HEALTH INFORMATION TECHNOLOGY AND NURSING HOMES

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Abstract

Nursing homes are considered lagging behind in adopting health information technology (HIT). Many studies have highlighted the use of HIT as a means of improving health care quality. However, these studies overwhelmingly do not provide empirical information proving that HIT can actually achieve these improvements. The main research goal of this dissertation is to review the current development of HIT in nursing homes, to determine the nursing homes use of HIT features in MDS software, and to examine whether these uses result in better quality of care as measured by Nursing Home Compare (NHC) quality measures. This dissertation includes three parts and each part has its own emphasis and methodology centered on the main topic of the use of HIT in nursing homes.

The first paper reviews the background and definitions of HIT as well as the most important applications and several standards that are currently used or under development. The second paper examines the use of commercial Minimum Data Set (MDS) software in nursing homes and identifies the HIT features that are available in the most commonly used software package. The frequency of use of each HIT feature in MDS software is also reported. The third paper evaluated whether the use of such HIT features is associated with better quality of care as measured by NHC.

This dissertation reviews the HIT, summarizes a list of top 12 advanced HIT features in commercial MDS software used by the surveyed nursing homes. The study also evaluates the

frequency of use of each feature. It concluded that although nursing homes were often viewed as technologically impaired, many of them had used quite advanced HIT in commercial MDS software.

The findings are helpful in prioritizing the importance of future HIT development in nursing homes. Understanding the highlighted issues and the evidence of HIT use for promoting quality of care in nursing homes is a top research and public health concern. Future research should extend the list of HIT features in the current commercial MDS software and interconnect such features with available EHR systems in the continuum of health care.

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1.0 INTRODUCTION

In the long-term care sector, nursing homes remain a principal setting for caring for people in need. In December 2007, there were 15,772 nursing homes in which 1,420,217 people resided (American Health Care Association, 2007). Those who stay in nursing homes nowadays tend to be older with worse functional status, while the discharge rate in nursing homes has increased (Decker, 2005). In addition, estimates also conclude that Medicare and Medicaid together funded 60 percent of all nursing home expenditures in 2007, of which 43 percent was paid by Medicaid[1] (see Table 13 in Centers for Medicare & Medicaid Services, 2008, p. 15). The nursing home spending grew faster with an increase of 4.0 percent in 2006 and 4.8 percent in 2007 (Centers for Medicare & Medicaid Services, 2009a). As a result of the high total expenditures, increased attention has been paid as to whether this high spending contributed to quality of nursing home care. Although this assumption seems straightforward, no study has found any clear evidence regarding whether higher nursing home spending has led to higher quality of care (GAO, 2002).

A study commissioned by the Institute of Medicine (IOM) showed that there were serious deficiencies in nursing home care leading to the deterioration of residents' health status (IOM, 1986). This study was a milestone for the later-enacted Federal Nursing Home Reform Act or OBRA '87 (The Omnibus Reconciliation Act of 1987), which established basic rights and

[1] In 2005, Medicare and Medicaid accounted for 16 and 44 percent, respectively, while the projected spending during 2007 accounted for 17.3 and 42.8 percent, respectively.

services for residents of nursing homes requiring Congress to issue a range of sanctions for underperforming nursing homes. The OBRA 87 reforms also provided the basis for the following initiatives to improve the quality of care and the quality of life for nursing home residents. As a result, nursing homes have undergone several initiatives to improve substandard quality of care and inadequate regulation (Weiner, Freiman, & Brown, 2007).

One of the most prominent initiatives is the requirement of an enforcement system for all nursing homes to electronically submit individual resident assessment data via state public health agencies to the Centers for Medicare & Medicaid Services (CMS) repository (Mor, Berg, et al., 2003). That is, all state licensed nursing homes are required to regularly conduct standard resident assessments using the federally mandated Resident Assessment Instrument (RAI version 2.0) and transmit the data to the state or federal agencies (Zimmerman, et al., 1995). These data consist of computerized information regarding resident interviews and direct observation of resident care. The aforementioned system is known as the Minimum Data Set (MDS). This requirement has paved the way for the public reporting of quality of care information in the long-term care industry.

Hospitals have led the way in developing a national network of electronic health infrastructure in response to what Bush Administration calls the "decade of Health Information Technology (HIT)" (Bush, 2004). This initiative was developed because many believe that the adoption of Health IT may improve the safety, quality, and efficiency of health care (IOM, 2000, 2001). Health IT usually includes a number of components such as: (1) Computerized Physician Order Entry (CPOE) - an example of clinical information systems, that was used to support clinical activities; (2) Electronic Health Record (EHR) - seen as a goal towards fully adopting Health IT; and (3) Standardization - another term for interoperability, which requires national

standards for health information to be able to shared within the entire health care system. In addition, the goal for Health IT is not only limited to a handful of areas, rather it could be applied to all that are within the full spectrum of health care delivery system.

The current computerized patient assessment systems (i.e., MDS) in U.S. nursing homes have demonstrated advantages in improving the quality of nursing home care (Castle, 2003; Mukamel & Spector, 2003; Mukamel, et al., 2007). Although the MDS contains clinical assessments information for residents during each admission, the way the data are recorded is not real-time and more specifically is not necessarily done per admission or event. Without comprehensive medical records (e.g., patient's past treatment or history, progress note, medication, etc.), it is not an efficient means for health care professionals to track patient's medical records when needed. Also, sharing of medical information cannot be attained because of the lack of interoperable standards to be used through groups of providers, academics, and vendors.

A number of nursing homes may have widely incorporated a variety of systems; however, the full adoptions of Health IT are still lagging behind hospitals (Rochon, et al., 2005). In response to these issues, we have carefully reviewed the associated literatures and found very few published studies have examined the adoption of commercial MDS software in nursing homes. This is important because the commercial MDS software is often used as a substitute for the one (i.e., RAVEN) that is free of charge from the CMS. The commercial software usually includes a number of features that are approximating Health IT. However, it is unclear whether the use of Health IT in nursing homes results in better quality of care measured by nursing home quality outcomes. The overall objective of this dissertation is to review the current status of Health IT in nursing homes as well as to assess the popularity of the use of Health IT by looking

at a selective advanced IT features across the current available MDS software. In addition, this study also proposes to evaluate the effects of such use on nursing home quality of care.

1.1 PURPOSE OF STUDY

This study is specifically designed to collect information on the use of commercial MDS software in nursing homes. Previous literature suggests that the use of HIT can increase quality of care within health care segments (Gawande & Bates, 2000a). It is essential to provide information regarding how nursing homes have adopted advanced IT features in commercial MDS software. This is significant because, as a mandatory system, MDS requires all resident assessment information to be collected and computerized. On the basis of ample literature supporting HIT in improving quality, we proposed that nursing homes with a greater use of HIT functions in commercial software, their quality of care would be better than those with a lower level of use.

This dissertation starts by summarizing the published literature pertaining to the issues of Health IT adoption relating to nursing homes. Overall, the purposes of this study are three fold:

(1) To review the current issues regarding health IT adoptions in nursing homes.

(2) To present a national survey that demonstrates the use of advanced Health IT features in nursing home MDS software.

(3) To determine whether the facility using more Health IT would have better quality of care by linking the survey date to nursing home compare quality data.

1.2 CONTRIBUTION OF CURRENT STUDY

It has been recognized that the current computer system in nursing homes is dated (Poon, et al., 2006). The computer or software system for nursing homes must either be replaced or upgraded to be compatible with the MDS system during the transition to interoperable HIT systems. Many nursing homes have used commercial MDS software for data transition. The software includes a variety of features that are approximate to HIT. This study is proposed to provide information regarding the current adoption of such software and the frequency of use of HIT features within their software. This study is also to determine whether the extensively use of such IT features in a nursing home would have better quality of care by linking the HIT adoption information to quality measures. If the results of this study showed positive effect in using HIT, it can be an incentive for nursing facilities to foster the adoption.

