert it to 100-point scale. This was accomplished for the entire population (N=95) and the mean readiness score was 69.1607. The median score for the population (N=95) was 74.3243 with a standard deviation of 18.39091 demonstrating a wide variation of readiness scores as shown in Table 6.

Table 6
Descriptive Readiness Score Converted to 100-Point Scale

Statistics

Readiness Score

N	Valid	95
	Missing	0
Mean		69.1607
Median		74.3243
Standard Deviation		18.39091
Minimum		.00
Maximum		97.30

It is important to include that the z-scores were calculated for the readiness sum scores of the entire population (N=95) and the outliers were identified and examined. Three outliers in the urban segment of the population were identified and one of the outliers had a z>3. The decision was made to drop this outlier due to its z-score (Figure 2). Therefore, the subsequent analysis of readiness scores was conducted with a population of 94.

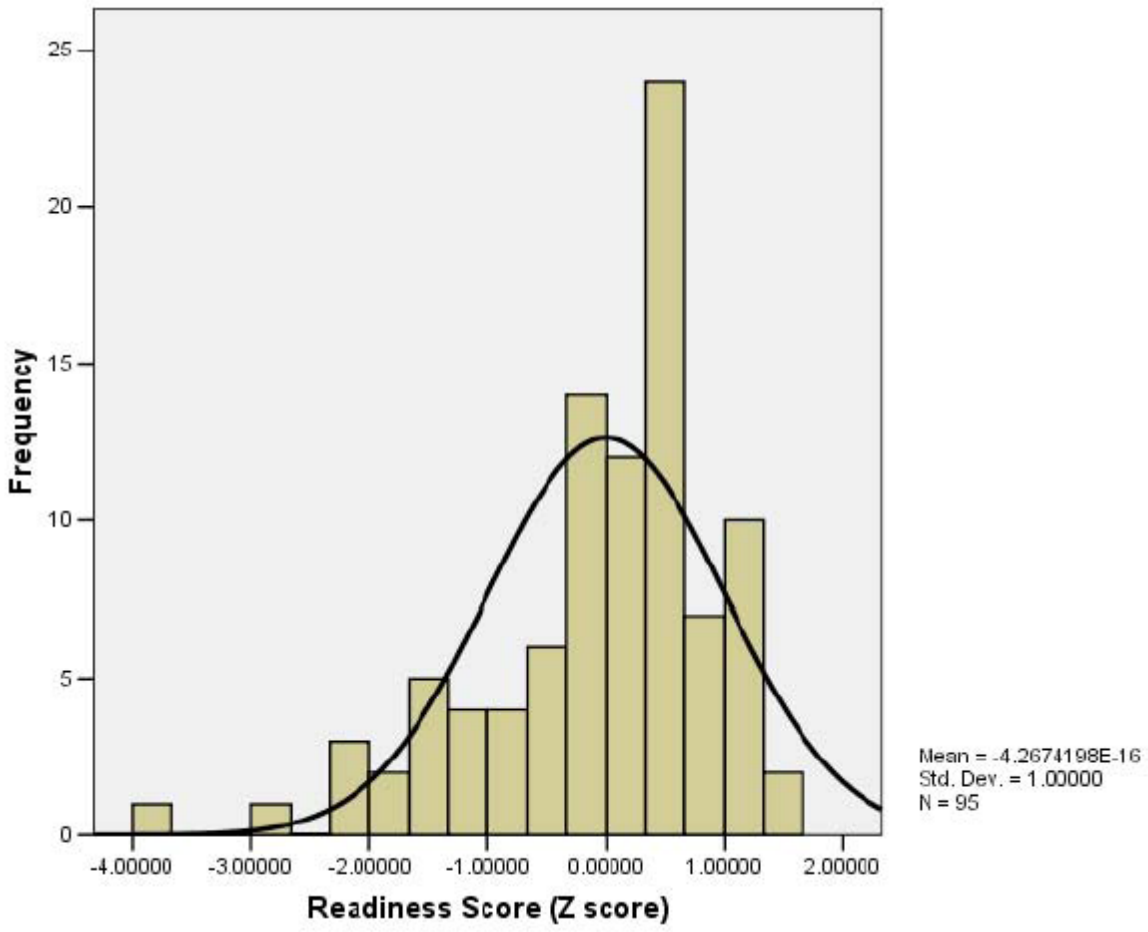

Figure 2. *z-scores of the readiness score were examined and indicated that there was one outlier with z>3.0. Therefore, that case was removed from the comparison parametric tests.

The distribution of readiness scores for hospitals shows that the scores are quasi normal. There is a slight skewing left which makes it difficult to know whether or not a normal distribution can really be assumed. To cover all bases, both parametric and non-parametric tests were applied to the study data to answer the research questions.

Parametric Distribution Assumed

An independent t-test of readiness was conducted comparing the readiness scores for the entire population (n=94) and the mean was 69.8965. This is a measure of the readiness for the THA member hospitals participating in this survey, question 1.

Then the t-test comparison was conducted with regard to the readiness score between the rural and urban segments of the population. The mean rural readiness score was 63.7772 (the answer to research question 2 as the rural hospital level of readiness) and the mean urban readiness score was 74.6303. This difference was significant (p=.002). Hence, the answer to the research question 3 was a significant difference was found between the level of readiness score for the rural and the urban THA member hospitals participating in this research as shown in Table 7.

