The Completeness of the Electronic Medical Record with the Implementation of Speech Recognition Technology

Daniel F. Cesene

Submitted in Partial Fulfillment of the Requirements

for the Degree of

Master of Health and Human Services

YOUNGSTOWN STATE UNIVERSITY

May, 2014

The Completeness of the Electronic Medical Record

with the Implementation of Speech Recognition Technology

Daniel F. Cesene

I hereby release this thesis to the public. I understand that this thesis will be made available from the OhioLINK ETD Center and the Maag Library Circulation Desk for public access. I also authorize the University or other individuals to make copies of this thesis as needed for scholarly research.

Signature:

Daniel F. Cesene, Student Date

Approvals:

Dr. Joseph P. Lyons, Thesis Advisor Date

Dr. Ronald K. Chordas, Committee Member Date

Dr. Richard L. Rogers, Committee Member Date

Dr. Salvatore A. Sanders, Associate Dean of Graduate Studies Date

Abstract

The advent of the electronic medical record (EMR) has transformed the process of clinical documentation. When combined with the speech recognition technology (SRT), EMR completeness has increased over methodologies without this technology. This research examined chart audit completion scores of physicians and scribes working within four Northeastern Ohio Emergency Services departments. SPSS® Statistics were used to perform a Repeated Measure Analysis using paired-samples *t* tests calculated to compare mean completion scores one month prior versus six months after SRT implementation. The mean completion score of pre-SRT implementation with and without the assistance of scribes was 5.5 ($sd = .8$) and the mean completion score of post-SRT implementation without the assistance of scribes was 6.0 ($sd = .9$) indicating a significant increase from pre-SRT versus post-SRT implementation ($t(17) = -3.9$, $p < 0.5$). The mean completion score of pre-SRT implementation without the assistance of scribes was 5.0 ($sd = 1.1$) and the mean completion score of post-SRT implementation without the assistance of scribes was 6.0 ($sd = .9$) also indicating a significant increase from pre-SRT versus post-SRT implementation ($t(17) = -4.7$, $p < 0.5$). These analyses validated the strong statistical probability that the completeness scores of physicians utilizing SRT will exceed the total completeness scores of physicians and scribes not using this technology. Subsequently, the null hypotheses were rejected in support of the alternative hypotheses, which concluded: 1) The completeness of the EMR will at least remain the same or improve with the implementation of SRT. 2) The completeness of the EMR will at least remain the same or improve when speech recognition technology is used without scribe utilization.

Table of Contents

Acknowledgements

It is best that an undertaking of this considerable magnitude should not be assumed accomplishable without the encouragement of others. The support of these appreciable souls serves to remind us that the process of education requires much more than adherence to pedagogic rhetoric or scholarly academia. We do well to consider that learning is truly a God-given inspirational process, uniquely synergized and impassioned by the wisdom and tutelage of those willing to sacrifice their resources and permit their own tiresome shoulders to be continually climbed.

While it would be nearly impossible to mention all who have assisted me in this endeavor, I would indeed be most remiss if I omitted those to whom I owe my deepest gratitude: I thank my wife Diane for her forbearance and willingness to brew the coffee and keep the covers warm. I thank my family for their loving reassurance: Shannon & Brent Hurd (Mackenzie & Aiden), Jeremy & Jody Cesene (Emma & Jacob), Aaron & Courtney Cesene, and Nathan & Brandy Cesene (Ayden & sibling in utero). I am indebted to my Thesis Committee: Chairman Dr. Joseph P. Lyons, Dr. Ronald Chordas, Dr. Richard Rogers, and Dr. Salvatore Sanders; who always made themselves available for my persistent musings. I am very grateful for my friends and associates from the Humility of Mary Health Partners: Valerie Mihalik and Tracy Weigel; who graciously provided relevant technical information and practical insight. Special thanks to Professor Joe Mistovich: Health Professions chair, along with my fellow student-assistant: Christopher Palmer. Last, but certainly not least, I owe a debt of gratitude to my "lifesavers": classmates and colleagues Lauren Kocher and Matthew Ozanich, without whom I would have almost certainly remained clueless and befuddled.

Chapter One

Introduction

Introduction

The advent of the electronic medical record (EMR) has transformed the process of medical record keeping. While changes in clinical documentation methodology have met with mixed review, there is indication that when combined with the implementation of speech recognition technology (SRT), the capabilities for generating a more comprehensive EMR have substantially improved. If advancements in medical technology have the responsibility of providing for the welfare of the patient while improving continuity of care, then the implementation of SRT within the documentation process must be shown to be safe and reliable through its contributions to EMR completeness. This chapter provides an account of the development and advancements of the EMR while presenting a more specific overview of the completeness of the EMR with the implementation of SRT in terms of the issues examined, the importance of the research conducted, and the specific problem to be addressed.

Clarification of terminology. While the usage of the terms: Electronic Medical Record (EMR) and Electronic Health Record (EHR) can be used interchangeably, according to the Office of the National Coordinator for Health Information Technology (ONC), both of these terms are distinct. While an EMR contains the medical history of the patient in one practice or facility, an EHR provides a record of a patient's overall care extending beyond the health organization that originally collected and compiled the information. The EHR is designed to share information with all providers involved in the patient's care. Data can be created, managed, consulted and exchanged by authorized personnel across all healthcare organizations. (Garrett & PhD, 2100)

EMR development and advancements. The basic concept of the EMR was initialized by innovators who envisioned the development of automated computerized systems which could be configured to reorganize individual patient records leading to enhanced utilization and efficiency. Subsequent collaboration between physicians and health information technology (HIT) focused on the expansion of processes able to provide timely and progressive information through the collection and aggregation of ancillary data used for epidemiological studies, medical reviews, and business audits. These advancements in technology led to the establishment of a newly devised electronic structure developed by Dr. Lawrence L. Weed, known as problem oriented medical records (POMR). Weed, who later became known as the Father of Problem Oriented Medical Records (Ferguson, 1999) found an revolutionary way to make it possible for physicians to check for drug allergies and interactions, determine medication dosages, and provide suggested diagnostic testing and interventions for hundreds of common medical complications. Together, the labors of these technological pioneers culminated in the transformation of medical documentation systems focused on improved patient care and safety (Pinkerton, 2006).

Financial incentives and legislative mandates. Dynamic factors involved in many recent EMR developments include both financial incentives provided and legislative mandates imposed upon the collection and transmission of electronic medical information through the Health Information Technology for Economic and Clinical Health Act (HITECH). Signed into law on February 17, 2009 as part of the American Recovery and Reinvestment Act of 2009, this legislature promoted the adoption of Meaningful Use (MU) within health information technology to improve safety, quality, and efficiency and to reduce health disparities. (U.S. Department of Health & Human Services, 2014) The term: Meaningful Use refers to specific legislatively-imposed criteria encompassing the application of certified electronic health record (EHR) technology which is clarified in the Literature Review chapter of this study. The program was designed to provide incentive payments of up to $63,750 to eligible professionals, eligible hospitals, and critical access hospitals (CAHs) as they adopt, implement, upgrade or demonstrate meaningful use of certified EMR technology (Table 1)(Centers for Medicare & Medicaid Services, 2014).

Patient care and safety compromised. As EMR technology increased, improved patient care and safety were to remain permanent objectives, however; subsequent studies such as the 2011 study based on reports to the FDA revealed an alarming elevation in complications, including: unclear drop-down menus contributing to prescription drug dosage errors, inaccurate medical records revealing improper and/or absent information resulting in unnecessary surgery, and network delays in transmitting medical images leading to serious injury and/or fatality (New Patient Safety Risks Associated With Growing EHR Adoption, 2013). Another study published by the Pennsylvania Patient Safety Authority in 2012 revealed that although EMR adoption was able to reduce some medical errors associated with clinical documentation, other electronic medical errors were steadily mounting. The study announced that medical error incident reports filed in 2011 had more than doubled 2010's figures. The majority of these incidents involved errors in human data entry, such as the entry of "wrong" data, the failure to enter data, and other technical failures on the part of the EMR system itself (Erin Sparnon & William M. Marella, 2012).

While organizations such as the Certification Commission for Healthcare Information Technology (CCHIT) was established in 2004 under the direction of the Department of Health and Human Services (HHS) as a certification authority for EHR adoption to provide improved standards for EMR authorization, the repercussions of faulty technology serve to reinforce the demand for increased HIT accountability (Rouse, CCHIT - Certification Commission for Healthcare Information Technology, 2014). Subsequently, continuous monitoring is needed to assess the viability of the EMR to ensure patient care and safety (Smelcer, Miller-Jacobs, & Kantrovich, 2009). Information from a 2012 report prepared by the Committee on Patient Safety and Health Information Technology Board on Health Care Services announced that future EMR systems would be reliant on upon improved HIT to provide interoperability, user-friendliness, and documentation completeness in order to ensure patient care and safety (Services, 2012). In order to remain effective, clinical documentation must improve the quality of the patient encounter and create greater efficiencies. An increasing need for accurate, complete, and accessible data within the EMR requires real-time documentation that can be provided through the implementation of SRT. Although evidence shows that SRT now plays a vital role the clinical documentation process, the implementation of this technology must be shown to support these overall HIT objectives (American Health Information Management Association, 2014).

Statement of the Problem

While there are three areas of concern affecting patient care and safety within the EMR, this research focuses on the problem of the completeness of the EMR with the implementation of speech recognition technology.

The first area of concern. The first area of concern affecting patient care and safety within the EMR involves the need for interoperability between electronic systems. In general, the term: interoperability, describes the capability of a medical system to run applications from competitive vendors across local or wide-area networks regardless of their architecture or operating systems (BusinessDictionary.com, 2014). While other areas of the problem are most relevant to this research, interoperability is explained here in order to help provide a greater understanding of the overall problem. Interoperability is one of many federal requirements necessary for the aforementioned Meaningful Use (MU). More specifically, interoperability permits data to be communicated within autonomous networks and also allows encrypted information to be transmitted to and among other proprietary systems. Future compliance to MU standards will require an advanced interoperability level allowing for data exchange without the need for human intervention (Rouse, 2010).

The second area of concern. The second area of concern affecting patient care and safety within the EMR involves user-friendliness. The term: user-friendliness has become synonymous in the world of health information technology with the idea of accessibility, or the ability of an operator or "user" to successfully interface with useable information (BusinessDictionary.com, 2014). It is critical that EMR users possess the ability to both input and manipulate essential patient data in a timely and proficient manner that is neither confusing nor intimidating. While the EMR has brought about many opportunities for the field of Health IT to create patient record systems which improve patient outcomes and decreased costs, there is evidence to show that one considerable impediment to efficiency is the enormous time required for clinical documentation (Amarasingham R, 2009).