1.3 ORGANIZATION OF DISSERTATION

The remainder of this dissertation is divided into four chapters including three papers (chapter 2, 3, and 4), followed by a conclusion in chapter 5. Each paper has its own theory and method that centered on the main theme pertaining to nursing home Health IT. Chapter 2 is the first paper reviewing the published literatures and current initiatives on nursing home Health IT. Chapter 3 is the second paper presenting the descriptive analyses with regard to the use of advanced IT features in commercial MDS systems in the surveyed nursing homes. This paper has been published on Journal of Applied Gerontology (Liu & Castle, 2009). Chapter 4 is the third paper using multivariate analyses to examine whether use of IT features commonly found in

commercial MDS software were associated with better quality of care measured by Nursing Home Compare quality measures (QMs). This paper has been accepted by the American Journal of Medical Quality for publication. Lastly, in Chapter 5, I summarized the results and significances from previous chapters.

2.0 LITERATURE REVIEW

In the healthcare industry, "patient safety" or "quality of care" remain the greatest concerns (American College of Healthcare Executives, 2007; Chassin & Galvin, 1998). Recently, many have suggested using available Health Information Technology (IT) features for promoting patient safety (Altman, Clancy, & Blendon, 2004).

IT, or more specifically health IT, is relatively a new topic in the U.S. healthcare arena. In other industries, IT has made it possible to lower costs, save time, and improve quality through its heavy investments of computer technology and information structures (Davenport & Short, 2003). For example, online retailers, such as Amazon.com, have provided web services allowing customers to search for million of products, to compare prices, and to read customer reviews and merchant ratings of products at their fingertips. The implementing of IT has fundamentally changed the business model and will likely to influence healthcare consumers' information-seeking behavior (Gawande & Bates, 2000c). In 2004, President Bush signed an Executive Order calling for widespread adoption of Electronic Health Record (EHR) within 10 years (Bush, 2004).

The aim of this paper is to review both the current status of and the research-based materials on HIT. The review includes the definitions of HIT, the effect of HIT on quality of care, and the HIT adoptions in general health care area and in nursing homes.

2.1 DEFINITIONS OF HIT

To fully understand the components of HIT, it is helpful to define what is meant by "health information technology." The concept of HIT can include computer, information system and the use of the Internet. For example, Brailer (2004) defined HIT 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." (p. 38)

The expert panelists from Massachusetts General Hospital defined HIT as "the use of a variety of electronic methods for managing information about the health and medical care of individuals and groups of patients" (Massachusetts General Hospital, 2006, p. 3). In 2004, President Bush created the Office of the National Coordinator on HIT (ONCHIT). It is formed to provide leadership for the development and nationwide implementation of interoperable HIT systems (Department of Health and Human Services, 2007c). The office stated that, "HIT allows comprehensive management of medical information and its secure exchange between health care consumers and providers. They claimed that the broad use of HIT will: (a) improve health care quality; (b) prevent medical errors; (c) reduce health care costs; (d) increase administrative efficiencies; (f) decrease paperwork; and (g) expand access to affordable care (line 1 in Department of Health and Human Services, 2007b)."

HIT also allows health care providers "to collect, store, retrieve, and transfer information electronically (MedPAC, 2006, p. 159)." Typical aspects of HIT include administrative and financial, clinical, and infrastructure etc., that can be used by hospitals or physicians (MedPAC, 2006, p. 9 table 7-1). The functions that have been used contain a core component of HIT that is also referred to as EHR. These functions digitize patient's medical records so that multiple users

can take advantage of data sharing at the same time in multiple locations (Department of Health and Human Services, 2007a). According to the American Health information Community, the EHR adoption has been set to be the top priority in promoting HIT (Department of Health and Human Services, 2008).

Early work regarding EHR includes a 1991 Institute of Medicine (IOM) report: "*The Computer-Based Patient Record: An Essential Technology for Health Care*" drawing attentions to a number of significant benefits of EHR (IOM, 1991). The report recommends the development and adoption of EHR "to improve the care of patients in both individual and population levels and, concurrently, to reduce waste through continuous quality improvement." It also noted that there existed various challenges to overcome during the migration of paper-based patient record to the EHR.

Although this is not a complete collection of all definitions of HIT, the field of healthcare has witnessed a renaissance in recognizing the use of HIT as a strategy to facilitate health care system over the recently. Between 1980 and mid-2000, the research on quality of care in healthcare typically incorporated the same solutions (e.g., dealing with the structure, process, and outcome) leading to the later developing of HIT. By reviewing a series of classic works in the IOM reports, it would be easier to understand why HIT has been identified as a key challenge to improve quality of care (see Appendix A).

2.2 SCOPE OF HIT

As noted earlier, several definitions exist for HIT including a multidimensional construct that can be defined by various perspectives. We have observed in the literature that the term HIT was

widely used but contains an elusive concept determined by a variety of scopes including the providers, the users, the applications, and the purposes of use.

Chaudhry el al. (2006) sorts HIT into several components, including technological (system applications), organizational process change (working redesign), human factors (user friendliness), and project management (achieving project milestones). The types of HIT systems can include electronic health records (EHR), computerized provider order entry (CPOE), clinical decision support system (CDSS), electronic results reporting, electronic prescribing, consumer health informatics/patient decision support, mobile computing, telemedicine, electronic health communication administration, data exchange networks, knowledge retrieval systems (Chaudhry, et al., 2006).

A recent report by Hamilton (2006) entitled "Evaluation Design of the Business Case of Health Technology in Long-Term Care: Final Report" identified eight types of HIT applications for using in post acute care: (a) supportive documentation, (b) census management, (c) point of care, (d) computerized physician order entry, (e) electronic health record, (f) telehealth or telemedicine, (g) assessment and care planning, and (h) electronic prescribing. Many of those applications have recently been studied extensively.

Another report by IOM (2003) identified eight core functionalities for EHR. They are (a) health information and data, (b) results management, (c) order entry or management, (d) decision support management, (e) electronic communication and connectivity, (f) patient support, (g) administrative processes, and (h) reporting and population health. This letter report was made to respond to a request from the Department of Health and Human Services (DHHS). It also provided functional models of the key care delivery-related capabilities of EHR system in order to facilitate the later work on EHR.

The IOM report "*Key Capabilities of an Electronic Health Record System: Letter Report*" concluded that the functional capabilities of an HIT system should include clinical documentation (health information or data), results management, order entry management, decision support, electronic communication and connectivity, patient support, administrative processes, and reporting and population health (IOM, 2003).

For health insurance plans, it is also important that their systems can interconnect with other health care providers through HIT because this would enable the ability to share clinical and administrative data across multiple settings. According to American Health Insurance Plan (AHIP) (Bayer, 2008), the use of HIT tools in connection with health plans has been offering opportunities in connecting patients and health care providers, giving health care practitioners key information at the point of care, offering customized online information and transparency of cost and quality data, and able to succeed in health information exchange (summarized in Table 2-1).

Table 2-1 The Examples of HIT Applications Used by The US Health Plans

Organizations	HIT applications	Results
Connect Patients and Health Care Providers		
CIGNA HealthCare	*Virtual house calls* offers patients to discuss non-urgent health issues and obtain advice from their doctors online.	As of July 2008, the HIT are available nationwide to all CIGNA members (i.e.,170,000) and participating physicians (i.e., 12,000).
Blue Cross Blue Shield of Massachusetts	*eRx Collaborative* offers e-prescribing to Massachusetts prescribers through two vendors.	Use such HIT at point of care resulted in charges to approximately 2.1 percent of all e-prescriptions sent annually (i.e.,104,000 Rx).
Group Health Cooperative	*MyGroupHealth interactive Web site* allows consumers to consult with doctors, nurses, and therapists via secure email; renew prescriptions; schedule and cancel appointments, etc.	About 22 percent of primary care encounters are virtual (i.e., four emails a day for a doctor with 20 patients).
Henry Ford Health System (HFHS)/Health Alliance Plan	*e-visit* integrating with EHR allows patients to consult with doctors about non-urgent health issues online via structured interviews.	90 percent of surveyed participants (i.e.,132 patients) in 2008 were satisfied with the quality of responses.
Kaiser Permanente	The online *My health manager personal health record (PHR)* allows patients to send e-mail to their doctors.	30 percent (i.e., 2.25 million) of adult members are now using such HIT resulted in about 3.5 million prescriptions, more than 1 million lab tests, and 300,000 emails.
WellPoint Inc.	Individual health record (IHR) integrating with EHR allows patients to access personal health record and doctors to monitor their conditions online.	75 percent of employees and 200 physicians are now using such HIT.
HealthPartners	*Integrated EHR-PHR* allows patients to enter their own information online.	More than 72,000 activities regarding doctor's appointments scheduled or rescheduled were done with such HIT each year.
Give Health Care Practitioners Key Information at the Point-of-care		
Aetna	*Clinical decision support information at the point of care (as part of NaviNet)* allows physicians to check patient-specific, evidence-based care considerations through pop-up alerts	This HIT was added as an addition to previous system *NaviNet* that has been implemented in the offices of nearly half of Aetna's network.

