

EFFECTS OF HEALTH INFORMATION TECHNOLOGY ADOPTION ON NURSING
HOME QUALITY RATING SCORES IN MINNESOTA NURSING HOMES

By

Cathy Marie Murray

David W. Rausch
Program Director and Associate Professor
(Chair of Committee)

Ted L. Miller
UC Foundation Professor
(Committee Member)

Elizabeth K. Crawford
Assistant Professor
(Methodologist)

Joanie C. Jackson
Assistant Professor, DNP Coordinator
(Committee Member)

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Cathy Marie Murray

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ABSTRACT

Adoption of health information technology (HIT) may be instrumental in improving quality of care in Minnesota nursing homes. The purpose of this non-experimental, quantitative study was to examine the relationship between nursing homes' quality of care, as measured by CMS Quality Rating Scores, and adoption of HIT systems in Minnesota nursing homes. Additionally, the purpose of the study was to examine the relationship between nursing homes' quality of care, as measured by the Minnesota Department of Health (MDH) inspection rating score, and the adoption of HIT systems in Minnesota nursing homes. The research questions were aimed at understanding the effects of HIT adoption on CMS overall quality rating scores and MDH inspection rating scores.

The study was conducted by examining the status of health information technology (HIT) in Minnesota nursing homes. Descriptive statistics of the 2011 Minnesota HIT e-health survey helped describe and summarize the data for further investigation. The relationships (correlation) of HIT adoption in nursing homes with CMS Quality Rating Scores were analyzed. Additionally, the relationships (correlation) of HIT adoption in nursing homes with Minnesota Department of Health (MDH) inspection results were analyzed. Pearson correlation coefficient equation and linear regression analysis were used to evaluate the hypotheses. The findings of this study revealed significant correlations with a small effect size for the HIT adoption of medication administration, medication reconciliation, computerized provider order entry (CPOE) laboratory test, computerized provider order entry (CPOE) medication, and CMS quality rating

scores. Additionally, the findings of this study revealed a significant correlation with a small effect size for the HIT adoption of medication reconciliation and MDH inspection scores. The findings of this study did not show a relationship between the remaining HIT systems and CMS quality ratings or MDH inspection scores. These findings contribute to positive social change by assisting to inform stakeholders of nursing homes that HIT adoption may have some relationship to quality of care and services as indicated by the CMS rating system and MDH inspection ratings. Policy makers and legislators can use this information as a guide to decision making concerning HIT adoption in Minnesota nursing homes.

DEDICATION

This dissertation is dedicated to my incredible husband, David, for his patience and understanding. To my father, Charles, who has led by example and showed me how to work hard to achieve my goals. To my daughter, Aimee, who was always there to listen and encouraged me to continue to accomplish the dissertation. To my son, Bryson, who was always understanding of the time and dedication required to finish the dissertation. To my mom, Leanna, who died before I achieved this dissertation; however, I know she would have been very proud and supportive. Lastly, I thank God for my supportive and loving family and all those at the University of Tennessee who have actively assisted me along the way.

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LIST OF ABBREVIATIONS

ADLs, Activities of Daily Living

AHCA, American Health Care Association

AMIA, American Medical Informatics Association

ANCOVA, Analysis of Covariance

ANOVA, Analysis of Variance

ARRA, American Recovery, and Reinvestment Act

CDC, Centers for Disease Control

CMS, Centers for Medicare and Medicaid Services

CPOE, Computerized Provider Order Entry

DHS, Department of Health and Human Services

EDR, Electronic Dental Record

EHR, Electronic Health Records

eMAR, electronic Medication Administration Record

GAO, Government Accounting Office

HIMSS, Health Information Management Systems Society

HIPAA, Health Insurance Portability and Accountability Act

HIT, Health Information Technology

HITECH, Health Information Technology for Economic and Clinical Health

IOM, Institute of Medicine

MDH, Minnesota Department of Health

MDS, Minimum Data Sets

NNHS, National Nursing Home Survey

OBRA-87, Omnibus Budget Reconciliation Act of 1987

OIG, Office of Inspector General

ONC, Office of the National Coordinator for Health Information Technology

PHR, Personal Health Record

RAI, Resident Assessment Instrument

SPO, Structure, Process, and Outcome

SPSS®, Statistical Package for the Social Science

VistA, Veterans Health Information Systems and Technology Architecture

WHO, World Health Organization

LIST OF SYMBOLS

M, mean

N, population size

r, correlation coefficient

R^2 , statistical measure of how close the data are to the fitted regression line

SD, standard deviation

CHAPTER I

INTRODUCTION

Technology in health care systems has drastically improved over the past several years; however, compared with other health care institutions, nursing homes lag behind in their adoption of health information technology (HIT) (Agency for Healthcare Research and Quality, 2010a). According to the United States Department of Health and Human Services (2014), HIT can be defined as the application of information processing involving both computer hardware and software that deals with the storage, retrieval, sharing, and use of health care information, data, and knowledge for communication and decision making. Examples include electronic health records (EHR), electronic dental record (EDR), and personal health record (PHR) (Department of Health and Human Services, 2014).

According to the American Hospital Association and the results of its latest Most Wired survey, hospitals have been aggressive in embracing technology (Rudansky, 2013). A study by the Institute of Medicine (IOM), titled *The Computer-based Patient Record: An Essential Technology for Healthcare*, focused on the need of HIT in hospitals (Institute of Medicine, 1991). Hospitals have recognized and reported on the improvement of quality service to their patients through technology (IOM, 1991). Technology is viewed as a solution to persistent problems in the quality of care across health settings, increasing efficiency while offering significant potential for cost savings (Hillestad et al., 2005; Institute of Medicine, 2001; Poon et

al., 2006). Previous research indicates HIT has substantial potential to reduce error and improve the quality and efficiency of health care (Bates et al., 2001; Institute of Medicine, 2001).

Many hospitals have very advanced systems of HIT; however, when a patient is discharged to a different level of care, the health care information is typically shared via paper, not electronically. Nursing homes have lagged behind other providers in comprehensive adoption of HIT (Brandeis, Hogan, Murphy, & Murray, 2007), and existing technology may be underutilized (Lui & Castle, 2008). As in hospital settings, adoption of electronic information systems in nursing homes has the potential to add value by improving efficiency in administrative and operational areas, and more importantly, by helping to integrate services and improve quality of care (Hedstrom, 2007).

Today, many educational institutions, such as Northwestern University, University of Chicago, University of Maryland, University of Missouri, University of Utah, and Walden University, are developing college/university level programs in HIT or informatics. Health information technology (HIT) has been correctly used interchangeably with “informatics” in recent literature (Procter, 2009). Health informatics is “the interdisciplinary study of the design, development, adoption, and application of IT-based innovations in healthcare services delivery, management and planning” (Procter, 2009, para. 1). Organizations have recognized the need for specialists in the HIT field (Hovenga, 2000). The evolution of HIT in the educational system was pioneered in the mid-1950s by Dr. Homer Warner, who led the cardiology department at Intermountain Healthcare LDS Hospital in Utah (International Center for Scientific Research, 1999). Warner’s ground-breaking work using computers for decision support in cardiology set the stage for the growth of the new field of academic study, which Warner termed medical informatics.

Warner was also a senior member of the Institute of Medicine of the National Academy of Sciences and president of the American College of Medical Informatics, participating in a variety of HIT initiatives (International Center for Scientific Research, 1999). In the 1970s, Warner (emeritus chair of the University of Utah's Department of Medical Informatics) and his Intermountain Healthcare colleagues created one of the nation's first versions of an electronic medical record (International Center for Scientific Research, 1999).

In 2004, President Bush set a goal to expand health information technology and established the Office of the National Coordinator for Health Information Technology in the United States Department of Health and Human Services (Ashkenaz, 2013). Additionally, President Obama has supported electronic health records in the health care plan. In 2009, Obama signed the Health Information Technology for Economic and Clinical Health (HITECH Act) as part of the American Recovery and Reinvestment Act (ARRA) (McGee, 2010). The legislation aimed at encouraging and supporting providers in the adoption of HIT, and incentivized the migration away from legacy paper health records and non-standard health records towards electronic health records (EHR) (McGee, 2010). Starting in 2011, physicians became eligible to receive incentive payments of up to \$44,000 for meaningful use of EHR (McGee, 2010). Meaningful use was defined as using EHR technology to improve quality, safety, efficiency, and reduce health disparities for patients (Centers for Medicare and Medicaid Services, 2014c). Additionally, meaningful use requires the engaging of patients and families to improve care coordination for the public health needs while still maintaining privacy and security of patient health information (Centers for Medicare and Medicaid Services, 2014a). In 2010, the Patient Protection and Affordable Care Act signed by President Obama also included

requirements that the federal and state governments establish new electronic systems for insurance-based exchanges (Pear, 2010).

Health care costs are escalating each year with total health care spending in the United States expected to reach \$4.8 trillion in 2021, up from \$2.6 trillion in 2010 (Aetna, 2014). According to Aetna (2014), wasteful spending accounts for some of the increase. In 2008, the United States Medicare program spent \$27 billion on nursing home care alone (American Health Care Association, 2010a). IOM (2012) suggests the biggest area of excess spending is redundant, inappropriate, or unnecessary tests and procedures with associated administrative costs. The IOM report estimated unnecessary health spending totaled \$750 billion in 2009 alone (IOM, 2012). According to research conducted by professors at Harvard University, 14% of all health care expenditures in the United States are considered administrative costs and at least half of this spending has been estimated to be wasteful (Wikler, Basch, & Cutler, 2012). HIT may be able to assist with increased efficiencies, resulting in the reduction of health care redundancy and administrative costs. Since Medicare and Medicaid are the primary sources of funding for geriatric care in the United States, and most people will require health care services as they age, improved HIT could be beneficial to counteract the increased costs to these programs.

Population demographics point to a national population trend resulting in a greater number of older adults than younger adults. The proportion of persons aged 65 years or older increased more than threefold, from 4.1% in 1900 to 12.9% by the end of 2009 (AHCA, 2010a). The first group of baby boomers began turning 65 on January 1, 2011 (Anderson, Goodman, Holtzman, Posner, & Northridge, 2012). AHCA (2010b) estimates the proportion of persons aged 65 or older to increase to 19.7% by 2030. As the life spans trend upward, the need for quality long-term care for the elderly will increase dramatically (IOM, 1986). According to the

American Health Care Association, the population of people over 65 in 2007 was nearly 38 million and is projected to almost double to over 71 million by 2030 (AHCA, 2010a).

The state of Minnesota has been acting upon these changing population conditions and encouraging the adoption of HIT. The Minnesota Department of Health, Office of Health Information Technology was established in September, 2009 and seeks to foster increasing use of sound informatics methodologies as a means to improve clinical and public health practice (Minnesota Department of Health, 2014b). In 2013, office-based physicians' HIT adoption in the state of Minnesota ranked among the highest at 75.5% compared to the national average of 48.1% (McCann, 2014). The state of Minnesota has kept careful records on the use of HIT in nursing homes as well as the elderly population statistics of those people residing in nursing homes. For example, the growth of the elderly population in Minnesota is already apparent. In 2011, the estimated population aged 65 and older in Minnesota was 731,631, which was an increase of 15% over the 2005 population report for this age group (McMurray, 2007). Nursing homes are required to meet the health care needs of many of these elderly people (AHCA, 2013b).

As of March 2013, there were 15,668 nursing homes in the United States with a total of over 1.3 million residents. As of March, 2011, 383 nursing homes were operating in the state of Minnesota (Minnesota Department of Health, 2011). Minnesota has regularly tracked HIT use through surveys conducted in 2008 and 2011 (Minnesota Department of Health, 2012b). In conjunction with Minnesota's regular tracking of HIT, it is important to also acknowledge that Minnesota is consistently at the top of all the other states in high quality nursing home care according to Forbes rankings published in 2014 (Forbes, 2014). The state was the top performer for its small percent of nursing home residents' hospitalizations within a 30-day period, at 7%

(Mullaney, 2014). Additionally, US News ranked Minnesota in the top 5 states for 30% of its nursing homes achieving a rating of five stars, a ranking above average, on the CMS Compare website (Comarow, 2014). HIT may play a role in these positive results. As a result of the above factors, the state of Minnesota provides a purposive sample of the population.

Beyond this explosion in proportional population size due to the baby boomers, increased longevity of older adults from improved healthcare and lifestyle also adds to the growth of the elderly population (Anderson et al., 2012). For the reasons of increased size and longevity of the elderly population, it is in the public interest to carefully look at the possibilities of cost savings associated with technology use in nursing homes. HIT can be extremely helpful to those taking care of patients. The health care professionals would have access to information about current medications, medical history, and other pertinent facts. Overall, our national health care system has become so complex, with so many specialists and advances in procedures, technology is needed for moving forward in providing quality services at an affordable price.

The Institute of Medicine (2013) released a report indicating America's health care system has become too complicated and costly to continue business as usual. Dr. Mark Smith, chair of the IOM committee on health system waste, and the IOM (2013) emphasize that better use of data, such as mobile technologies and electronic health records that offer significant potential to capture and share these data better, is a critical element of a continuously improving health system. In order for this to occur, the National Coordinator for Health Information Technology, information technology developers, and standard-setting organizations should ensure that these EHR systems are robust and interoperable (Smith & IOM, 2013). Clinicians and care organizations should fully adopt EHR technologies, and patients should be encouraged

to use tools, such as personal health information portals, to actively engage in their own care (Smith & IOM, 2013).

Many health care professionals see health care technology as improving efficiency, so more time can be committed to the patients instead of cumbersome paperwork (Huryk, 2010). Technology can also increase accuracy of services provided (Donaldson & Lohr, 1994); for example, medication errors have been shown to be diminished by technological advances (Bates et al., 2001; Institute of Medicine, 2001). Some researchers also believe that computer systems can be used to reduce error and improve the reporting of adverse incidents in health care settings (Shojania, Ducan, McDonald, & Wachter, 2001). Kohn, Corrigan, and Donaldson (2000) and the Government Accounting Office (GAO) (2003) have concluded that widespread adoption of HIT systems is critical to improving healthcare quality. Lee, Cain, Young, Chockly, and Burstin (2005) reiterated that the adoption of HIT is necessary in order to achieve higher quality, lower cost healthcare, and to provide safer delivery of care to recipients.

According to the GAO (2003), the lack of integrated data and HIT limits the government's and healthcare leaders' ability to maintain quality, due to lack of availability and reliability of the information. The GAO (2003) postulated that in order to have a high-quality healthcare system, the widespread use of integrated HIT systems is required. In a review that consisted of 256 published studies, Chaudhry et al. (2006) found that adoption of HIT improves quality in areas of adherence to guideline-based care, enhanced surveillance and monitoring, and decreased medication errors. Additionally, the benefits of using computerized provider order entry (CPOE) and clinical documentation information systems in hospitals resulted in improved quality of care (Rantz et al., 2004; Rosenbloom et al., 2005).

In this current study, the relationship between the number of HIT systems adopted in nursing homes in the state of Minnesota and the Centers for Medicare and Medicaid Services' overall Quality Rating Scores were explored (CMS, 2011). Additionally, this study explored the relationship between the number of HIT systems adopted in nursing homes in the state of Minnesota and score for the Minnesota Department of Health inspection deficiencies as reported on Nursing Home Compare website (CMS, 2011). Finally, this study provided an update on the current number of HIT systems utilized in nursing homes in the state of Minnesota. Based on a 2011 survey conducted for the Minnesota Department of Health (Minnesota Department of Health, 2012a), HIT adoption can be studied. Although other states have not tracked HIT adoption extensively and are not federally required to track HIT adoption, all states must comply with the same federal regulations for quality and services in nursing homes. The state of Minnesota tracked HIT adoption in 2008 and 2011, and may be a proxy to represent all states because of the similarities of the elderly populations.

Statement of the Problem

Nursing homes have traditionally lagged behind hospitals in the area of HIT use (Rochon et al., 2005). Nursing homes use a variety of systems to record the health information. Although some information was collected electronically, a vast majority was collected manually via paper (Halvorson, 2009). Since 1998, all state licensed nursing homes have been required to electronically transmit data generated by the federally mandated Resident Assessment Instrument (RAI) to the Centers for Medicare and Medicaid Services (CMS) (Mor et al., 2003). The data generated from the RAI are referred to as the Minimum Data Sets (MDS) (DHS, 2010b). These MDS are used in the nursing home industry as a clinical assessment tool for residents residing in

nursing homes in the state of Minnesota and throughout the United States. Collection of the data contained in the MDS is further utilized as quality indicators.

The United States Department of Human Services (DHS) has developed MDS collection software called jRaven (DHS, 2010b). The jRaven software, which is offered free of charge through the CMS, is not commonly used. Due to the incompatibility of the current software with jRaven, most nursing homes use commercial software instead of this free software; however, none of the software (free or commercial) is comprehensive. The jRaven and commercial software systems contain clinical assessment information for residents during the nursing home admission process; unfortunately, real-time data, hospital transfer data, medical history, and other critical medical information components are not comprehensively provided or utilized. In the 2004 National Nursing Home Survey (NNHS), 1,500 nursing homes were selected from a sample of approximately 16,000 nursing homes as part of a continuing series of a nationally representative sample of nursing homes, their services, their staff, and their residents (DHS, 2013). Of the 1,500 selected nursing homes, 283 refused to participate and 43 were considered out of scope for one or more of the following reasons: the nursing home had gone out of business, the facility failed to meet the definition used in the survey, or it was a duplicate of another facility in the sample. A total of 1,174 nursing homes participated, providing an 81% response rate (Centers for Disease Control, 2004). A stratified, multistage, probability design was employed in the study, and a systematic sampling technique was used to select nursing homes to be included in the sample (CDC, 2004). As part of the 2004 National Nursing Home Survey, respondents were presented with 12 functional areas of patient care and asked to select all areas that were supported by an electronic HIT. The 12 areas assessed were:

- admission, discharge, and transfer information
- physician orders

- medication orders and drug dispensing
- laboratory/procedures information
- patient medical records, including nurse's notes, physician notes, and MDS forms
- medication administration information
- minimum data sets (MDS)
- dietary
- daily personal care by nursing assistants
- billing/finance
- staffing/scheduling information
- human resources/personnel information. (Department of Health and Human Services, 2004, p. FC26)

As shown by the results of the 2004 National Nursing Home Survey, nursing homes throughout the United States are utilizing HIT in a variety of ways and to varying degrees. The 2004 National Nursing Home Survey results indicated the majority of nursing homes utilized less than 40% percent of electronic data systems available capacity in their daily operations. The electronic data systems utilized were primarily for accounting and MDS purposes only. Based on this preliminary review of the 2004 National Nursing Home Survey, HIT utilization remains limited and variable across surveyed nursing homes, with significant challenges in HIT adoption (Poon et al., 2006). Use of HIT appears to be predominantly driven by financial functions as reflected by the use of electronic claims submission checking (Poon et al., 2006). While there is increased interest in the adoption of HIT for quality of care improvements, HIT adoption remains in its infancy (Poon et al., 2006). Based on information derived from the 2004 survey, it is unclear whether the use of HIT in nursing homes results in better quality of services. Currently, the data that are available only address the HIT adoption and use and do not relate implementation of the technology to the quality of care in nursing homes.