The third area of concern. The third area of concern affecting patient care and safety within the EMR involves clinical documentation completeness. Medical record completeness is determined by the degree of conformity to an expected or required standard (Merriam-Webster Dictionary, 2014). The "degree of conformity" within the patient record is most germane to our present research because it signifies that in order for a patient record to be complete the patient record must contain required information that meets or matches specific criteria. The following two contrasting examples of this concept of *conformity* relating to completeness will help to bring clarity: *Example One*: An Emergency Services physician is expected or required to enter information into EMR record identifying an impression or diagnosis of the patient's condition. After obtaining information from a urine culture, the provider uses the assessment to conclude that the patient has a medical condition known as Acute UTI (Urinary Tract Infection). The provider properly responds by entering the identified diagnosis into the EMR. Since the information that the provider entered into the EMR meets or matches the criteria expected or required, this portion of the EMR *is in conformity to an expected or required standard*. Subsequently, this portion of the EMR *is considered complete*. *Example Two*: An Emergency Services physician is expected or required to enter information into the EMR identifying an impression or diagnosis of the patient's condition, however; after assessment, the provider failed to enter information into the EMR identifying an impression or diagnosis of the patient's condition. The absent or omitted information *does not* meet nor match the expected or required criteria, therefore; this portion of EMR *is not in conformity to an expected or required standard*. Subsequently, this portion of the EMR *is not considered complete*.

Studies specific to EMR comprehensiveness, such as the 2009 research conducted within a large Korean hospital, have helped to determine that the degree to which the patient medical record conforms to an expected or required standard is indicative of EMR completeness (Junghwa Jang, 2013). Other significant studies, such as the research that recently examined EMR problems within a larger American hospital respiratory care environment have also established the importance of documentation completion (McKelvy, 2011). Together this research helps to demonstrate that the completeness of the EMR is a measurable component that is essential to patient care and safety.

Background and Need

Interoperability, user-friendliness, and record completeness have been identified as areas of concern affecting the patient care and safety within the EMR. Specific to this present research, user-friendliness and record completeness now reiterated while strategic interventions are explored.

Impediments to user-friendliness. Vital to the user-friendliness within the EMR is the understanding that all "operatives" need to possess the ability to input and manipulate essential patient data in a timely and proficient manner. An operative in the HIT industry is commonly referred to as any professional user who has the need to access and/or interact with electronic medical record data. Two major impediments to obtaining these objectives are: inefficient mechanisms and untimely methodologies.

Innovation as overall intervention to assist user-friendliness. Medical consultants, engineers, and technicians have accommodated the challenges of documentation efficiency through the development of innovative equipment and improved methodologies. Modernized devices and software designed to help prevent and/or counteract many foreseen complications in the management of health records include: the incorporation of graphic user interfaces (GUIs) and various (WIMPs) windows, icons, menus, and pointing devices (Ameen, 2009). Other creative EMR technology includes: the usage of orders management; otherwise known as Computerized Provider Order Entry (CPOE), advanced Decision Support Systems (DSS), and barcoding. In support of this new technology the Institute of Medicine (IOM) has recommended computerized orders and decision-support applications as main Health Information Technology (HIT) mechanisms for increasing patient safety (Staggers, Weir, & Phansalkar 2008). These commendations help to strengthen an earlier position of the IOM praising HIT for being a major mechanism used to reduce errors (Linda T. Kohn, 2000).

Impediments to record completeness. Essential to completeness, the EMR must contain all necessary data to ensure that the conformity to an expected or required standard, therefore; the incompleteness of the EMR is a major impediment to patient care and safety.

Medical transcription as an intervention to record completeness. Many hospitals and physicians utilize the services of medical transcription. Medical transcription is the transfer of oral dictation from doctors and other medical professionals into text (What is Medical Transcription, 2014). Medical transcription has progressed into a process through which the health information of the patient is dictated by the provider, digitally recorded, and then electronically transmitted to a medical transcriptionist (MT) as a voice file. The MT listens to the voice file and then converts the information into a text file that can either be sent back to the physician for storage and/or entered into the EMR. The MT has served as a very helpful intervention to the problem of incompleteness because the MT incorporates methodology which gives them the opportunity to pause and/or rewind a digital recording as many times as necessary in order to clearly understand the provider's intent which helps to avoid and or eliminate any ambiguity. In addition, the MT can also verify the medical terms that are used and listen for any mistakenly repeated phraseology, hesitations, or corrections made within the provider's monologue. Most importantly, MTs are trained to flag critical medical errors and then reorganize the transcript to meet the expected or required standards of the medical record. In cases of ambiguity, a MT is trained either to omit, flag, or correct the questionable item (David, 2009).

Incorporating the use of a scribe as an intervention to incompleteness. In addition to the utilization of the MT, both individual providers and medical facilities often incorporate the use of a scribe. Although the terms: Medical Transcriptionist (MT) and medical scribe are often used interchangeably within some medical literature, the two terms are distinct. The scribe often takes on more of a secretarial role and may serve as a personal assistant to the provider. The scribe also acts as an intermediary for the provider that can track ancillary medical data, document elements of the patient encounter, and facilitate communication between other medical personnel and the provider. A scribe's core responsibility is to capture accurate and detailed documentation of the encounter in a timely manner. While scribes are not permitted to make independent decisions or translations beyond the directives of the hospital or provider, the scribe may play an important role in assisting the provider by locating information for review, and researching requested information (Using Medical Scribes in a Physician Practice, 2012).

As the medical profession has now almost fully transitioned from paper records to electronic medical records, the utilization of scribes is one of the ways which has helped many Emergency Services doctors to address some of the problems associated with reductions in patient treatment that accompany the time-consuming demands of clinical documentation and the EMR in particular. A principal selling point indicated by nationwide scribe services provider, Scribe America is that: "scribe-assisted ED physicians are able to mitigate their burden to document, and focus on patient care at the bedside" (Emergency Medicine, 2014).

Drawbacks of scribes and medical transcription. While there are benefits to medical transcription and scribe utilization, hospitals have looked for alternative approaches to help offset two of the major drawbacks of these services, namely: prohibitive costs and delays in documentation turn-around time (TAT). Relative to cost, transcription can be a huge expense to any budget. Some medical facilities pay upwards of 17 cents per line of transcription (Franklin Square Services, 2014). According to a 2009 white paper published by Nuance Communications, a larger medical facility can average over 16.7 million lines of annual text (Nuance Communications, 2009). These fees add up to an estimated average annual transcription expense of 2.8 million dollars per year (.17 x 16,700,000 = $2,839,000). Regarding TAT, a 2008 report of the American Health Information Management Association and Medical Transcription Industry Association's Joint Task Force on Standards Development had substantial findings impacting administrative decision-making: A survey sent to health information managers (HIM) indicated that a majority of respondents reported that the expected TATs for both paper and EMR outputs in their institutions were approximately 24 hours for clinical documentation components such as medical history, physicals, operative reports, consultations, progress notes, pathology reports, and cardiology reports. The survey also revealed that there was a tie in the voting of expected TAT for the complete document output process that can take between 48 and up to 72 hours (Lucci, Bermudez, Howe, & Lorne, 2008). These numbers may be representative of huge gaps in service that affect the continuity of patient care which are not beneficial to patient safety.

SRT as an intervention to lack of user-friendliness and record completeness. A promising and productive innovation to improve both user-friendliness and medical record completeness is the implementation of SRT into the EMR process. In the last half of the decade SRT usage has expanded exponentially. Now employed within a multiplicity of medical environments including: patient care, clinical research, health-system management, health-services planning, total quality improvement, billing, risk management, and government reporting, SRT has unquestionably become a permanent and indispensable technological tool. One of the huge advantages of SRT implementation is that talk to text technology now makes it possible for physicians to perform clinical documentation within 90-95% accuracy (Figure 1) (Madison, 2013). Talk to text technology enables your words to instantly become type words on your computer. The benefit of talking versus typing makes SRT a very efficient tool over some other methodologies because with little exception most people find that they can talk much faster than they can type. An acoustical model (Figure 2) further illustrates how SRT translates what is spoken into type. This feature of SRT is very important because in addition to efficiency, SRT also helps those with specific physical disabilities or limitations to be able to work in competitive employment (Cavalier, 1996). Competitive employment is often referred to as employment opportunities that any person can apply for regardless of disability status (Center, 2012).

Implications of climbing SRT difficulties. While SRT methodologies are continually improving, there are present complications within the EMR ranging from inattention to carelessness (What is Voice Transcription, 2014). Far from an exhaustive list, the implications surrounding SRT incompleteness include: treatment and medication errors, billing mistakes, non-compliance to required standards, and erroneous alerting mechanisms (Hogan & Wagner, 1997). As mounting incompleteness within the EMR remains of importance to patient care and safety, further research involving the completeness of the EMR with the implementation of SRT remains a most appropriate endeavor.

Purpose of the Study

Purpose Statement

The purpose of this study is to examine the completeness of electronic medical records produced by Emergency Services physicians before and after the implementation of speech recognition technology *with or without* the assistance of a scribe.

Rationale for the Study

Completeness of the EMR remains of critical importance to patient care and safety. The implementation of SRT within four Northeastern Ohio Emergency Services Departments has significantly reduced and/or replaced scribe usage as the Emergency physician has been given a greater responsibility in the EMR documentation process. This study specifically measures chart completeness pre-SRT implementation and post-SRT implementation with and without the use scribes. An assessment of the results of this research will help policy makers to evaluate present effectiveness of this technology which will in turn help to facilitate future decision making.

Research Questions

This study will answer two distinct research questions relating to the completeness of the EMR with the implementation of the SRT:

1. Will the completeness of the electronic medical record at least remain the same or improve with the implementation of speech recognition technology?
2. Will the completeness of the electronic medical record at least remain the same or improve when speech recognition technology is used *without* scribe utilization?

Research Hypotheses

The research questions have led to the proposal of the following hypotheses:

Hypothesis One:

H_1: $\mu 1 \leq \mu 2$

The completeness of the electronic medical record will at least remain the same or improve with the implementation of speech recognition technology.

Hypothesis Two:

H_1: $\mu 1 \leq \mu 2$

The completeness of the electronic medical record will at least remain the same or improve when speech recognition technology is used without scribe utilization.

Description of Completeness Score. In this study, μ1 represents the mean completeness of the medical record under conditions during the period in place before the implementation of speech recognition technology while μ2 represents the mean completeness of the medical record under conditions during the period in place after the implementation of speech recognition technology. A detailed description of the mean completeness scores are found in Chapter four results section.