Table 7
Parametric Distribution Assumed

t-test Level of Readiness

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Readiness Score	94	18.92	97.30	69.89865	17.02595
Valid N (listwise)	94				

t-test Comparison of readiness score between rural and urban

Group Statistics

	Q1_5 Urban or Rural	N	Mean	Std. Deviation	Std. Error Mean
Readiness Score	Rural	41	63.7772	19.80368	3.09282
	Urban	53	74.6303	12.82180	1.76121

Independent Samples Test

	t-test for Equality of Means						
	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Readiness Score	-3.215	92	p=.002	-10.85310	3.37576	-17.55766	-4.14854

Non-Parametric Distribution Assumed

The distribution of total objectives met for all hospitals demonstrates that the distribution is not normal. For this reason, non-parametric tests were applied with the total objectives met variable.

To ensure that the slightly nonnormal distribution of the readiness scores did not explain the difference found with the t-test, an additional nonparametric test was also conducted. The

Mann Whitney U-test showed that even with the assumption of a normal distribution is not made, the difference in readiness between urban and rural hospitals is still statistically significant at p=0.026. The Kruskal-Wallis test was also performed on the readiness scores for the rural and urban respondents and there was a significant difference (p=.026) as well (See Tables 8, 9, and 10).

Table 8
Mann-Whitney Test

Ranks				
	Urban or Rural	N	Mean Rank	Sum of Ranks
Zscore (ReadinessScore)	Rural	41	40.80	1,673.00
	Urban	54	53.46	2,887.00
	Total	95		

Test Statistics[a]

	Zscore (ReadinessScore)
Mann-Whitney U	812.000
Wilcoxon W	1,673.000
Z	-2.221
Asymp. Sig. (2-tailed)	.026

a Grouping Variable: Urban or Rural

Although the above analysis answered the three research questions in the study, the analysis was extended into new areas to see whether there were any other findings of interest that were not foreseen when the study was designed. The application of the Kruskal-Wallis test demonstrated a significant difference in the self-perceived criteria met and the actual readiness score p=.038 and p=.018, respectively.

Table 9
Kruskal-Wallis Test

Ranks			
	Urban or Rural	N	Mean Rank
Zscore (ReadinessScore)	Rural	41	40.80
	Urban	54	53.46
	Total	95	

Test Statistics[a,b]	
	Zscore (ReadinessScore)
Chi-Square	4.934
df	1
Asymp. Sig.	.026

a Kruskal Wallis Test
b Grouping Variable: Urban or Rural

During the analysis, the readiness score for East, Middle, and West Tennessee were calculated. The Kruskal Wallis nonparametric test was used to test whether there were geographic differences in readiness score and total "meaningful use" objectives met, according to whether hospitals were located in East, Middle, or West Tennessee. The answer was "yes" for the East and West (Chi square of 8.010, with p=0.018) (See Table 10).

Table 10
NPar Tests / Kruskal-Wallis Test

Ranks			
	Tenn Regions	N	Mean Rank
Total_met	East	34	54.32
	Middle	37	49.92
	West	24	36.08
	Total	95	
Zscore (ReadinessScore)	East	34	55.37
	Middle	37	49.72
	West	24	34.92
	Total	95	

Test Statistics (a,b)		
	Total_met	Zscore (ReadinessScore)
Chi-Square	6.535	8.010
Df	2	2
Asymp. Sig.	.038	.018
a Kruskal Wallis Test		
b Grouping Variable: Tenn Regions		

Summary

The level of readiness was described for the total number (N=95) of respondents in answer the first research question. The THA rural and urban hospital members' level of readiness was determined and the rural hospital members' level of readiness was the answer to the second research question. The THA rural member hospital readiness score was lower than the urban member hospitals and this difference was statistically significant (p=.026). Readiness scores for East Tennessee and West Tennessee were significantly different (p=.016), and the East Tennessee readiness score was higher than West Tennessee.

CHAPTER 5

DISCUSSION AND IMPLICATIONS

This study documented a measure of readiness for the implementation of the "meaningful use" criteria in the Tennessee Hospital Association member hospitals and also demonstrated a significant difference (p=.026) in the level of readiness of the rural hospitals that was lower when compared with the urban hospitals' level of readiness. While there was a wide range within the urban and rural groups, the difference in the level of readiness between the two groups was definable.

Limitations

Methodological limitations included the sample inclusion criteria THA member hospitals that were not rehabilitation, psychiatric, or specialty long-term-care facilities. In addition, surveys were received from 12 hospitals that were part of a for-profit hospital system that were not included in the survey because they are nonmembers of THA, and it is not known the impact, if any, that their inclusion in the survey might have caused. The excluded hospitals have different reporting criteria and "meaningful use" definition; therefore, their absence was appropriate.

This research topic is relatively new in the U. S., with unfolding definitions, and evolving vendor certification and capabilities; therefore, further pilot testing of the instrument was rendered not meaningful and was not conducted. Content validity was established; however, the reliability of the instrument was not established and could be considered a limitation. The relationship of "meaningful use" criteria to information system functionality is not clearly and consistently defined within the industry, and the EHR technology is still evolving. Comparison

studies for the future may find it necessary to compare additional or different functionality capabilities.