Table 2-1 (continued)

Shared Health/BlueCross BlueShield of Tennessee	*Care Opportunities* are integrated with nationally recognized clinical practice guidelines displayed in patients' online clinical health records (CHR) allowing physicians to view for improving care.	Integrated with CHR so that the notations regarding when to have flu shots, pap tests, etc. can be tracked at recommended intervals.
Kaiser Permanente	*KP HealthConnect* is a comprehensive EHR system to replace paper charts, which includes data on members' medical histories, prescription drug use, and adverse reactions, etc.	Such HIT enables 14,000 plus physicians in 22 hospitals to access electronic health information covering 4.8 million members.
Offer Customized Online Information and Transparency of Cost and Quality Data		
ActiveHealth Management/Aetna	*CareEngine* is an interactive personal health record used to compare data in members' PHRs to nationally recognized medical best practices	About 6 million members have used such HIT.
vielife/CIGNA HealthCare	*Second Life* on a virtual island is an online game for the next wave of web-based health education (e.g., currently provides nutrition information).	Such HIT is still on the pilot stage.
Health Alliance Plan	*Member Health Reminder* is a system to promote use of preventive care and chronic disease services	More than 3,000 individuals used such HIT online.
Humana Inc.	*Personalized web page* is part of personal care advance/care hub initiative will be rolled out by Humana in 2009 in order to send reminders about preventive care.	N/A
Aetna	*Health care Providers' pricing* allows members to access and compare the prices of common medical procedures	Such HIT tool has been available in 25 communities throughout the country as of 2008.
Health Alliance Plan	*Health Care Decision Support* is an interactive system helping members in making informed health decisions.	In the first quarter of 2008, Nearly 2,700 members used such HIT (i.e., 245 percent increase over the same period in 2007).
Blue Cross Blue Shield of Louisiana	*Coverage Advisor* allows members to estimate total out-of-pocket health care costs (e.g., premiums, deductibles, and copayments).	N/A

Table 2-1 (continued)

Health Information Exchange		
HealthPartners	*Minnesota Health Information Exchange (HIE)* provides medication histories to health care providers.	It is expected to implement such HIT in 2010. Information to be exchanged includes lab orders, lab results, data from Minnesota's immunization registry, claims-based pharmacy histories, etc.
The New England health Care	*The New England Health Care EDI Network and MA-SHARE* is a system developed by a group of Massachusetts health plans to simplify communications among health plans and health care providers.	The number of prescribers using the e-prescribing system grew from 360 to 933, while the number of electronic prescriptions written per month increased from 11,304 to 44,710 from June 2007 to June 2008.
Blue Cross Blue shield of Michigan	*The secure Web portal* allows doctors to exchange members' health information regarding e-prescriptions, copayments and deductibles, and claims.	Such HIT has been used by 95 percent of doctors and hospitals in Michigan.

Source. This table displays a summary of the results from *Bayer, E. (2008). Trends and Innovations In Health Information Technology. Washington, DC: American Health Insurance Plan.*

2.2.1 Electronic Health Record

Electronic Health Record (EHR) is essential in HIT adoptions. Its counterpart, paper-based patient records, are composed of personal health profiles documenting patient's medical history, written orders and progress notes in paper chart. The paper-based medical record has its long tradition in compiling a lifetime history of a patient. However, there have been a number of disadvantages of using such medical records such as its poor availability, ambiguous and incomplete data, fragmentation, and illegible handwriting (Dick & Steen, 1997).

What made EHR stand out is that it incorporate the fundamental of HIT such as "computer-stored collection of health information about one person linked by a person identifier" (Waegemann, 2002), which relies on computers and information system to record and store patient's medical history. Today, a growing number of health care providers have recognized the advantage of EHR because the old fashion paper-based records not only failed to satisfy the need for instant data retrieving but also presented flaws in recording patient's heath information (e.g., no standardized structure exists and it is too difficult to read the handwriting) (Walsh, 2004).

Wang et al. (2003) provide a framework for estimating the financial effects in a comparison between EHR and paper-based patient records. They performed a cost-benefit analysis of EHR used by primary care physicians. The study was conducted in an ambulatory-care setting using information from published studies, focus groups, and their EHR system. They reported that a provider was estimated to accrue 86,400 USD net benefit for using EHR in a 5-year period (Wang, et al., 2003). Millier et al. (2007) conducted a study to estimate the financial costs and benefits of six community health centers implementing EHR. Their results suggest that the efficiency gains were mostly from financial benefits of reduced medical record and transcription costs.

A GAO report, *HHS's Efforts to Promote Health Information Technology and Legal Barriers to Its Adoption*, proposed that an EHR generally includes: "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 processes for health care delivery (GAO, 2004, p. 10)."

The Healthcare Information and Management Systems Society (HIMSS) defined EHR on their web site as: "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 (HIMSS, 2006)."

Both definitions suggest that EHR is a tool that allows health information to be reposited in an electronic format and enable only authorized users to access in several locations, and in real-time manner. It is also important to note that several other variant terms referred to EHR are existed such as: *Electronic Patient Record (EPR), Electronic Medical Record (EMR), or Computer-Based Patient Record (CPR).* [2] Despite a variety of synonyms for EHR, the core clinical contents of it are literally similar. EHR remains the widespread used term by the majority of current literatures.

In summary, EHR supports not only the clinical records but also the collection of data for uses such as billing, quality management, outcomes reporting, resource planning, and public health disease surveillance and reporting. There has been very little agreement on the current level of EHR adoption (Middleton, 2005). However, most survey shows that EHR were not yet widespread for both the inpatient and outpatient care (Ash & Bates, 2005).

[2] Beyond EPR, EMR, and CPR, Waegemann (2002) in his report "Status Report 2002: Electronic Health Records" provided a list of other common synonyms of electronic health record: Patient-Carried Medical Record (PMR), Computerized Medical Record (CMR), Digital Medical Record (DMR), and Personal Health Record (PHR).

2.2.2 Computerized Physician Order Entry

Computerized Physician Order Entry (CPOE) is a commonly found application for HIT. It is an electronic prescribing medication system used at the time medications are ordered and filled. Sometimes, it is also referred to as "Computerized Provider Order Entry". The uses of CPOE were considered to be able to "improve quality by standardizing processes and by providing physicians guidance as they care for patients" (Kuperman & Gibson, 2003). For example, CPOE can provide alerts on medication dosing when certain indicator falls out of the pre-set ranges (Kuperman, et al., 2007).

Although there are a variety of features associated with CPOE systems (e.g., ordering, intuitive human interface, patient safety, billing), the most prominent one is for patient safety, which is related to the prevention of adverse drug events (Bates, 2000, 2007). For example, two studies on the implementing of CPOE found that it had entirely eliminated the transcription errors by 11.3% (Mekhjian, et al., 2002) and 13% (Cordero, Kuehn, Kumar, & Mekhjian, 2004). Another study using CPOE for preventing medication errors found 55% reductions in the serious medication error rate (Bates, et al., 1998). More examples as to how CPOE may benefit to patient safety will be introduced in 2.2.3.