Significance to the Field

This study identifies the role of SRT completeness within the EMR to help ensure patient care and safety. The results of this study may help decision makers and medical providers to more knowledgeably evaluate the effectiveness of SRT implementation when considering future methodologies and strategies for clinical documentation and the incorporation of scribe and/or transcription services.

Ethical Considerations

This study followed all policies and procedures as outlined by the Youngstown State University Institutional Review Board (YSUIRB) to ensure that this research was conducted in an ethical manner which minimized any potential risks to participants. The YSUIRB determined that this secondary analysis of data collected from a prior YSUIRB approved research protocol was found to meet the criteria of exemption for existing data research. A copy of the National Institutes of Health (NIH) Office of Extramural Research Certificate and a copy of the YSUIRB Letter of Exemption are included in Appendix A of this study.

Chapter One Summary of the Introduction

Chapter one presented an introduction to the theme of this study, namely: the completeness of the EMR with the implementation of SRT. Three areas of concern have been discussed. EMR completeness was identified as an important component affecting patient care and safety. The background and need section of this study has shown the relevance of this research upon the subject matter. The purpose of this study was recognized as examining the completeness of Emergency Services provider charts pre-SRT implementation and post-SRT implementation both *with* and *with and without* the assistance of scribes. The review of the literature found in the following chapter has led to the research questions and accompanying two hypotheses:

1) *The completeness of the electronic medical record will at least remain the same or improve with the implementation of speech recognition technology*.
2) *The completeness of the electronic medical record will at least remain the same or improve when speech recognition technology is used without scribe utilization*.

This study is significant to the field of research by further identifying the role of SRT completeness within the EMR to ensure patient care and safety. Other benefits of this scholarship include: assisting administrators and clinicians to more knowledgeably evaluate the effectiveness of SRT implementation when developing future documentation methodologies and strategies, and helping to provide substantial statistical data for further considerations in the employment and/or exclusion of scribe and transcription services.

Chapter Two

Literature Review

Introduction

This chapter presents a review of the literature which examined eight specific areas related to the completeness of the electronic medical record with the implementation of speech recognition technology. The first section of the review includes research related to the EMR background and history, Meaningful Use goals and outcomes, and remedies to patient care and safety. The second section of the review addresses research related to the evaluation of documentation time, the evolution of SRT, and the contribution of scribes and medical transcription. Finally, the third section of the review examined the importance of SRT to healthcare and discusses research related to mounting complications with electronic medical records and speech recognition technology.

Body of the Review

Section One

The electronic medical record background and history. Knowing the background and history of the Electronic Medical Record (EMR) has clarified information necessary for this present research by providing a suitable framework from which to construct this thesis. This study reveals that although the advent of the EMR has brought about technological changes in clinical documentation along with other ancillary benefits, it is important to note that the first and foremost intent of EMR enactment has always been patient care and safety. The concept of the electronic medical record (EMR) was initialized in the 1960's by innovative individuals who envisioned the development of a computerized system that could be configured to automate and reorganize individual patient records in ways that would enhance utilization subsequently leading to improved patient care and safety. In 1967, collaborative efforts began between medical providers and health information technology (Health IT). Their efforts focused on the expansion of automated processes that would provide timely and progressive information in addition to the collection and aggregation of ancillary data used for epidemiological studies, medical reviews, and business audits. Ultimately, their work culminated in the transformation of documentation designed to provide better patient care and safety. During the next decades, EMR systems made substantial improvements which led to even further progress. Sophisticated technological configurations led to the establishment of a newly devised electronic structure developed by Dr. Lawrence L. Weed who became known as the Father of Problem Oriented Medical Records (POMRs). Author of copious literature (Weed, 1997), Dr. Weed set out to establish a computer-based tool, the problem-knowledge coupler, which provided just-in-time computer support to both the physician and the patient as they work through the process of diagnosing and treating new medical problems. Dr. Weed's vision of a comprehensive health care system based on a new generation of computer tools was instrumental in pointing the way toward the next generation of medical thinking (Ferguson, 1999). Advancements in design allowed providers to check for drug actions, dosages, allergies and interactions, while at the same time providing suggested diagnostics and treatment plans for hundreds of common medical complications (Pinkerton, 2006).

Meaningful Use (MU) goals and outcomes. Researching the goals and objectives of MU has helped to determine that these outcomes are compatibility with the original intent and design of EMR technology. Desired outcomes of MU include: the engagement of patients and family in healthier lifestyles, the improvement of patient care, the coordination of public health, and the maintenance of privacy and security of patient health information. Expected outcomes of federal compliance include: improved clinical results, enriched population health, increased transparency and efficiency, empowered individuals, and more robust research data on health systems (EHR Incentives & Certification: Meaningful Use Definition & Objectives, 2014).

Remedies to patient care and safety. From this information we identify the basis of the research problem germane to our study. According to a 2012 report prepared by the Committee on Patient Safety and Health Information Technology Board on Health Care Services, the remedy required to ensure the viability of EMR systems to provide patient care and safety include: interoperability, improved user-friendliness, and documentation completeness (Services, 2012).

An evaluation of clinical documentation time and information technology. In a 2006 study, physicians in typical hospital settings were spending much of their daily working time on documentation (Kevin J. O'Leary MD, 2006). A broad study of the perceptions of medical residents about the time they spend on documentation revealed that two-thirds of the providers reported spending over four (4) hours or almost one-third of their average shift time in clinical documentation. Disturbingly, interns reported spending more time on imputing data than on direct patient care (Oxentenko AS, 2010). Other studies evaluating time efficiency have noted a considerable increase in initial time spent completing clinical documentation using an EMR as compared to processing information on paper. Putting things into perspective, the implication of this study indicate that if providers spent an average of 30% of their work charting and record keeping, the time would add up to approximately eight-hundred (800) yearly hours, the equivalent of over 33 days and nights, just attempting to undertake the task of clinical documentation (Poissant L, 2005). In a 2004 study of EMR usage, electronic medical documentation was shown to deliver more complete access to the patient record, and improved communication among the clinical healthcare team (Embi PJ, 2004). Contrasting these benefits, researchers in another study identified several unintended consequences of EMR operation, including: changes to workflow, increased note writing time, and an adverse effect on documentation quality. Thus, it was determined that documentation time becomes counterproductive and even competitive to patient care when clinicians inadvertently replace the needs of the patient with the demands of documentation (Weir CR, 2003).

A cross-sectional study of urban hospitals in Texas used a Clinical Information Technology Assessment Tool, which measured a hospital's level of automation based on physician interactions with the information system. This study showed that automation of hospital information was associated with reduced rates of inpatient mortality, complications, costs, and length of stay. After receiving a response from 41 of 72 hospitals (58%) they determined that for all medical conditions studied a 10-point increase in the automation of notes and records was associated with a 15% decrease in the adjusted odds of fatal hospitalizations (0.85; 95% confidence interval, 0.74-0.97). Higher scores in order entry were associated with 9% and 55% decreases in the adjusted odds of death for myocardial infarction and coronary artery bypass graft procedures, respectively. For all causes of hospitalization, higher scores in decision support were associated with a 16% decrease in the adjusted odds of complications (0.84; 95% confidence interval, 0.79 - 0.90). Higher scores on test results, order entry, and decision support were shown to be associated with lower costs for all hospital admissions (-$110, -$132, and -$538 respectively; $p < .05$). The conclusion of this study was that hospitals with automated notes and EMR, order entry, and clinical decision support had fewer complications, lower mortality rates, and lower costs (Amarasingham R, 2009).

Section Two

The evolution of SRT. Originating with Alexander Graham Bell's earlier inventions, it is known that by 1881, Alexander, his cousin Chichester Bell, and colleague Charles Tainter invented a simple recording device that converted air pressure and sound waves into electrical impulses. The Bell/Tainter invention led to the formation of other such devices as the Columbia Graphophone in 1888, the Dictaphone in 1907, and the Ediphone which was created by Thomas Edison. These machines were capable of recording dictation and served as an initial step in the creation of a machine that could automatically transcribe the sound of human voice. Bell Laboratories' Homer Dudley later developed a speech synthesizer called the Voice Operating Demonstrator (VODER), which was subsequently demonstrated at the 1939 New York World Fair. In the 1950s, innovators Davis, Biddulph, and Balashek constructed a device capable of number recognition. Their machine measured the resonance of the human vocal tract during vowel regions of each digit of speech. In the 1970s, innovator Lenny Baum of Princeton University, along with associates from the ARPA Speech Understanding Research project helped other SRT visionaries to realize that future objectives of the electronic speech would include the understanding of speech rather than just the recognition of words. Companies such as IBM, Philips, AT&T, and Dragon Systems began to incorporate this mathematical type of pattern–matching technology into their product development. Predating the advent of the Internet, a network of collaborators, led by Lawrence Roberts, developed the largest speech recognition project ever founded, called: the Speech Understanding Research (SUR) program. While their goal was to develop an innovative system that could actually understand speech, concurrent efforts by IBM and AT&T Bell Laboratories were taking their research in opposite directions. Inventor Fred Jelinek created a voice activated typewriter (VAT) called the Tangora. This novel device which allowed individuals to train their typewriter to recognize the uniqueness of their voice was termed: transcription. This technology was later the basis for medical transcription services and scribes (Madison, 2013). Among those who made notable contributions to the field of speech recognition was modernizer Raymond Kurzweil, PhD who was the principal inventor of several innovations, including the CCD flatbed scanner, the print-to-speech reading machine for the blind, the commercial text-to-speech synthesizer, the first music synthesizer (Klatt, 1987), the first commercially marketed mathematical search engine for speech recognition (Kurzweil Accelerating Intellegence, 2014).

Scribe evaluation. In a 2010 study of scribe usage, researchers discovered that of the 23 physicians in the study who worked with scribes, 39% stated that they felt that the quality of the EMR with the implementation of SRT would not be able to match the efforts produced by the scribes. This percentage may be reflective of some the valuable contributions of scribes which include: organization, grammar, and error detection (Garcia, David, & Chand, 2010). In contrast to these findings, recently the United States Department of Labor Bureau of Statics, projected that the employment of medical transcriptionists will grow approximately eight percent (8%) from 2012 to 2022, however; this increase may be deceiving. While the demand for healthcare is expected to increase the overall need for transcription and scribe services, actual employment opportunities are expected to decrease due to productivity stemming from other technological advances, such as SRT (Occupational Outlook Handbook: Medical Transcriptionists, 2014). This prediction of the Bureau of Statics' is of import to this research because it further evidences the need for increased productivity within clinical documentation, moreover; the forecast unambiguously indicates that advances in HIT provide advantages in technology such as SRT that have now begun to eclipse the efficiency of MT and scribes.