Limits to generalizability included geographic location and homogenicity. This study was conducted in a specific geographic location, Tennessee, and all participants were THA member hospitals. Therefore, reference to the population studied must be made clear in any further research. Also, the definition of rural hospitals as put forth by the NRHA is specific to area and special disparate issues addressed; this could prove confusing to future researchers and must be explained accordingly.

Discussion

These research findings provide an important baseline for comparison in future research. The activity for implementation of certified EHRs is accelerating and as factors unfold regarding the implementation and the progress toward fully implemented "meaningful use" criteria, many research opportunities may well emerge and can be compared with the findings of this research.

The definition of "meaningful use" is still unfolding as is the actuality of certified EHRs. As such, there will be changes in the approach to what should be reported as well as how it is reported. This research provides a comparison point as well as a definition of what was necessary to measure the achievement of the "meaningful use" reporting functionality, as shown in Appendix A.

The Tennessee Hospital Association is eager to learn of the findings of this research for a number of reasons. One is the use of the findings to direct technology resources to areas of need and or least readiness for the implementation of the "meaningful use" criteria. Second, there are plans, according to Dr. Rich Leftwich, the Chief Medical Informatics Officer for Tennessee (personal communication, March 6, 2012), to develop a scorecard to demonstrate progress of

Tennessee Hospital Association facilities toward meeting the "meaningful use" criteria, and this research can serve as a baseline measure for that score card. Third, findings such as the demonstration of a higher level of readiness in the eastern part of the state as compared to the western part of the state could impact decisions related to support as well as resources for implementation.

The National Rural Health Association is extremely anxious (B. Slabach, personal communication, March 9, 2012) to receive the results of the research to share with its Rural Health Association members and use to further justify continued federal support and perhaps increased monetary support for the implementation of the "meaningful use" criteria in the rural hospital population nationwide.

There is not a universal measure of readiness for "meaningful use" criteria implementation related to specific information technology functionality which has been published. In fact, there is little or no research published on the readiness for meeting "meaningful use" criteria and this research will serve as a resource point from which other research may compare and contrast as well as further define the needs for "meaningful use" criteria reporting.

Implications for Nursing Practice

The data set contained responses reflecting the level of implementation of patient care order entry by nurses as compared to physicians. Order entry by nurses was dramatically greater in both the urban and rural hospitals. As "meaningful use" unfolds and the physician order entry accelerates, this research will serve as a comparative baseline from which to display and quantify this change. There are opportunities for nurses to use these findings as a starting point from which to measure patient care outcomes and relate them to the level of readiness identified in

these findings as well as relate them to the future points of "meaningful use" implementation and the differences, if any, in the patient care outcomes measured at that time.

In the findings from this research, a very small number of hospitals identified having no pharmacy technology system. It would be interesting to investigate more deeply the medication safety issues and patient medication errors in that group of hospitals as compared to hospitals with a pharmacy system. The same is true for the measurement of patient education outcomes and readmission rates as the data set reflected a very small number of hospitals in this study population that had a patient access portal operational at the time of the data collection. Further nursing and organizational research in the area of patient safety outcomes and the level of readiness is a critical opportunity; using these data as a baseline comparison for the THA member hospital population could prove helpful to future larger studies.

Future Research Considerations

The conceptual model (Weiner, 2009) points out the needed components of achieving readiness. While this research study acknowledges that the ARRA and HITECH Act funding is the driving force of the current industry push to meet "meaningful use" criteria, hence the outside influence of the federal funding and the mandated reporting is driving the EHR adoption, further research to explore the outcome, the positive and the negative ramifications of such a strong external influence on the level of readiness of the organization or hospital as a whole is warranted and will be interesting to follow.

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APPENDIXES

APPENDIX A – Summary of Overview of Meaningful Use Objectives

Summary Overview of Meaningful Use Objectives.*	
Objective	**Measure**
Core set of objectives to be achieved by all eligible professionals, hospitals, and critical access hospitals to qualify for incentive payments	
Record patient demographics (sex, race, ethnicity, date of birth, preferred language, and in the case of hospitals, date and preliminary cause in the event of death)	Over 50% of patients' demographic data recorded as structured data
Record vital signs and chart changes (height, weight, blood pressure, body-mass index, growth charts for children)	Over 50% of patients 2 years of age or older have height, weight, and blood pressure recorded as structured data
Maintain up-to-date problem list of current and active diagnoses	Over 80% of patients have at least one entry recorded as structured data
Maintain active medication list	Over 80% of patients have at least one entry recorded as structured data
Maintain active medication allergy list	Over 80% of patients have at least one entry recorded as structured data
Record smoking status for patients 13 years of age or older	Over 50% of patients 13 years of age or older have smoking status recorded as structured data
For individual professionals, provide patients with clinical summaries for each office visit; for hospitals, provide an electronic copy of hospital discharge instructions on request	Clinical summaries provided to patients for over 50% of all office visits within 3 business days; over 50% of all patients who are discharged from the inpatient department or emergency department of an eligible hospital or critical access hospital and who request an electronic copy of their discharge instructions are provided with it
On request, provide patients with an electronic copy of their health information (including diagnostic-test results, problem list, medication lists, medication allergies, and for hospitals, discharge summary and procedures)	Over 50% of requesting patients receive electronic copy within 3 business days
Generate and transmit permissible prescriptions electronically (does not apply to hospitals)	Over 40% are transmitted electronically using certified EHR technology
Computer provider order entry (CPOE) for medication orders	Over 30% of patients with at least one medication in their medication list have at least one medication ordered through CPOE
Implement drug–drug and drug–allergy interaction checks	Functionality is enabled for these checks for the entire reporting period
Implement capability to electronically exchange key clinical information among providers and patient-authorized entities	Perform at least one test of EHR's capacity to electronically exchange information
Implement one clinical decision support rule and ability to track compliance with the rule	One clinical decision support rule implemented
Implement systems to protect privacy and security of patient data in the EHR	Conduct or review a security risk analysis, implement security updates as necessary, and correct identified security deficiencies
Report clinical quality measures to CMS or states	For 2011, provide aggregate numerator and denominator through attestation; for 2012, electronically submit measures