2.2.3 Patient Safety

Patient safety is central to quality of care. The issues on patient safety are usually related to individual or system defects associated with human error (Leape, et al., 1998). To address patient safety issues, the Institute of Medicine (IOM) report: *To Err Is Human: Building a Safer Health System* identified medical errors as the leading causes of death and injury (IOM, 2000). This

report stated that there were 44,000 to 98,000 deaths per year in hospitalized patients and that more than 1 million patients are injured as a result of error (IOM, 2000).

Another landmark report by the IOM: *Crossing the Quality Chasm: A New Health System for the 21st Century* suggested six aims (i.e., safe, effective, patient-centered, timely, efficient, equitable) for quality improvement in health care system (IOM, 2001). This report clearly articulated the chasm (i.e., gap) between the care people *should* receive and *do* receive, which may cause medical errors if without proper remedy.

Medical errors were defined as injuries from medical treatment (Brennan, et al., 1991; Leape, et al., 1991). These errors usually result in various types of medical injuries in health care (e.g., diagnostic, treatment, preventive, etc.) (Leape, Lawthers, Brennan, & Johnson, 1993). Among those, "medication errors" are the most common mistakes, which usually happen in the process of ordering, dispensing, or administering a medication (i.e., drugs) and could result in injuries (Bates, et al., 1999).

Adverse drug events (ADEs) and medication errors can be associated depending on whether the errors are preventable or not. ADEs were defined as injuries resulting from the use of a drug (Field, et al., 2001). They can be further classified as "preventable" if they are related to a medication error or "non-preventable" if they are not related to medication errors (see Figure 1 in Morimoto, Gandhi, Seger, Hsieh, & Bates, 2004). Gurwitz et al. (2000) found that the ADEs in the studied nursing homes were at a rate of 1.89 per 100 resident-months, with only half to be preventable. The same study also reported an incidence of potential ADEs to be 0.65 per 100 resident-months (Gurwitz, et al., 2000).

In overall long-term care setting, Gurwitz et al. (2005) determined that the rate of ADEs was 9.8 per 100 resident-months. The occurrences were undoubtedly a serious matter drawing

the public's attention to fix this "chasm". If an automated system is implemented, many undesirable medical errors could be averted and the harms to patient would be successfully mitigated.

In summary, several computerized techniques allow the detections of a broad array of adverse events (Bates, et al., 2003). These techniques include automated methods used to produce algorithms such as counting the number of radiology reports for inpatient fall preventions or computer-generated signals include laboratory test results such as high serum drug level.

2.3 HIT STANDARDS

The information transmit procedure requires standards to facilitate a smooth transmitting or interoperability. Standards are vocabularies in HIT adoptions because it enables the possibility for a variety of systems to be able to communicate with each other (Mead, 2006). Yet public and private efforts have been attempting to coordinate various stakeholders to ensure a fully integrated health IT. For example, these include a number of ongoing projects for mapping the terminologies between standard clinical vocabularies and other important vocabularies (i.e. regulatory and interface terminologies) (Tuttle, White, & Harvell, 2007).

Table 2-2 shows a list of selected standards that are commonly used and discussed (The National Health Information Infrastructure, 2008b). Based on their functionality, these standards can be categorized as either terminology or messaging standards (GAO, 2004). Messaging standards refer to *how* electronic messages should be formatted, while terminology standards handle the contents as to *what* the HIT data element is about.

For example, Logical Observation Identifier Names and Codes (LOINC) is an example of *terminology standard* used as the language to present the test result. It is recently developed for reporting laboratory and other clinical observations is a universal code system (McDonald, et al., 2003). The codes exist for laboratory observations such as partial pressure of arterial blood oxygen (PO_2) and percentage lymphocytes, etc. (The Regenstrief Institute, 2005). The EHR-Lab Interoperability and Connectivity Specification (ELINCS), however, is an example of *messaging standard* which is based on the HL7 and can be used during the electronic transmission of the results from the lab to the resident's doctor (California HealthCare Foundation, 2006).

The ONCHIT has taken the lead on creating a nationwide HIT infrastructure and facilitating the establishment of data and technical standards (The National Health Information Infrastructure, 2008a). Recently, a new bill proposed that, by the end of 2009, the HIT standards will be tested by the National Institute of Standards and Technology to determine if they meet the national guidelines allowing for the secure electronic exchange and use of HIT (The Majority Staff of the Committees on Energy and Commerce, 2009).

In summary, it is urgent now to develop and review current available standards to facilitate EHR information communication. The U.S. Department of Health and Human Services has taken the lead in building a health infrastructure through promoting interoperability (Yasnoff, et al., 2004).

Table 2-2 Examples of HIT Standards

Name	Functionality	Category
Terminology		
LOINC	"Logical Observation: Identifiers, Names, and Codes" is a code set that assigns universal identifiers to laboratory and other clinical observations, so that results can be pooled and exchanged.	Lab
SNOMED-CT	"Systematized Nomenclature of Human and Veterinary Medicine" is a nomenclature that provides a common language to codify the clinical information captured in an electronic health record (EHR) during patient care. It enables a consistent way of indexing, storing, retrieving, and aggregating clinical data across medical specialties and sites of care.	Clinical
ICD-9-CM ICD-10	"International Classification of Diseases" is classification systems that group diseases and procedures for easy retrieval by computers. They are useful for reporting or other instances where data aggregation is needed, such as measuring quality or processing claims for reimbursement.	Billing
NCPDP	"National Council for Prescription Drug Programs" is a standard that allows electronic transfer of prescriptions between pharmacies, and for physicians to submit prescriptions electronically.	Drugs
NDF-RT	"The national drug file reference terminology" is a drug terminology derived from the U.S. Department of Veterans Affairs' (VA) National Drug file as a reference standard for medications.	Drugs

Table 2-2 (continued)

Messaging		
HL7	"Health Level 7" is a computer language that allows the transmission of a patient's basic demographic information, medical history, diagnoses, and financial information between different clinical applications. HL7's Version 2.0 is the most widely implemented healthcare standard worldwide.	Clinical
RxNorm	RxNorm is a developing project of the NLM. It is a nomenclature that provides standard names for clinical drugs (active ingredient + strength + dose form) and for dose forms as administered.	Drugs
CPT-4	"Current Procedural Terminology" is a coding system for the billing of medical procedures.	Billing
ASC/X12N	Accredited Standards Committee governs the transmission of electronic claims data, such as external financial transactions, financial coverage verification and insurance transactions and claims.	Financial
ELINCS	EHR-Lab Interoperability and Connectivity Standards is a standard that is currently under development; it will be used to transfer lab results from laboratory information systems to EHRs in the outpatient setting.	Lab

Sources: The National Library of Medicine (NLM) has been recommended as the appropriate body to coordinate and disseminate the mappings with the Unified Medical Language System (UMLS) Metathesaurus. Detail information are available online at http://www.nlm.nih.gov/research/umls/ (Retrieved January 30, 2008)

2.4 HIT INITIATIVES

Appendix B provides a snapshot of significant public actions in chronological order. These initiatives include a number of works to harmonize standards, and to create new regulations to foster the adoption of Health IT. However, the progress in adopting HIT in health care areas has been slow despite a variety of HIT innovations available. As we discussed in previous sections, applications such as CPOE, EHR, and others adopting computerized technologies were available and used in many facilities. A number of benchmark research institutions have provided several insights on HIT adoptions.

For example, the Regenstrief Institute is a university based medical research foundation. It has implemented a community-based information system known as Regenstrief Medical Record System (RMRS) since 1973 (Weiner, et al., 2003). RMRS is a Medical record system based on the notion of giving providers access to an integrated internet-based database (McDonald, 1997). It is proposed to ensure that the supports of clinical decisions and intervention can be attained in the longitudinal patient care (Weiner, et al., 2003).

Large integrated health plan, such as Kaiser Permanente (KP), has been adopting comprehensive EHR applications speedily. The KP is a California based integrated health plan that has developed the world's largest civilian electronic health record. Their system, KP HealthConnect, enables 14,000 plus physicians in 22 hospitals to access electronic health information covering 4.8 million members (Kaiser Permanente, 2008).