Section Three

Importance of SRT to healthcare. A 2002 study revealed that SRT has been used by successfully by radiologists for many years. Positive attributes include: faster delivery of reports to providers and report turnaround (Edward C. Callaway, 2002). Substantial research conducted in the HUS Helsinki Medical Imaging Center from 2005-2007 concluded that SRT helps to speed up the processing time from the completion of imaging and archiving to when the report was stored and then made available for other clinicians online (Mika A. Koivikko, 2008). An anonymous article found in Health Management Technology discusses how that SRT improves EMR return on investment (ROI). The general consensus was that SRT was helping to increase clinical documentation speed while diminishing time at the end of the day where physicians had previously had to labor to finish their documentation responsibilities with a keyboard. “Physicians were able to portray the uniqueness of each patient encounter better within the note.” says Dr. Nathaniel Gould, physical medicine and rehabilitation physician. "When you rely on transcription, and don't see your work for a week, you may not even remember what you said or who the patient was," he explains (Speech recognition improves EMR ROI: medical group decided that to be most successful with EMR adoption, 100 percent physician population utilization would be necessary, 2009). In a recent interview with Keith Belton: Senior Director, Solutions Marketing, Nuance Communication, an unidentified representative from the Advanced Healthcare Network discussed some of the reasons why SRT has become important to healthcare. Mr. Belton pointed out that both front end and back end speech recognition enhances the use of the EMR. Mr. Belton suggested that providers do not like the idea that they are turned into typists and sometimes they complain about getting carpel tunnel syndrome. Mr. Belton indicated that one of the benefits of front end speech recognition is that dictation is directly placed into the EMR and is immediately available for other members of the care team, eliminating turnaround time and the need for a transcriptionist. Mr. Belton concluded by revealing that SRT advantages are distinctly important in a medical era when hospitals are limiting costs, reducing length of stay, and improving communication. “It is very real-time documentation as the information is available to all members and they can more quickly react to any changes and care plans, and prescriptions are instantly available”, Belton said (Belton, 2013). For the sake of clarification, front-end speech recognition systems generate on-screen text from the physicians dictations in real-time, which permits physicians to edit and finalize documents themselves. In comparison, back-end systems allow dictations to be automatically processed by the speech recognition server in the background and the MT is presented with a transcribed text and the original audio file.

Mounting EMR complications. In 2011, a study based on reports to the FDA revealed an alarming elevation in complications, including: unclear drop-down menus contributing to prescription drug dosage errors, inaccurate medical records revealing improper and/or absent information resulting in unnecessary surgery, and network delays in transmitting medical images leading to serious injury and/or fatality (New Patient Safety Risks Associated With Growing EHR Adoption, 2013). A study published by the Pennsylvania Patient Safety Authority also determined that the numbers of electronic medical errors were steadily mounting. The study announced that eleven-hundred and forty-two (1,142) EMR related medical error incident reports were filed in 2011, which were more than double 2010's figures. The majority of incidents involved errors in human data entry, such as the entry of “wrong” data or the failure to enter data, along with technical failures on the part of the EMR system itself. Although these problems were not linked to SRT, they indicate a further need for accuracy within the patient record which will help to further ensure patient health and safety (Erin Sparnon & William M. Marella, 2012).

Chapter Two Summary of the Literature Review

This literature review examined specific areas relating to the problem of EMR completeness with the implementation of SRT.

A review of the background and history of the EMR has revealed that although the EMR has advanced to accomplish many diverse objectives, the original intent and design of the EMR was to modernize technology in a manner that would ensure patient care and safety.

A study of Meaningful Use (MU) has determined that these legislative incentives and mandates were set in place to enable evolving EMR technology to maintain standards of compliance further ensuring patient care and safety.

From the evaluation of documentation time and automated information systems we conclude that there are mixed reviews concerning EMR time versus traditional paper record keeping. It would appear that although there are initial increases in the documentation time, these temporary limitations are offset by later advantages of productivity. Excessive clinical documentation time can be detriment to patient care and safety when clinicians are hyper focused on documentation instead the needs of the patient.

Of outstanding importance were the conclusions of the study that showed the correlation between medical record automation and reduction in complications, lower mortality rates, and lower costs.

The evolution of SRT portion of the research has shown that technology has tremendously advanced and continues to develop better ways of ensuring the care and safety of patients.

Research shows that MT and scribe services have a positive impact on clinical documentation within the EMR by helping to reduce error and increasing communication. While some research shows that a substantial number of physicians prefer scribe services and feel that SRT alone is not a desirable option, other studies forecast that opportunities for MT and scribe services will diminish as advancement in technology and SRT overshadow the cost prohibitive nature of transcription.

Concerning the importance of SRT to healthcare, studies have indicated that SRT continues to increase EMR productivity. Many physicians' greatest endorsement is the fact that SRT implementation has helped to expedite documentation time and reduce or eliminate after hours office time. Some of the greatest benefits of SRT have been shown to be better ROI and reduction in turnaround time.

Lastly, an examination of the mounting complications of EMR reveals that a major cause of concern is record error stemming from improper or incomplete information that is missing from the record.

In conclusion, Chapter two review of the literature serves to validate the need for statistical research that assesses patient care and safety through an analysis of the completeness of EMR with the implementation of SRT. Chapter three will present an overview of the methodology used to collect statistical information in preparation for answering the proposed research questions.

Chapter Three

Methods

Introduction

The completeness of the electronic medical record (EMR) with the implementation of speech recognition technology has been shown to be of utmost importance in ensuring patient care and safety. Therefore; the methodology for this study was specifically designed to answer two research questions and their associated hypotheses:

1. *Will the completeness of the electronic medical record at least remain the same or improve with the implementation of speech recognition technology?*
2. *Will the completeness of the electronic medical record at least remain the same or improve when speech recognition technology is used without scribe services.*

Hypothesis One:

$H_1: \mu 1 \leq \mu 2$

The completeness of the electronic medical record will at least remain the same or improve with the implementation of speech recognition technology.

Hypothesis Two:

$H_1: \mu 1 \leq \mu 2$

The completeness of the electronic medical record will at least remain the same or improve when speech recognition technology is used without scribe utilization.

Settings/Participants

A quantitative, non-experimental study conducted a secondary analysis of data collected from the patient records of Emergency Services physicians from among four Northeastern Ohio medical facilities.

Description of the Study

Randomly selected patient records were examined for the entry or omission of patient information. A scoring system was used to tabulate the numerical results. Analysis of this data assessed the completeness of the EMR pre-SRT implementation and post-SRT implementation with and without the assistance of utilization.

Measurement Instruments

The completeness of physicians' charting was assessed through an audit of actual EMR(s) using a specially designed Chart Audit Collection Tool (CADCT) (See Appendix C) which was used to record the presence or absence of specific data from within the physician charting. Each individual patient record was examined for the entry or omission of seven components of expected or required patient information, including: Chief Complaint (CC), History Physical Impression (HPI), Electrocardiogram (EKG), Medical Decision Making Progress Notes (MDMPN), Progress Notes (PN), Disposition (DISP), and Diagnosis/Impression (DI).

A scoring system was used to rate the completeness of the each evaluated chart. A single point was scored if there was an entry made in the medical record for each of these fields. In establishing a completeness score, the sum of all points earned was considered. In this study, chart completeness scores could range from charts containing all seven completed fields which would receive a total score of 7 to charts containing zero completed fields which would receive a total score of 0 (Table 2).

Data Collection/Procedures

Two chart audits of patient medical records were conducted for this study. The first audit assessed the completeness of the physician's patient's records pre-SRT implementation and the second audit would assess the completeness of the physician's patients' records post-SRT implementation. In order to make sure that there was an unskewed comparison of EMR completeness, the same five physicians were chosen from each of four Emergency Services facilities to participate in both pre-SRT and post-SRT implementation of chart audits. Each of these physicians (n = 20) were specifically chosen by administrative officials because they were considered to be representative of a larger pool of other full-time Emergency Services physicians employed at that time (N = 70). In both pre-SRT implementation and post-SRT implementation audits, the individual patient's EMR(s) were randomly selected from among hundreds of accessible records through a methodical process involving the selection of every third record for examination.

Pre- implementation audit. The first audit was conducted approximately one month prior to the implementation of speech recognition technology. At three of four facilities 20 patient records per physician were randomly selected for review and audit. Ten of these patient records were prepared with the assistance of scribe, while 10 patient records were prepared without the assistance of a scribe. One of the four facilities did not utilize scribes, so only 10 records per physician were selected from this location. In this first audit the actual number of patient records audited varied due to medical record availability. A total of 348 patient records (N=348) were initially reviewed in this portion of the investigation (Table 3).

Post-implementation audit. The second audit was conducted approximately six months post-SRT implementation. At the time of this second audit, two of previous twenty physicians which had been used in the first pre-SRT implementation audit were no longer working. In addition, only 10 patient records which were prepared without the assistance of a scribe were collected and audited from each of the eighteen remaining physicians (n = 18). Subsequently, a total of 180 patient records (N = 180) were reviewed in this portion of the investigation (Table 4).

Data Analysis

Descriptive Statistics Analysis. A descriptive statistics analysis was incorporated within this research to organize collections of data used to examine EMR completeness. SPSS® Statistics was used to compare numerical frequencies and percentages of seven independent variables contributing to the total completeness score. The statistical data examined consisted of the four following groups of data: 1) pre-SRT implementation with and without the assistance of scribes (Table 5), 2) pre-SRT implementation without the assistance of scribes (Table 6), 3) pre-SRT implementation with the assistance of scribes (Table 7), and 4) post-SRT implementation without the assistance of scribes

(Table 8). The results of these analyses are presented in the following chapter of this thesis.

Repeated Measures Analysis. SPSS® Statistics was used to perform a Repeated Measures Analysis. Often referred to as a Dependent *t* Test or a Paired-Samples *t* Test (Cronk, 2012), this statistical assessment was used to compare the average means scores of two related samples. This research examined the average mean chart completeness scores of patient medical records prepared one month pre-implementation of SRT and then approximately six months post-SRT implementation. The variance in time between audits was needed to allow enough time for both the accumulation of medical records and for Emergency Services physician's to gain relative experience with the integration and operation of the new SRT system. Specific data for this analysis was obtained through descriptive statistics which were used to calculate the average mean completion scores from individual physician's patients' chart audits both pre-SRT implementation and post-SRT implementation. Since two of the physicians who were involved in the pre-implementation audit were unable to participate in the post-SRT implementation audit, these chart audits results were first removed from both pre-SRT implementation and post-SRT implementation scoring. The average mean scores were later derived from an adjusted total of (n = 18) physicians contributing the following: pre-SRT implementation audits derived from patient charts prepared with and without the assistance of scribes (n = 308), pre-SRT implementation audits derived from patient charts prepared without the assistance of scribes (n = 176), pre-SRT implementation audits derived from patient charts prepared with the assistance of scribes (n = 132), and post-SRT implementation audits derived from patient charts prepared without scribe assistance (n = 180) (Table 9). The detailed results of this statistical analysis are presented in the following chapter of this study.