The 2004 National Nursing Home Survey was a starting point for the assessment of nursing home health information systems; however, no follow-up survey has been conducted on a national scale since 2004. The Minnesota Department of Health, along with their association

partners, Aging Services of Minnesota and Care Providers of Minnesota, conducted two surveys, one in 2008 and the other in 2011, regarding the adoption and use of Electronic Health Records (EHR) in nursing homes in the state of Minnesota (Minnesota Department of Health, 2012b; StratisHealth, 2008). The 2008 research survey results showed that 32% of nursing homes reported full or partial implementation. Twenty-two percent of nursing homes reported they had not implemented an EHR and/or have no plans for implementation. Thirty-eight percent of respondents are in the planning or information-gathering stage while 8% are in the vendor development or selection stage (StratisHealth, 2008). By the time of the 2011 research survey, Minnesota nursing homes reported 69% had EHR installed, while 25% had EHR in process and only 6% had no EHR (Minnesota Department of Health, 2012b). Comparison of these surveys indicates a significant increase in the number of nursing homes with EHR from 2008 to 2011. The 37% growth in the installation and use of EHR was indicated in Minnesota from 2008 to 2011 (Minnesota Department of Health, 2012b).

Identifying the relationship in quality of care and services of nursing homes that have adopted some form of HIT is difficult because only a few nursing homes have adopted extensive HIT (Poon et al., 2006), and it is not known if the nursing homes that have adopted HIT solutions provide better quality of care and services (Lui & Castle, 2008). Research is needed to identify the current number of HIT systems adopted in nursing homes and determine the relationship of adoption to quality of care throughout the United States. Furthermore, research is necessary to understand the relationship between the number of HIT systems adopted and CMS Quality Rating Scores and Minnesota Department of Health inspection deficiencies as reported on Nursing Home Compare. The need is supported in the literature; for example, Lui and Castle (2008) suggested that more research is needed to determine whether nursing homes rated as

providing better quality of care and services have adopted HIT systems. The state of Minnesota has tracked HIT systems adoption in 2008 and 2011.

Multiple technology researchers have suggested that HIT has the potential to enable better care for patients, and to help clinicians achieve continual improvements in the quality of care (Bates et al., 2001; Chaudhry et al., 2006; Landley & Beasley, 2007). Thus, the problem this study aims to investigate is whether a relationship exists between nursing home EHR adoption and CMS Quality Rating Scores of nursing homes. Additionally, this study further investigated whether a relationship exists between nursing home EHR adoption and service deficiencies. This latter score was derived from the Minnesota Department of Health inspection deficiencies as reported on Nursing Home Compare (CMS, 2011).

Purpose of the Study

Creswell (2014) indicates a purpose statement establishes the intent of the entire research study. The purpose of this non-experimental, quantitative study is to examine the relationship between nursing homes' quality of care and services, as measured by CMS Quality Rating Scores, and adoption of HIT systems in Minnesota nursing homes. Additionally, the purpose of the study is to examine the relationship between nursing homes' quality of care and services, as measured by the Minnesota Department of Health inspection deficiencies, and the adoption of HIT systems in Minnesota nursing homes. Minnesota Nursing Home Compare quality data, including the five star quality rating score and survey results were utilized as the dependent variable(s). The National Nursing home survey of 2004 consisted of 12 essential HIT areas. The Minnesota Department of Health, along with its partners, Aging Services of Minnesota and Care Providers of Minnesota, conducted an EHR adoption and use survey consisting of 25 key

functional areas of EHR. This study utilized the more recent 2011 survey, consisting of over 25 key functional areas of EHR, as the independent variables. Variables such as location, size of the facility, ownership, and chain affiliation were used to describe the characteristics of nursing homes. Additionally, due to the varying degrees of health information systems used in nursing homes, the study used a descriptive, exploratory-designed research method to investigate the utilization of HIT based on the Minnesota e-health report criteria. The examination of these variables may provide valuable information to nursing home stakeholders (i.e. owners, management, and personnel) that will influence future decisions about HIT adoption in nursing homes.

The CMS Quality Rating Score is defined as the overall quality rating score assigned to nursing homes by CMS; it is based on a five star rating system which is updated annually and posted on the CMS website (CMS, 2014b). The five star CMS Quality Rating Score based on a sophisticated composite measure as defined by CMS. Minnesota Department of Health inspection data are gathered from each nursing home annually (9 to 15 months apart) and posted on the CMS website (CMS, 2014b). Survey points can range from a one to five star rating with one representing much below average and 5 representing much above average. Variables such as geographic region, bed size, ownership, and chain affiliation are collected annually and used to describe the nursing homes. CMS categorizes each nursing home as urban or rural. Bed size is reported annually, based on the certificate of need approved by licensure for nursing homes and categorized by bed size of 100 or less versus more than 100 beds. Ownership of the nursing home is for-profit or not-for-profit, such as church affiliated, or government owned. A chain affiliated nursing home is considered as consisting of more than one nursing home under the same operational entity (CMS, 2014b).

Research Questions/Hypotheses and Sub-hypotheses

The analysis of this study focused on the following research questions:

1. What are the issues and status with the use of electronic health records in Minnesota nursing homes based on the 2011 Minnesota e-health survey?
2. Is there a relationship between electronic health records adoption and use in Minnesota nursing homes with CMS Quality Rating Scores?
3. Is there a relationship between electronic health records adoption and use in Minnesota nursing homes with Minnesota Department of Health inspection results as reported on CMS Nursing Home Compare?
4. Do any of the following nursing home facility variables (location, size of facility, ownership, chain affiliation and overall EHR systems adopted) predict CMS Quality Rating Scores in nursing homes?
5. Do any of the following nursing home facility variables (location, size of facility, ownership, chain affiliation and overall EHR systems adopted) predict Minnesota Department of Health inspection results as reported on CMS Nursing Home Compare?

The research hypothesis is that there will be a statistically significant relationship (correlation) between the number of EHR systems adopted and CMS Quality Rating Scores of nursing homes in Minnesota. Additionally, there will be a statistically significant relationship (correlation) between the increased number of EHR systems adopted and the Minnesota Department of Health inspection results as reported on CMS Nursing Home Compare. The EHR systems adopted by nursing homes will be a statistically significant predictor of CMS Quality Rating Scores and Minnesota Department of Health inspection scores.

Rationale for the Study

As the population continues to age, and people continue to live longer, nursing home care will continue to be crucial to our society. According to the American Health Care Association, the population of people over 65 in 2007 was 38 million and will rise to over 70 million by 2030 (AHCA, 2010a). The increase in the population of those people over 65 will lead to an increased need for health care services provided by nursing homes. In the United States, as of 2008, over 1.4 million citizens resided in nursing homes (AHCA, 2010a). The number of citizens residing in nursing homes will grow proportionately with the increasing population of elderly.

As stated in an article dated April 6, 2011, printed by KTXS News, nursing home residents could lose Medicaid benefits in the event of a constricted state budget and would not have a place to live and receive care (Mares, 2011). According to CMS (2011), the United States government spending increased 4.4% from 2010 to 2011, resulting in \$149.3 billion in total expenditures on healthcare in nursing home facilities. Continuing care retirement communities had a similar acceleration in growth from 2010 to 2011, of 3.2%, based on CMS (2011) data. A faster growth in 2011 was primarily due to a sharp increase in Medicare spending for nursing homes (CMS, 2012a). Although specific reasons for the sharp increases in Medicare are unknown, the increased legislation of nursing homes and decreased income growth of the private sector are partially to blame. With tight restraints on finances, nursing home care could get progressively worse unless more efficient and effective ways are identified to deliver this care at a reasonable cost.

As in other provider settings, adoption of HIT in nursing homes has the potential to add value by improving efficiency in administrative and operational areas, and more importantly, by helping to integrate services and improve quality of care (Resnick, Manard, Stone, & Alwan,

2009). In a 2008 report issued by Kerry Weems, Acting Administrator of the Centers for Medicare & Medicaid Services, trends from 2005-2007 indicated nursing home deficiencies and complaints were cited in over 91% of all nursing homes in the United States (Weems, 2008). Previous research suggested that the use of HIT can improve the quality of care within health care segments (Gawande & Bates, 2000). With the constraints of limited resources and the growing population of the elderly, nursing homes will look for ways to more efficiently and effectively deliver quality services.

Research indicates nursing home nurses would like expanded clinical nursing care data distinctly different than hospital nurses as they coordinate the care of patients in transition from a short hospital stays to a longer nursing home stays (Turpin, 2000). Additionally, research denotes the development of automated systems for continuing care across organizational boundaries is desirable and assists caregivers in obtaining more complete patient information (Turpin, 2000). If information technology can positively affect the quality of services for the elderly, then the nursing home providers may want to adopt more comprehensive HIT.

Theoretical/Conceptual Framework

In 1991, the Institute of Medicine (IOM) published a study titled *The Computer-based Patient Record: An Essential Technology of Healthcare*. The focus of the study was on the use of informatics in hospitals (IOM, 1991). In hospital settings, sophisticated HIT systems assist in the diagnosis of patients, support care management, and enhance adherence to clinical guidelines (Alexander, 2008). According to the Department of Health and Human Services (2009), the Health Information Technology for Economic and Clinical Health (HITECH) Act, part of the American Recovery and Reinvestment Act of 2009, designated funding to modernize the health

care system by promoting and expanding the adoption of health information technology (DHS, 2009). Also, according to the Department of Health and Human Services (2009), HITECH supports the rapid adoption of health information technology by hospitals and clinicians through Medicare and Medicaid incentive payments to physicians and hospitals for meaningful use of electronic health records. There is no funding under the HITECH Act for nursing home electronic health records (McDonald-McClure & Levi, 2010).

Research on HIT can be complicated. Many departments and specialties within the nursing homes are involved in the process of incorporating health information technology utilization. All of the departments/specialties need to be unified in the integration of the health information technology systems. Bogenrieder (2002) hypothesized that the social architecture for organizational learning requires organizations become knowledgeable about all the relationships and interrelationships within the organization. In order to better understand the complexity of the departments and specialties involved in HIT, the illustration (Figure 1) identifies potential departmental and specialty input.

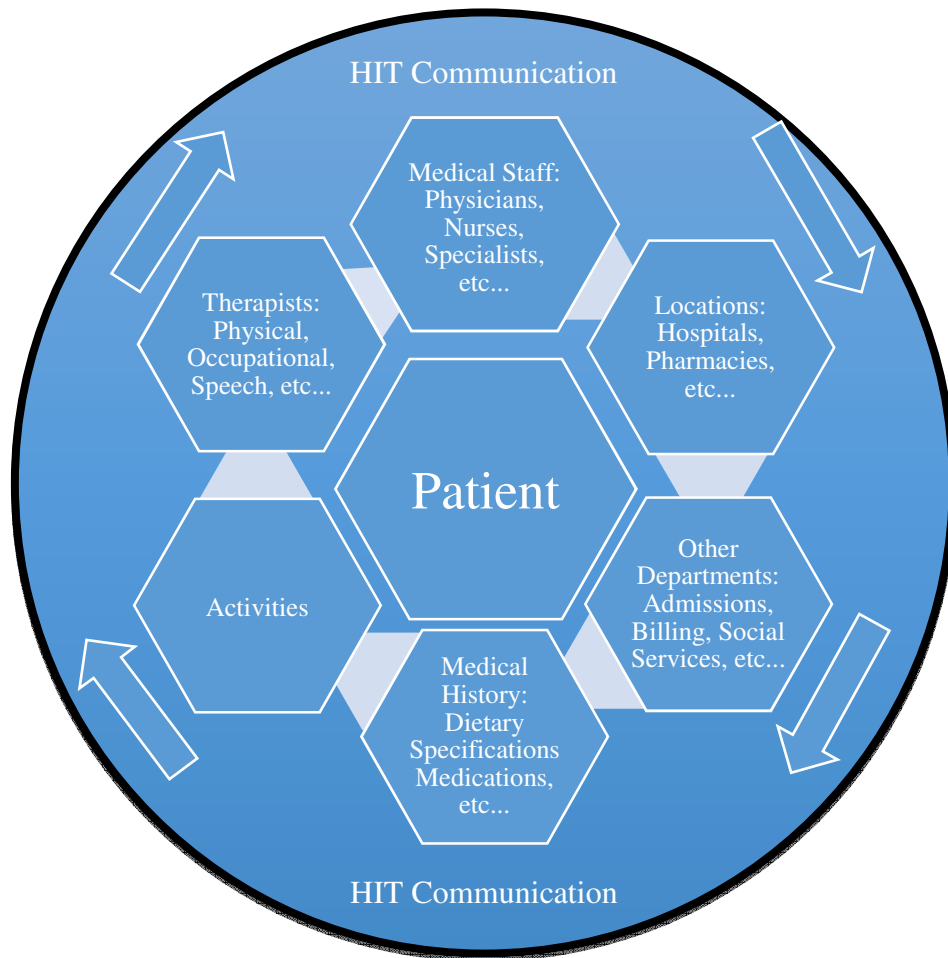


Figure 1 Departmental/Specialty Information Involved in Patient HIT Communication.

HIT is reliant on the exchange of information between departments or specialties. One aspect of this study was focused on the relationship of the integration or adoption of health information technology and resulting outcomes as based on CMS Quality Rating System and Minnesota Department of Health inspection rating scores.

Clinical or health information systems are virtually absent in most nursing homes (Alexander, 2008). Therefore, the vast numbers of elderly people who reside in the facilities are not reaping the benefits that HIT systems are thought to contribute, including better management of chronic conditions, greater efficiencies, and improved access to information (Alexander,

2008). By having a better understanding of the relationship between adopted HIT systems and CMS Quality Rating Scores and Minnesota Department of Health deficiencies, the benefits could be further supported.

The diffusion of innovations theory, described by Rogers (2003), is a process by which an innovation is communicated through appropriate channels over time among the members of the social system. The five-step process (knowledge, persuasion, decision, implementation, and confirmation) is critical to the adoption of the proposed innovation. An important feature of diffusion of innovations theory is that the innovation-decision of an individual is highly dependent on innovation-decisions of all other individuals within the system. According to Rogers (2003), individuals adopt an innovation based on the relative advantage, compatibility, complexity, trial ability, and observability. When the perceived relative advantage of HIT systems is high, it is more likely that the HIT systems will be adopted.

Rogers (2003) posited relative advantages, including cost and benefits, of adoption have consistently proven to be among the best predictors of innovation acceptance, because adopters want to know the degree to which the innovation is better than the existing system. This study focused on the relative advantage of HIT adoption by exploring the relationship between HIT and CMS Quality Rating System and Minnesota Department of Health inspection results. HIT was the independent ratio variable, based on the Minnesota e-health survey of 25 essential areas adopted. CMS Quality Five stars (1-5 stars or 10-50 points) were the dependent interval variables. Additionally, Minnesota Department of Health (CMS) survey results score (1-5 stars or 10-50 points) were the dependent ratio variables.

The adoption of HIT could have an impact on CMS quality rating scores and CMS survey/inspection results for nursing homes. HIT flows through an interconnected world

containing nursing homes, hospitals, consumers, physicians, payers and research that may relate to quality services. Relationships can best be illustrated in Figure 2.

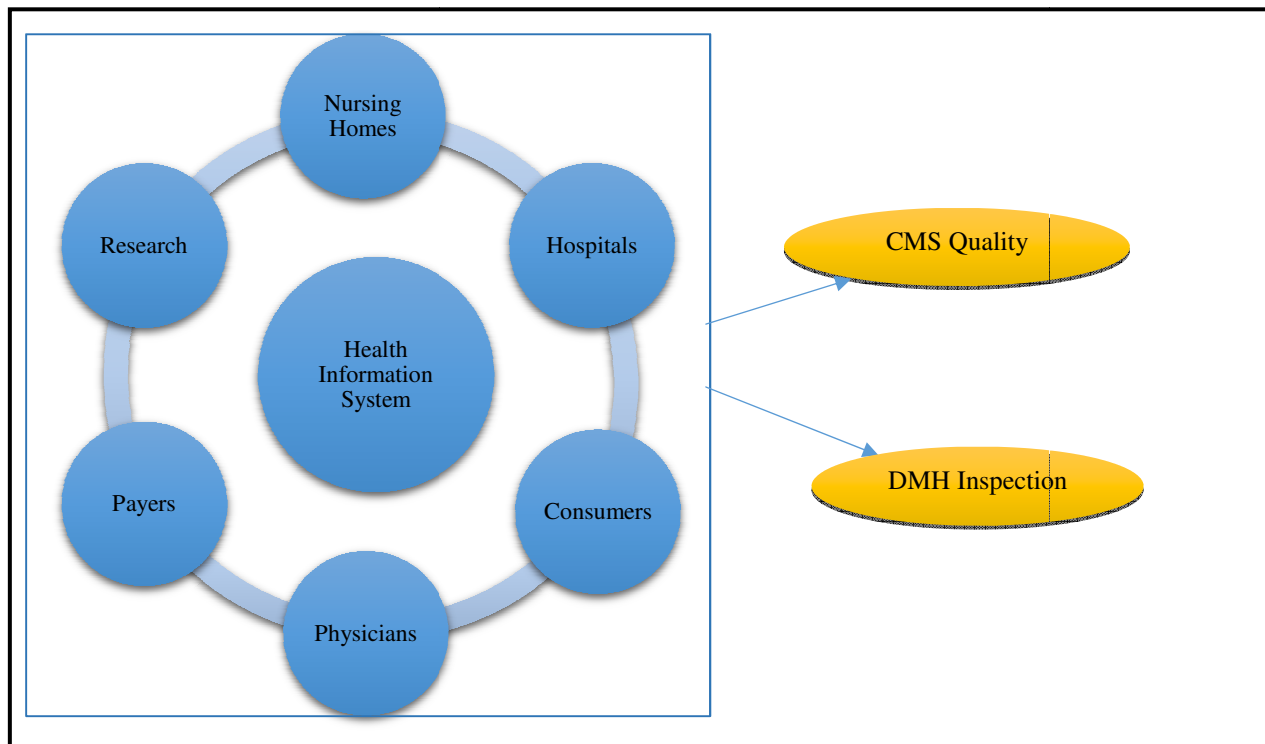


Figure 2 How HIT Flows Through an Interconnected World and May Relate to Quality Services.

Significance of the Study

According to executives in the healthcare industry, financial challenges, healthcare reform implementation, governmental mandates, patient safety, and quality ranked as the top five issues confronting health care in 2010 (Branz, 2011). A study conducted by the RAND Corporation (2010) suggested the use of health information technology has the potential for significant savings. Additionally, the RAND study indicates HIT utilization will increase patient safety and improve overall health care (RAND, 2010). The efficiency and resulting savings occur when the same work is performed by fewer resources. If the hospital and nursing home

can share data electronically, then the same information could be collected only once and not separately by each entity (duplication of services).

In a study conducted by the Commonwealth Fund Commission on a High Performance Health System (2006), the United States had one of the lowest efficiency scores for the provision of healthcare. According to the report, the United States spends 7.3% of national health expenditures on health administration and insurance, compared to about 5.6 % in Germany, and 2% in France and Japan (Commonwealth Fund on High Performance Health System, 2006).

Patient safety can also be improved by the electronic transmission of data. For example, allergies or certain drug sensitivities can have an electronic automatic alert or warning sound within the computer's programming for each electronic medical record, thereby reducing the potential for medication errors. Currently, this data transfer is done manually and is more susceptible to human error (Agency for Healthcare Research and Quality, 2010a). In addition, health information technology can support the clinician by scanning electronic medical records for quality assurance. Nearly one million patient safety incidents occurred among Medicare patients over the years 2006, 2007, and 2008 (Scapiro, 2010).

Most of the HIT studies completed to date have focused on hospital HIT. This study concentrated on nursing home health information technology and the relationship to CMS Nursing Home Quality Rating Scores and Minnesota Department of Health (CMS) score of deficiencies for Minnesota nursing homes.