The Veterans Health Administration (VHA) has had an automated information system serving a total of 21 service networks. The veterans health information systems and technology

architecture (VistA) has provided significant applications such as computerized patient record system (CPRS), VistA-Rad (i.e., radiologist tools such as x-ray), and bar code medication administration (BCMA) for closing the "quality chasm" (Perlin, Kolodner, & Roswell, 2004).

Until recently, a growing body of statistical and anecdotal evidence suggests that the HIT adoption in nursing homes still lag behind significantly (Poon, et al., 2006). Kaushal et al. (2005) evaluated the adoption of EMR (i.e. EHR) and found that the adoption rate in nursing homes was only about 1%, which significantly lags behind hospitals (i.e., 18%). In reviewing recent HIT literatures, we found only a few studies in relation to nursing home settings.

Rochon et al. (2005) evaluated the implementation of CPOE with CDS system in a benchmark LTC institution providing 10 insights to those who wanted to adopt such system in LTC settings. These insights were helpful in assisting other institutions that are considering the implementation of such system in the LTC setting. For example, they concluded that selection of software for CPOE requires compromise; the continued commitment of the vendor to the product is essential, and that the ability to add CDS to a CPOE system is critical.

Judge et al. (2006) conducted a randomized controlled trial with the use of CPOE with CDS in a large LTC facility. They concluded that the alerts for risk ranged from 12 to 13 percent of total medication orders, which are relating to renal insufficiency imbalance and drug-associated constipation, respectively. They also found that the facilities had a low response rate to these alerts and concluded that the LTC settings must propose a new approach towards developing a system-wide system.

Other types of HIT were also studied for detecting adverse events that are *not* relating to medication. For example, Wagner et al. (2005) used incident-reporting systems over 4-month period in six nursing homes for preventing incident of fall. This study chose a total of 10

modifiable risk factors such as restraint use, and integrated these factors into a self-developed program. They found that the use of such systems has potential to strengthen quality improvement efforts and to improve documenting of adverse incidents.

Brandeis et al. (2007) assessed the EHR system that were used to connect 11 community nursing homes with one medical center for better communication. The purposes of this study was to follow the implementation of EHR, allowing the software to be used at various sites, providing hardware, and establishing Internet connectivity. They found an improvement in communication between providers across institutions (Brandeis, et al., 2007). However, no clear indications given as to whether the implementation of such system had a potential to improve quality or performance.

In summary, nursing home residents are more likely to be either vulnerable or ailing. Without proper management, they may end up with serious problems such as delirium, lethargy, hemorrhage, and falls (Field, et al., 2001). That is, nursing home HIT adoptions would involve more applications than other health care settings do in terms of the fact that nursing home settings would need a close tie with other institutions for care managements. However, due to the expensive costs of HIT, research have suggested that nursing homes were less likely to adopt associated HIT if those systems were not relating to regulatory and clinical needs (Poon, et al., 2006; Subramanian, et al., 2007).

2.5 BARRIERS TO THE ADOPTION OF HIT

There are varieties of barrier that may hinder the adoption of HIT. For example, the top three barriers reported by the 2003 Commonwealth Fund National Survey of Physicians and Quality of

Care were: (a) cost of system start-up and maintenance; (b) lack of local, regional, and national standards; and (c) lack of time to consider acquiring, implementing, and using a new system (The Commonwealth Fund, 2003, p. 4).

Financial supports Audet et al. (2004) identified that the start-up cost is one of above 3 barriers to physicians' view on HIT adoption. Although such financial costs has been named top one barrier for adopting HIT, it is still less well documented (Kuperman & Gibson, 2003). This study also noted that the associated costs of HIT implementation could be higher in the introducing stage. The misalignment of costs and benefits of adopting HIT can make financial costs the biggest impediment for adopting HIT (Middleton, Hammond, Brennan, & Cooper, 2005).

Culture Bottles (1999) pointed out that physician and hospital culture can be the obstacles to the adoption of HIT in the healthcare system. He explained that physicians who are not belonging to the healthcare system might not abide by the facility's HIT requirement.

Confidentiality Other challenges with regard to the privacy and confidentiality of individuals' health information remain but no overall strategy has yet been able to ensure that privacy protections would be built into computer networks linking insurers, doctors, hospitals and other health care providers (GAO, 2007a, 2007b). As outlined in an IOM report, concerns over the privacy and security of electronic health information usually fall into two general categories: (a) inappropriate releases of information from individual organizations and (b) the systemic flows of information throughout the health care and related industries (IOM, 1997, p. 54). For example, any intentional or unintentional access or dissemination of information in violation of organizational policy would be considered as the first category. In addition, the Health Insurance Portability & Accountability Act of 1996 (HIPAA) has required that all

transactions and activities involving the health information transfer must comply with the standard for that transaction. It is to ensure proper concerns about the privacy and security of electronic health information.

Although HIPAA[3] Privacy Rules clearly define and secure protected health information (PHI) (i.e. PHI can be disclosed and transmitted through secure and interoperable electronic systems without written patient authorization), it is like to grapple with both state and federal laws. It thus raised an argument regarding whether this could result in a legal barrier to the achievement of interoperable health information systems that allow disclosure of patient information. To answer this question, a study carefully reviewed nearly 500 judicial opinions involving the HIPAA and concluded that HIPAA did not act as a legal barrier to the adoption of HIT (Rosenbaum, Borzi, Burke, & Nath, 2007).

Standardization The noteworthy technical barriers for HIT adoption are not just the scanty of hardware but rather the standards (Middleton, et al., 2005). The need for common standards to record and transmit clinical information has been widely recognized as a key to a successful HIT. The goal of standardization is to ensure the interoperability among different systems so that they are able to communicate with each other using a set of common languages (i.e., standards). Interoperability has been considered as a fundamental requirement for widespread adoptions of EHR (Brailer, 2005). The National Alliance for Health Information Technology (NAHIT) delineated interoperability as "the ability of different information technology systems, software

[3] Health Insurance Portability and Accountability Act of 1996, Pub. L. no. 104-191. (1996). This regulation involving protected health information (PHI) and privacy of medical information.

applications and networks to communicate, to exchange data accurately, effectively and consistently, and to use the information that has been exchanged".[4]

In summary, although a number of barriers have been cited as barriers against the HIT adoption, the question on how these barriers can intercorrelate with the future HIT adoption remain a question mark because the baseline adoption rate is hard to measure (Jha, et al., 2006). However, it is important to document the major barriers to be addressed in further HIT adoption (Poon, et al., 2006).

2.6 UNINTENDED CONSEQUENCES OF USING HIT

Despite HIT has been recognized as having a potential to improve quality and reduce errors (Gawande & Bates, 2000a), a number of studies posses skeptical attitude toward the adoption for better quality of care (Ash, Berg, & Coiera, 2004; Berger & Kichak, 2004; Koppel, et al., 2005). The studies pointed to CPOE and proposed that it might cause risk by introducing new types of errors.

For example, a recent study by Ash et al. (2007) suggested that the unintended consequences of CPOE can be positive, negative, or both, depending on one's perspective, and these consequences continue to exist over the duration of uses. A study found an increase in mortality rate when using CPOE in the Children's Hospital of Pittsburgh's pediatric ICU (Han, et al., 2005). Koppel et al. (2005) concluded that a widely used CPOE system actually facilitated 22 types of medication error risks. This study recommended takes further steps to focus

[4] National Alliance for Health Information Technology: What is interoperability? Available online at http://www.nahit.org/cms/

primarily on the organization of work, not only technology and to forcefully examine the technology in use.

In summary, these studies did not negate the potential of using HIT to facilitate the quality improvement. Instead, they pointed out an vital truth that, without developing evidence-based method and educating staffs, HIT applications would not guarantee improved care (i.e., it could actually foster errors in some way), which may seriously bring our attentions to something other than just focus on adopting the HIT.

2.7 THE NATIONAL HEALTH INFORMATION INFRASTRUCTURE

The National Health Information Infrastructure (NHII) was a concept proposed in a 2003 consensus conference (Yasnoff, et al., 2004). It is also an initiative in progress that involves clinical information systems and HIT applications throughout the entire health care continuum (NCVHS Work Group on National Health Information Infrastructure, 1998). This concept consists of several functions and model capabilities, which require a fair amount of input from stakeholders. In addition, the NCVHS Work Group (1998) suggested four systems to be done in the future: (a) population-based data, (b) computer-based health records, (c) knowledge management and decision support, and (d) telemedicine.