Blumenthal, D., Tavenner, M. (2010, July).The "Meaningful Use" Regulation for Electronic Health Records.The New England Journal of Medicine, 1006114.

APPENDIX A – Summary Overview of Meaningful Use Objectives Cont.

Summary Overview of Meaningful Use Objectives (Continued.)	
Objective	**Measure**
Eligible professionals, hospitals, and critical access hospitals may select any five choices from the menu set	
Implement drug formulary checks	Drug formulary check system is implemented and has access to at least one internal or external drug formulary for the entire reporting period
Incorporate clinical laboratory test results into EHRs as structured data	Over 40% of clinical laboratory test results whose results are in positive/negative or numerical format are incorporated into EHRs as structured data
Generate lists of patients by specific conditions to use for quality improvement, reduction of disparities, research, or outreach	Generate at least one listing of patients with a specific condition
Use EHR technology to identify patient-specific education resources and provide those to the patient as appropriate	Over 10% of patients are provided patient-specific education resources
Perform medication reconciliation between care settings	Medication reconciliation is performed for over 50% of transitions of care
Provide summary of care record for patients referred or transitioned to another provider or setting	Summary of care record is provided for over 50% of patient transitions or referrals
Submit electronic immunization data to immunization registries or immunization information systems	Perform at least one test of data submission and follow-up submission (where registries can accept electronic submissions)
Submit electronic syndromic surveillance data to public health agencies	Perform at least one test of data submission and follow-up submission (where public health agencies can accept electronic data)
Additional choices for hospitals and critical access hospitals	
Record advance directives for patients 65 years of age or older	Over 50% of patients 65 years of age or older have an indication of an advance-directive status recorded
Submit electronic data on reportable laboratory results to public health agencies	Perform at least one test of data submission and follow-up submission (where public health agencies can accept electronic data)
Additional choices for eligible professionals	
Send reminders to patients (per patient preference) for preventive and follow-up care	Over 20% of patients 65 years of age or older or 5 years of age or younger are sent appropriate reminders
Provide patients with timely electronic access to their health information (including laboratory results, problem list, medication lists, medication allergies)	Over 10% of patients are provided electronic access to information within 4 days of its being updated in the EHR

*This overview is meant to provide a reference tool indicating the key elements of meaningful use of health information technology. It does not provide sufficient information for providers to document and demonstrate meaningful use in order to obtain financial incentives from the Centers for Medicare and Medicaid Services (CMS). The regulations and filing requirements that must be fulfilled to qualify for the Health IT financial incentive program are detailed at www.cms.gov.

Blumenthal, D., Tavenner, M. (2010, July).The "Meaningful Use" Regulation for Electronic Health Records.The New England Journal of Medicine, 1006114.