Definition of Terms

Adoption: The “decision to make full use of an innovation as the best course of action available”
(Rogers, 2003, p. 473).

CMS: The Centers for Medicare & Medicaid Services (CMS) is an agency within the US Department of Health & Human Services responsible for administration of several key federal health care programs (Centers for Medicare and Medicaid Services, 2010).

CMS Quality Rating Scores: Measure of performance for nursing homes (CMS, 2011).

Electronic Health Records (EHR): The Electronic Health Records (EHR) is a longitudinal electronic record of patient health information generated by one or more encounters in any care delivery setting. Included in this information are patient demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data, and radiology reports. The EHR automates and streamlines the clinician's workflow. The EHR has the ability to generate a complete record of a clinical patient encounter - as well as supporting other care-related activities directly or indirectly via interface - including evidence-based decision support, quality management, and outcomes reporting (Healthcare Information Management Systems Society, 2011).

Health Informatics: Health Informatics is “the interdisciplinary study of the design, development, adoption, and application of IT-based innovations in healthcare services delivery, management and planning” (Procter, 2009, 1st paragraph).

Healthcare information technology: Health information technology (HIT) provides the umbrella framework to describe the comprehensive management of health information across computerized systems and the secure exchange between consumers, providers, government and quality entities, and insurers (Stanford, 2010). Electronic Health Records (EHR) and Health information technology (HIT) are often used interchangeably in the literature.

MDS: The Minimum Data Sets (MDS) is part of the U.S. federally mandated process for clinical assessment of all residents in Medicare or Medicaid certified nursing homes. This process provides a comprehensive assessment of each resident's functional capabilities and helps nursing home staff identify health problems (DHS, 2010a).

Methodology and Data Collection

The research methodology utilized in this study was quantitative and non-experimental. The research design was to utilize descriptive and correlation statistics to compare HIT adoption with CMS quality rating system scores. Statistics were also be utilized to compare HIT adoption with Minnesota Department of Health inspection scores. The descriptive statistics indicated the means, standard deviations, and range of scores for independent and dependent variables in this study. Descriptive statistics were provided for the sample of Minnesota nursing homes responding to the HIT survey, including location, size of the facility, ownership, and chain affiliation. The study compared the health information technology (HIT) systems adopted and the CMS Quality Rating System results (1-5 stars). The study also compared the HITs adopted and Minnesota Department of Health inspection results (1-5 stars). The descriptive, exploratory design focused on the HIT adopted in each nursing home, based on the Minnesota Department of Health 25 essential EHR survey results. Correlation statistics were utilized. Relationships (correlations) were found; therefore additional statistics were utilized, including analysis of variance (ANOVA) on location, size of facility, ownership, chain affiliation and overall EHR adoption in the Minnesota nursing homes.

Methodological Assumptions

Assumptions are those elements of the research that the researcher presumes are true (Joyner, Rouse, & Glatthorn, 2013). In this study, the assumptions are:

1. There is a need to improve the quality in Minnesota nursing homes. This is assumed to represent similar conditions nationwide (Institute of Medicine, 2000, 2001; Kohn et al., 2000; Mor et al., 2003).
2. Nursing home leaders are proponents of adopting HIT systems, but are unsure if this change will result in either improved CMS Quality Rating Scores or decreased Minnesota Department of Health (CMS) deficiencies.
3. Data collected by the CMS Quality Rating System are accurate, valid, reliable, and up to date.
4. Data collected by the Minnesota Department of Health (CMS) survey process are accurate and up to date.
5. The data on HIT are filled out completely, with accurate data based on the nursing homes' latest software and its utilization of the software.
6. The facility characteristics included as variables (urban or rural region, bed size, ownership, chain affiliation) sufficiently described the nursing home.

Delimitations of the Study

Delimitations are those elements the researcher can control and employ to define the boundaries of the study (Joyner et al., 2013). Delimitations of this study include:

1. Only Minnesota data were utilized for this study.

2. In order to assure manageability of the collected data, CMS Quality Rating Scores focused on the five stars as reported on Nursing Home Compare.
3. In order to assure manageability of the collected data, inspection data focused on the overall survey performance or total number of deficiencies of the nursing home.
4. Due to the large number of nursing homes in Minnesota, the population involved in this study was focused only on those returning the HIT adoption survey in Appendix B.

Limitations of the Study

Limitations are those elements over which the researcher has no control (Joyner et al., 2013). Limitations of the study include:

1. The data that were analyzed were previously collected and reported; therefore, the data collected by the CMS Quality Rating System are assumed to be collected under proper procedures for data collection.
2. The data that were analyzed were already collected and reported; therefore, the data collected by the Minnesota Department of Health (CMS) are assumed to be collected under proper research procedures for data collection.
3. The psychometric properties of the data collection instruments for HIT adoption used in this study were determined by Minnesota Department of Health.
4. In order to assure manageability of the collected data, the Minnesota 25 essential EHR systems have been collected in 316 (85%) of Minnesota nursing homes.
5. Only Minnesota data were utilized for this study. The data cannot be generalizable to the United States or possibly other states.

CHAPTER II

REVIEW OF LITERATURE

Introduction

According to executives in the health care industry, financial challenges, healthcare reform implementation, governmental mandates, patient safety, and quality ranked as the top five issues confronting health care in 2010 (Branz, 2011). According to RAND Corporation (2010), a nonprofit research organization, the United States healthcare system is in trouble. Despite investing over \$1.7 trillion annually in healthcare, the United States is plagued with inefficiency and poor quality health care services (RAND, 2010). According to many professionals in the healthcare industry, patient safety and quality of care remain the most significant areas of needed improvement (Chassin & Galvin, 1998). The Agency for Healthcare Research and Quality has reported significant advances over the last several years; however, Dr. Donald Berwick, founder and senior fellow at the Institute for Healthcare Improvement, emphasizes healthcare quality and safety is nowhere near where it needs to be in 2014 and remains an area of needed improvement (Rice, 2014)

In 2000, the Institute of Medicine (IOM) Committee on the quality of healthcare in America released its first report. The report, *Too Err Is Human: Building a Safer Health System*, found at least 44,000 and perhaps as many as 98,000 people die each year as a result of a medical error (IOM, 2000). This initial report was followed by another report on safety and patient-centered care called *Crossing the Quality Chasm* (IOM, 2001). The executives in health care and

these two reports bring the inadequacies of the healthcare system to the forefront. The United States is still recognized by the global community as providing less than adequate service and outcomes, at a high cost. According to the World Health Organization (2011), the United States' per capita costs for health care are among the highest in the world. The United States spends a higher portion of its gross domestic product on healthcare than any other country, but ranks 37 out of 191 countries in healthcare performance (WHO, 2011).

One of the more significant obstacles to improved patient care and cost reduction is the lack of real-time access to current, comprehensive patient medical information. Information needs to be readily retrievable for both patients and healthcare providers. Duplication of obtaining, storing and maintaining medical information by different providers for a single patient can be cumbersome and costly. Currently, a physician and hospital collect information from the patient independently. When a patient is discharged from the hospital, then the nursing home will receive limited information from the hospital. Typically, nursing homes must recollect the information already supplied to other providers. In 2004, President Bush signed an Executive Order providing for incentives for widespread adoption of Electronic Health Records (EHR) within 10 years (Bush, 2004). As of October 2013, 85% of hospitals and more than 6 out of 10 healthcare professionals had received an EHR incentive payment (CMS, 2014c). A revised timeline extended the deadline for HIT adoption to 2017 for physicians and hospitals; however, no timeline has been established for nursing homes (CMS, 2014c).

History of Nursing Home Quality

The quality of care in nursing homes has been a recurrent matter of public concern and policy discussion for the past 50 years (Walshe, 2013). The first governmental effort to improve

nursing home quality occurred in 1950, by requiring states to license nursing homes (Winzelberg, 2003). In 1965, Medicare and Medicaid programs were created and initiated funding for nursing homes; therefore, federal regulations were enacted to pay for nursing home care (Walshe, 2013). Medicare and Medicaid significantly expanded the number of and public financing for nursing homes; by the 1970s, the number of nursing homes increased almost twofold and spending for nursing home care increased fourfold, to almost \$20 billion annually (Winzelberg, 2003).

By 1986, the public outcries regarding poor quality of care provided in nursing homes in the United States were overwhelming (Dube & Mitchell, 1986; Elwell, 1984). Quality problems in nursing homes reported throughout the United States led the United States Congress to commission the IOM to conduct a study on quality of care and services in Medicare/Medicaid certified nursing homes (Coleman, 1991). Due to continued concerns of quality, an IOM (1986) report outlined proposals for a comprehensive reform of the standards of nursing home care with a focus on the quality of care. The recommendations by the IOM (1986) were that the federal government needed to become more involved in standardizing the quality of care, implementing revisions to nursing home performance standards and inspection processes, mandating training of nursing home employees, and improving the assessment of the needs of nursing home residents. The General Accounting Office (GAO) (1987) also recommended strengthening regulations after concluding that more than one-third of licensed nursing homes were operating below the minimum federal standards.

The conclusions of the IOM (1986) and GAO (1987) led to the federal nursing home legislation within the Omnibus Budget Reconciliation Act of 1987 (OBRA-87) (Winzelberg, 2003). The goal of the legislation was to improve the quality of care through the utilization of a

survey process administered by state officials and care standards. Based on the IOM (1986) report, the Minimum Data Sets (MDS) instrument was developed and nationally implemented in 1991. The MDS resident assessment is a method of assessing the needs of residents residing in nursing homes and is designed to formulate individual care plans, which in turn were expected to drive improvements in care quality (Rahman & Applebaum, 2009).

In 2003, the GAO released a report regarding the quality of nursing homes and acknowledged that CMS's nursing home survey data since 1999 showed a significant decline in the proportion of nursing homes with serious quality problems; however, the trend masked two important continuing issues: inconsistency in how states conduct surveys and understatement of serious quality problems (Government Accountability Office, 2003). As late as 2003, the GAO postulated that the volume of quality related problems in nursing homes still remained.

According to the GAO (2003) data, nursing homes showed a 9% decrease in the number of deficiency citations related to serious deficiencies from 1997 to 2002. Most recently, in a report issued by CMS (2012a), the percentage of surveys resulting in the determination of unacceptable quality of care has declined from 4.4% in 2008 to 3.3% in 2011. Although these results are encouraging, the issue of poor quality of care in nursing homes continues to remain at the forefront of national discussions and debates. The Office of Inspector General (OIG) (2008) conducted a study and concluded 91% of the nursing homes were cited for deficiencies. Seventy-four percent of these deficiencies were directly related to quality of care (Office of Inspector General, 2008).

In December 2008, the Centers for Medicare and Medicaid (CMS) enhanced their Nursing Home Compare website by adding a set of quality ratings for each nursing home that participates in Medicare and Medicaid (Abt, 2013). The five-star quality rating system was

developed to provide residents and their families with an easy way to understand assessment of nursing home quality (Abt, 2013). Performance on health inspection surveys, staffing levels, and quality measures derived from the MDS are the essential components of the five-star ratings for nursing homes (Abt, 2013).

History of Health Information Technology

Health information technology (HIT) has been correctly used interchangeably with “informatics” in recent literature. Homer R. Warner, one of the fathers of medical informatics, founded the Department of Medical Informatics at the University of Utah in 1968 (IOM, 1991). Dr. Warner described informatics as the study, invention, and implementation of structures and algorithms to improve communication, understanding, and management of medical information (Silverstein, n.d.). Dr. Silverstein described “informatics as the science and art of modeling and recording real-world clinical concepts and events into data used to derive actionable information” (Silverstein, n.d., p. 2). His definition includes expertise in medicine, information science, information technology, and scholarly study of issues that impact the productive use of information systems by clinical personnel (Silverstein, n.d.). Many other definitions for informatics exist; however, the primary theme among them is the use of information technology to improve communication among professional medical employees caring for patients in various healthcare settings. Informatics uses electronic methods to manage a patient’s healthcare needs. The American Medical Informatics Association (AMIA) has adopted four concepts or cornerstones for a new information management environment for healthcare. The AMIA cornerstones represent medical knowledge, acquiring and presenting clinical information, managing change, and integrating information (Silverstein, n.d.).

By executive order of President George W. Bush in 2004, the Office of the National Coordinator for Health Information Technology (ONC) was established as a staff division within the United States Department of Health and Human Services (Healthcare Information Management Systems Society, 2013a). The office was formed to provide leadership for the development and implementation of an interoperable, private, and secure nationwide health information system (Healthcare Information Management Systems Society, 2013a). Since the passage of the American Recovery and Reinvestment Act of 2009, which contains the Health Information Technology for Economic and Clinical Health Act (HITECH), the United States Department of Health and Human Services has encouraged the widespread adoption and meaningful use of electronic health records to potentially improve quality, safety, efficiency, and coordination of care (Conway, 2013). HIT allows health care providers to collect, store, retrieve, and transfer information electronically and has the potential to improve the quality, safety, and efficiency of health care (MedPAC, 2004).

Once the definition of informatics or HIT has been explicitly stated, a focus on the need for HIT use in nursing homes can more clearly be established. Information technology has made it possible to lower costs, save time, and improve the quality in many industries through business process redesign (Malhotra, 1998). For example, online retailers, such as Amazon.com, Barnesandnoble.com, and Staples.com, have provided web services to millions of customers to compare prices, read customer reviews, and access expert ratings of millions of products at the customers' fingertips. The implementation of information technology has fundamentally changed the business model and will likely influence consumers of health care in the future. The Patient Protection and Affordable Care Act directs individual states to establish health insurance exchanges and directs the federal government to establish exchanges in states that do not

establish their own exchanges (Cannon, 2013). Based on this regulation, the website <https://www.healthcare.gov/> was launched in October, 2013 to establish insurance exchanges. Numerous issues plagued the website, including site overload, site crashes, an ineffective sign up process, poor customer service, data center outages, privacy violations, and security risks (Brown, 2013). Although the healthcare.gov website is plagued with many problems, the movement toward the use of computer technology to enroll people in healthcare is likely to continue for years to come.

The Affordable Care Act requires that all nursing homes develop quality assurance and performance improvement programs (AHCA, 2013a). The tracking and trending of quality measures for quality assurance and performance improvement programs will require more extensive use of health information technology. A United States Department of Health and Human Services (2006) report, entitled “Evaluation Design of the Business Case of Health Technology in Long-Term Care: Final Report”, identified eight types of health information technology application, including: supportive documentation, census management, point of care, computerized provider order entry (CPOE), electronic health records (EHR), telehealth or telemedicine, assessment and care planning, and electronic prescribing (Hamilton, 2006). Based on the 2004 National Nursing Home Survey, these applications have been implemented in varying degrees by nursing homes (DHS, 2004).

The first area identified by the federal government in need of HIT application was the area of assessment. The resident assessment instrument was introduced to long term care in October, 1995 (DHS, 1995). The instrument was very complicated and cumbersome. Due to this fact, many providers immediately saw a need for information technology to assist professionals in tracking and completing this assessment, called minimum data sets (MDS).

Many providers now have electronic data; however, some facilities have limited this electronic data to the MDS only.

The MDS is used as the primary source for reporting information to the federal and state government and determines the payment received by the nursing home. The electronic medical record is more than just the MDS. According to a study by the California Health Care Foundation (2007), health information technology is used primarily for state or federal payment and certification requirements. The study goes on to indicate only 20% of long term care providers use clinical health information or electronic medical records (California Health Care Foundation, 2007). Applications such as progress notes, medication and treatment administration, care planning, electronic prescribing, and other decision support tools are not automated and require extensive time for each professional to find in the paper medical records. In addition, the information technology being used is not integrated with different agencies or facilities (California Health Care Foundation, 2007).

Quality and HIT

Increasingly, the federal government has stressed the value of HIT in helping providers to share information quickly, monitor compliance with treatment guidelines, and measure and improve their own performance (Robert Wood Johnson Foundation, 2011). Researchers at the IOM (2001) describe the current health care delivery system as poorly organized, and the delivery of care is complex and uncoordinated, requiring steps that slow down care and decrease rather than improve safety. Cumbersome and duplicated processes waste resources, leave unaccountable voids in coverage, lead to loss of information, and fail to coordinate all health professionals involved to ensure care is appropriate, timely, and safe (IOM, 2001). The IOM

(2001) indicated the desired quality of care in the United States could be achieved through six specific goals for improvement in the areas of safety, effective services, patient-centered services, timeliness, and efficiency. HIT has the potential to improve the quality of care to attain these goals (Bates, 2002; Institute of Medicine, 2006).

At least 1.5 million Americans are injured or die each year by preventable drug errors in hospitals, nursing homes, and outpatient clinics (IOM, 2006). Based on a study of physicians, over 80% of the medication errors involved informational or personal miscommunication, including miscommunication among colleagues, misinformation in the medical record, inaccessible medical records, and mishandling of patients' requests or messages (Woolf, Kuzel, Dovey, & Phillips, 2004). Some researchers believe that computer systems can be used to reduce error and improve the reporting of adverse incidents in health care (Wald & Shojania, 2001). Adverse drug events (ADEs) are defined by the IOM as "injuries resulting from a medical intervention related to the drug" (IOM, 2007). ADEs are estimated at approximately two million events a year among all United States nursing home patients (Handler & Hanlon, 2010). Over 93,000 deaths a year and \$4 billion of excess healthcare expenditures are attributed to ADEs, which represents the most costly and significant patient care issue in nursing homes (Handler & Hanlon, 2010).

HIT and Quality Adoption Theories

The Donabedian Model (2003) is a conceptual model that provides a framework for evaluating the quality of care in nursing homes. Donabedian described three categories of acquiring information about health care quality: structure, process, and outcome (AHRQ, 2010a). The structure measures focus on the conditions under which care is provided and highlights

institutional characteristics that facilitate quality, such as staffing, policies, and regulatory standards. The process measures focus on what a health care provider does to improve patients' health and emphasizes the interaction between the patient and the healthcare provider. Finally, the outcome measures focus on changes in health status that are attributable to health care (AHRQ, 2010b). Donabedian's (2003) framework begins with obtaining data on performance (structure, process, and outcomes) and analyzing patterns associated with these performance data. After obtaining the information and analyzing the patterns, interpretation for generating hypotheses can occur. Based on the information gathered, action is taken, and the cycle starts over again (Donabedian, 2003).

The Donabedian model is a theory of quality health care and the process of evaluating it and is supported by research. Trinkoff et al. (2013) examined turnover, staffing, and skill mix in nursing homes and found higher turnover, lower staffing, and higher skill mix resulted in adverse patient outcomes. Castle, Engberg, and Men (2007) studied the effect of staff turnover and quality of care and found that reducing staff turnover from high to medium resulted in better quality of care. Researchers posited that in order to be able to maintain and sustain quality in nursing homes, it is necessary to have a structural approach to understanding the organizational processes necessary to make the changes permanent (Donabedian, 2003).

Castle and Ferguson (2010) used Donabedian's structure, process, and outcome (SPO) to examine nursing home quality indicators. The SPO approach has theoretical underpinnings in that good structure should facilitate good process, and good process should facilitate good outcomes (Castle & Ferguson, 2010). Currently, the quality of nursing homes is assessed using several quality indicators, and many of these indicators are based on the SPO framework (Castle & Ferguson, 2010).