To pull all HIT components in the picture, Kaushal et al. (2005) estimated a five years functional capabilities of a model national health information network (NHIN). They concluded that it would cost $156 billion in capital investment over 5 years and $48 billion in annual operating costs. They also suggested that the current functionality of a model NHIN remains

unsustainable where financial constraints exist and lack of widespread standards (Kaushal, et al., 2005).

Moreover, the LTC sector has also evaluated its association with NHII (Harris, Chute, Harvell, White, & Moore, 2003). The report concluded that the most significant challenges in achieving NHII remain "the lack of standards to permit the interoperability among computerized systems". It also suggested future efforts to develop payment and quality monitoring methods to be consistent with the NHII.

2.8 CONCLUSIONS

The current HIT in health care is still under developing. Several interoperable standards and applications are available for use; however, it would take time for every facility to adopt these technologies and most importantly to make sure that the interoperability issue can be attained. In the mean time, nursing home providers have faced an urgent need for HIT to meet the state and federal requirements. These requirements can include but not limited to the submission of MDS information. In our review regarding HIT adoptions, the answers to what is the prevalence of HIT adoptions in nursing home are under debate but believed to be low. For nursing homes to adopt HIT, it would need to know what types of HIT should be developed, how many HIT applications or features that are currently available, and are able to interoperate with those in other health care area. To address these issues, it would definitely need more inputs from future research.

In order to develop nursing homes' HIT, several stakeholders have teamed up to facilitate the development of standards. For example, two recent reports reviewed the use and need for

HIT in nursing homes based on the available literatures and multiple stakeholder discussions (The University of Colorado at Denver, 2007a, 2007b). This report was aimed to harmonize the available standards by mapping the current taxonomies used by nursing homes.

In addition, the Certification Commission for Healthcare Information Technology (CCHIT) founded by the U.S. Department of Health and Human Services (HHS) has begun specifying certification criteria for nursing home EHRs (Harvell, Dougherty, Lake, & Mitchell, 2008). The goal for their work was to develop a conformant profile of LTC HIT. The actual certification for LTC HIT would be coming in 2010 (Harvell, et al., 2008).

In view of the future LTC HIT reform, it should also take into account the Medicare and Medicaid needs for data submission so that the state level data requirements could be linked to nursing homes information. Finally, more business models would be needed to demonstrate whether the state-level health information exchange would be sustainable.

3.0 HEALTH INFORMATION TECHNOLOGY IN NURSING HOMES

3.1 ABSTRACT

This study describes nursing homes' use of Minimum Data Set (MDS) software and identifies the features that are available in the most commonly used software packages. Data came from the On-line Survey, Certification and Reporting (OSCAR) system and a national survey of nursing home administrators (n=2,899) conducted in 2005. The result shows that 2,397 (82.7%) of nursing homes used third party MDS software and that more than 85% of those facilities purchased the software from one of five vendors. Advanced features in the software were available to most (87-98%) of the facilities; however, most of these features were not being used all the time. The findings are instructive in showing the use of health information technology in nursing homes. Nursing homes are often viewed as technologically impaired. It would seem like, with respect to MDS software at least, that many nursing homes are using quite advanced health information technology.

3.2 BACKGROUND

Information technology (IT) has significant potential to reduce error and improve the quality and efficiency of health care (Bates, et al., 2001; IOM, 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 (Wald & Shojania, 2001). Since October 1998, all state licensed nursing homes have been required to electronically transmit data generated by the Federally mandated Resident Assessment Instrument (RAI) via state public health agencies to the Centers for Medicare and Medicaid Services (CMS) (Mor, Berg, et al., 2003). The data resulting from the RAI are referred to as the Minimum Data Set (MDS). Because of this requirement, a market has developed to sell software to nursing homes to manage their MDS automation needs. These systems offer a range of features beyond basic compliance. There is little empirical research on the use of such advanced software by nursing homes. We therefore examined, in a nationally representative sample, the prevalence of commercial MDS automation software, the range of features available, and whether nursing homes report actually using advanced features beyond those required for compliance with federal reporting.

Examining MDS automation systems is important, as these systems have the potential to influence resident care in the nursing home. Most MDS automation software on the market offers a variety of features beyond data entry and transmission. These systems are intended to help facilities support their care processes, offer some efficiencies in meeting multiple reporting requirements, and improve reimbursement (Berger, 2006). That is, there is a great deal of information about residents that can be captured in an electronic format, and could subsequently

be used in resident care processes (Wunderlich & Kohler, 2001). There is great potential for advanced Health Information Technology (HIT) features that are integrated with MDS systems to enhance the administrator's ability to manage the facility, track quality, and monitor multiple performance indicators.

3.3 OVERVIEW OF HIT IN NURSING HOMES

HIT is used to collect, store, retrieve, and transfer clinical, administrative, and financial health information electronically (GAO, 2004). The IOM publication *To Err is Human* drew attention to the potential for HIT to improve quality of care and prevent medical errors across the health care system (IOM, 2000). The focus of HIT development and implementation has been mainly on acute and ambulatory care settings (American Health Information and Management Association, 2005; Hamilton, 2006; Kramer, et al., 2004). Commonly found HIT systems provide Computerized Physician Order Entry (CPOE), Electronic Health Records (EHR), or Point of Care (POC) to access data for entry and retrieval (e.g., reviewing records, entering orders at the bedside or in the examination room) (Hamilton, 2006). In addition, electronic systems for management operations such as patient scheduling and reimbursement have been available for longer and are used frequently (American Health Information and Management Association, 2005; Baron, Fabens, Schiffman, & Wolf, 2005; Poon, et al., 2006). EHR is an electronic formatting of medical records documenting patient's medical history, written orders, and progress notes. CPOE is a system making information available for physicians at the time an order is entered (Bates, et al., 1998; Bates, et al., 1999). POC is a technology automating care

provider's procedure, visit notes, and educational materials at the point of care (Anderson & Wittwer, 2004).

Although the implementation of HIT in the long-term care (LTC) sector is recognized to be lagging behind the acute and ambulatory settings (American Health Information and Management Association, 2005; Hamilton, 2006), there is a wide range of software products available for nursing homes. These products offer a range of functions covering different domains such as financial management, administration, ancillary care, support, and resident care (McKnight's LTC News, 2005). In this research, we focus on products for resident care (i.e., MDS automation systems).

3.4 CONCEPTUAL FRAMEWORK

We developed a conceptual framework (shown in Figure 1) to represent the overlap among the many specific product functions that are available in the market, the more idealized goals of HIT, and the reporting requirements that nursing homes currently face. This conceptual framework was developed from our review of the literature.