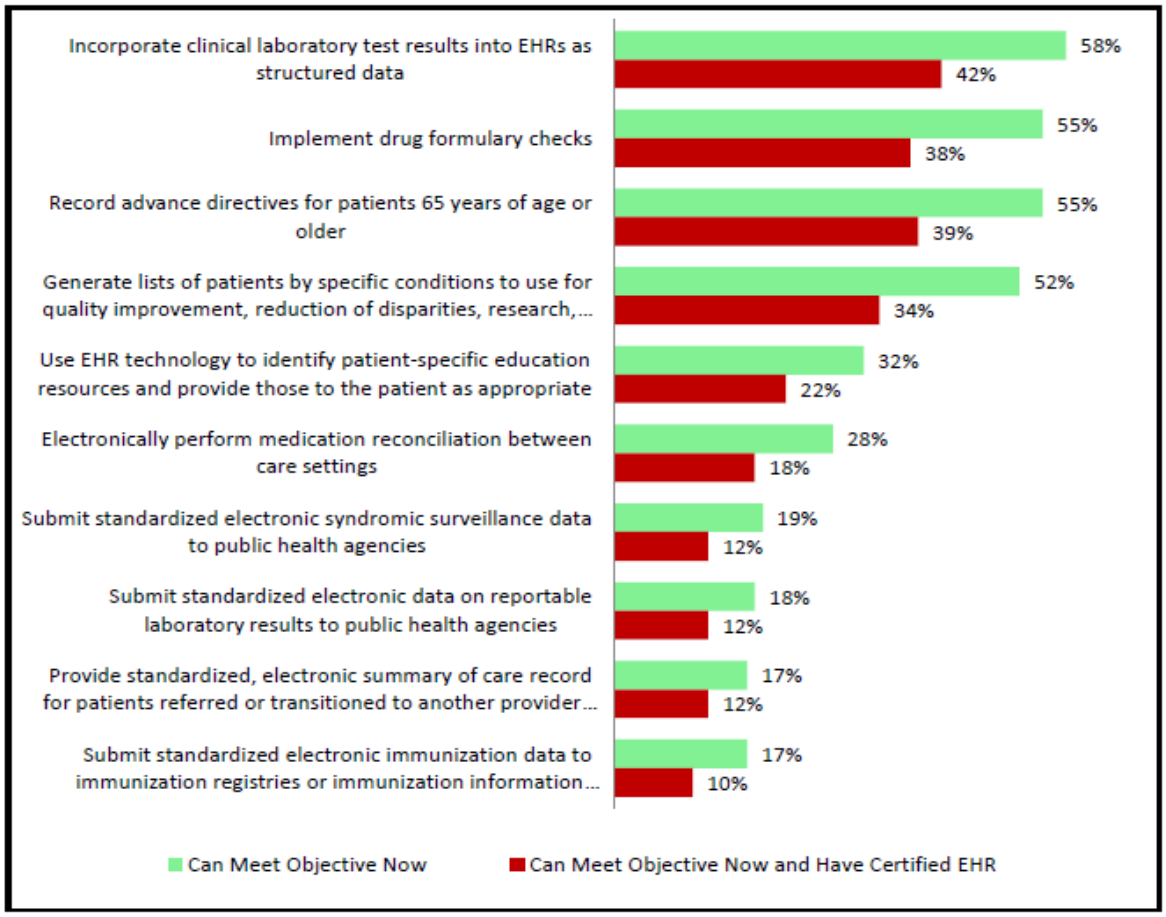
APPENDIX B – Tennessee Hospital Association Survey Questions

Meaningful use criteria Bluementhal & Tavnner NEJKM July 2010	Tennessee Hospital Association Survey Questions	Rating/Scoring Methodology
General Core Measures:		
1. Record standardized patient demographics	6-8.Electronic Inpatient Charting	o Fully Implemented o Partially o Planning o Not at All
2. Record Vital Signs and Chart Changes	6-8. Electronic Inpatient Charting	o Fully Implemented o Partially o Planning o Not at All
3. Maintain up to date, standardized problem list of current and active diagnosis	6-8. Electronic Inpatient Charting 6-12. Computerized Provider Order Entry (CPOE)	o Fully Implemented o Partially o Planning o Not at All o Fully Implemented o Partially o Planning o Not at All
4. Maintain active medication list	6-3. Pharmacy System 6-4. e-MAR (Electronic Medication Administration Record)	o Fully Implemented o Partially o Planning o Not at All o Fully Implemented o Partially o Planning o Not at All
5. Maintain active medication allergy list	6-3. Pharmacy System 6-4. e-Mar (Electronic Medication Administration Record) 6-5. Bedside Medication Verification System	o Fully Implemented o Partially o Planning o Not at All o Fully Implemented o Partially o Planning o Not at All o Fully Implemented o Partially o Planning o Not at All
6. Record standardized smoking status for patients 13 years of age or older	6-8. Electronic Inpatient Charting	o Fully Implemented o Partially o Planning

		o Not at All
7. Provide an electronic copy of hospital discharge instructions upon request	10-1. Broadband; Does our hospital have a network infrastructure capable of supporting robust EHR applications?	o Yes o No o Unsure
8. Upon request, provide patients with a standardized, electronic copy of their health .	4. Health Information Exchange (HIE) and Regional Health Information 6-1. Clinical Data Repository (CDR) 10-1. Broadband; Does our hospital have a network infrastructure capable of supporting robust HER applications?	o Yes o No o Fully Implemented o Partially o Planning o Not at All o Yes o No o Unsure
9. Computerized provider order entry (CPOE) for medication orders	6-7. Order Entry/Resulting 8-8. Can physicians electronically order lab tests from your laboratory using their EHR system? 6-12.Computerized Provider Order Entry (CPOE)	o Fully Implemented o Partially o Planning o Not at All o Yes o No o Fully Implemented o Partially o Planning o Not at All
10. Implement drug-drug and drug allergy interaction checks	6-3.Pharmacy System 6-4.e-MAR (Electronic Medication Administration Record) 6-5.Bedside Medication Verification System	o Fully Implemented o Partially o Planning o Not at All o Fully Implemented o Partially o Planning o Not at All o Fully Implemented o Partially o Planning o Not at All
11. Implement standardized capability to electronically exchange key clinical info among providers and . . .	4. Health Information Exchange (HIE) and Regional Health Information 6-15. Interface engine/expertise	o Yes o No o Fully Implemented

		o Partially o Planning o Not at All
12. Implement one clinical decision support rule and track compliance	6-2. Lab Information System 6-15. Interface engine/expertise	o Fully Implemented o Partially o Planning o Not at All o Fully Implemented o Partially o Planning o Not at All
13. Implement systems to protect privacy and security of patient data in the EHR .	10-1. Broadband; Does our hospital have a network infrastructure capable of supporting robust EHR applications? 4. Health Information Exchange (HIE) and Regional Health Information 6-1. Clinical Data Repository (CDR)	o Yes o No o Unsure o Yes o No o Fully Implemented o Partially o Planning o Not at All
14.Report clinical quality measures generated directly from the EHR to CMS or states	6-1. Clinical Data Repository (CDR) 4. Is your hospital connected to any HIE/RHIO 6-15. Interface engine/expertise	o Fully Implemented o Partially o Planning o Not at All o Yes o No o Fully Implemented o Partially o Planning o Not at All