According to Castle and Ferguson (2010), from 2005 to 2010, MEDLINE nursing home studies either directly or indirectly applied the method of conceptualizing quality indicators. Structural quality indicators are easy to measure and often are routinely available; however, structural quality indicators can meet structural quality measure standards, but not necessarily provide quality care (Castle & Ferguson, 2010). Structural quality indicators include ownership, size, specialty services, and staffing size. Donabedian (1988) theorizes that structural quality indicators can be necessary but by themselves are not sufficient. For example, higher staffing levels would seem to provide improved quality of care; however, empirical studies find no such relationship (Castle, 2008). As a way of explaining this apparent anomaly, staffing levels are viewed as extremely important, but how staff are used (i.e., processes) may be just as inherently linked to quality (Castle, 2008). Process quality indicators are easy to interpret objectively, such as whether a resident received a pneumonia vaccination or not (Castle & Ferguson, 2010). Process indicators assess what is being done, not necessarily the appropriateness of what is being done, such as the case in which medications are given to the wrong resident (Handler et al., 2008). Outcome indicators are considered more stringent quality indicators because deviations from appropriate care should influence residents' health outcome (Donabedian, 1988). On outcome quality indicators, the change in residents' health status must be attributable to prior care and health status (Spector, 1998).

The achievement of the outcome of quality care requires that structures and processes be in place to support this change. Radley et al. (2013) examined the processing of prescription drug orders through a computerized provider order entry (CPOE) system and found with CPOE use, the likelihood of error decreased by 48%. Additionally, Yu et al. (2009) studied the effect of the use of CPOE on medication related outcomes in 3,364 hospitals and found that hospitals

using a fully implemented CPOE system had significantly better medication administration outcomes than their counterparts without this technology. Donabedian (2003) recommended that outcomes should be considered in conjunction with the structure and processes necessary to attain the desired outcome.

In addition to the Donabedian SPO approach, Nolan's (1973) Stage Theory offers possible explanations for adoption of HIT. Nolan's (1973) Stage Theory postulated four stages that all organizations follow, toward a point at which an information system is considered fully integrated. Nolan's four stages are initiation, expansion, formalization, and maturity. The stages represent growth from early stages, when computers are used to meet basic organizational needs, to later stages resulting in the full integration of computer applications (Nolan, 1973). Limited studies have been done in the area of full integration of computer applications in nursing homes. The most prominent and ongoing study is being conducted by Dr. Gregory Alexander at the University of Missouri. In previous studies, Alexander (2008) determined the integration of HIT in Missouri nursing homes was inadequate. The integration of admissions, scheduling, and resources in resident management systems was low. Additionally, the integration of resident management systems and other computerized systems (i.e., laboratory, pharmacy, human resources, and finance) was not sophisticated (Alexander, 2008).

A study published in the *Journal of the American Medical Informatics Association* in April, 2009 indicated adoption of electronic information systems in nursing homes has the potential to add value by improving efficiency in administrative and operational areas, and more importantly, by helping to integrate services and improve quality of care (Resnick et al., 2009). The study found 96% of nursing homes used informatics for the MDS; however, only 17% used informatics for electronic medical records including medication administration (Resnick et al.,

2009). Electronic medical records can assist the different disciplines (nurses, therapists, dietitians, etc.) to coordinate their efforts more easily. With the United States Congress appropriating more than \$20 billion for health information technology as part of the February 2009 economic stimulus package (Kaplan & Harris-Salamone, 2009), clearly an emphasis on electronic medical records is forthcoming. Although most of this stimulus money was allocated to hospitals, nursing homes could also benefit. In addition, the transition from hospital to a nursing home could be drastically improved by transmitting electronic information from one level of care to another. GAO (2004) states electronic medical records include:

A longitudinal collection of electronic health information about the health of an individual or the care provided; immediate electronic access to patient and population level information by authorized users; decision support to enhance the quality, safety, and efficiency of patient care; and support of efficient process for health care delivery. (p. 10)

In 2009, President Obama signed the HITECH Act, Health Information Technology for Economic and Clinical Health, as part of ARRA, the “American Recovery and Reinvestment Act” (McGee, 2010). Nursing home informatics needs to be an important part of health care technology; however, adoption of health information systems in nursing homes has been slow. According to Nolan’s (1973) Stage Theory, the full integration of computer applications has not been achieved in nursing homes.

Another theory providing a basis for HIT adoption is Rogers’ diffusion of innovation, which describes the innovation-decision process in five stages: knowledge, persuasion, decision, implementation, and confirmation (Rogers, 1995). Van der Ven, Polley, Garud, and Venkataraman (1999) described the innovation journey as having three main periods: initiation, development, and implementation/termination. Common to the above two models is considerable support for the importance of communication in social networks, as it enables the

diffusion of innovation (Gosling, Westbrook, & Braithwaite, 2003). Ash (1997) concluded that greater diffusion will occur in organizations that encourage communication. Nursing home staff rely heavily on information from outside of the organization, like hospitals, physicians, patients, and other healthcare professionals; therefore, the health care technology innovation appears to have stalled in the knowledge or initiation phase.

Michael Powell, Federal Communications Commission head in 2001, said the shift to digital technology will be messy and confusing (Burke, 2011). Burke (2011) conceived that the implementation process of technology and organizational change has unanticipated consequences. Things do not go as planned and people often resist the change (Burke, 2011). Complexity catastrophe refers to the degree of interdependencies of systems that ultimately limits the organization's performance and can occur in the implementation process of technological and organizational change (Fleming & Sorenson, 2001). A theory, called complexity science, has emerged as a focus of research to understand the webs of relationships that influence organizational efforts (Anderson & McDaniel, 2000; Zimmerman, Linberg, & Plsek, 2001). Nursing homes have been identified by researchers as complex adaptive systems (CAS), where attention is given to the relationships (connectivity) of workers, cognitive diversity, and information flow (technology) (Anderson, Corazzini, & McDaniel, 2004; Chaffee & McNeill, 2007; McDaniel & Driebe, 2001). Nursing homes that emphasize innovation and teamwork in their approach to technology are more likely to succeed when implementing quality improvement activities (Berlowitz, Young, Hickey, & Saliba, 2003).

Staff involvement in the change process is essential for successful work redesign (Axtell & Parker, 2003). McCullough, Casey, Moscovice and Prasad (2010) theorized that HIT systems are designed to enhance communication among healthcare workers; therefore, adopting this HIT

will equip healthcare workers with information needed to reduce errors and provide quality care. Lawhorne, Ouslander, and Parmelee (2008) reported better nursing home performance on the MDS quality indicator for toileting with process improvement teams supported by HIT. HIT can assist staff in better communication. Gaps in communication have been identified as detrimental to sustained improvement in nursing homes (Scott-Cawiezell et al., 2004; Shortell, Bennett, & Byck, 1998).

Barriers to HIT Adoption

A variety of barriers exists for the adoption of health information systems. In a study conducted by Cook, Sorensen, Wilkinson, and Berger (2013), physicians perceived that insufficient time and lack of a single source information system with convenient access to computers were the greatest barriers to utilizing HIT. The top three barriers to adoption reported by the 2003 Commonwealth Fund National Survey of Physicians and Quality Care were: cost of system start-up and maintenance; lack of local, regional and national standards; and lack of time to consider acquiring, implementing, and using a new system (Audet, Doty, Shamasdin, & Schoenbaum, 2005). Additional concerns noted by health care professions have centered on personal patient privacy (Audet et al., 2005).

The Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009 represents the largest United States Government initiative to date designed to encourage widespread use of electronic health records (EHR) (Menachemi & Collum, 2011). Even with the incentives provided in the law, the financial issues, including adoption and implementation costs, ongoing maintenance costs, loss of revenue associated with temporary loss of productivity, and declines in revenue, present a larger disincentive for health care organizations to adopt and

implement HIT (Menachemi & Collum, 2011). The biggest impediment to adopting HIT may well be due to the misalignment of costs and benefits (Middleton, Hammond, Brennan, & Cooper, 2005). The national adoption of HIT may lead to a cost savings in efficiency of more than \$81 billion dollars per annum, according to the RAND Corporation study; however, Fonkych and Taylor (2005) concluded organizations will not recognize maximum savings for about 15 years. Based on a study conducted in Maryland nursing homes, Sharp (2010) concluded that limited reimbursement (65% of nursing homes responding to survey) and monetary challenges (76% of nursing homes responding to the survey) are the main reasons for the lack of adoption of HIT in nursing homes.

Implementation of HIT systems creates major disruptions in workflow and may cause fragmented care during this initiation phase (DePhillips, 2007). Loss of productivity based on the disruption of workflow for clinical staff stems from end-users learning the new system. One study involving several internal medicine clinics estimated a productivity loss of 20% in the first month alone (Menachemi & Collum, 2011). In addition, some physicians are not employed directly by the hospital, clinic, or nursing home; therefore, the physician culture or lack of participation can be an obstacle to the adoption of HIT in the healthcare system (Bottles, 1999).

Interoperability describes the extent to which information systems and devices can exchange data and interpret that shared data. For two systems to be interoperable, they must be able to exchange data and subsequently present that data in a manner in which it can be understood by the user (Healthcare Information Management Systems Society, 2013b). Chaudhry et al. (2006) considered that standards are needed to support interoperability. HIMSS (2013b) supports establishing standards in healthcare to provide a common language and set of expectations to permit data exchange and sharing between clinicians, labs, hospitals, pharmacies,

and patients. In a study of Minnesota nursing homes, researchers found that cost (72%), complexity of technology selection process (26%), and lack of technical infrastructure (24%) were the main barriers to HIT adoption (StratisHealth, 2008). Sharp (2010) found that concerns about lack of integration of HIT systems were another major barrier as found in Maryland nursing homes.

Electronic Health Records (EHR) are necessary for care continuity by facilitating the exchange of patients' health information among providers managing or assuming the patient's care at each level of care (hospital, nursing home, home, etc.). EHR also serve to transfer accountability, help avoid preventable adverse events that might occur during transitions, satisfy regulatory requirements, and influence the follow up of care (McMurray et al., 2012). Most current health information systems are vendor-specific, with an excessive number of commercially available options which do not interface with one another (Oatway, 2004). Programs designed for acute care settings are not sufficient for nursing homes because of the larger records and length of stay associated with long term care. Oatway (2004) posited the inevitability of these issues is multiplied when it is considered that no certifying agency to standardize the system for universal use has been established. A study released in 2004 by the American Academy of Family Physicians' survey data reported 1,297 member physicians used health information systems in their practice; however, only 0.4% used the same or compatible software systems (Valdes, Keibbe, Tolleson, Kunik, & Petersen, 2004). The Health Insurance Portability and Accountability Act (HIPAA) established some general guidelines for EHR; however, standardization of the EHR has been only partially developed (Phillips, Wheeler, Campbell, & Coustasse, 2010).

Recognition of the need for interoperability is starting to unfold in healthcare organizations. As a group, Intermountain Healthcare, Geisinger Health System, Group Health Cooperative, Kaiser Permanente, and Mayo Clinic have created the Care Connectivity Consortium to pioneer the effective connectivity of electronic patient information in a way that adequately protects patient privacy (Allen, 2012). Five major providers of electronic medical records banded together in 2013 to form CommonWell Health Alliance to address the need for standards of HIT (Herper, 2013). Many health care organizations are putting a renewed focus on interoperability (in 2014), with the meaningful use incentive program requiring both vendors and providers to adopt common data standards in three critical areas. The three critical areas include how messages are sent and received, the structure and format of information, and terms used within these messages (Brino, 2013).

A study by Byrne et al. (2010) compared the HIT in the Department of Veterans Affairs (VA) to norms in the private sector. The VA has developed and adopted HIT systems that support a broad range of patient care and administrative processes, including EHR, radiological imaging, laboratory and medication ordering, and administration. The system was known as Veterans Health Information Systems and Technology Architecture (VistA) (Byrne et al., 2010). The VA has achieved close to 100% adoption of several VistA components since 2004; however, the private sector has not reached any significant adoption of HIT. Byrne et al. (2010) concluded the VA's investment in VistA is associated with significant value through reductions in unnecessary and redundant care, process efficiencies, and improvements in care quality. The result is yielding \$3.09 billion in cumulative benefits.

Another barrier to HIT adoption often mentioned in research and reports is the risk of patient privacy violations due to the increasing amount of health information exchanged

electronically (Menachemi & Collum, 2011). The Health Insurance Portability and Accountability Act (HIPAA) of 1996 was intended to address potential threats to patient privacy posed by computerization and standardization of medical records (Gunn et al., 2004). In January, 2013, the U.S. Department of Health and Human Services released the Omnibus Final Rule, significantly modifying the privacy and security standards under the Health Insurance Portability and Accountability Act (HIPAA) (DHS, 2013). The Omnibus Final Rule aimed to encourage the development of interoperable HIT and health information exchanges and expanded HIPAA compliance (Wang, Delphine, & Huang, 2013). As technology becomes more integrated with health records, healthcare providers will face increasing risks/liabilities in storing, handling, and transmitting electronic health information, including information on email, smart phones, and text and cloud technology. Rose (2013) postulated health care providers will need to mitigate liability associated with noncompliance of HIPAA and HITECH Act by conducting risk assessments, identifying electronic protected health information, developing action plans addressing allowed external sources (vendors, consultants, etc.), reviewing security rules, and making sure business associate agreements are comprehensive (Rose, 2013).

Potential Importance of HIT

As it relates to the complexity and quality of health care organizations, Wagner (2004) offers the following:

Effective care does not happen by chance or by simply working harder. It requires the concerted and coordinated activities of multiple people and disciplines, and a delivery system reconfigured to facilitate its execution. Both the delivery of high-quality care and the evolution of practice systems to support it require teams that can effectively blend diverse skills and perspectives toward a common aim. (p. 1037)

HIT could be essential for the delivery of high-quality care in nursing homes for a variety of reasons. First, HIT can detect anomalies through real-time monitoring and assurance processes, using tools like computerized provider order entry (CPOE) and clinical decision support systems (AHRQ, 2001). Gurwitz, et al. (2005) estimated over 20,000 fatal or life-threatening events occur annually in nursing homes. Hillestad et al. (2005) posited over 200,000 adverse drug events per year could be eliminated by the installation of CPOE in hospitals. CPOE is an electronic medication administration system which has been found to improve the quality by standardizing processes and by providing physicians' guidance (Kuperman & Gibson, 2003). The physician can be provided alerts on medication dosing when a particular indicator falls outside the pre-set ranges (Kuperman & Gibson, 2003).

Studies on CPOE found implementing the system had reduced, and in some cases entirely eliminated, transcription errors. One study found medication orders entered via CPOE were also associated with a significant reduction in medication turnaround time and less likely to require pharmacist intervention. The patient received the medication in a more timely manner and with greater accuracy (Davis et al., 2013). Another study found a 55% percent reduction in serious medication errors by using CPOE (Bates et al., 2001). Gurwitz et al. (2005) found that adverse drug events in the studied nursing homes were at a rate of 1.89 per 100 resident-months. HIT could help nursing homes respond to these events in more timely fashion and make necessary corrections to medication orders.

Second, nursing homes could benefit from more efficient and accurate transfer of data within EHR among all providers. This transfer of data could occur between nursing homes, physicians, specialists, other nursing homes, hospitals, clinics and other health care providers. The data in HIT could include all relevant procedures provided for the patient in each level of

care, allowing the nursing home staff a better overall understanding of care needed by each patient. HIT serves to “facilitate interinstitutional and interpractioner communication and collaboration” (Coleman & Boulton, 2003, p. 556). Patients whose conditions require complex care need services from different practitioners in multiple settings, but hospitals, nursing homes, physicians and other providers often operate independently, without knowledge of the problems, services, information, medication, or patient preferences in the previous settings (Coleman & Boulton, 2003). During transitions to or from the nursing home, patients are at risk for medical errors, service duplication, inappropriate care, and critical components of care being overlooked (Coleman & Boulton, 2003).

Third, HIT can offer better cost control methods by avoiding duplication of services and improving productivity. At 90% adoption of HIT, Hillestad, et al. (2005) estimated the potential HIT efficiency savings for both inpatient and outpatient care combined could average more than \$77 billion per year. Although these savings would accrue to different stakeholders, consumers could obtain the largest benefits in reduced premiums or fewer tax dollars needed for health care (Hillestad et al., 2005). Hillestad et al. (2005) suggested that the use of HIT could result in a reduced length of stay in hospitals, allowing the patient to transition to a less costly provider more quickly. Studies have also indicated with HIT use, there is an improved efficiency in time required for nurses to complete documentation and savings from reduced staff to process lab, radiology, and pharmacy orders (Pizziferri et al., 2005; Poissant, Pereira, Tamblyn, & Kawasumi, 2005; Schmitt & Wofford, 2002). Transcription costs, and physical storage spaces for paper medical records are virtually eliminated or significantly reduced when HIT is adopted (Schmitt & Wofford, 2002).

Finally, application of HIT can be utilized to assess the quality of care using standardized measurements. Quality reporting systems utilizing the MDS data in nursing homes can generate reports for quality of care feedback (Mor et al., 2003). Nursing home staff would be able to assess the facility's performance and set up more effective quality assurance programs, therefore utilizing HIT to improve the quality of care (Bates, 2002; Institute of Medicine, 2001).

CHAPTER III

RESEARCH METHODOLOGY

This chapter describes the research methodology that was used to carry out the proposed study. This includes a description of the population and sample, survey and inspection information, variables analysis, instrumentation, and research design. This study was an ex post facto design, utilizing existing sources of data (Kowalczyk, 2014). According to Creswell's (2014) definition of research studies, the study would be described as a correlational, quantitative research design method.

The proposed research was conducted by examining the status of electronic health records in Minnesota nursing homes based on the 2011 Minnesota e-health survey. Descriptive statistics of the 2011 Minnesota HIT adoption survey helped describe and summarize the data for further investigation. The relationship (correlation) of electronic health records adoption in Minnesota nursing homes with CMS Quality Rating Scores were analyzed. In addition, the relationship (correlation) of electronic health records adoption in Minnesota nursing homes with Minnesota Department of Health inspection results as reported on the CMS Nursing Home Compare were analyzed. The CMS Quality Rating Scores and Minnesota Department of Health (CMS) inspection scores for each nursing home were categorized into five groups: much above average (five star), above average (four star), average (three star), below average (two star) and much below average (one star). The 25 HIT survey questions for each nursing home were

examined individually. The research questions are exhibited in the data matrix (Mills, 2011) as follows:

Table 1 Data Matrix for Research Questions

Questions:	Data Source 1	Data Source 2	Data Source 3
Status of MN EHR	MN EHR survey		
Relationship (correlation) of EHR adoption with CMS quality rating scores	MN EHR survey	CMS quality rating scores	
Relationship (correlation) of EHR adoption with MN Dept. of Health inspection scores	MN EHR survey		MN Dept. of Health inspection scores
Regression analysis, ANOVA, ANCOVA of overall EHR adoption, location, size of facility, ownership, and chain affiliation with CMS quality rating scores	MN EHR survey	CMS quality rating scores	
Regression analysis, ANOVA, ANCOVA of overall EHR adoption, location, size of the facility, ownership and chain affiliation with MN Dept. of Health inspection scores	MN EHR survey		MN Dept. of Health inspection scores

Description of the Population and Sample

According to the Centers for Disease Control and Prevention (2012), the number of nursing homes in the United States in 2011 was 15,702, with over 1.7 million beds and an occupancy rate of 86%. For the purposes of this study, the focus was on the state of Minnesota. The state of Minnesota has been aggressively following the nursing home utilization of HIT by conducting surveys in both 2008 and 2011. Many of the state's laws governing nursing homes are designed to make use of HIT. The 2007 Minnesota Legislature mandated a statute requiring all hospitals and health care providers to have an interoperable electronic health records system in place by January 1, 2015 (Minnesota Department of Health, 2014a). HIT status in nursing homes has not been assessed on a federal level since the 2004 National Nursing Homes Survey. Additionally, other states have only collected minimal data on HIT in nursing homes, thus the analysis of Minnesota EHR adoption status surveys conducted in 2008 and 2011 becomes a very unique opportunity for research that is useful as a precedent for other states.