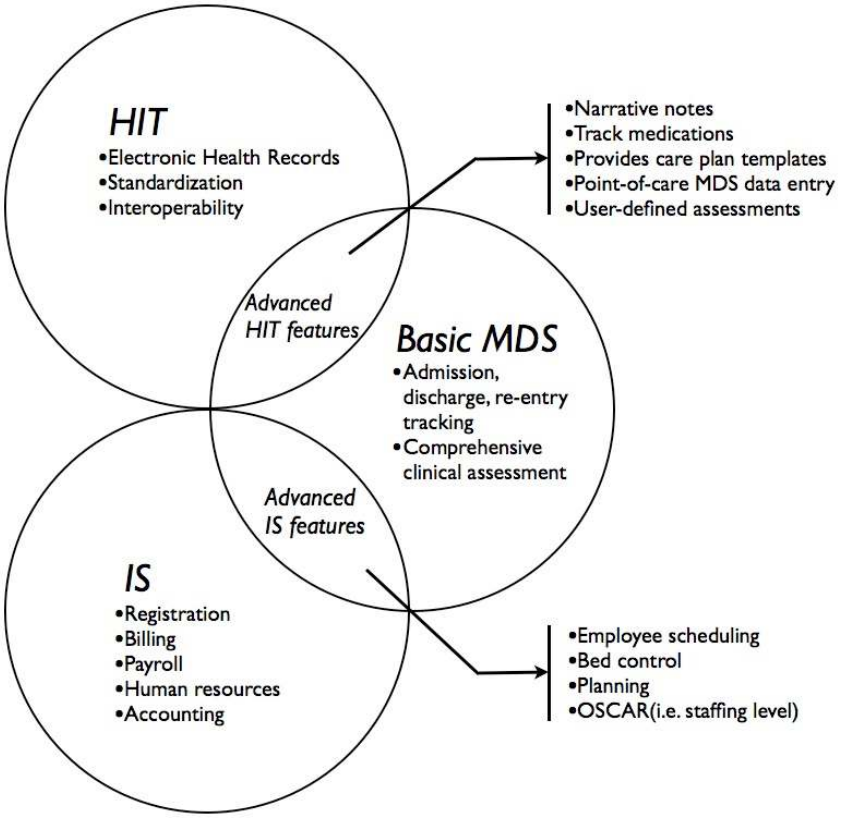


Figure 1 Conceptual Framework for Health Information Technology in Nursing Homes

Note. HIT=health information technology; IS=information system; MDS=Minimum Data Set; OSCAR=On-line Survey, Certification and Reporting.

We define basic information system (IS) functions as those relating to management and operations, human resources, payroll, and accounting. These functions are required of any firm, and computerized solutions for these tasks have been available for many years. In LTC sector, as with other categories of health care providers, some essential business functions depend on information about the overall number of residents and the number of residents in specific categories (i.e., age, gender, and level of need). This information is used for reimbursement, bed assignments, and to make decisions about staff assignment, recruitment, and need for agency staff (i.e., maintaining proper staffing ratios requires up-to-date information about occupancy). Using such a system, the basic information about nursing home operational and resident

characteristics reported to CMS (Centers for Medicare & Medicaid Services, 2007) can be automated.

HIT features, by contrast, are essentially clinical in nature. Features such as Medical Administration Records, EHRs, and narrative notes can be computerized to reduce redundant paperwork and implement quality improvement strategies and clinical practice guidelines (e.g., screening for potentially harmful drug interactions, fall prevention). Any such system must include or be integrated with a database that tracks admissions and discharges (and readmissions of former residents). Thus, an HIT system overlaps with basic MDS functionality. The MDS requires an assessment at admission, discharge and reentry, thus providing a resident census at any given time. The main contrast with the MDS is that most HIT systems are predicated on continuous or real-time data collection, whereas most MDS data is collected approximately every 90 days (with the exceptions of assessments for the Medicare Prospective Payment System and any corrections and significant changes in resident status). Nevertheless, most HIT features imply greater interaction with electronic record keeping than the current MDS system.

There are two overlapping areas in Figure 1. First, we defined the features within the area where HIT overlaps with MDS as “advanced HIT features”. These features were found in most commercial MDS systems and were also found to be associated with resident care (McKnight’s LTC News, 2005). These features are also part of EHRs (Stead, Kelly, & Kolodner, 2005). Thus, before fully implementing HIT, the advanced HIT features provided in commercial MDS systems can be an intermediate step toward the implementation of HIT.

Second, the overlapping area between the conventional IS and an MDS system was defined as features that were not associated with direct resident care but was related to daily management. These features can be included in both the facility’s IS and the commercial MDS

systems. For example, a nursing home may already have its own information system to facilitate registration, billing, payroll, and so on, or it may purchase commercial MDS software that comes with a variety of these IT features.

3.5 MDS AUTOMATION SOFTWARE

There are two ways to obtain software for conducting the RAI and transmitting the MDS to CMS. Nursing homes can either download a free program, RAVEN, from the CMS website, or purchase a commercial product. The free software has only basic functions for data entry and reporting, whereas commercial software products offer a wide range of advanced features such as billing, physician and nurse order entry, care planning, incident assessment and quality improvement (McKnight's LTC News, 2005). Commercial software products must be certified to meet the data reporting requirements (e.g., record length, proper use of text and numeric characters).

The decision to purchase and use a commercial MDS product can be seen as either a way to meet the requirements for electronic data submission or as part of a larger IT strategy that encompasses IS and HIT. These decisions may depend on considerations such as staffing levels and knowledge about IS (Nahm, Mills, & Feege, 2006; Ossip-Klein, et al., 2002) and compatibility issues (Wolff & Sydor, 1999). An electronic system for nursing notes must meet state and federal regulatory requirements for proper record keeping (Zuber, 2002). The consequences of violating those requirements can include severe financial penalties, thus presenting a barrier to implementation.

Most MDS software on the market offers a variety of features beyond data entry and transmission. These systems are intended to help facilities support their care processes, offer some efficiencies in meeting multiple reporting requirements, and improve reimbursement (Berger, 2006). There is a great deal of information about residents that could be captured in an electronic format and integrated into the care process (Wunderlich & Kohler, 2001). Thus, there is great potential for advanced HIT features that are integrated with MDS systems to enhance the administrator's ability to manage the facility, track quality, and monitor multiple performance indicators.

We therefore report the first-ever national descriptive data on the availability and use of advanced HIT features in MDS software. The objectives of this study were to examine: (a) how many nursing homes use commercial MDS software, (b) the prevalence of selected advanced HIT features, and (c) how often nursing home administrators report using these advanced HIT features.

3.6 METHODS

3.6.1 Data Sources

This study draws on two datasets, (a) the National Nursing Home Staffing Survey (NNHSS) and (b) the Online Survey, Certification, and Reporting (OSCAR), both from 2004. NNHSS was conducted to collect data on facility characteristics such as staffing and the use of advanced HIT features. The OSCAR data were used for basic facility descriptive information.

3.6.2 Sampling and Procedure

The mailing information for the nursing homes came from the OSCAR (further described below). During the spring of 2005, the survey was mailed to 4,000 nursing home administrators, and 2,899 were returned in usable form (representing 72% of the original sample). We also retained the OSCAR facility ID number so that we could examine facility characteristics of the sample. Small nursing homes (<30 beds) were excluded from the sample because their measured staffing characteristics would have a low signal-to-noise ratio.

The facility sample frame was based on county unemployment rates. This was because, in prior data-collection initiatives, facilities with variation in staffing characteristics were obtained using this approach. As the name of the survey suggests, the primary goal of this survey was to collect staffing information, thus the use of county unemployment rates. The questions examining nursing homes' experiences on the use of MDS software were included as an additional section of the survey.

The average unemployment rate in 2004 as reported by the Bureau of Labor Statistics was used as a source of information on unemployment rates. That is, all nursing homes in the United States were divided into market areas with low, medium, and high unemployment rates. The bottom 10% tail of the unemployment distribution (< 3.7% unemployment) was defined as low, the top 10% tail (> 8.0% unemployment) was defined as high, and the middle 80% was defined as medium unemployment. We randomly chose a third of the sample (i.e., 1,333 nursing homes) from each of these unemployment categories. Facility response rates were very similar for each of these unemployment categories, and nursing homes from all U.S. states were included in the final sample.

3.6.3 Survey Development

The first part of this survey included administrator characteristics (e.g., age, gender, education, minority, tenure, and professional membership) and facility staffing characteristics (e.g., staffing levels, turnover, and stability of nurse staffing). For example, we asked questions about the administrator (e.g., gender, education, and age) and how long he or she had been a nursing home administrator and whether he or she was a member of a professional society or organization. We also included questions regarding the number of full-time equivalent (FTE) nurses (e.g., nurse aide, registered nurses, and licensed practical nurses) in the survey.

There is no published literature examining nursing homes' experiences on the use of MDS software. We reviewed trade magazines for guidance and to develop survey questions and found a national poll of software vendors (McKnight's LTC News, 2004). The results of this poll showed extensive information of vendors' products. For example, among the 60 vendors in 2000, about 84% of them offered resident care applications, 86% offered administration applications, and 75% offered financial applications (McKnight's LTC News, 2000). For our study, we used categories from this prior poll. However, we mainly targeted "resident care" features, because this category of IT features is considered to be more relevant to quality of care.