Chart 4. Percent of hospitals reporting they can meet each meaningful use **menu set** objective versus the percent reporting they both have certified EHR technology and can meet each objective



Source: AHA analysis of survey data from 1,297 non-federal, short-term acute care hospitals collected in January 2011. Hospitals were asked to separately identify whether their EHRs were certified for each objective and whether the hospital could meet the objective.

APPENDIX D – ETSU IRB Letter

East Tennessee State University
Office for the Protection of Human Research Subjects • Box 70565 • Johnson City, Tennessee 37614-1707
Phone: (423) 439-6053 Fax: (423) 439-6060

January 31, 2012

Kathyrn Wilhoit
1161 Willow Springs Drive
Johnson City, TN 37601

Dear Mrs. Wilhoit,

Thank you for recently submitting information regarding your proposed activity entitled, "Measuring the Readiness of Tennessee Hospitals to meet "Meaningful Use Criteria" with special emphasis on the Rural Hospitals ".

I have reviewed the information, which includes a description of the proposed activity.

The determination is that this proposed activity meets neither the FDA nor the DHHS definition of research involving human subjects. Therefore, it does not fall under the purview of the ETSU/VA IRB and does not require ETSU/VA IRB approval.

Thank you for bringing this proposed activity forward to the ETSU/VA IRB for evaluation and for your commitment to excellence.

Sincerely,

George Youngberg, M.D.
Chair, ETSU/VA IRB

Accredited Since December 2005

APPENDIX E – Tennessee Hospital Association Email (1)

	Jean Young [jyoung@tha.com]
Sent:	Wednesday, March 09, 2011 10:40 AM
To:	Wilhoit, Kathryn
Subject:	RE: A few questions about the survey population. and the results population. !!!!
Attachments:	HIE_HIT Survey 2010_analysis col added_dups removed_file for KW_2011 0309.xls
Importance:	High

We have 143 hospital members of THA. We only surveyed 115 of these because we dropped the psychiatric, rehabilitation, and long term care facilities from the group to survey. We received 95 responses. THA did not survey the 12 Community Health System hospitals or the 5 Select Specialty hospitals since they are not members of THA.

I have attached the spreadsheet to this email so you can do the analysis on bed size, rural/urban and expenses. We used total expense as reported in the most recent Joint Annual Report of Hospitals to assign each hospital to an expense group (1-6). These are the figures used to assign these groups:

Expense Groups
1 = Less than $6,000,000
2 = $6,000,000 to $10,000,000
3 = >$10,000,000 to $15,000,000
4 = >$15,000,000 to $50,000,000
5 = >$50,000,000 to $150,000,000
6 = Greater than $150,000,000

I hope this is helpful to you.

Jean Young
Asst. VP, THA Information Services
Tennessee Hospital Association
Phone (615) 401-7429
Toll free 1-866-284-2446
FAX (615) 401-7475
jyoung@tha.com

APPENDIX F – Slabach Permission Email

From: Brock Slabach <bslabach@nrharural.org>
Sent: Friday, March 09, 2012 6:19 PM
To: Wilhoit, Kathryn
Subject: RE: Hello, and update from Kathryn Wilhoit

Hi Kathryn,

What terrific news. I'm so glad you shared with me of your progress. Of course, you're more than welcome to use the graphs that you need for your dissertation. I look forward to sharing the results of your research more broadly. Perhaps we can discuss at some point when you're ready. I'm sure the industry would like to know the detail of what you found in TN. I'm sure its not that dissimilar than rural, in general.

Take care and have a terrific weekend!
Brock

From: Wilhoit, Kathryn [WilhoitKW@msha.com]
Sent: Friday, March 09, 2012 11:33 AM
To: Brock Slabach
Subject: Hello, and update from Kathryn Wilhoit

I have crunched my research data and hope to get everything written and finished so that I can graduate on May 5, 2012!!! YEA!!!

I will be so excited to share with you the findings of my data. I was able to identify a "significant difference" statistically significant difference in the level of readiness score for rural and urban hospitals in Tennessee.

Hopefully, there is a small piece of this that will help you in your work at the NRHA.

I do need to get an email that gives me the written approval to use some of your graphs in my dissertation writing. These are some graphs from your presentation to the NRHA. Of course, I will give full credit to you as the generator and presenter of this information.

If you would email and confirm that it is with your approval that I include this information, I will be able to print it and include it into the dissertation document appendix.

Thanks so much for all your help and guidance in my research. I look forward to sharing with you the findings and working to see how this may be helpful to others in the future.