By the end of 2011, Minnesota nursing homes occupancy rate was 89.9% (CMS, 2012b). The number of nursing homes in the state of Minnesota, based on the most recently published 2011 data, was 382 (Centers for Medicare and Medicaid Services, 2012b; Minnesota Department of Health, 2012a). Of these 382 nursing homes, 175 were classified as rural, and 207 were classified as urban. Additionally, 108 were for-profit ownership, 236 were non-profit, and the remaining 38 were government owned. Bed size of 100 beds or more accounted for 100 nursing homes with the remaining 282 having less than 100 beds (CMS, 2012b). Chain affiliated nursing homes accounted for 274 nursing homes (CMS, 2010).

Survey and Inspection Information

The Minnesota Department of Health conducted a survey in 2011 on EHR adoption status of Minnesota nursing homes. The response rate was 83%; 316 nursing homes responded out of the 382 Minnesota licensed nursing homes. The Minnesota Department of Health EHR survey form is included in Appendix B.

Individual state governments oversee the licensing of nursing homes in their state. In addition, states have a contract with the Centers for Medicare and Medicaid Services (CMS) to monitor those nursing homes that want to be eligible to provide care to Medicare and Medicaid beneficiaries. Quality of service inspections of the nursing homes are conducted by specially trained and qualified state and federal survey personnel at least annually, and these inspections must adhere to requirements broadly outlined in the Social Security Act. These inspections occur unannounced and within a 9 to 15 month window. Based on this required inspection, data are collected at least annually from each nursing home on inspection results, quality indicators, and staffing. The collection of these data is mandatory for the nursing homes to be licensed and able to admit residents. The collection of this data is stored in the CMS database and is utilized to formulate the CMS Quality Star Ratings. Additionally, due to the mandates by federal and state governments, informed consent is also required for residents in a nursing home and includes the ability for state and federal government to gather survey data for review. Privacy of the resident is protected by publicizing unidentifiable resident information.

Variables Analysis and Instrumentation

In 2011, Minnesota Department of Health conducted a survey focusing on 25 key EHR systems, including, (a) MDS assessment, (b) assessments other than MDS, (c) diagnosis or

condition list, (d) resident demographics, (e) vital signs, (f) medical history and physical, (g) activities of daily living (ADLs), (h) advance directives, (i) allergy list, (j) care plan, (k) therapy plan, (l) clinical notes, (m) medication administration record (eMAR), (n) barcode medication administration, (o) medication reconciliation, (p) resident list/census, (q) laboratory tests, (r) medications, (s) nursing orders, (t) physician orders, (u) laboratory reports, (v) radiology reports, (w) immunization registries, (x) report disease results to public health agencies, and (y) ePrescribing (Minnesota Department of Health, 2012b). For purposes of this study, the EHR systems have an interval scale of measurement of 0-25 systems.

CMS Quality Rating Scores are based on a five star rating system and are updated annually and posted on the CMS website. The five star CMS Quality Rating Scores are based on a sophisticated composite measure. CMS Survey Data are gathered on each nursing home annually (9 to 15 months apart) and posted on the CMS website. CMS calculates a total health inspection score for each facility based on weighted deficiencies and number of repeat revisits needed. Note that a lower health inspection survey score corresponds to fewer deficiencies and revisits and thus better performance score on the health inspection. CMS collects each health inspection score from individual nursing homes and determines the nursing home's overall rating on the inspection process. The top 10% in each state receive a five-star rating on the health inspection, worth a maximum of 50 points, and the bottom 20% receive a one-star rating on the health inspection, resulting in 10 points or less, with the rest of the facilities in a state falling somewhere in-between (CMS, 2012). CMS Quality Rating Scores and Minnesota Department of Health inspection scores for each nursing home are categorized into 5 groups: much above average (five star), above average (four star), average (three star), below average (two star), and much below average (one star). CMS and Minnesota Department of Health categorically assign

a point scale to each star as follows: five star = 50 points, four star = 40 points, three star = 30 points, two star = 20 points, and one star =10 points.

CMS categorizes each nursing home as urban or rural. Bed size is reported annually, based on the certificate of need approved by licensure for nursing homes. The nursing homes are categorized by bed size of 100 or less versus more than 100 beds. Ownership of the nursing home is either for-profit, non-profit or government owned. Nursing homes have chain affiliations consisting of more than one location or are stand-alone facilities. See Appendix A for variable matrix.

Centers of Medicare and Medicaid under the direction of the Department of Health and Human Services develop, administer, and collect data for Nursing Home Compare continually. For survey results and quality indicators, a team of trained health inspectors conduct onsite health inspections, on average, about once a year. For survey results, inspectors look for the care of residents, the process of care, staff and resident interactions, and the nursing home environment (CMS, 2011). For quality indicators, the information is self-reported by the nursing home and comes from data that nursing homes routinely collect on all residents at specified times from the minimum data sets (MDS).

Rates of HIT adoption have been collected via a survey conducted in 2011 by the Minnesota Department of Health in collaboration with its partners, Care Providers of Minnesota, Aging Services of Minnesota and Stratis Health. The survey focused on the main components of electronic data as identified by the Minnesota Department of Health. The results were employed to determine the extent of the use of health information technology adopted, based on answers to question 11 of the survey. Question six requests the current overall EHR adoption status of the nursing home. Question 11 requests the current or planned use of 25 specific EHR

functionalities by the nursing home. Refer to Appendix B (Minnesota Department of Health, 2012b).

Research Design Including Data Analysis Techniques

The purpose of this non-experimental quantitative study is to ascertain whether a relationship exists between the number of HIT systems adopted by Minnesota nursing homes and CMS Quality Rating Scores. In addition, one of the goals of the study was to ascertain whether a relationship exists between the number of HIT systems adopted by Minnesota nursing homes and Minnesota Department of Health inspection scores as calculated by the CMS five-star program.

Based on the results, the analyses were utilized to determine the answers to the research questions:

1. What were the 2011 status and issues regarding health information technology in Minnesota nursing homes based on the Minnesota e-Health report based on descriptive statistical investigation?
2. What relationship, based on inferential statistics, does health information technology adoption and use in Minnesota nursing homes have with CMS Quality Rating Scores?
3. What relationship, based on inferential statistics, does health information technology in Minnesota nursing homes have with Minnesota Department of Health inspection results?
4. Do any of the following nursing home facility variables (location, size of facility, ownership, chain affiliation and overall EHR systems adopted) predict CMS Quality Rating Scores in nursing homes?

5. Do any of the following nursing home facility variables (location, size of facility, ownership, chain affiliation and overall EHR systems adopted) predict Minnesota Department of Health inspection results as reported on CMS Nursing Home Compare?

Hypotheses bridge the gap between theory and reality (LoBiondo-Wood & Haber, 2002).

Previous studies investigated adoption of HIT systems in healthcare from a perspective of user acceptance, nature of the implementation process, and HIT sophistication (Alexander, Madsen, Herrick, & Russell, 2008; Au, Ngal, & Cheng, 2008; Kim & Kankanhalli, 2009). Research on HIT adoption in nursing homes and the relationship to quality of care is recommended for further study (Alexander et al., 2008; Lui & Castle, 2008). The National Nursing Home Survey conducted in 2004 supports the belief that the adoption of HIT systems is low in nursing homes; therefore, further research is needed as more nursing homes have implemented HIT in recent years (Alexander et al., 2008; Lui & Castle, 2008). This study also identified which nursing home variables, if any, may be more predictive of higher quality rating scores by exploring the relationships between HIT and quality, taking into consideration the extraneous variables of location, size of facility, ownership, and chain affiliation. See data matrix for research questions (Mills, 2011).

Research methodologies were evaluated when choosing a strategy for this study.

Approaches to research studies led to one of the three common types of research methodologies: quantitative, qualitative, and mixed methods studies (Creswell, 2009). Trochim and Land (1982) defined quantitative research as a design used to structure the research and to show how all the major parts of the research project work together to try to address the central research question. Trochim and Donnelly (2008) presumed research methodology should match the research purpose, questions, and hypotheses. Healthcare quality is usually measured and reported

retrospectively (Clark, 2007); therefore, CMS Quality Rating Scores were non-experimental and provided specific quantitative numbers. Quantitative research methods are frequently described as deductive in nature and assume that there is a single truth that exists, independent of human perception (Lincoln & Guba, 1985). According to Creswell (2009), a quantitative methodology is appropriate when there is a need to explain or validate relationships between two or more variables. Numerical data were analyzed in this study; therefore, a quantitative approach of research is appropriate (Leedy & Ormrod, 2005).

According to the Centers for Disease Control and Prevention (2012), the number of nursing homes in the United States in 2012 was 15,702, with over 1.7 million beds and an occupancy rate of 86%. In 2011, the number of nursing homes in Minnesota was 383, with an occupancy rate of 90.6% (Minnesota Department of Health, 2011). For purposes of this study, data from the 316 nursing homes responding to the Minnesota e-health survey in 2011 were utilized.

The study drew on three primary databases: a) Nursing Home Compare overall score, as produced by Medicare.gov; b) Nursing Home Compare survey score, as produced by Medicare.gov; and c) Minnesota e-health survey conducted by the Minnesota Department of Health, as shown in Appendix B. Nursing Home Compare overall score and survey score have been tested for validity and reliability by the Centers for Medicare and Medicaid (CMS, 2011). The procedure included a collection of the above data for each nursing home in the sample. In this study, an analysis of the number of HIT systems adopted in Minnesota Nursing Homes, current and/or planned, were investigated. Data were analyzed to determine the relationship between Centers for Medicare and Medicaid Services (CMS) Quality Rating Score and the number of HIT systems adopted in Minnesota Nursing Homes.

The 2011 Minnesota e-health survey focused on 25 key EHR components, including MDS assessment, assessments other than MDS, diagnosis or condition list, resident demographics, vital signs, medical history, activities of daily living (ADLs), advance directives, allergy list, care plan, therapy plan, clinical notes, medication administration record (eMAR), barcode medication administration, medication reconciliation, resident list/census, laboratory tests, medications, nursing orders, physician orders, laboratory reports, radiology reports, immunization registries, report disease results to public health agencies, and ePrescribing (Minnesota Department of Health, 2012b). CMS Quality Rating Scores are based on a five star rating system, updated annually, and posted on the CMS website. The five star CMS Quality Rating Scores are based on a complex composite measure. CMS Survey Data are gathered on each nursing home annually and posted on the CMS website, and the survey deficiencies score can range from 0 to 50. CMS categorizes each nursing home as urban or rural. Bed size is reported annually, based on the certificate of need approved by licensure for nursing homes, and is categorized by nursing homes consisting of 100 or fewer beds versus more than 100 beds. Ownership of the nursing home is either for-profit, non-profit or government ownership. Nursing homes are either stand-alone operations or a group of nursing homes forming a chain affiliation.

After collection of all data, a descriptive analysis of all independent and dependent variables in this study was completed. This report included means, standard deviations, and range of scores for these variables (Creswell, 2014). Beyond the descriptive analysis, a determination was made if a correlation exists between CMS quality ratings and HIT. Next, a determination was made if a relationship (correlation) exists between the score on the Minnesota Department of Health inspection deficiencies report and HIT. Many researchers categorize non-

experimental quantitative designs as correlational and causal-comparative research (Joyner et al., 2013). For purposes of this study, correlation and causal-comparative research were utilized. The associational and comparative approaches are similar in that the researcher studies attribute independent variables over which the researcher does not have control (Gliner, Morgan, & Leech, 2009). Correlation designed research is a non-experimental form of research using the correlational statistic to describe and measure the degree or relationship between two or more variables or groups of scores (Creswell, 2014). Causal-comparative research is in effect when the researcher compares two or more groups in terms of a cause that has already happened (Creswell, 2014). The data were downloaded into Statistical Package for the Social Sciences (SPSS®) for statistical analysis allowing a comparison of many groups of data to determine if any relationships (correlations) exist. When relationships (correlations) existed, then ANOVA, ANCOVA, and regression were calculated for further analysis. Additionally, regression analysis was utilized to analyze the relationship between HIT, the independent variable, and CMS quality scores and Minnesota Department of Health deficiency report, the dependent variables. Multiple regression provides the relative prediction of one variable among many in terms of the outcome (Creswell, 2014). Joyner et al. (2013) stated that the researcher has much less control over the independent variables. In this study, the researcher has no control over the independent variables; however, the design was able to show whether relationships exist between variables (Joyner et al., 2013).

Quantitative hypotheses are predictions the researcher makes about the expected outcomes of relationships among variables (Creswell, 2014). According to Creswell (2014), research hypothesis narrows the purpose statement and become significant signposts for the reader. The following research hypotheses were utilized in this study:

1. The first hypothesis formulated the 2011 status and issues regarding health information technology in Minnesota nursing homes based on the Minnesota e-Health report utilizing descriptive statistical investigation.
2. The second hypothesis is there will be a statistically significant relationship (correlation) between the number of HIT systems adopted and CMS Quality Rating Scores of nursing homes in Minnesota. The null hypothesis is there will not be a statistically significant relationship (correlation) between the number of HIT systems adopted and CMS Quality Rating Scores of Minnesota nursing homes.
3. The third hypothesis is there will be a statistically significant relationship (correlation) between the numbers of HIT systems adopted and lower Minnesota Department of Health (CMS) number of survey deficiencies. The second null hypothesis is there will not be a statistically significant relationship (correlation) between the numbers of HIT systems adopted and lower Minnesota Department of Health (CMS) number of survey deficiencies.
4. Do any of the following nursing home facility variables (location, size of facility, ownership, chain affiliation and overall EHR systems adopted) predict CMS Quality Rating Scores in nursing homes in Minnesota? The fourth hypothesis is location, size of facility, ownership, chain affiliation and overall EHR systems adopted will be a statistically significant predictor of CMS Quality Rating Scores in nursing homes in Minnesota. The null hypothesis is location, size of facility, ownership, chain affiliation and overall EHR systems adopted will not be a statistically significant predictor of CMS Quality Rating Scores in Minnesota nursing homes.

5. Do any of the following nursing home facility variable (location, size of facility, ownership, chain affiliation and overall EHR systems adopted) predict Minnesota Department of Health inspection results as reported on CMS Nursing Home Compare?
The fifth hypothesis is location, size of facility, ownership, chain affiliation and overall EHR systems adopted will be a statistically significant predictor of Minnesota Department of Health inspection results as reported on CMS Nursing Home Compare in nursing homes in Minnesota. The null hypothesis is location, size of facility, ownership, chain affiliation and overall EHR systems adopted will not be a statistically significant predictor of Minnesota Department of Health inspection results as reported on CMS Nursing Home Compare in nursing homes in Minnesota.

In summary, descriptive statistics were utilized to discuss the characteristics of Minnesota nursing homes in this study. The nursing home variables of interest in this study are location, size of facility, ownership and chain affiliation, CMS Quality Rating Scores, Minnesota Department of Health deficiencies score, and EHR systems adopted and in use. As the primary focus of this study was to ascertain the nature of the relationship between the number of HIT systems adopted and CMS Quality Rating Score, a relational research study was designed. Additionally, a relational research study was designed to analyze the relationship between the number of HIT systems adopted and Minnesota Department of Health (CMS) inspection deficiencies.

CHAPTER IV

RESULTS

The purpose of this non-experimental, quantitative study was to determine the relationship between HIT systems adoption and CMS Quality Rating Scores in Minnesota nursing homes. Another purpose of this study was to determine the relationship between HIT systems adoption and Minnesota Department of Health inspections deficiencies in Minnesota nursing homes. Additionally, this study sought to identify which nursing home facility variables (location, size of the facility, ownership and chain affiliation), if any, are predictive of CMS Quality Rating Scores. This chapter is organized into seven sections: (a) introduction, (b) descriptive statistics of variables and research question one, (c) research question two analysis, (d) research question three analysis, (e) research question four analysis, (f) research question five analysis, and (g) summary. The research questions analyses provide a detailed discussion of the results as they relate to hypotheses and research questions of the study. Data analysis for this study was conducted using IBM's Statistical Package for Social Science (SPSS®). Chapter IV reports the findings and results of the study derived from an analysis of selected variables from the 2011 Minnesota nursing home e-health survey, CMS Quality Rating Scores, and Minnesota Department of Health inspection results as reported on CMS Nursing Home Compare.

Descriptive Statistics and Research Question 1

The first hypothesis was related to the 2011 status and issues regarding health information technology in Minnesota nursing homes based on the Minnesota e-Health report utilizing descriptive statistical investigation.

The facility characteristics of this study are representative of nursing homes in Minnesota and the United States. The 2011 Minnesota nursing home e-health survey (Appendix B) was administered in December, 2011. For this study, 382 Minnesota nursing homes were surveyed, and the data from 316 of the nursing homes (83% response rate) completing the survey were utilized. The overall Quality Rating Scores and Minnesota Department of health inspection Quality Rating Scores on CMS nursing home compare website as of December, 2011 were applied to the study. The nursing home variables of interest are location, size of facility, ownership, chain affiliation, Quality Rating Scores, and HIT systems adopted. Table 2 displays that 45.9% of the 316 Minnesota nursing homes were urban and 54.1% were rural. In the United States in 2011, the percent of nursing homes classified as urban was higher than in Minnesota. The total number of nursing homes in the United States was 15,675 with 10,796 (68.8%) as urban and the remaining 4,886 (31.2%) as rural (Centers for Medicare and Medicaid Services, 2012b).

Table 2 Urban/Rural

	Frequency	Percent	Valid Percent	Cumulative Percent
Urban	145	45.9	45.9	45.9
Rural	171	54.1	54.1	100.0
Total	316	100.0	100.0	

Table 3 displays the size of the Minnesota nursing homes with 72.2% consisting of less than 100 beds and 27.8% consisting of 100 beds or more. In the United States in 2011, the average numbers of beds in nursing homes were larger than Minnesota nursing homes. The total number of United States nursing homes less than 100 beds was 2,066 (13.2%) nursing homes and 13,609 (86.8%) nursing homes with beds of 100 or more (American Health Care Association, 2012).

Table 3 Size of Facility by Number of Beds

		Frequency	Percent	Valid Percent	Cumulative Percent
	Less than 100 beds	228	72.2	72.2	72.2
	100 beds or more	88	27.8	27.8	100.0
	Total	316	100.0	100.0	

Ownership of the nursing homes consisted of three categories including for-profit, not for profit, and government owned. Table 4 displays Minnesota nursing homes, which consisted of 31.6% as for-profit, 58.2% non-profit, and 10.1% government owned. In the United States, the reported number of for-profit nursing homes were significantly higher than in Minnesota. Nursing homes in the United States consisted of 10,823 (69%) for-profit; 3,953 (25.2%) not for profit, and the remaining 899 (5.7%) government owned (American Health Care Association, 2012).

Table 4 Ownership of Nursing Homes

		Frequency	Percent	Valid Percent	Cumulative Percent
	For-profit	100	31.6	31.6	31.6
	Not-for-profit	184	58.2	58.2	89.9
	Government owned	32	10.1	10.1	100.0
	Total	316	100.0	100.0	

Table 5 displays Minnesota nursing homes chain affiliation with 28.2% stand-alone facilities and the remaining 71.8% as part of a chain or group of nursing homes. The majority of nursing homes in Minnesota are chain affiliated. In the United States, nursing homes were more frequently affiliated with a chain than Minnesota nursing homes. The United States had 12,383 (79%) nursing homes as chain affiliated, and the remaining 3,292 (21%) nursing homes were stand-alone nursing homes (Centers for Medicare and Medicaid Services, 2012b).