Chapter Three Summary of the Methods

In Chapter Three we presented a detailed description of the methodologies involved in this study and offered an overview of the further data analysis. In Chapter Four we will examine the major findings of this study in which we will enhance the validity, quality, generalizability, and transferability of the results in preparation for the final discussions and conclusions of this research.

Chapter Four

Results

Introduction

The completeness of the electronic medical record (EMR) with the implementation of speech recognition technology (SRT) has been shown to be of importance to patient care and safety. This chapter presents detailed results and specific findings of both the descriptive and inferential statistics used within this research to provide response to the two research questions and their accompanying hypotheses:

1. Will the completeness of the electronic medical record at least remain the same or improve with the implementation of speech recognition technology?

2. Will the completeness of the electronic medical record at least remain the same or improve when speech recognition technology is used without scribe services.

Hypothesis One:

$H_1: \mu 1 \leq \mu 2$

The completeness of the electronic medical record will at least remain the same or improve with the implementation of speech recognition technology.

Hypothesis Two:

$H_1: \mu 1 \leq \mu 2$

The completeness of the electronic medical record will at least remain the same or improve when speech recognition technology is used without scribe utilization.

Descriptive Statistics

Descriptive statistics were incorporated to organize collections of data used in this research. SPSS® Statistics was used to analyze four groups of independent variables contributing to the total completeness score of the EMR: 1) pre-SRT implementation with and without the assistance of scribes, 2) pre-SRT implementation without the assistance of scribes, 3) pre-SRT implementation with the assistance of scribes, and 4) post-SRT implementation without the assistance of scribes.

The numerical frequency and percentages of completeness scores pre-SRT implementation with and without the assistance of scribes were as follows: Chief Complaint (*n* = 308 or 100%, *SD* = .000), History Physical Impression (*n* = 269 or 87.3%, *SD* = .333), Electrocardiogram (*n* = 169 or 54.9%, *SD* = .498), Medical Decision Making (*n* = 286 or 92.9%, *SD* = 2.58), Progress Notes (*n* = 176 or 57.1%, *SD* = .496), Disposition (*n* = 248 or 80.5%, *SD* = .397), and Diagnosis/Impression (*n* = 250 or 81.2%, *SD* = .392). The total completion score pre-SRT implementation with and without the assistance of scribes containing all seven completed audit criteria was (*N* = 1706 or 26.6%, *SD* = 1.29) (Table 5).

The numerical frequencies and percentages of completeness scores pre-SRT implementation without the assistance of scribes were as follows: Chief Complaint (*n* = 176 or 100%, *SD* = .000), History Physical Impression (*n* = 140 or 79.5%, *SD* = .405), Electrocardiogram (*n* = 91 or 51.7%, *SD* = .501), Medical Decision Making (*n* = 161 or 91.5%, *SD* = .280), Progress Notes (*n* = 89 or 50.6%, *SD* = .501), Disposition (*n* = 118 or 67%, *SD* = .471), and Diagnosis/Impression (*n* = 120 or 68.2%, *SD* = 467) The total completion score pre-SRT implementation without the assistance of scribes containing all seven completed audit criteria was (*N* = 895 or 14.2%, *SD* = 1.36) (Table 6).

The numerical frequencies and percentages of completeness scores pre-SRT implementation with the assistance of scribes were as follows: Chief Complaint (*n* = 132 or 100%, *SD* = .000), History Physical Impression (*n* = 129 or 97.7%, *SD* = .15), Electrocardiogram (*n* = 78 or 59.1%, *SD* = .494), Medical Decision Making (*n* = 125 or 94.7%, *SD* = .225), Progress Notes (*n* = 87 or 65.9%, *SD* = .476), Disposition (*n* = 130 or 98.5%, *SD* = .123), and Diagnosis/Impression (*n* = 130 or 98.5%, *SD* = .123). The total completion score pre-SRT implementation with the assistance of scribes containing all seven completed audit criteria was (*N* = 811 or 43.2%, *SD* = .892) (Table 7).

The numerical frequencies and percentages of completeness scores post-SRT implementation without the assistance of scribes were as follows: Chief Complaint (*n* = 180 or 100%, *SD* = .000), History Physical Impression (*n* = 166 or 92.2%, *SD* = .269), Electrocardiogram (*n* = 111 or 61.7%, *SD* = .488), Medical Decision Making (*n* = 179 or 99.4%, *SD* = .075), Progress Notes (*n* = 152 or 84.4%, *SD* = .363), Disposition (*n* = 148 or 82.2%, *SD* = .383), and Diagnosis/Impression (*n* = 139 or 77.2%, *SD* = .421). The total completion score post-SRT implementation without the assistance of scribes containing all seven completed audit criteria was (*N* = 1075 or 41.1%, *SD* = 1.14) (Table 8).

Comparative analysis of pairings. Descriptive analyses were also conducted to compare three separate pairs of data: 1) pre-SRT implementation with and without the assistance of scribes compared with post-SRT implementation without the assistance of scribes. 2) pre-SRT implementation without the assistance of scribes compared with post-

SRT implementation without the assistance of scribes. 3) pre-SRT implementation with the assistance of scribes compared with post-SRT implementation without the assistance of scribes (Table 11).

Statements of the results for the comparative statistical analyses. In an analysis of *pair one* between total completeness percentage scores pre-SRT implementation with and without the assistance of scribes compared to post-SRT implementation without the assistance of scribes, the results indicated an increase of 14.5% in the total completeness percentage scores of pre-SRT implementation without scribes (26.6%) compared to post-SRT implementation without scribes (41.1%) (41.1 – 26.6 = 14.5).

In an analysis of *pair two* between total completeness scores pre-SRT implementation without the assistance of scribes versus post-SRT implementation without the assistance of scribes, the results of the analysis indicated an increase of 26.9% in the total completeness percentage scores pre-SRT implementation with and without scribes (14.2%) compared to post-SRT implementation without the assistance of scribes (41.1%) (41.1 – 14.2 = 26.9).

In an analysis of *pair three* between total completeness scores pre-SRT implementation with the assistance of scribes versus post-SRT implementation without the assistance of scribes, the results of the analysis indicated a slight decrease of 2.1% in the total completeness percentage scores pre-SRT implementation with the assistance of scribes (43.2%) compared to post-SRT implementation without the assistance of scribes (41.1%) (43.2 – 41.1 = 2.1).

Inferential Statistics

SPSS® was used to perform a Repeated Measures analysis (paired-samples *t* test) which assessed the differences between the average mean chart completeness scores of three pairs of data: Pair One) pre-SRT implementation with and without the assistance of scribes versus post-SRT implementation without the assistance of scribes, Pair Two) pre-SRT implementation without the assistance of scribes versus post-SRT implementation without the assistance of scribes, and Pair Three) pre-SRT implementation with the assistance of scribes versus post-SRT implementation without the assistance of scribes.

Pair One: Mean chart completeness scores pre-SRT implementation with and without the assistance of scribes ranged from 3.7 (53% complete) to 6.3 (90% complete), while mean chart completeness scores post-SRT implementation without the assistance of scribes were higher, ranging from 4.0 (57% complete) to 6.8 (97% complete).

Pair Two: Mean chart completeness scores pre-SRT implementation without the assistance of scribes ranged from 2.6 (37% complete) to 6.3 (90% complete) while mean chart completion scores post-SRT implementation without the assistance of scribes were higher, ranging from 4.0 (57% complete) to 6.8 (97% complete).

Pair Three: Mean chart completeness scores pre-SRT implementation with the assistance of scribes ranged from 4.4 (62% complete) to 7.0 (100% complete) while mean chart completion score post-SRT implementation without the assistance of scribes were slightly lower, ranging from 4.0 (57% complete) to 6.8 (97% complete).

Statement of the results for the repeated measures analyses. A paired-samples *t* test was calculated to compare the mean score of pre-SRT implementation with and without the assistance of scribes versus the mean score of post-SRT implementation without the assistance of scribes. The mean of the pre-SRT implementation with and without the assistance of scribes was 5.5 (*sd* = .8), and the mean of the post-SRT implementation without the assistance of scribes was 6.0 (*sd* = .9) (Table 11). In this two-tailed statistical analysis, a significant increase was found from pre-SRT implementation with and without the assistance of scribes versus post-SRT implementation without the assistance of scribes ($t(17) = -3.9$, $p < 0.5$) (Table 13). The Pearson's Coefficient showed that a strong positive correlation was found ($r(16) = .858$, $p < .000$) indicating a significant linear relationship between these two variables and the strong statistical probability that as one variable increases the other variable will also increase (Table 12).

A paired-samples *t* test was calculated to compare the mean score of pre-SRT implementation without the assistance of scribes versus the mean score of post-SRT implementation without the assistance of scribes. The mean of the pre-SRT implementation without the assistance of scribes was 5.0 (*sd* = 1.1), and the mean of the pos-SRT implementation without the assistance of scribes was 6.0 (*sd* = .9) (Table 11). In this two-tailed statistical analysis, a significant increase was found from pre-SRT implementation without the assistance of scribes versus post-SRT implementation without the assistance of scribes ($t(17) = -4.7$, $p < 0.5$) (Table 13). The Pearson's Coefficient showed that a strong positive correlation was found ($r(16) = .697$, $p < .001$) indicating a significant linear relationship between these two variables and the strong statistical probability that as one variable increases the other variable will also increase (Table 12).

A paired-samples *t* test was calculated to compare the mean score of pre-SRT implementation with the assistance of scribes versus the mean score of post-SRT implementation without the assistance of scribes. The mean of the pre-SRT implementation with the assistance of scribes was 6.1 ($sd = .7$), and the mean of the pos-SRT implementation without the assistance of scribes was 5.9 ($sd = .8$) (Table 13) In this two-tailed statistical analysis, no significant difference was found from pre-SRT implementation with the assistance of scribes versus post-SRT implementation without the assistance of scribes ($t(12) = 1.5$, $p > 0.5$) (Table 13). The Pearson's Coefficient showed that a strong positive correlation was found ($r(11) = .743$, $p < .004$) indicating a significant linear relationship between these two variables and the strong statistical probability that as one variable decreases the other variable will also decrease.