Sincerely, kw

Kathryn Wilhoit

Kathryn Wilhoit, PhDc, RN, NEA-BC, FACHE
Corporate Vice President
Mountain States Health Alliance
423 431 1007

APPENDIX G – Tennessee Hospital Association Email (2)

From: Jean Young [jyoung@tha.com]
Sent: Thursday, October 28, 2010 4:18 PM
To: Wilhoit, Kathryn
Cc: Mary Layne Van Cleave; Russell Leftwich
Subject: HIE HIT survey follow up and analysis
Attachments: HIE and HIT Survey.pdf

Kathryn,
Tennessee Hospital Association (THA) has been working with Russell Leftwich and the Office of eHealth Initiatives to gather information from hospitals about readiness for EHR adoption and health information exchange. THA, working with the Office of eHealth and others, designed a HIE/HIT survey (using ***SurveyMonkey***®) for hospitals to complete that will provide an environmental assessment that will allow a gap analysis and help focus state resources to assist eligible hospitals in qualifying for EHR incentive payments. I have attached a copy of the HIE/HIT survey to this email.

As I mentioned recently THA is in the midst of our annual member satisfaction survey and we requested that no follow-up calls be made to hospitals related to this HIE/HIT survey until after our member survey is completed. We have recently added another week to our member survey to allow for more responses from our members. Our new targeted end-date for the member survey is end-of-day Friday, November 12 but we will need to touch base with each other around that time to ensure that THA has completed the member survey before any follow up calls on the HIE/HIT survey begins.

Once follow-up has been done and additional HIE/HIT surveys are completed, THA will provide access to the survey results to you for analysis. Hospital-level survey responses *without facility identifiers* will be provided to you. Some information will be added to the database to assist you in the analysis. The fields to add for each hospital will include region, rural/urban indicator, and size. If necessary, additional fields may also be added prior to the database being provided to you for analysis.

I look forward to working with you on this project.

Jean Young
Asst. VP, THA Information Services
Tennessee Hospital Association
Phone (615) 401-7429
Toll free 1-866-284-2446
FAX (615) 401-7475
jyoung@tha.com

APPENDIX H – AHA Permission Email

From: Steinberg, Caroline
Sent: Wednesday, November 09, 2011 7:54 AM
To: 'WilhoitKW@msha.com'
Cc: Deweese, Tom
Subject: Re: This is a request to reprint the charts and graphs from the American Hospital Association Research analysis 2011

Permission granted! Please cite us as appropriate. If you have any further questions, please feel free to contact me.

Caroline Rossi Steinberg
Vice President, Trends Analysis
The American Hospital Association
Liberty Place, Suite 700
325 Seventh Street, NW
Washington, DC 20004
Ph: 202-626-2329
Fax: 202-626-4319

From: Wilhoit, Kathryn [mailto:WilhoitKW@msha.com]
Sent: Friday, November 04, 2011 05:15 PM
To: Mitchell, Alicia
Cc: Deweese, Tom
Subject: This is a request to reprint the charts and graphs from the American Hospital Association Research analysis 2011

As you are well aware, the American Hospital Association undertook to survey its membership in 2010 and 2011 to determine the level of readiness of hospital members to implement the "meaningful use" criteria as defined from the rules and regulations emanating from the ARRA and HITECH Acts.

I am a doctoral nursing student at East Tennessee State University and have been in very close contact with Tom Deweese, who has taught me much about your progress in this research and the results in chart form. As I am writing the dissertation portion of my program and plan to analyze Tennessee's level of readiness from a survey conducted here in Tennessee, I plan to refer to the AHA research and findings and would like permission to reprint the graphs that were generated from the 2010-2011 data collections. I would give full credit to the AHA and make no modifications to the material. The research findings that you have are very important to pointing out the additional resources needed by rural hospitals and also the need to examine and extend the timeline for implementation. It is my hypothesis that the Tennessee survey data will show the same findings.

In order to be concise, I will end here, but I will answer any and all questions that you might have of me or the work that I am writing. Thanks in advance for your support and permission.

Respectfully submitted,
Kathryn Wilhoit

Kathryn Wilhoit, PhDc, RN, NEA-BC, FACHE
Corporate Vice President
Mountain States Health Alliance

APPENDIX I – Weiner Permission Email

From: Weiner, Bryan J <weiner@email.unc.edu>
Sent: Tuesday, April 10, 2012 2:36 PM
To: Wilhoit, Kathryn
Cc: Bryan_Weiner@unc.edu
Subject: Re: Communication regarding a request to quote your work in my dissertation

Kathryn,

My apologies for the delay in my reply.

You are welcome to use the diagram in your work with appropriate citation.

It might be worthwhile to talk be phone. I'm working with a faculty member here to assess the organizational readiness of UNC Healthcare's 55 outpatient clinics to achieve meaningful use.

Perhaps we could compare notes?