Table 5 Chain Affiliation of Nursing Homes

		Frequency	Percent	Valid Percent	Cumulative Percent
	Chain	227	71.8	71.8	71.8
	Stand-alone	89	28.2	28.2	100.0
	Total	316	100.0	100.0	

CMS Quality Rating Scores were analyzed for the Minnesota nursing homes responding to the survey. For the 316 Minnesota nursing homes responding to the survey, 7.9% had a one star rating, 19% had a two star rating, 17.4% had a three star rating, 32% had a four star rating, and 23.7% had a five star rating. Table 6 displays those results. Nursing homes in the United States in December, 2011 represented lower overall ratings than Minnesota nursing homes. United States nursing homes consisted of the following star ratings: 15.6% had a one star rating,

20% had a two star rating, 21.2% had a three star rating, 27.3% had a four star rating and 15.9% had a five star rating (Abt Associates & Colorado Foundation for Medical Care, 2013). In order to further illustrate the differences of the CMS overall quality rating scores, a bar graph is provided in Figure 3

Table 6 CMS Overall Quality Rating 5 Star Scores

		Frequency	Percent	Valid Percent	Cumulative Percent
	1 star	25	7.9	7.9	7.9
	2 star	60	19.0	19.0	26.9
	3 star	55	17.4	17.4	44.3
	4 star	101	32.0	32.0	76.3
	5 star	75	23.7	23.7	100.0
	Total	316	100.0	100.0	

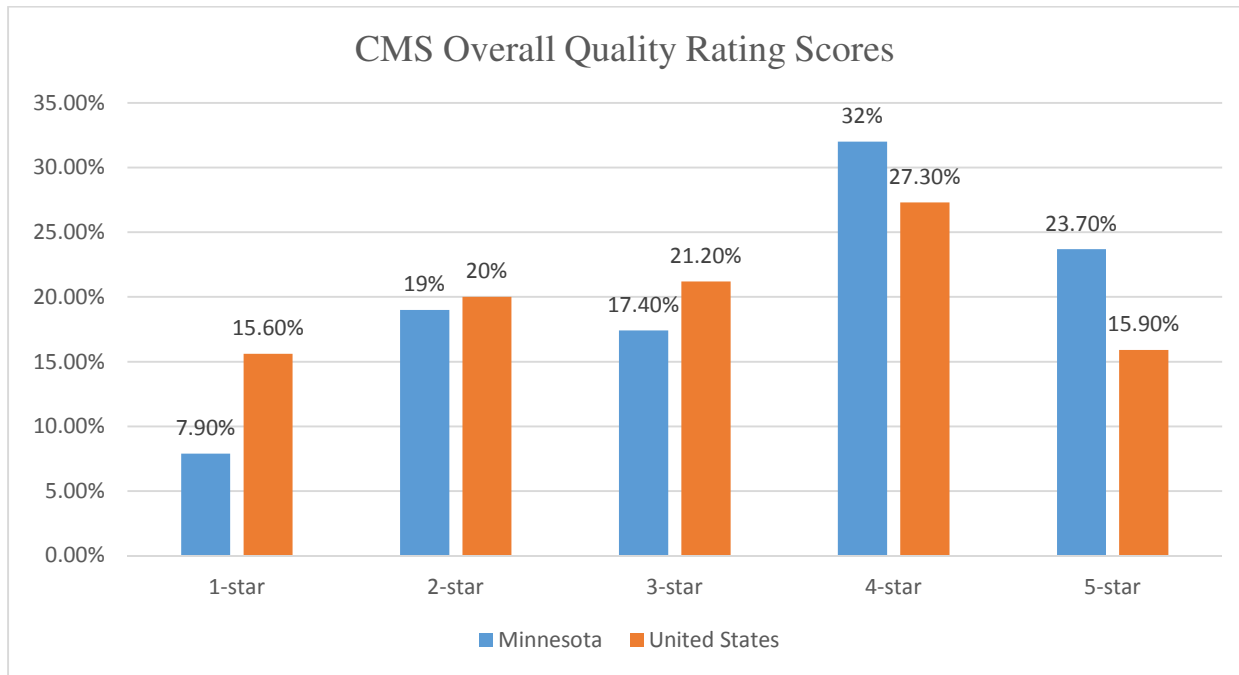


Figure 3 Comparison of CMS Overall Quality Rating Scores

Minnesota Department of Health inspection scores were also analyzed. For the 316 nursing homes responding to the survey, 19.6% had a one star rating, 20.6 had a two star rating, 24.1% had a three star rating, 21.5% had a four star rating, and 14.2% had a five star rating. Table 7 displays those results. In December, 2011, United States nursing homes represented less variation with Minnesota nursing homes in Quality Star Ratings for inspections. United States nursing homes consisted of 19.4 % with a one star rating, 22.8% with a two star rating, 23.5% with three star rating, 23.7%, with a four star rating, and 10.6% with a five star rating (Abt Associates & Colorado Foundation for Medical Care, 2013).

Table 7 MDH Inspection 5 Star Scores

	Frequency	Percent	Valid Percent	Cumulative Percent
1 star	62	19.6	19.6	19.6
2 star	65	20.6	20.6	40.2
3 star	76	24.1	24.1	64.2
4 star	68	21.5	21.5	85.8
5 star	45	14.2	14.2	100.0
Total	316	100.0	100.0	

Sixty-nine percent of nursing homes (N=217) that responded to the survey had an EHR installed and in use. Another 25% of nursing homes surveyed were in the process of getting an EHR with the remaining 6% of nursing homes having no EHR (Minnesota Department of Health, 2012a). Figure 4 shows the distribution of nursing homes based on the HIT systems adopted. The results indicate that 99% of nursing homes with EHR were utilizing HIT primarily for documenting MDS assessments. The results support Bates (2002) and Castle and Lui's (2008) assertions that MDS HIT systems lead the adoption of HIT in nursing homes. The least

adopted of HIT was e-prescribing; however, 51% surveyed indicated a plan to implement e-prescribing in the next 18 months. More details about HIT adoption are displayed.

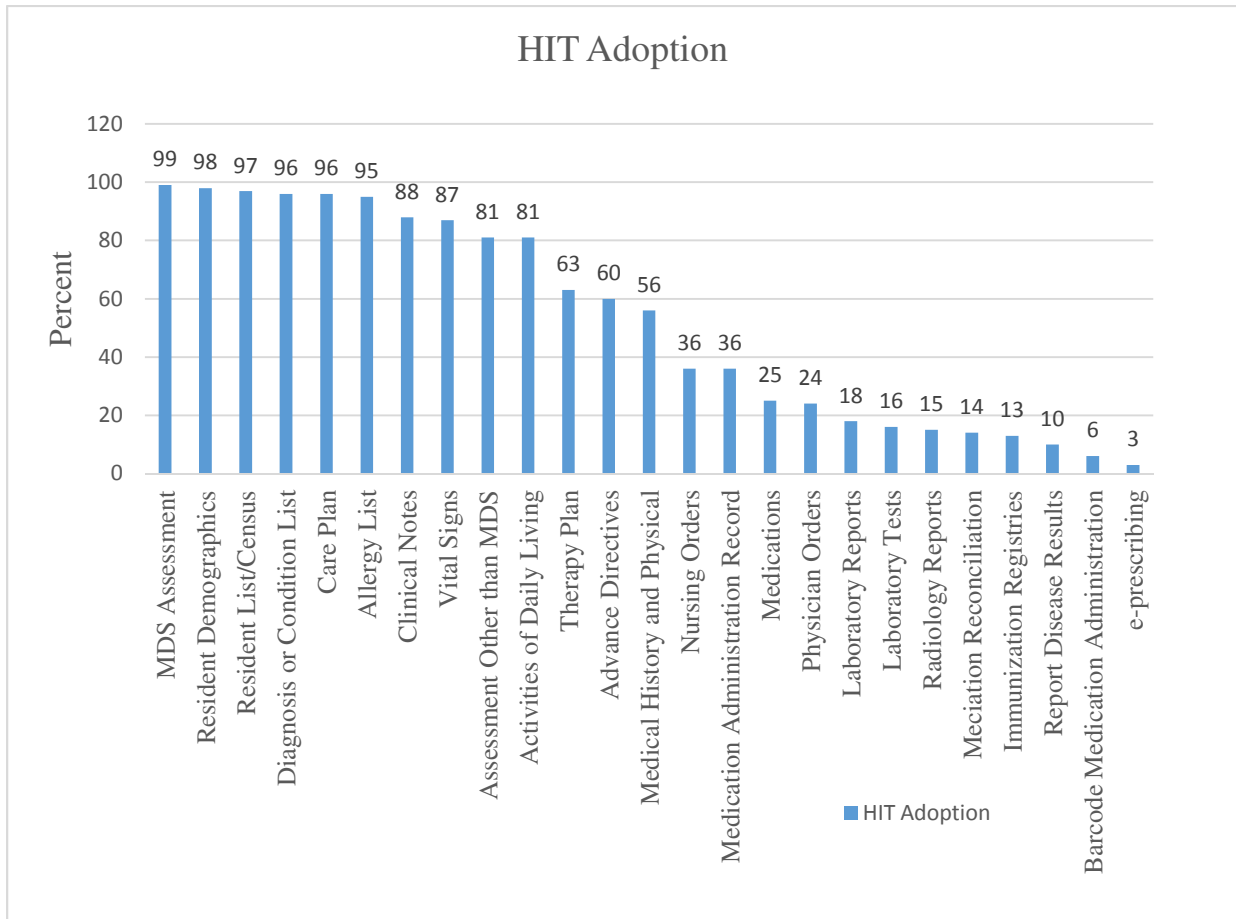


Figure 4 Histogram of the Distribution of HIT Systems Adopted by Percentage (Minnesota Department of Health, 2012b)

Figure 5 shows the distribution of nursing homes planning to adopt HIT systems in the next eighteen months after the survey was completed. The results indicate that 100% will have MDS assessment implemented. The results point to a growing interest in medication administration record, medication reconciliation, and e-prescribing. The results support the acknowledged need by nursing home professionals for a well-designed medication

administration system(Rochon et al., 2005). Research has shown reduced medication errors and errors related to drug interactions with a comprehensive medication administration system (Rochon et al., 2005).

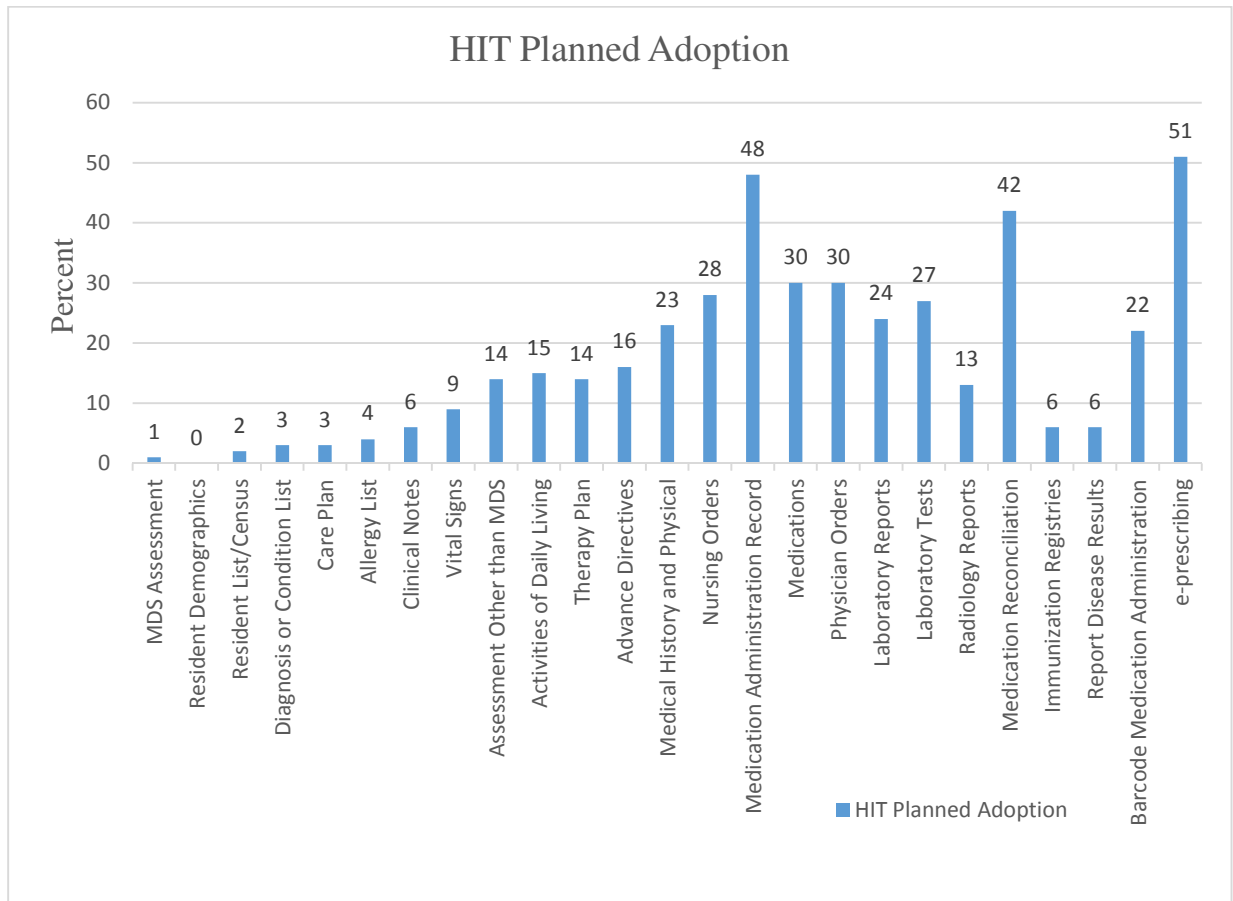


Figure 5 Histogram of the Distribution of HIT Systems Planned Adoption by Percentage (Minnesota Department of Health, 2012b)

Research Question 2

The descriptive statistical investigation of the Minnesota nursing homes provides the basis for the next two research questions. The primary focus of this study was to ascertain the

nature of the relationship between HIT adoption in Minnesota nursing homes and CMS Quality Rating Scores.

The second hypothesis stated that there will be a statistically significant relationship (correlation) between the HIT systems adopted and CMS Quality Rating Scores of nursing homes in Minnesota. The null hypothesis states that there will not be a statistically significant relationship (correlation) between the HIT systems adopted and CMS Quality Rating Scores of Minnesota nursing homes. A correlation analysis was used to assess the nature of the relationship between the HIT systems adopted and the CMS quality rating scores of nursing homes in Minnesota. The results show that there is no significant correlation between the CMS quality rating scores and the following:

- overall EHR adoption
- MDS assessment
- assessments other than MDS
- diagnosis or condition list
- resident demographics
- vital signs
- medical history and physical
- activities of daily living
- advance directives
- allergy list
- care plan
- therapy plan
- clinical notes
- barcode medication administration
- resident list/census
- nursing orders
- physician orders
- laboratory reports
- radiology reports
- immunization registries
- report disease result to public health agencies
- e-prescribing

Based on these findings, the null hypothesis was accepted for the above HIT adoption systems and CMS Quality Rating Scores. Significant correlations with a small effect size (strength) were found between CMS Quality Rating Scores and HIT adoption of medication administration record (eMAR), medication reconciliation, CPOE of laboratory tests, and CPOE of medications.

According to Cohen (1988), the strength of the relationship can be explained by r and can be interpreted as follows small (0.10 – 0.19), medium (0.30 – 0.49), and large (0.5 – 1.0). As noted in Table 8, CMS Quality Rating Scores (N = 316, M = 34.46, SD = 12.575) were significantly related to HIT adoption of Medication administration record (eMAR) (N = 316, M = 2.97, SD = .917), $r = .124$, $p < .05$. Therefore, we reject the null hypothesis that there is no relationship in CMS Quality Rating Scores and HIT adoption of Medication Administration Record (eMAR). The use of HIT adoption of Medication Administration Record (eMAR) has a relatively small effect size on CMS Quality Rating Score.

Table 8 Correlations of CMS Quality Rating Scores and Medication Administration Records

		Overall 5 star score	Medication administration record (eMAR)
Overall 5 star score	Pearson Correlation	1	.124*
	Sig. (2-tailed)		.028
	N	316	316
Medication administration record (eMAR)	Pearson Correlation	.124*	1
	Sig. (2-tailed)	.028	
	N	316	316

*Correlation is significant at the 0.05 level (2-tailed).

As noted in Table 9, a significant correlation with a small effect size (strength) was found between the CMS Quality Rating Scores (N = 316, M = 34.46, SD = 12.575) and HIT of

Medication Reconciliation, (N = 316, M = 2.38, SD = 1.015), $r = .135$, $p < .05$. Therefore, we reject the null hypothesis that there is no relationship in CMS Quality Rating Scores and HIT adoption of Medication Reconciliation. The use of HIT adoption of medication reconciliation has a small effect size on CMS Quality Rating Score.

Table 9 Correlations of CMS Quality Rating Scores and Medication Reconciliation

		Overall 5 star score	Medication reconciliation
Overall 5 star score	Pearson Correlation	1	.135*
	Sig. (2-tailed)		.016
	N	316	316
Medication reconciliation	Pearson Correlation	.135*	1
	Sig. (2-tailed)	.016	
	N	316	316

*Correlation is significant at the 0.05 level (2-tailed).

As noted in Table 10, a significant correlation with a small effect size (strength) was found between CMS Quality Rating Scores (N = 316, M = 34.46, SD = 12.575) and HIT of Computerized Provider Order Entry Laboratory Tests (N = 316, M = 2.25, SD = 1.029), $r = .134$, $p < .05$. Therefore, the null hypothesis that there is no relationship in CMS Quality Rating Scores and HIT adoption of CPOE laboratory tests was rejected. The use of HIT adoption of CPOE laboratory tests has a relative small effect size on CMS Quality Rating Scores.

Table 10 Correlations of CMS Quality Rating Scores and CPOE Laboratory Tests

		Overall 5 star score	CPOE Laboratory Tests
Overall 5 star score	Pearson Correlation	1	.134*
	Sig. (2-tailed)		.017
	N	316	316
CPOE Laboratory Tests	Pearson Correlation	.134*	1
	Sig. (2-tailed)	.017	
	N	316	316

*Correlation is significant at the 0.05 level (2-tailed).

As noted in Table 11, a significant correlation with a small effect size (strength) was found between CMS Quality Rating Scores (N = 316, M = 34.46, SD = 12.575) and HIT adoption of CPOE Medications (N = 316, M = 2.50, SD = 1.073), $r = .122$, $p < .05$. Therefore, the null hypothesis that there is no relationship in CMS Quality Rating Scores and HIT adoption of CPOE Medication is rejected. The use of HIT adoption of CPOE medication has a relative small effect size on CMS Quality Rating Scores.

Table 11 Correlations of CMS Quality Rating Scores and CPOE Medications

		Overall 5 star score	CPOE Medication
Overall 5 star score	Pearson Correlation	1	.122*
	Sig. (2-tailed)		.030
	N	316	316
CPOE Medication	Pearson Correlation	.122*	1
	Sig. (2-tailed)	.030	
	N	316	316

*Correlation is significant at the 0.05 level (2-tailed).