Statement of the results for the hypotheses testing. Based upon statistical findings we therefore; reject the first null hypothesis (H_0) that the completeness of the electronic medical record will not at least remain the same nor improve with the implementation of speech recognition technology, in support of the alternative hypothesis (H_1) that the completeness of the electronic medical record will at least remain the same or improve with the implementation of speech recognition technology. Based upon statistical findings we also reject the second null hypothesis (H_0) that the completeness of the electronic medical record will not at least remain the same nor improve when speech recognition technology is used without scribe utilization, in support of the alternative hypothesis (H_1) that the completeness of the electronic medical record will at least remain the same or improve when speech recognition technology is used without scribe utilization.

Chapter Four Summary of the Results

Chapter Four examined the major statistical findings of this study in order to enhance the validity, quality, generalizability, and transferability of the results in preparation for the final discussions and conclusions of this research found in the following chapter.

Chapter Five

Discussion

Introduction

While the advent of the electronic medical record (EMR) has transformed the process of clinical documentation, there is indication that when combined with the implementation of speech recognition technology (SRT) the overall capabilities for generating a more time-conscience, cost-effective, and comprehensive EMR have substantially improved. Research has shown that EMR completeness is of vital importance to ensuring patient care and safety. In order to protect patient welfare while ensuring continuity of care, the implementation of SRT within the EMR process must reliably provide for patient care and safety through the delivery of EMR completeness.

The purpose of this quantitative, non-experimental research was to study the effects of SRT on EMR completeness through an analysis of chart audits from Emergency Services physicians' pre-SRT implementation and six months post-SRT implementation. After preliminary investigation and thorough literature review, pertinent research data was analyzed using SPSS® Statistical software which validated the study findings and confirmed both of the alternative hypotheses:

1) *The completeness of the electronic medical record will at least remain the same or improve with the implementation of speech recognition technology.*

2) The completeness of the electronic medical record will at least remain the same or improve when speech recognition technology is used without scribe utilization.

Discussion

The completeness of the electronic medical record (EMR) with the implementation of speech recognition technology (SRT) was chosen as the focus for this study for several essential reasons:

First, it was vitally important to determine whether the post-SRT implementation within the EMR process of the Emergency Services Departments would contribute or detract from EMR completeness. If EMR post-SRT implementation completeness would at least remain the same or increase, it would further demonstrate that SRT was a beneficial instrument that had been was successfully integrated within EMR software and could potentially be utilized progressively throughout the overall corporate medical system.

Secondly, and most germane to this research, the participating Northeastern Ohio medical facilities chosen for this study were in the process of exploring the financial feasibility of SRT usage in relation to cost effectiveness and return on investment (ROI) of scribes and medical transcriptionists employed within their Emergency Services Departments. SRT has been introduced within these facilities as a tactical methodology developed to increase productivity, reduce costs, and decrease documentation turnaround time (TAT) while providing improved continuity of care and patient safety. Therefore; it was expedient to take advantage of the opportunity to measure and compare pre-SRT versus post-SRT implementation completeness at a time when Emergency Services physicians faced a reduction in scribes and transcription services while being able to utilize advancement in technology such as SRT. Establishing that the physicians' post-

SRT implementation EMR completeness scores had actually increased without the assistance of scribes served to confirm that SRT is a trusted and reliable resource that can contribute to patient care and safety, reduce turnaround time (TAT), and provide substantial financial savings on transcription services and/or scribe employment.

Thirdly, the implications of this research may have far reaching impact not only on the administrative decision making of other departments within the current hospital system, but will also affect other clinical settings that might gleam valuable insight from these research findings. As SRT is utilized in similar settings, this and other statistical research provide evidence-based information and other empirical data for the strategical planning of future endeavors.

Major results of the study. The major results of this study were acquired through an analysis of pre-SRT implementation and post-SRT implementation chart audit data collected from the EMR of Emergency Service physicians. While the physician's records audited in this study were selected by the hospital administration, the actual EMRs chosen for the chart audit were randomly selected from among available patient records. Individual EMR(s) were selected through an orderly process of examining every third chart record audit. Although this selection process was arduous, this random selection process minimized the risk of selection bias. The chart audit tool used for this examination contained a check list of criteria which was used in this research to determine EMR completeness. Chart audits were collected one month prior to SRT implementation and approximately six months post-SRT implementation to assure that physicians had ample time to adjust to both SRT methodology and the minimization of scribes. After collection, the research data was entered into SPSS® Statistics for further analysis which included summation of completeness scores.

Descriptive analyses. The descriptive analyses used for this study provided numerical frequencies, percentages, and measures of central tendency contributing to the total completeness score of the EMR both pre-SRT implementation and post-SRT implementation. Three pairs of examined data revealed: 1) a substantial increase of (14.5%) in the total completeness percentage scores of pre-SRT implementation with and without the assistance of scribes compared with post-SRT implementation without the assistance of scribes, 2) a substantial increase of (26.9%) in the total completeness percentage scores pre-SRT implementation without scribes when compared to post-SRT implementation without the assistance of scribes, and finally 3) a very slight decrease of 2.1 in the total completeness scores of pre-SRT implementation with the assistance of scribes when compared to post-SRT implementation without the assistance of scribes. As was demonstrated in the Repeated Measures Analysis of these same pairings, the slight decrease in the total completeness score was shown to have no statistical difference and did not invalidate the research hypotheses.

Inferential statistical analyses. The Repeated Measures analyses used for this study calculated and compared the mean completion scores three pairs of variables determining EMR completeness: 1) a significant increase was found from pre-SRT implementation with and without the assistance of scribes versus post-SRT implementation without the assistance of scribes ($t(17) = -3.9, p < 0.5$), 2) a significant increase was found from pre-SRT implementation without the assistance of scribes versus post-SRT implementation without the assistance of scribes ($t(17) = -4.7$, $p < 0.5$) and 3) no significant statistical difference was found from pre-SRT implementation with the assistance of scribes versus post-SRT implementation without the assistance of scribes ($t(12) = 1.5$, $p > 0.5$). Regarding this third pairing of data comparing pre-SRT implementation with the assistance of scribes versus post-SRT implementation without the assistance of scribes, the results of this analysis showed that there was a *p value* of .147 which is greater than .05 indicating that there was no significant statistical difference in the results of that pairing data. Although the results are inconclusive, it may be important to consider that the results of this particular analysis may indicate that medical facilities that do not presently utilize SRT may obtain comparable EMR completeness score when scribes are entirely used to assist physicians.

Other considerations for discussion. As previously mentioned in the literature review, studies such as those study published by the Pennsylvania Patient Safety Authority determined the need for accuracy within the patient record which will help to further ensure patient health and safety (Erin Sparnon & William M. Marella, 2012). While completeness within the EMR is certainly a contributing factor to patient safety, completeness within the EMR is not an indication of accuracy. Therefore; while this research was able to determine a measure of EMR completeness, it was beyond the scope of this study to attempt to establish any measure of accuracy within the EMR. Another consideration for discussion includes the fact that actual measurements of EMR completion time were also beyond the scope of this research, however; based upon physician survey responses earlier assimilated by this Northeastern Ohio medical facility, it was surmised that physicians' perceived that they were able to more quickly complete the EMR post-SRT implementation compared to pre-SRT implementation.

Limitations

There are several limitations that should be taken into consideration when reviewing this research. First, the physicians for this study were chosen by hospital administration instead of random selection. Although there is likelihood that they are merely representative of all Emergency Services Department physicians there is still always the remote possibility that these physicians were chosen based upon some administrative bias or some personal physician affinity. Secondly, the data collected from the chart audit tool had not included the "critical care" component into the total completeness score because administrators felt that present researchers lacked the expertise to medically determine the actual need for critical care services within the treatment of each individual patient. While this decision was quite understandable, the omission and/or inclusion of this additional data may have impacted the total completeness scores and thus the overall findings of this study. Thirdly, at the time that the post-SRT audit was conducted there was no internal evidence within the EMR to physically demonstrate that SRT had actually been utilized by physicians, however; actual SRT usage was surmised based upon individual physician survey responses gathered earlier from this medical facility.

Recommendations for Future Research

Based upon the results of this study, there are several recommendations for future research. First, some of the limitations of this study may be minimized or eliminated in a revised adaptation of this study at a later date. A longer post-SRT implementation time period before further research at these medical facilities would afford physicians to have a much more substantial learning curve in which to gain knowledge and experience with the operation of both electronic medical records and speech recognition technology. It may also be helpful if future research would randomly select physicians and individual electronic medical records for audit while also incorporating both critical care and various time measurement components which were absent from this present study. Additional recommended research would likely include studies designed to evaluate internal record accuracy by critically examining each of the individual audit criteria in detail.

Conclusions

Former research such as the 2010 study by Garcia, David, & Chand determined that 39% of the physicians in their study stated that they felt that the quality of the EMR with the implementation of SRT would not be able to match the efforts produced by the scribes. In contrast, this present research led investigators to a further understanding of the overall impact of the completeness of the EMR with the implementation of SRT. The addition of information from this present research had greatly contributed to that understanding through four major conclusions that have emerged from the results of this study. First, the incorporation of speech recognition technology into the electronic medical record process has been shown to provide physicians with a valuable instrument to perform clinical documentation in a consistent and effective manner which contributes to overall patient care and safety through electronic medical record completeness. Secondly, the results of this study indicate the statistically probability that physicians working without the assistance of scribes post-SRT implementation will exceed the total completeness scores of physicians working with and without the pre-SRT implementation assistance of scribes. Thirdly, the results of this study indicate the statistical probability that physicians working without the assistance of scribes post-SRT implementation will exceed the total completeness scores of physicians working without scribe assistance pre-SRT implementation. Lastly, the results of this research may prove to have many far-reaching implications throughout the medical facilities involved in this study as well as the entire healthcare industry by providing administrators, physicians, and other ancillary care sources with further clinical evidence in support of future SRT implementation and/or other ancillary decision-making involving EMR completeness.