Bryan

Sent from my iPhone

On Apr 8, 2012, at 9:16 PM, "Wilhoit, Kathryn" <WilhoitKW@msha.com> wrote:

> Currently, I am working on a dissertation regarding the measurement of the readiness of hospitals in Tennessee to meet the reporting timelines and content for the "meaningful use" criteria reporting for monetary reward through the American Recovery and Reinvestment Act of 2009.
>
> Your description of "readiness" and the model that outlined all the factors that affect the readiness of an organization to be successful. I would like to use the model diagram and certainly will give full credit to you for the work. Your work is very much related to the readiness of hospitals to achieve a successful computerization of physician orders and other computer integration.
>
> If you request additional information, please let me know. I look forward to your reply.
>
> *Kathryn Wilhoit*
>
> Kathryn Wilhoit, PhD, RN, NEA-BC, FACHE
> Corporate Vice President
> Mountain States Health Alliance
> 423 431 1007
> **Let's make a patient-centered difference for a patient or family, today!**

VITA

KATHRYN W. WILHOIT

Personal Data:	Date of Birth: June 30, 1947 Place of Birth: Greeneville, Tennessee Marital Status: Married
Education:	Public Schools, Greeneville, Tennessee B.S. Nursing, East Tennessee State University, Johnson City, Tennessee, 1969 M.S. Nursing, University of Virginia, Charlottesville, Virginia, 1981 Ph.D. Nursing, East Tennessee State University, Johnson City, Tennessee, 2012
Professional Experience:	Staff Nurse, Laughlin Memorial Hospital; Greeneville, Tennessee, March 1969 – June 1969 Head Nurse, Leigh Memorial Hospital; Norfolk, Virginia 1969 – 1971 Instructor and Coordinator of Practical Nursing Program, Johnson City Vocational School; Johnson City, Tennessee, 1971 – 1973 Director of Nursing Education, Memorial Hospital; Johnson City, Tennessee, 1974 – 1975 Assistant Director of Nursing, Memorial Hospital; Johnson City, Tennessee, 1975 – 1980 Director of Nursing, Johnson City Medical Center; Johnson City, Tennessee, 1981 – 1988 Associate Administrator, Mountain States Health Alliance; Johnson City, Tennessee, 1988 – 1992 Vice President, Mountain States Health Alliance; Johnson City, Tennessee, 1992 – 1998 CEO of Northside Hospital, Mountain States Health Alliance; Johnson City, Tennessee, 1998 – 2003 Vice President and CNO, Mountain States Health Alliance; Johnson City, Tennessee, 1998 – 2003 Vice President and CNE, Mountain States Health Alliance; Johnson City, Tennessee, 2003 – 2007 Corporate Vice President, Mountain States Health Alliance; Johnson City, Tennessee, 2007 – present

Publications:

Wilhoit, K.W. (1988). "Changing the Image of the Med/Surg Nurse: How One Hospital is Doing it and Why." *Nursing Management.*

Wilhoit, K.W. (1992). "Tennessee Nurse." *Tennessee Nurses' Association,* p. 32.

Garmany, J.D., Gonzales, F., Ketron, M., Bismark, L., Hall, J., Terry, K., Wilhoit, K.W., & King, M. (1998). "Implementation of Critical Incident Stress Debriefing." *Tennessee Nurse*, pp. 20-22.

Wilhoit, K.W. (2001). "Now is a Great Time to Choose the Nursing Profession." *Article printed in Kingsport Times-News, May.*

Wilhoit, K.W. (2004). "New Nurses' Perception of Nursing Practice and Quality Patient Care." *Journal of Nursing Care Quality.*

Wilhoit, K.W. (2004). "Senior Partnership Practicum." *Journal of Nurses in Staff Development.*

Wilhoit, K.W., et al (2006). "Health Care Financial Management for Nurse Managers." Jones and Barlett Publishers: Sudbury, Massachusetts, Chapter 3.

Wilhoit, K.W., Mustain, J., & King, M. (2006). "The Role of Frontline RNs in the Selection of an Electronic Medical Record Business Partner." *CIN: Computers, Informatics, Nursing.*

Wilhoit, K.W. (2006). "I.T. as the Catalyst for a Patient-Centered Culture with Safety as a Visible Priority." *Nursing Management*.

Wilhoit, K.W. (2008). "Change Readiness Assessment for Conversion to Electronic Medical Records." *JONA.*

Wilhoit, K.W. (2009). "Electronic Records: What are the Keys to Success." *The Business of Caring.*

Wilhoit, K.W. (2009). "Cures for EMR Implementation Headaches." *The Business of Caring.*

Wilhoit, K.W. (2010). "Preparing for Organizational Change." *CIN: Computers, Informatics, Nursing.*

Wilhoit, KW. (2011). "Focus on Medications that May Increase the Potential for Falls, Immobility, and Confusion in Patients over 65 Years of Age." *Physician's Compass.*

Honors and Awards:

Golden Apple Award for Nursing Education, 1987.

Outstanding Alumni, East Tennessee State University, 1990 and 1997.

Honorarium for Women and Industry Award Recipient, Altrusa International, Kingsport Chapter, 1991.

Alma. L. Gault Leadership Award, District V Tennessee Nurses Association, 1996.
Meritorious Service Award, Tennessee Hospital Association, 1997
Paul Harris Award, Rotary 2003
Health Care Hero, May 19, 2000
Leader in Christian Service Award, Milligan College 2002
Performance Improvement Champion, Mountain States Health Alliance, 2005 and 2006.
Operational Effectiveness Pillar Quality Award 2011, Mountain States Health Alliance, 2005 and 2006.