Research Question 3

The descriptive statistical investigation of the Minnesota nursing homes provides the basis for the third research question. The additional focus of this study was to ascertain the nature of the relationship between the HIT adoption in Minnesota nursing homes and Minnesota Department of Health inspection results as reported on CMS Nursing Home Compare.

The third hypothesis stated that there will be a statistically significant relationship (correlation) between the HIT systems adopted and Minnesota Department of Health inspection (CMS) rating scores as reported on Nursing Home Compare. The null hypothesis stated that there will not be a statistically significant relationship (correlation) between the HIT systems adopted and Minnesota Department of Health inspection (CMS) rating scores as reported on Nursing Home Compare of Minnesota nursing homes. A correlation analysis was used to assess the nature of the relationship between the HIT systems adopted and Minnesota Department of Health inspection (CMS) rating scores. The results show that there is no significant correlation between the Minnesota Department of Health inspection (CMS) rating scores and the following:

- overall EHR adoption
- MDS assessment
- assessments other than MDS
- diagnosis or condition list
- resident demographics
- vital signs
- medical history and physical
- activities of daily living
- advance directives
- allergy list
- care plan
- therapy plan
- clinical notes
- barcode medication administration
- resident list/census
- nursing orders
- physician orders

- laboratory reports
- radiology reports
- immunization registries
- report disease result to public health agencies
- e-prescribing
- medication administration record (eMAR)
- CPOE of laboratory tests
- CPOE of medications

Based on these findings, the null hypothesis was accepted for the above HIT adoption systems and Minnesota Department of Health inspection (CMS) rating scores.

However, a significant correlation with a small effect size (strength) was found between Minnesota Department of Health inspections (CMS) rating scores and HIT adoption of medication reconciliation. According to Cohen (1988), the strength of the relationship can be explained by r and can be interpreted as follows small (0.10 – 0.19), medium (0.30 – 0.49), and large (0.5 – 1.0). As noted in Table 12, a significant correlation with a small effect size (strength) was found between Minnesota Department of Health inspection rating scores ($N = 316$, $M = 29.02$, $SD = 13.309$) and HIT of Medication Reconciliation ($N = 316$, $M = 2.38$, $SD = 1.015$), $r = .183$, $p < .01$. Therefore, we reject the null hypothesis that there is no relationship in Minnesota Department of Health inspection rating scores and HIT adoption of medication reconciliation. The use of HIT adoption of medication reconciliation has a relative small effect size on Minnesota Department of Health Inspection rating scores.

Table 12 Correlations of MDH Inspection Scores and Medication Reconciliation

		MDH Inspection 5 star score	Medication Reconciliation
MDH Inspection 5 star score	Pearson Correlation	1	.183**
	Sig. (2-tailed)		.001
	N	316	316
Medication reconciliation	Pearson Correlation	.183**	1
	Sig. (2-tailed)	.001	
	N	316	316

**Correlation is significant at the 0.01 level (2-tailed).

Research Question 4

The fourth hypothesis stated that location, size of facility, ownership, chain affiliation, and overall EHR systems adopted will be statistically significant predictors of CMS Quality Rating Scores in nursing homes in Minnesota. The null hypothesis stated that location, size of facility, ownership, chain affiliation, and overall EHR systems adopted will not be statically significant predictors of CMS Quality Rating Scores in Minnesota nursing homes. In exploring hypothesis four, regression analysis was completed, and the R-square shows that about 6.4% of the variation in CMS Quality Rating Scores is explained by the model. This model demonstrates a very weak fit. Figure 6 provides a scatterplot for a visual display of the model.

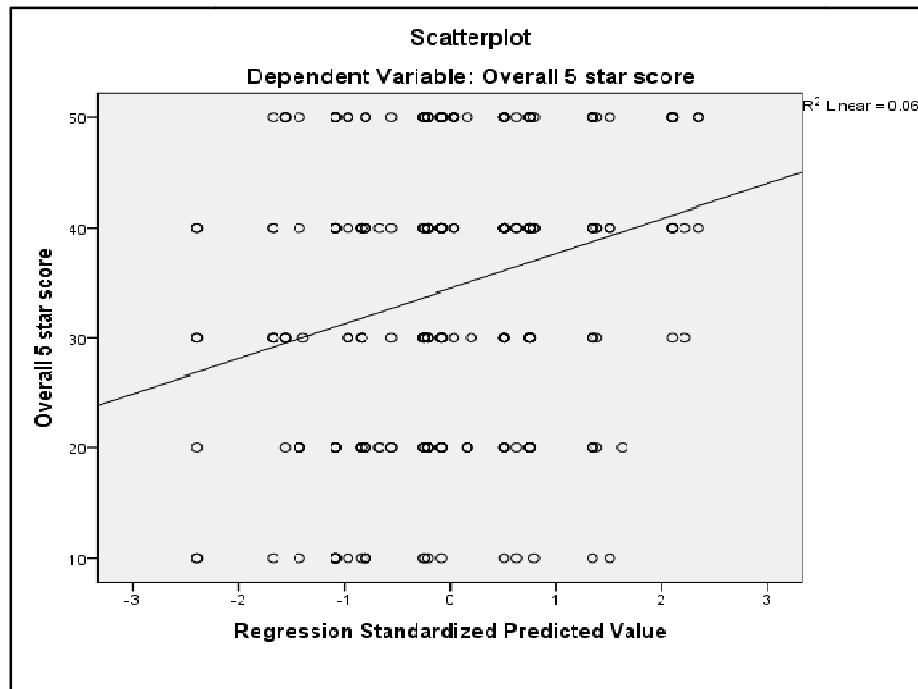


Figure 6 Scatterplot of the Prediction Model for CMS Quality Rating Scores

Table 13 demonstrates the effect of each predictor on the CMS Quality Rating Scores. Ownership ($p = .000$) is significant to the model because $p < .01$. Location, size of facility, chain affiliation, and overall EHR adoption do not significantly contribute to the model. A value of 31.694 for the constant indicates that nursing home regulators can expect that the nursing home based on ownership should have an average CMS Quality Rating Scores of 32 or three stars or more rating.

Table 13 Coefficients of the Model

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	31.694	5.239		6.050	.000
R-U by RUCA	-2.660	1.579	-.106	-1.684	.093
Size	-1.883	1.691	-.067	-1.113	.266
Chain affiliation	-2.291	1.569	-.082	-1.460	.145
Ownership	5.065	1.197	.246	4.231	.000
E H R	1.880	1.509	.069	1.246	.214

a. Dependent Variable: Overall 5 star score

Research Question 5

The fifth hypothesis is location, size of facility, ownership, chain affiliation, and overall EHR systems adopted will be a statistically significant predictor of Minnesota Department of Health inspection results as reported on CMS Nursing Home Compare in nursing homes in Minnesota. The null hypothesis is location, size of facility, ownership, chain affiliation, and overall EHR systems adopted will not be a statistically significant predictor of Minnesota Department of Health inspection results as reported on CMS Nursing Home Compare in nursing homes in Minnesota. In exploring hypothesis five, regression analysis was completed, and the R square shows that about 5.4% of the variation in Minnesota Department of Health inspection rating scores is explained by the model. The model is a very weak fit. Figure 7 provides a scatterplot for a visual display of the model.

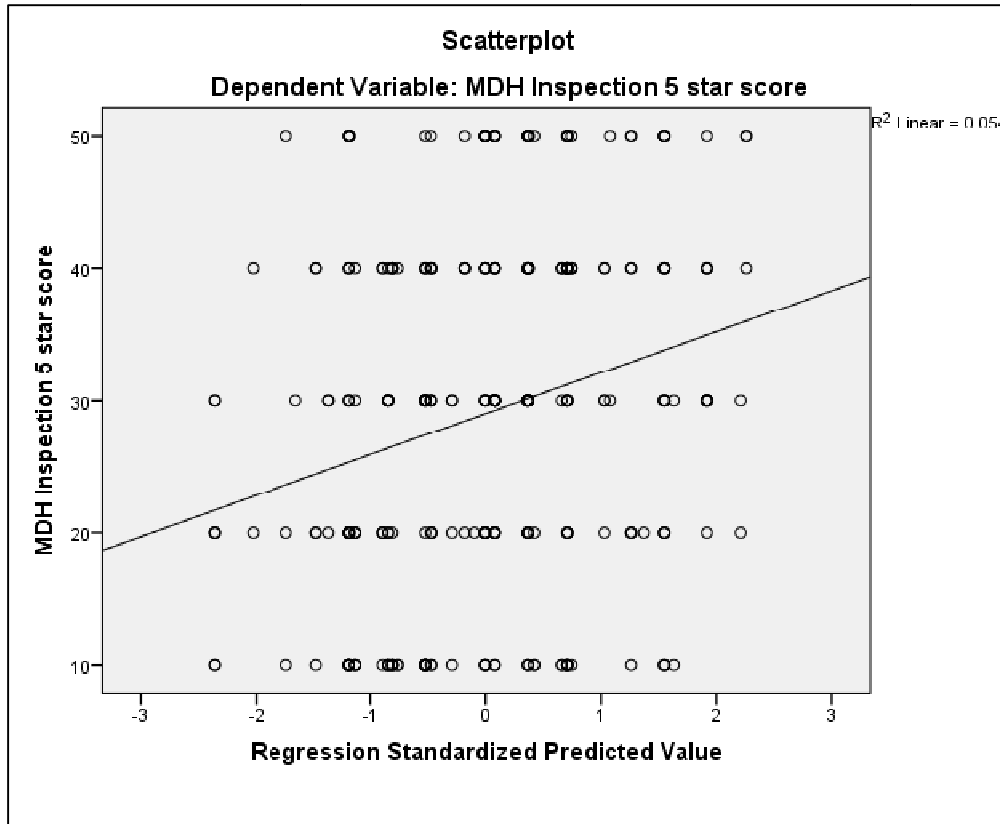


Figure 7 Scatterplot of the Prediction Model for Minnesota Department of Health Inspection Rating Scores

Table 14 demonstrates the effect of each predictor on the Minnesota Department of Health inspection rating scores. Ownership ($p < .000$) is significant to the model because $p < .05$. Location, size of facility, chain affiliation, and overall EHR adoption does not significantly contribute to the model. A value of 31.439 for the constant indicates that nursing home regulators can expect that the nursing home based on ownership should have an average CMS Quality Rating Score of 31 or three+ star rating.

Table 14 Coefficients of the Model

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	31.439	5.573		5.641	.000
R-U by RUCA	-3.666	1.680	-.137	-2.182	.030
Size	-2.607	1.799	-.088	-1.449	.148
Chain affiliation	-2.755	1.669	-.093	-1.650	.100
Ownership	4.815	1.274	.221	3.780	.000
E H R	.889	1.606	.031	.554	.580

a. Dependent Variable: MDH Inspection 5 star scores

Summary

Chapter IV presents results of the adoption of HIT systems and its relationship to CMS Quality Rating Scores for nursing homes. Additionally, chapter IV presents results of the adoption of HIT systems and its relationship to Minnesota Department of Health inspection rating scores. Correlation analysis was used to evaluate the data. The results indicate that no statistically significant relationship was found between the CMS Quality Rating Scores and the majority of the HIT adoption systems; however, significant correlations with a small effect size (strength) were found between CMS Quality Rating Scores and HIT of medication administration record (eMAR), medication reconciliation, CPOE of laboratory tests, and CPOE of medications. Additionally, the results indicate that no statistically significant relationship was found between the Minnesota Department of Health inspection rating scores and the majority of HIT systems adopted; however, a significant correlation with a small effect size (strength) was found between Minnesota Department of Health inspection scores and HIT of medication reconciliation. Another finding was that ownership was a significant predictor of both CMS quality rating scores and Minnesota Department of Health inspection rating scores; however, the

model fit is weak. Chapter V presents a discussion of the findings, implications for change, and recommendations for future research.

CHAPTER V

DISCUSSION AND CONCLUSION

The purpose of this study was to identify the relationships of healthcare information technology (HIT) adoption on nursing home quality rating scores and MDH inspection scores and explore the current status of HIT adoption in Minnesota nursing homes. In addition, correlation analyses were done on a dataset created from the e-health HIT adoption survey, CMS five star quality rating scores, and MDH five star inspection rating scores. The study examined the relationship between HIT systems adopted and CMS five star quality rating scores. The relationship between HIT systems adopted and MDH five star inspection rating scores was also explored. Regression analyses were done to determine if any of the following: location, size of facility, ownership, chain affiliation, and overall EHR systems were predictors of CMS five star quality rating scores and MDH five star inspection rating scores. Chapter V presents a discussion of the findings of this quantitative non-experiment study.

Summary of Findings

A review of the literature was conducted on HIT adoption in health care. The review revealed studies from the GAO (2004), IOM (2001), and OIG (2008), all of which recommended the widespread adoption of HIT to improve the quality of care in nursing homes. Previous research indicates HIT has substantial potential to reduce error and improve the quality and efficiency of health care (Bates et al., 2001). Five research questions guided the study and

descriptive statistics. Correlation and regression analysis were used to determine the relationship HIT adoption may have on the quality in nursing homes. The following sections review each of the five research questions and provide conclusions as they relate to each question.

Research question one was addressed to determine the 2011 status of HIT in Minnesota nursing homes based on the Minnesota e-health survey. Among the 382 total Minnesota nursing homes, 316 completed the Minnesota e-health survey and were included in research question one. The results indicate 69% of nursing homes that responded to the survey had an overall EHR installed and in use. Another 25% of nursing homes surveyed were in the process of getting an EHR with the remaining 6% having no EHR. Further break-down of the HIT systems indicated over 90% of nursing homes with EHR were utilizing HIT primarily for documenting MDS assessments, resident demographics, resident census, diagnosis, care plan, and allergies. Less than 10% were utilizing HIT for reporting diseases, barcode medication administration, and e-prescribing.

Overall, five star quality rating scores were higher in Minnesota than in any of the other states. Seventy-three percent of Minnesota nursing homes achieved three stars or higher ratings compared to only 64.4% of the overall United States nursing homes. MDH inspection scores represented less variation as compared to the overall United States.

Research question two focused on the relationship (correlation) between the HIT systems adopted and CMS Quality Rating Scores of nursing homes in Minnesota. The question was addressed by running a correlation statistical analysis between CMS quality rating scores and HIT adoption systems. No statistically significant relationship was found between CMS quality rating scores and overall EHR, including most of the HIT systems; however, significant correlations with a small effect size (strength) were found between CMS quality rating scores

and HIT adoption of medication administration (eMAR), medication reconciliation, CPOE of laboratory tests, and CPOE of medications. CMS Quality Rating Score was higher for those Minnesota nursing homes adopting HIT for the use of medication administration (eMAR), medication reconciliation, CPOE of laboratory tests, and CPOE of medications.

Research question three focused on the relationship (correlation) between HIT systems adopted and MDH inspection rating scores in Minnesota. The questions were addressed by running a correlation statistical analysis between MDH inspection rating scores and HIT adoption systems. No statistical significant relationship was found between MDH inspection rating scores and overall HER, including most of the HIT systems; however, significant correlations with a small effect size (strength) were found between MDH inspection rating scores and HIT adoption of medication reconciliation. MDH inspection rating scores were higher for those Minnesota nursing homes adopting the HIT use of medication reconciliation.

Research question four focused on determining if location, size of facility, ownership, chain affiliation, and overall EHR adopted, would be a statistically significant predictor of CMS Quality Rating Scores in Minnesota nursing homes. The findings suggest that ownership can be predictive of CMS Quality Rating Scores ($p < .01$). This finding supports previous research on ownership in nursing homes. Hillmer, et al. (2005) concluded that the quality was lower in for-profit nursing homes based on a comprehensive review of 38 studies published including the period 1990 through 2002. Comondore, et al. (2009) suggested nonprofit nursing homes deliver higher quality care than for-profit nursing homes based on a systematic review and meta-analysis of 82 studies published during the period 1962 through 2003. Quality has been a long standing policy issue in the nursing home sector with over three decades of substandard care practices in particular facilities (Institute of Medicine, 2001). Given that nearly 69% are for-profit, there has

been an interest among researchers and policy makers in establishing a causal link between ownership and quality (Grabowski & Stevenson, 2008). Nursing home ownership remains of substantial policy interest. Ownership status is reported on the CMS Nursing Home Compare website (Centers for Medicare and Medicaid Services, 2014b).

Research question five focused on determining if location, size of facility, ownership, chain affiliation, and overall EHR adopted would be a statistically significant predictor of MDH inspection rating scores. The findings suggest that ownership can be predictive of MDH inspection rating scores ($p < .01$). As stated in the research question four summary, previous research supports this finding. Based on these results, further research on ownership and quality is recommended.

Conclusions and Implications of the Study

Previous research on HIT adoption focused primarily on hospitals. Hospitals that have adopted more integrated HIT systems are realizing a positive relationship between HIT adoption and quality (Byrne et al., 2010). The relationship between overall HIT adoption and quality in nursing homes has not yet been definitively answered; however, several conclusions were drawn based on the analysis of data in this study.

- Nursing home utilization of HIT is growing in Minnesota. StratisHealth (2008) reported that 32% of nursing homes in Minnesota reported having a fully or partially implemented EHR. In 2011, MDH (2012b) reported the percent of nursing homes in Minnesota having an EHR installed and in use had grown to 69%. Implications of the 2011 survey suggest EHR will continue to grow with the planned increase of adoption in the areas of

medication administration (48%), medication reconciliation (42%), and e-prescribing (51%).

- Nursing homes in Minnesota (73%) have higher average CMS Quality Rating Scores than the rest of the United States (64.4%). The higher than average quality rating scores implies Minnesota nursing homes are providing better services to their residents and families.
- Ownership of nursing homes in Minnesota is primarily non-profit (58.2%) as compared to the United States (25.2%).
- CMS Quality Rating scores have a significant relationship to HIT adoption of medication administration record (eMAR), medication reconciliation, CPOE of laboratory tests, and CPOE of medications. The use or plan to use these HIT systems can have a potential impact on quality.
- MDH inspection rating scores have a significant relationship to HIT adoption of medication reconciliation. The use or plan to use this HIT system can have a potential impact on quality.
- Ownership of nursing homes could be a predictor of CMS Quality Rating Scores and MDH inspection scores. The implication is non-profit nursing homes have an edge on quality services as compared to for-profit nursing homes.
- Although HIT adoption has increased from 2008 to 2011, only 69% had EHR installed and in use in 2011. Some of the 25 key EHR systems may still have an adoption rate too low to show a real correlation on the quality.

Recommendations for Practice

The findings of this study lead to several recommendations for further adoption of HIT systems in nursing homes. These recommendations may have particular relevance for national, state, and local stakeholders of nursing homes. Leaders at local nursing homes must continue to study the benefits and rewards of HIT systems adoption to improve their quality of care and services.

Lawmakers at the federal and state levels need to continue to expand funding opportunities for HIT adoption in nursing homes. Field et al. (2009) and Simon, Rundall, and Shortell (2007) stated that the adoption of CPOE, a group of HIT systems responsible for medication management, has improved the safety and quality of all aspects of the medication management process in hospitals. Adverse drug events and inappropriate medication prescribing in hospitals were reduced by 23% percent with the use of CPOE (Bates et al., 2001). Research on the effect of HIT adoption in nursing homes is scarce. If nursing home research showed similar results, quality of care in nursing homes could be improved. The findings of this study help support significant results of these researchers in Minnesota nursing homes.