References

(2014). Retrieved from BusinessDictionary.com: http://www.businessdictionary.com/definition/user-friendly.html

(2014). Retrieved from BusinessDictionary.com: http://www.businessdictionary.com/definition/interoperability.html

(2014, February 16). (E. Britannica, Producer) Retrieved from Merriam-Webster Dictionary: http://www.merriam-webster.com/dictionary/accuracy

Amarasingham, R. P.-W. (2009, January 26). Clinical Information Technologies and Inpatient Outcomes. *Archives of Internal Medicine*, 108-114. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/19171805?dopt=Abstract

Ameen, L. (2009, August 8). Different Types of Computer Interfaces. Retrieved from The Different Types of Computer Interfaces: http://ezinearticles.com/?T-D-T-of-C-I&id=2727903

American Health Information Management Association. (2003, October). Speech Recognition in the Electronic Health Record. Retrieved from library.ahima.org/xpedio/groups/public/documents/ahima/bok1_022107.hcsp?dDocName=bok1_022107

American Health Information Management Association. (2014, September). Speech Recognition in the Electronic Health Record (Updated). *84*(9). Retrieved from http://library.ahima.org/xpedio/idcplg?IdcService=GET_HIGHLIGHT_INFO&QueryText=xPublishSite+%3Csubstring%3E+%60BoK%60+%3CAND%3E+%28

xCategory+%3Csubstring%3E+%60HIM+Career%60%29&SortField=xPubDate&dDocName=bok1_050341&HighlightType=HtmlHighlight

Belton, K. (2013, August 23). Speech Recognition: How this fits into EHRs and MTs' roles. (A. H. Professionals, Interviewer) Retrieved from http://health-information.advanceweb.com/Editorial/Content/editorial.aspx?CTIID=330

Betis, C. (2007, July 13). *Front-end or Back-end Speech Recognition?* Retrieved from http://speechrecognition.wordpress.com/2007/07/13/front-end-or-back-end-speech-recognition/

Callaway, E. C. (2002). Speech Recognition Interface to a Hospital Information System Using a Self-Designed Visual Basic Program: Initial Experience. *Journal of Digital Imaging*(15).

Cavalier, A. R. (1996, January 1). Talking Instead of Typing:Alternate Access to Computers Via Speech Recognition Technology. *Focus On Autism and Development Disabilities, 11*(2), 79.

Center, D. P. (2012, June). Data and Record Keeping Requirements for Good Ips Fidelity. Retrieved from http://www.dartmouth.edu/~ips/page19/page67/files/data-and-record-keeping-requirements-for-good-ips-fidelity.pdf

Centers for Medicare & Medicaid Services. (2014, April 10). *EHR Incentive Programs*. Retrieved from CMS.gov: http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/index.html?redirect=/EHRIncentivePrograms/

Committe on Patient Safety and Health Technology Board on Health Care. (2012). *" Front Matter ." Health IT and Patient Safety: Building Safer Systems for Better Care.* Washington, DC: The National Academies Press. Retrieved from http://books.nap.edu/catalog.php?record_id=13269

Cronk, B. C. (2012). Paired Samples T-Test. In *How To Use SPSS Seventh Edition* (pp. 65-69). Glendale, CA: Pyrczak Publishing.

David, G. C. (2009, August 19). Listening to what is said – transcribing what is heard: the impact of speech recognition technology (SRT) on the practice of medical transcription (MT). *Sociology of Health and Wellness*, 924-938.

EHR Incentives & Certification:Meaningful Use Definition & Objectives. (2014, February 23). Retrieved from http://www.healthit.gov/providers-professionals/meaningful-use-definition-objectives

Embi, P. Y. (2004, March 11). Impacts of computerized physician documentation in a teaching hospital: perceptions of faculty and resident physicians. *Journal of American Medical Information Association*. Retrieved from http://www.amia.bmj.com/content/11/4/300.abstract?ijkey=93ea197c8dd699cb8aeaa4dbe9a5a1996fb10342&keytype2=tf_ipsecsha

Emergency Medicine. (2014, February 25). Retrieved from ScribeAmerica: http://scribeamerica.com/emergency_medicine.html

Ferguson, T. (1999, May). Outstanding Achievement Awards. *The Ferguson Report, 3*. Retrieved from http://www.fergusonreport.com/articles/fr059903.htm

Franklin Square Services. (2014, March 2). *Transcription Rate Comparison*. Retrieved from http://www.franklin-square.com/transcription_per_line.htm

Garcia, A. D. (2010). Understanding the work of medical transciptionists in the production of medical records. *Health Informatics Journal*, 87-100.

Garrett, P. (2010, January 4). *EMR vs EHR – What is the Difference?* Retrieved from http://www.healthit.gov/buzz-blog/electronic-health-and-medical-records/emr-vs-ehr-difference/

Hogan, W. R., & Wagner, M. M. (1997). Accuracy of Data in Computer-based Patient Records. *JAMIA*, 342-355. Retrieved from http://jamia.bmj.com/content/4/5/342.full

Junghwa Jang, S. H. (2013). The effects of an electronic medical record on the completeness of documentation in the anesthesia record. *International Journal of Medical Informatics, 82*, 702-707.

Klatt, D. (1987). Review of Text-to-Speech Conversion for English. *Journal of the Acoustical Society of America*, 737-93.

Kohn, L. T. (2000). *To Err Is Human: Building a Safer Health System.* Retrieved from http://www.nap.edu/openbook.php?isbn=0309068371

Kurzweil Accelerating Intellegence. (2014, March 19). *Ray Kurzweil biography*. Retrieved from http://www.kurzweilai.net/ray-kurzweil-biography

Lucci, S. M., Bermudez, B., Howe, J., & Lorne, J. (2008). *Transcription Turnaround Time for Common Documentation Types.* American Health Information Management Association and Medical Transcription Association, Joint Task

Force on Standards Development. Retrieved from http://www.ahdionline.org/Portals/0/downloads/TAT4CDT.pdf

Madison, J. (2013). *Speech or Voice Recognition: History and Resources*. Retrieved from http://www.thefreeresource.com/speech-or-voice-recognition-history-resources-software

McKelvy, B. J. (2011). To ERR is not only human, but also an electronic medical record and a documentation problem too. *American Journal of Respiratory and Critical Care Medicine*.

Mika A. Koivikko, M. A. (2008, December). Improvement of Report Workflow and Productivity Using Speech Recognition—A Follow-up Study. *Journal of Digital Imaging, 21*, 378-382.

New Patient Safety Risks Associated With Growing EHR Adoption. (2013, June 26). Retrieved from http://www.ihealthbeat.org/articles/2013/6/26/new-patient-safety-risks-associated-with-growing-ehr-adoption

NIV. (Copyrighted 2011). *Holy Bible.* Biblia, Inc. Retrieved from http://biblehub.com/niv/genesis/7.htm

Nuance Communications. (2009). *Cost Savings With Computer Aided Transcription-Three Case Studies.* Retrieved from http://www.nuance.com/healthcare/pdf/wp_healthcare_escriptionCostSavings.pdf

O'Leary, K. L. (2006, April 5). How hospitalists spend their time: insights on efficiency and safety. *Journal of Hospital Medicine*, 88-93. Retrieved from PubMed.Gov: http://www.ncbi.nlm.nih.gov/pubmed/17219478?dopt=Abstract

Oxentenko AS, W. C. (2010, April 12). Time spent on clinical documentation: a survey of internal medicine residents and program directors. *Archives of Internal Medicine*, 377-380. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/20177042?dopt=Abstract

Pinkerton, K. (2006, July 27). History of the Electronic Medical Records. Retrieved from http://ezinearticles.com/?History-Of-Electronic-Medical-Records&id=254240

Poissant L, P. J. (2005, April 24). The Impact of Electronic Health Records on Time Efficiency of Physicians and Nurses: A Systematic Review. *Journal of American Medical Information Association*, 505-516.

Rouse, M. (2010, May). Retrieved from http://searchhealthit.techtarget.com/definition/meaningful-use

Rouse, M. (2014, March 9). *CCHIT - Certification Commission for Healthcare Information Technology*. Retrieved from http://searchhealthit.techtarget.com/definition/CCHIT

Smelcer, J. B., Miller-Jacobs, H., & Kantrovich, L. (2009). Usability of Electronic Medical Records. *Journal of Usability Studies*, 70-84. Retrieved from http://www.upassoc.org/upa_publications/jus/2009february/smelcer4.html

Sparnon, E. M. (2012). *The Role of the Electronic Health Record in Patient Safety Events.* Patient Safety Authority. Retrieved from http://www.patientsafetyauthority.org/ADVISORIES/AdvisoryLibrary/2012/Dec;9(4)/Pages/113.aspx

Speech recognition improves EMR ROI: medical group decided that to be most successful with EMR adoption, 100 percent physician population utilization would be necessary. (2009, Octoboer 1). Retrieved from The Free Library: http://www.thefreelibrary.com/Speech recognition improves EMR ROI: medical group decided that to be...-a0210032281

Staggers, N., Weir, C., & Phansalkar, S. (2008, April). *Patient Safety and Quality: An Evidence-Based Handbook for Nurses.* Retrieved from http://www.ncbi.nlm.nih.gov/books/NBK2644/

U.S. Department of Health & Human Services. (2014, February 16). *Health Information Privacy*. Retrieved from http://www.hhs.gov/ocr/privacy/hipaa/administrative/enforcementrule/hitechenforcementifr.html

United States Department of Labor Bureau of Labor Statistics. (2014, January 8). *Occupational Outlook Handbook: Medical Transcriptionists*. Retrieved from http://bls.gov/ooh/Healthcare/Medical-transcriptionists.htm

Using Medical Scribes in a Physician Practice. (2012, November). *AHIMA*, 64-69. Retrieved from ibrary.ahima.org/xpedio http://www.library.ahima.org/xpedio/groups/public/documents/ahima/bok1_049807.hcsp?dDocName=bok1_049807

Weed, L. L. (1997, July 26). New connections between medical knowledge and patient care. *BMJ*, 231. doi:doi: http://dx.doi.org/10.1136/bmj.315.7102.231

Weir CR, H. J. (2003). Direct text entry in electronic progress notes. An evaluation of input errors. *Methods of Information In Medicine*, 61-70. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12695797?dopt=Abstract

What is Medical Transcription. (2014, March 11). Retrieved from http://degreedirectory.org/articles/What_is_Medical_Transcription.html

What is Voice Transcription. (2014). Retrieved from http://www.wisegeek.com/what-is-voice-transcription.htm

Appendix A

National Institutes of Health Office of Extramural Research Certificate

Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that **Daniel Cesene** successfully completed the NIH Web-based training course “Protecting Human Research Participants”.

Date of completion: 05/29/2013

Certification Number: 1187892

Appendix B

Institutional Review Board Letter of Approval

International Review Board Letter of Approval (Copy)

Youngstown
STATE UNIVERSITY

One University Plaza, Youngstown, Ohio 44555
Office of Grants and Sponsored Programs
330.941.2377
Fax 330.941.2705

January 31, 2014

Dr. Joseph Lyons, Principal Investigator
Mr. Daniel Cesene, Co-investigator
Department of Health Professions
UNIVERSITY

RE: HSRC Protocol Number: 095-2014
Title: The Accuracy and Completeness of the Electronic Medical Record with the Implementation of Speech Recognition Technology

Dear Dr. Lyons and Mr. Cesene:

The Institutional Review Board has reviewed the abovementioned protocol and determined that it is exempt from full committee review based on a DHHS Category 5 exemption.

Any changes in your research activity should be promptly reported to the Institutional Review Board and may not be initiated without IRB approval except where necessary to eliminate hazard to human subjects. Any unanticipated problems involving risks to subjects should also be promptly reported to the IRB.

The IRB would like to extend its best wishes to you in the conduct of this study.

Sincerely,

[redacted]

Dr. Scott Martin
Interim Associate Dean for Research
Authorized Institutional Official

SCM/cc

Youngstown STATE UNIVERSITY 100 years 1908-2008 A PROUD PAST A PROMISING FUTURE

Mr. Joseph Mistovich, Chair
Department of Health Professions

www.ysu.edu YSU

Appendix C

Chart Audit Data Collection Tool

CHART AUDIT DATA COLLECTION TOOL

Date:	**Provider:**		**Criteria for Audit:**	**No PA/CNP on case (signature?)**
				No resident on case (signature?)
Site:	**Reviewer:**			**August 2012 date of service**
				Admits/Transfers
date of service				
acct #				
chief complaint(s)				
HPI (4 elements):	Y N	Y N	Y N	Y N
anatomic location, severity, onset time, treatment PTA, anything make symptoms better/worse, assoc. symptoms				
EKGs (4 elements present)	Y N	Y N	Y N	Y N
med. Decision making/progress notes MACRO ONLY?	Y N	Y N	Y N	Y N
Med. Decision making/	Y N	Y N	Y N	Y N
/ED course/progress notes (besides standard macro)				
critical care	Y N	Y N	Y N	Y N
Admit or Transfer Disposition	ICU/CCU telemetry OR cath lab general floor other______________________ not documented	ICU/CCU telemetry OR cath lab general floor other______________________ not documented	ICU/CCU telemetry OR cath lab general floor other______________________ not documented	ICU/CCU telemetry OR cath lab general floor other______________________ not documented
Final Diagnosis(s) or Impression	not documented	not documented	not documented	not documented
comments:				
Scribe?	none	none	none	none
Scribe Name				

Appendix D

Tables

Table 1

Comparison Medicare EMR Incentive versus Medicaid EMR Incentive

Medicare EMR Incentive Program	Medicaid EMR Incentive Program
Run by CMS	Run by State Medicaid Agency
Maximum incentive amount is $44,000	Maximum incentive amount is $63,750
Payments over 5 consecutive years	Payments over 6 years, does not have to be consecutive
Payments adjustments will begin in 2015 for providers who are eligible but decide not to participate	No payment adjustments for providers who are only eligible for the Medicaid program
Providers must demonstrate meaningful use every year to receive incentive payments	In the first year providers can receive an incentive payment for adopting, implementing, or upgrading EMR. Providers must continue to demonstrate meaningful use every year to receive payments

Table 2

Chart Audit Data Collection Tool Scoring System

		Scoring Points	% Completed
Seven	Completed Fields	7	100%
Six	Completed Fields	6	86%
Five	Completed Fields	5	71%
Four	Completed Fields	4	57%
Three	Completed Fields	3	43%
Two	Completed Fields	2	29%
One	Completed Fields	1	14%
Zero	Competed Fields	0	0%

Table 3

Pre-SRT Implementation Audit of Patient Medical Records Initially Reviewed N = 348

Health Care Facility	without scribes	with scribes	Total
A	48	51	99
B	49	51	100
C	50	49	99
D	50	0	50
Total	197	151	348

Table 4

Post SRT Audit of Patient Medical Records Reviewed N = 180

Health Care Facility	without scribes	with scribes	Total
A	40	0	40
B	50	0	50
C	40	0	40
D	50	0	50
Total	180	0	180

Table 5

Independent Variables Contributing to Total Completeness Score
Pre-SRT Implementation with and without the assistance of Scribes (N =308)

	CC	HPI	EKG	MD	PN	DIS	D	Ttl Comp Score
Frequency	308	269	169	286	176	248	250	1706
Percentage	100%	87.3%	54.9%	92.9%	57.1%	80.5%	81.2%	26.6%*
SD	.000	.333	.498	.258	.496	.397	.392	1.29

* Indicates the percentage of EMR containing all seven completed criteria

Table 6

Independent Variables Contributing to Total Completeness Score
Pre-SRT Implementation without the assistance of Scribes (N =176)

	CC	HPI	EKG	MD	PN	DIS	D	Ttl Comp Score
Frequency	176	140	91	161	89	118	120	895
Percentage	100%	79.5%	51.7%	91.5%	50.6%	67%	68.2%	14.2%*
SD	.000	.405	.501	.280	.501	.471	.467	1.36

* Indicates the percentage of EMR containing all seven completed criteria

Table 7

Independent Variables Contributing to Total Completeness Score
Pre-SRT Implementation with the assistance of Scribes (N =132)

	CC	HPI	EKG	MD	PN	DIS	D	Ttl Comp Score
Frequency	132	129	78	125	87	130	130	811
Percentage	100%	97.7%	59.1%	94.7%	65.9%	98.5%	98.5%	43.2%*
SD	.000	.15	.494	.225	.476	.123	.123	.892

* Indicates the percentage of EMR containing all seven completed criteria

Table 8

Independent Variables Contributing to Total Completeness Score Post-SRT Implementation without the assistance of Scribes (N =180)

	CC	HPI	EKG	MD	PN	DIS	D	Ttl Comp Score
Frequency	180	166	111	179	152	148	139	1075
Percentage	100%	92.2%	61.7%	99.4%	84.4%	82.2%	77.2%	41.1%*
SD	.000	.269	.488	.075	.363	.383	.421	1.14

* Indicates the percentage of EMR containing all seven completed criteria

Table 9

Adjusted Pre SRT/Post SRT Audit of Patient Medical Records Reviewed

	without scribes	with scribes	Total
Pre SRT	176	132	308
Post SRT	180	0	180

Table 10

Physician's Average Mean Scores

Pre-SRT w & w/o scribes	Pre-SRT w/o scribes	Pre-SRT w/scribes	Post-SRT w/o scribes
5.00	4.10	5.90	4.50
4.40	2.60*	6.20	5.90
3.68	2.63	4.45	4.50
5.70	5.20	6.20	6.00
6.20	5.90	6.50	6.70
6.00	5.11	6.73	6.30
5.90	4.80	7.00	6.80*
6.15	5.40	6.90	6.70
5.90	5.30	6.50	6.30
5.95	5.60	6.30	6.60
5.85	5.90	5.80	6.20
5.37	5.56	5.20	5.40
5.55	4.80	6.30	5.00
3.70*	3.70	***	4.00*
6.10	6.10	***	6.60
6.10	6.10	***	6.70
6.00	6.00	***	6.50
6.30**	6.30**	***	6.80

*   Denotes lowest average mean score
** Denotes highest average mean score
*** Denotes no scribes available

Table 11

Paired Samples Statistics

	Mean	Std. Deviation
Pair One		
Pre-SRT with and without scribes	5.5	.8
Post-SRT without scribes	6.0	.9
Pair Two		
Pre-SRT without scribes	5.0	1.0
Post-SRT without scribes	6.0	.9
Pair Three		
Pre-SRT with scribes	6.1	.7
Post-SRT without scribes	5.9	.8

Table 12

Paired Samples Correlations

	Correlation	Sig.
Pair One Pre-SRT without and with scribes Post-SRT without scribes	.858*	.000
Pair Two Pre-SRT without scribes Post-SRT without scribes	.697*	.000
Pair Three Pre-SRT with scribes Post-SRT without scribes	.743*	.004

* Indicating a significant linear relationship between the two variables

Table 13

Paired Samples Tests

	t	df	sig (two-tailed
Pair One Pre-SRT without and with scribes Post-SRT without scribes	-3.9	17	.001*
Pair Two Pre-SRT without scribes Post-SRT without scribes	-4.7	17	.000*
Pair Three Pre-SRT with scribes Post-SRT without scribes	1.5	12	.147**

* Indicates statistical significance
** Indicates no statistical significance

Appendix E

Figures

Figure 1

How Speech Recognition Works

Step One: The speech engine loads a list of grammar (words) to be recognized.

Step Two: Audio from a speaker is captured by a microphone or telephone.
The audio is turned into a waveform (a mathematical representation of that unique sound).

Step Three: The speech engine looks at features or distinct characteristics that are derived from the waveform of that sound and then compares them with its own acoustic model.

Step Four: The search engine searches its acoustical space, using grammar to guide the search. The search engine determines which words in the grammar the Audio most closely matches and then returns a result.

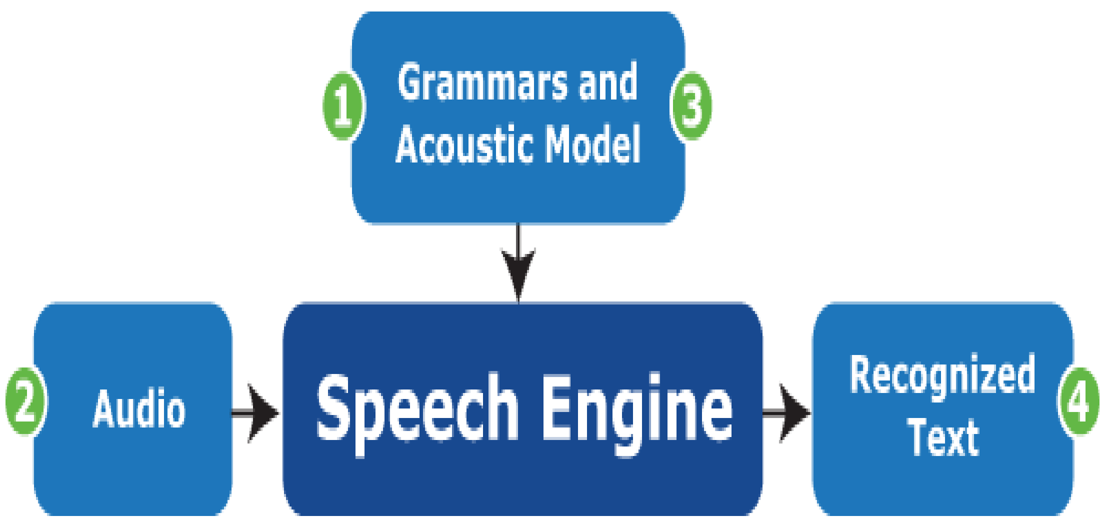

Figure 2

The Speech Recognition Acoustical Model