Research shows nursing homes have low HIT adoption rates nationally (Department of Health and Human Services, 2004). The findings of this study support the assertion that HIT adoption has improved; however, HIT adoption is still low. The low HIT adoption rate may not allow a full analysis of the impact HIT could have on the quality. Researchers suggest that in order for adoption of HIT to positively influence the quality of services in nursing homes, HIT systems must be well integrated and properly aligned with the workflow in the organization (Halley, Brokel, & Sensimeier, 2009; Levinson, 2007; Sharp, 2010). Researchers also suggest the HIT systems adoption must be supported by strong leadership (Ash, 1997; Poissant et al.,

2005; Smith & IOM, 2013). Stakeholders report that the main barrier to the adoption of HIT is high costs associated with both hardware and software (Cherry, Carter, Owen, & Lockhart, 2008). Leaders play an important role in collaborating with federal and state policy makers to promote policies to assist in HIT adoption and implementation costs.

System integration and interoperability need to continue to be a focal point for health care HIT systems. Although the data analyzed in this study did not capture details about the level of integration that is present in nursing homes, the data do suggest that a high variability exists in the adoption of HIT systems in nursing homes. Figure 3 (p. 68) shows that nursing home adoption of HIT ranges from a low of only 3% (e-prescribing) to a high of 99% (MDS). Twelve of the 25 key areas of HIT were below 50% adoption. Bates and Gawande (2003) found that integrated HIT systems prevented medical errors because of improved communication, availability of timely information, and provision of decision support. Leaders in healthcare need to work with vendors to develop HIT systems that meet interoperability standards to enable information sharing among healthcare settings. A wide variety of HIT systems are available on the market; however, Valdes, Kibbe, Tolleson, Kunik, and Peterson (2004) cautioned that many are not ready for interoperability. Establishing set standards for nursing home HIT systems would be a positive step to promote integrated HIT system adoption. In order to improve HIT adoption rates in nursing homes, further study is needed.

Conclusions and Recommendations for Further Study

Future research should investigate the effect of HIT on the direct costs associated with medication administration and errors, acquired pressure ulcers, urinary tract infections, reoccurring hospitalizations, falls, quality of care fines, and potential litigation. The costs of HIT

systems may be offset by a reduction in these costs. Researchers in hospital settings have shown HIT adoption streamlines processes, supports effective decision making, integrates complex tasks, and provides real-time data (Brandeis et al., 2007). This is especially relevant in medication safety (Brandeis et al., 2007). A greater understanding of cost savings realized through the use of HIT could potentially increase the likelihood that these systems will be adopted.

A survey on HIT adoption throughout the United States in nursing homes should be conducted. Analysis of this survey could include exploring the relationship between quality of care and HIT adoption. As indicated in this study, Minnesota is one of the only states conducting a survey on HIT adoption in nursing homes. Other states could also benefit from this type of study.

Adoptions of HIT systems have been widely accepted in business and government as a quality improvement feature of any organization. Healthcare organizations have been slow to respond in adopting or implementing HIT systems. HIT adoption in nursing homes has lagged behind other healthcare organizations. Adoption of HIT may be instrumental in improving the quality of care in nursing homes. Nursing home residents and their families expect to receive high-quality healthcare in nursing homes. Adoption of HIT systems can be an integral part of providing high-quality healthcare by assisting healthcare professionals' efficiency, communication, and reduction of errors.

The current study provides baseline information needed to guide nursing home stakeholders about a possible relationship between HIT adoption and CMS Quality Rating Scores in Minnesota nursing homes. In addition, the study provides information about a possible relationship between HIT adoption and MDH inspection rating scores. The findings of this study

revealed significant correlations with a small effect size for the HIT adoption of medication administration, medication reconciliation, computerized provider order entry (CPOE) laboratory test, computerized provider order entry (CPOE) medication, and CMS quality rating scores. Additionally, the findings of this study revealed a significant correlation with a small effect size for the HIT adoption of medication reconciliation and MDH inspection scores. This study contributes to positive change by helping inform stakeholders that the current HIT system adoption needs to be increased in nursing homes. Additionally, stakeholders are made aware of the potential impact HIT adoption can contribute to the quality of services in nursing homes. This information can also be utilized by policy makers and legislators for decision making in HIT adoption.

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APPENDIX A

LIST OF VARIABLES FOR STUDY

APPENDIX A

LIST OF VARIABLES FOR STUDY

	Variables Labels	Levels of the Variables	Scale of Measurement
Dependent Variables	CMS Quality Rating Scores	5-star rating system (1-5); 1 star = 10 points, 2 star = 20 points, 3 star = 30 points, 4 star = 40 points, 5 star = 50 points	Categorical/ Ordinal
	Minnesota Department of Health Inspection Data	5-star rating system (1-5); 1 star = 10 points, 2 star = 20 points, 3 star = 30 points, 4 star = 40 points, 5 star = 50 points	Categorical/ Ordinal
Independent Variables	Health Information Systems	# of systems used (0-25) Based on Question 11 on the survey	Interval
Extraneous Variables	Location	1-Rural 2-Urban	Nominal
	Size of facility	1-less than 100 beds 2-100 beds or more	Nominal
	Ownership	1-For-Profit 2-Nonprofit 3-Government-owned	Nominal
	Chain Affiliation	1-yes 2-no	Nominal

APPENDIX B

2011 MINNESOTA NURSING HOMES ASSESSMENT OF EHR ADOPTION

APPENDIX B

2011 MINNESOTA NURSING HOMES ASSESSMENT OF EHR ADOPTION

1. Who is completing the Survey?

Your Name:

Your Title:

Your Telephone Number:

Your Email Address:

Facility Characteristics

This survey uses the terms “nursing home” and “facilities” to refer to licensed nursing homes and certified boarding care homes

2. Which facility is the survey for?

Facility Name:

Facility City:

Facility Zip Code:

Facility County:

3. Which statements that best describe your facility? (check all that apply)

- Hospital attached
- Part of an integrated health care system
- Part of or affiliated with a large multi-facility chain (≥ 8 nursing homes, not including housing and assisted living)
- Part of or affiliated with a small or medium multi-facility chain (< 8 nursing homes, not including housing and assisted living)
- Stand-alone facility

4. What other services, in addition to skilled nursing, do you provide at your facility/on your campus (select all that apply)

Services:

- Adult Day Care
- Hospice
- Home Health
- Swing Beds
- Outpatient Rehab
- Memory Care
- Other (specify)
- None of the above

Types of Housing Projects:

- Subsidized Rental (e.g. HUD)
- Independent Living (with or without supportive services)
- Licensed Board and Lodging
- Assisted Living Apartments
- Other Housing
- Other (specify)
- None of the above

5. Which statement best describes the ownership of your facility? (select one)

- City/county/hospital district government
- Department of Veteran Affairs
- For Profit
- Indian Health Services
- Not For Profit
- Other (specify)

Adoption of Electronic Health Records (EHR) System

This survey will be asking questions about your electronic health records (EHR) system.

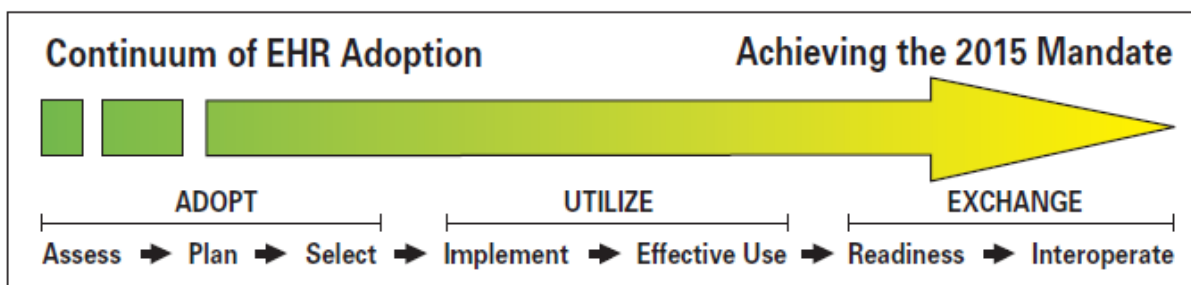
Electronic health records is a real-time patient health record with access to evidence-based decision support tools that can be used to aid clinicians in decision-making. **Reference:**

<http://www.hhs.gov/healthit/glossary.html>

This DOES NOT include excel, access, or similar tools. An EHR system may interface with the Minimum Data Sets (MDS) software but MDS software alone does not constitute an EHR system.

Description of an EHR: In licensed nursing homes and certified boarding care homes EHR systems may include functionalities and activities such as medication administration record, assessment, care planning, documentation of clinical notes, diagnosis lists, progress notes, orders, and decision support tools and may support electronic exchange of health information. The survey will ask questions about your facility's adoption and use of EHRs systems and secure exchange of health information. These three categories, adopt, use, and exchange, are part of the Minnesota Model for Adoption Interoperable EHRs, which is depicted in the figure below. For more information on the Minnesota Model or to review Minnesota's statewide implementation plan go to <http://www.health.state.mn.us/ehealth/ehrplan.html>

Figure 1. Minnesota Model for Adopting Interoperable Electronic Health Records



6. Which statement best describes your facility's current EHR system? (select one)
- We do not have an EHR system
 - We are assessing and/or planning for the adoption of an EHR system but have not selected and are not using a system
 - We have selected or begun implementing an EHR system but are not yet using the system
 - We have an EHR system implemented and in use for some of units of our facility
 - We have an EHR system implemented and in all of our facility
7. Indicate your facilities plans regarding an EHR system within the next 18 months. (select all that apply)
- No plans to adopt or use an EHR system
 - Assess and plan for EHR system
 - Select and implement an initial EHR system (e.g. first EHR system for facility)
 - Select and implement a new EHR system (e.g. change to a different vendor or system)
 - Increase the functionalities/capability/use of the EHR system (e.g. more effective use of EHR system)
 - Develop capacity of EHR system to electronically exchange health information with another system (exchange readiness)
 - Electronically exchanging health information with another system (interoperability)
 - No major changes planned to current EHR system
 - Do not know
8. Indicate the largest challenges that affect your facility's EHR adoption, implementation, and upgrades: (select up to 3)
- Availability of information technology staff and knowledge
 - Availability of internal knowledge/technical resources
 - Availability of product to meet to facility needs
 - Availability of vendor to provide technical support
 - Corporate support/commitment
 - Cost to acquire
 - Cost to update and/or maintain
 - Effects on workflow
 - Facility/staff support and commitment
 - Management/leadership commitment
 - Return-on-investment concerns
 - Security/privacy concerns

- Staff education and training
- Other (specify):
- No challenges

9. Indicate the EHR system vendor used by your facility: (select all that apply)

- | | |
|---|--|
| <input type="checkbox"/> ACCUMED TECHNOLOGY SOLUTIONS | <input type="checkbox"/> KEANE CARE, INC. |
| <input type="checkbox"/> AMERICAN DATA | <input type="checkbox"/> MDI ACHIEVE, INC |
| <input type="checkbox"/> AMERICAN HEALTHTECH, INC. | <input type="checkbox"/> MEDITECH, INC |
| <input type="checkbox"/> ANSWERS ON DEMAND | <input type="checkbox"/> MELYX CORPORATION |
| <input type="checkbox"/> CAREVOYANT, INC | <input type="checkbox"/> MOMENTUM HEALTHWARE, INC. |
| <input type="checkbox"/> CMS/RAVEN | <input type="checkbox"/> OPTIMUS EMR, INC |
| <input type="checkbox"/> HEALTHLAND | <input type="checkbox"/> POINTCLICKCARE |
| <input type="checkbox"/> HEALTHMEDX | <input type="checkbox"/> SAUNDERS ASSOCIATES |
| | <input type="checkbox"/> OTHER (specify): |

10. If you would like to clarify your answers related to adoption of EHRs, please provide comments below. (optional)

Use of Electronic Health Records (EHR)

11. Indicate the current or planned use of the following EHR functionalities by your facility

EHR functionality	Currently using through EHR	Plan to use through EHR in next 18 months	No plans for use through EHR in next 18 months	Do not know
Electronic documentation of				
MDS assessment/CAAs	○	○	○	○
Assessments other than MDS	○	○	○	○
Diagnosis or condition list	○	○	○	○
Resident demographics	○	○	○	○
Vital signs (e.g., blood sugar, O ₂ levels)	○	○	○	○
Medical history and physical	○	○	○	○
Activities of Daily Living (ADLs)/ Point of Care (POC)	○	○	○	○
Advance directives	○	○	○	○
Allergy list	○	○	○	○
Care plan	○	○	○	○
Therapy/treatment plan	○	○	○	○
Clinical notes	○	○	○	○

Medication administration record (eMAR)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Barcode medication administration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Medication reconciliation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Resident list/census	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (specify):	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Computerized Provider Entry Order Provider (CPOE): CPOE allows a provider's orders to be entered electronically instead of being recorded on order sheets or prescription pads				
Laboratory Tests	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Medications	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nursing Orders	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Physician Orders	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (specify)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Results Viewing				
Laboratory reports	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Radiology reports	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (specify)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Public health reporting				
Submit electronic data to immunization registries or immunization information systems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Submit electronic data on reportable disease results to public health agencies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (specify)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e-Prescribing send prescriptions directly from a provider's system to an outside pharmacy without an interim step from the facility staff or resident				
ePrescribing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12. Indicate the current or planned use of the following EHR clinical decision support tools by your facility

Clinical Decision Support (CDS) refers broadly to providing clinicians or patients with clinical knowledge and patient-related information, intelligently filtered or presented at appropriate times, to enhance patient care. Clinical knowledge of interest could range from simple facts and relationships to best practices for managing patients with specific disease states, new medical knowledge from clinical research, and other types of information. **Reference:**

http://www.himss.org/ASP/topics_clinicalDecision.asp

Clinical Decision Support Tools	Currently Using through EHR	Plan to use through EHR in next 18 months	No plans for use through EHR in next 18 months	Do not know
Use				
Clinical guidelines based on resident problem list, gender, and age	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Care plans and flow sheets (chronic or rehab)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (specify):	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Alerts/ reminders for				
Medication (e.g. doing support, drug allergy)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Resident specific or condition specific activities (e.g. foot exam)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Preventive care services due (immunizations)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Missing labs and tests	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Medical and dental visits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other specify	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

13. Indicate which of the follow applications your EHR electronically interfaces with (no manual steps or duplicative data entry): (select all that apply)

- Accounting
- Billing
- MDS
- Payroll
- Staffing and Scheduling
- Therapy (OT, PT, RT, Speech)
- Time and attendance
- None
- Do Not Know
- Other (specify):

14. If you would like to clarify your answers related to electronic health records use, please provide comments below. (optional)

Exchange of Health Information

The following questions refer to your facilities ability to perform secure health information exchange. Electronic health information exchange does not include paper, mail, phone, or fax exchange of information.

Health information exchange or HIE means the electronic transmission of health related information between organizations according to nationally recognized standards [Minn. Stat. §62J.498 sub. 1(f)]. **Reference:** <https://www.revisor.mn.gov/statutes/?id=62J.498>.

15. Indicate the status of your facility’s ability to electronically **send information to partners**

Partners	Facility electronically sending information	Facility not electronically sending information, but plan to in next 18 months	Facility not electronically sending information with no plans to be in next 18 months	Do not know
Assisted Living Facilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Behavioral/Mental Health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clinics/Ambulatory Providers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dental/Oral Health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Health Plans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Home Health Agencies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hospice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hospitals outside your system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hospitals in your system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Laboratories	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Local Health Departments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other Nursing Homes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pharmacies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tribes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Veteran’s Administration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vision Care	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (specify):	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

16. Indicate the status of your facility’s ability to electronically **receive information from partners**

Partners	Facility electronically receiving information	Facility not electronically receiving information, but plan to in next 18 months	Facility not electronically receiving information with no plans to be in next 18 months	Do not know
Assisted Living Facilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Behavioral/Mental Health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clinics/Ambulatory	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Providers				
Dental/Oral Health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Health Plans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Home Health Agencies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hospice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hospitals outside your system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hospitals in your system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Laboratories	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Local Health Departments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other Nursing Homes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pharmacies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tribes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Veteran's Administration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vision Care	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (specify):	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

17. Indicate the type of information your facility **would like** to receive electronically [check all that apply]

- Clinical/summary care record
- Current/active medication list
- Medical history and physical
- Immunization history
- Laboratory results
- Patient demographics
- Radiology reports
- Other (specify)

18. With which partners do you have the **greatest need** to electronically exchange health information with? (check top five)

- Assisted Living Facilities
- Behavioral/Mental Health
- Clinics/Ambulatory Providers
- Dental/Oral Health
- Health Plans
- Home Health Agencies
- Hospice
- Hospitals outside your system
- Hospitals in your system
- Laboratories
- Local Health Departments
- Other Nursing Homes
- Pharmacies

- Tribes
- Veteran's Administration
- Vision Care
- Other (specify):

19. Indicate which methods your facility uses to provide residents and/or residents' family electronic access to their health information (select all that apply)

- Personal health record
- Place information on a flash drive, UBS drive, or CD
- Portal access with the internet
- Secure email
- Do not provide electronic access to health information
- Do not know
- Other (specify):

20. If using portal access with the internet to provide residents and/or residents' family electronic access to their health information, indicate the type of information (select all that apply)

- Billing
- Care Plans
- Diagnosis/Problem List
- Immunizations
- Medication History
- Physician Orders
- Progress Notes (Interdisciplinary)
- Test report or results
- Therapy/Treatment Plans
- Vital Signs
- Do not use portal access with the internet
- Other (specify)

21. Indicate the largest challenges related to electronic exchange of health information with outside organizations: (select up to 3)

- Capabilities of others to receive and send electronic data unknown
- Capacity of others to send and receive is limited or does not exist
- Competing priorities
- Facility Support
- HIPAA, privacy or legal concerns
- Inability of system to generate/receive/send electronic messages/transactions in standardized format
- Insufficient information on exchange options available
- Lack of or limited access to technical support or expertise
- Subscription rates for exchange services are too high
- Unclear value on return on investment (ROI)
- Other (please specify): _____
- Not applicable- there are no challenges to exchange

22. If you indicated competing priorities, please briefly list or explain the competing priorities.

23. If you would like to clarify your answers related to health information exchange, please provide comments below. (optional)

General Questions

24. Does your organization, in relation to your EHR system, conduct or review security risk analysis information and update as necessary as part of your risk management processes?

- Yes
- No
- Not Sure

25. Which EHR-related skills and/or roles are in greatest need within your organization? This includes adding new staff or developing the current staff. (select up to 3)

- A person to lead the implementation of an EHR
- People to develop and write reports from an EHR
- People to help design, maintain and customize an EHR for use in our facility
- People to get the EHR ready for use (e.g. entering orders, patient information, etc.)
- People to manage and process the data, information, and knowledge (e.g. informatics nurse or clinician)
- People to train staff on how to use the EHR
- Other (specify):

26. Describe the benefits or value your facility has experienced from EHR systems and/or health information exchange (optional)

27. Would you be willing to share your EHR or health information exchange story with others in your field? (select one)

- Yes
- Maybe
- No

VITA

Cathy Marie Murray was born in Chillicothe, Missouri, to the parents of Charles and Leanna McElwee. She is the sister to one brother, Chad. She is married to David Murray and has two children, Aimee and Bryson. She attended Braymer High School in Braymer, Missouri. After graduation, she attended the University of Missouri in Columbia, Missouri. She obtained a Bachelors of Health Science degree in Health Services Management and later furthered her education by becoming a Registered Nurse. She accepted her first professional position as an administrator in a health care company. Cathy graduated with a Masters of Business Administration degree from the University of Missouri. She has held various executive positions in the health care profession. She graduated May 2015 with a Doctor of Education in Learning and Leadership from the University of Tennessee at Chattanooga.