Thus, in the second section of our questionnaire, we asked, "what software do you use for MDS (i.e., Manufacturer and product name)?" Next, two questions were asked for each of 12 different features: (a) "does your MDS software have any of the following features?" (i.e., yes or no). (b) "For each please circle how much the feature is currently used" (i.e., using a displayed score with labels from 1 to 10 and text labels assigned only to both ends; 1= *not at all*, 10=*all the time*). The full set of features is shown in Table 2 (below).

3.6.4 OSCAR

The OSCAR data come from the Medicare or Medicaid certification process conducted by the state licensure and certification agencies. These data include almost all (i.e., 97%) nursing homes in the United States. In 2004, approximately 17,000 nursing homes nationwide were included in the data. There are several hundred data elements in the OSCAR, although only data pertaining to characteristics of the facility were used in this investigation, including factors such as chain membership, occupancy rate, and ownership (Wunderlich & Kohler, 2001). These are considered to be the most reliable data elements in the OSCAR (Straker, 1999).

We examined the facility characteristics from the OSCAR data to ensure our sampled data were nationally representative. The data were also used to examine whether facility characteristics were associated with the use of MDS software. This follows the premise of many other studies that have pointed out that facility characteristics are often associated with facility operations and quality of nursing home care (Carter & Porell, 2003; Harrington, 2005). The characteristics we examined were (a) bed size (Banaszak-Holl, Zinn, & Mor, 1996; Harrington, Zimmerman, Karon, Robinson, & Beutel, 2000; O'Neill, Harrington, Kitchener, & Saliba, 2003), (b) ownership status (i.e., for-profit or not for-profit ownership; (Harrington, Woolhandler, Mullan, Carrillo, & Himmelstein, 2001; O'Neill, et al., 2003), (c) chain affiliation (Castle, 2001), (d) Medicaid occupancy (Harrington, et al., 2000), and (e) occupancy rate (Donoghue, 2006).

In addition, we examined two market characteristics. Market characteristics may also be associated with facility operations and quality of nursing home care (Carter & Porell, 2003; Harrington, 2005). We examined two characteristics. First, we examined the Herfindahl index, which is a measure of competition. It was defined as the sum of squared market shares of all nursing homes competing in the same area (i.e., county). A higher value for a nursing home

indicates it was operating in a less competitive market (Banaszak-Holl, et al., 1996). Second, we examined certificate of need (O'Neill, et al., 2003).

3.6.5 Analysis

Descriptive statistics are provided for the sample of nursing homes, including facility characteristics (e.g., number of beds, occupancy rate, etc.), staffing characteristics (e.g., FTE agency, nurse aides, registered nurses, and licensed practical nurses per 100 residents), and market characteristics (e.g., competition). *t* tests were used to examine any differences between the nursing homes having commercial MDS systems and those not having these systems.

Descriptive statistics are also provided for the availability, use, and frequency of use of features in commercial MDS software packages. This information is provided for a total of 12 features.

To explore the association between facility and market characteristics and the use (i.e., "all the time use", vs. "sometime use") of HIT features in MDS software, we used *t* tests for the variables with continuous scales (e.g., Herfindahl index, occupancy, number of citations). For the categorical variables (e.g., size of beds, chain, ownership, certificate of need), chi-squire tests were used to examine the associations. It should be noted that the original scale for the bed size (i.e., number of beds) was continuous; however, for these comparisons, we divided them into four groups (to do so, we used the same cut points presented in the NNHS). For parsimony, we do not present any findings for the staffing characteristics, as few significant findings were identified.

In addition, we first present a pie chart to display the most frequently used software packages purchased by the surveyed nursing homes. Second, a histogram was used to display the

details of the frequency of use (e.g., *not at all, less or greater than half of the time, and all the time*) for each HIT feature.

3.7 RESULTS

Table 3-1 shows descriptive data on the nursing home sample separated by the purchasing status of commercial MDS system (i.e., *yes or no*). A total of 2,397 (82.7%) nursing homes had purchased MDS software for transmitting MDS information, whereas 502 (17.3%) nursing homes had not purchased any systems from vendors. Comparing those who had commercial systems to those who did not have such a system, we find the Herfindahl index, number of deficiency citations, certificate of need, and all four staffing characteristics to be significantly different ($p>.05$). That is, having certificate of need, a lower Herfindahl index, lower staffing levels, and lower number of deficiency citations were associated with having commercial MDS software.

Figure 2 shows a pie chart of the five most frequently used MDS packages. The five most frequently used MDS packages accounted for 86% of all facilities in our sample. The most commonly used software package was from American Health Tech Inc. (29%). It is noteworthy that 68.6% of respondents reported their MDS software included all 12 features of interest, whereas 18.2% reported 11 features, 4.9% reported 10 features, and 8.3% reported 9 or fewer features (results not shown).

Table 3-2 shows the availability of advanced features and the frequency of use of each feature in commercial MDS software. In general, all of the surveyed administrators reported a high percentage of feature availability (ranging from 87.5 to 98.6%). For availability, the most

common feature was “lists MDS assessments due or incomplete” (98.6%), while the least common feature was “tracks all medications and orders” (87.5%). The financial management feature was among the least-common features (88.8%).

Table 3-2 also shows most features were reported with a high percentage (more than 90%) of any use, except for “progress notes,” which was reported as the least-used feature (68.1%), followed by “accident and incident assessment” (73.7%) and “integrated with financial management system” (88.3%). We also present the frequency of all-the-time use (with the scores of 10) and sometime use (with the scores of 2 to 9). It is noteworthy that “providers suggested care plan templates for clinical issues” and “providers suggested care plan templates for behavioral issues” were the only two features for which the proportion reporting “all the time” exceeded “sometime”.

Table 3-1 Descriptive Statistics of Facility, Staffing, and Market Characteristics of Nursing Homes and MDS Software

Had commercial MDS software system	**Full Sample**	**YES** N=2397 (82.7%)	**NO** N=502 (17.3%)	***p-value***
Facility Characteristics				
Number of beds	118.9 (67.9)[a]	118.6 (71.3)	120.3 (49.0)	.61
Occupancy rate	86.2%[b]	86.0%	87.3%	.07
Medicaid census	65.9%	65.6%	67.2%	.15
Affiliation (Chain)	44.1%[c]	43.7%	45.8%	.77
Ownership (Non-profit)	16.1%[d]	15.6%	18.5%	.11
Number of deficiency citations	4.1 (2.2)	3.9 (2.1)	5.0 (2.3)	.00
Staffing Characteristics				
FTE agency NAs per 100 residents	6.9 (7.7)	4.9 (.07)	16.5 (.58)	.00
FTE NAs per 100 residents	32.6 (11.8)	31.8 (10.5)	36.6 (4.7)	.00
FTE LPNs per 100 residents	20.8 (4.5)	20.6 (4.5)	21.8 (4.1)	.00
FTE RNs per 100 residents	18.6 (5.0)	17.9 (4.9)	21.9 (3.6)	.00
Market Characteristics				
Herfindahl index[§]	2135.1 (2240.1)	2001.3 (2165.8)	2773.8 (2469.7)	.00
Certificate of Need	75.0%	78.8%	56.6%	.00

Note. N=2899 [§]The range of the Herfindahl index for having commercial software is 42.1 to 10000 and for not having commercial is 42.5 to 10000. This table displayed %, Mean (S.D.), and p-value. (a) NA = Nurse Aide; RN = Registered Nurse; LPN = Licensed Practical Nurse; FTE = Full time-equivalent. (b) Statistics presented come from the analytic file consisting of 2,648 facilities and 1,212 markets. (c) a) The National Nursing Home Survey (NNHS) reported a value of 107.6; b) The NNHS reported a value of 86.3; c) The NNHS reported a value of 54.2; d) The NNHS reported a value of 38.5. Please be noted that, because the metrics used for the staffing variables were defined differently, we are unable to compare the staffing characteristics of the NNHS with our data.
(SOURCE: http://www.cdc.gov/nchs/data/nnhsd/nursinghomefacilities2006.pdf)

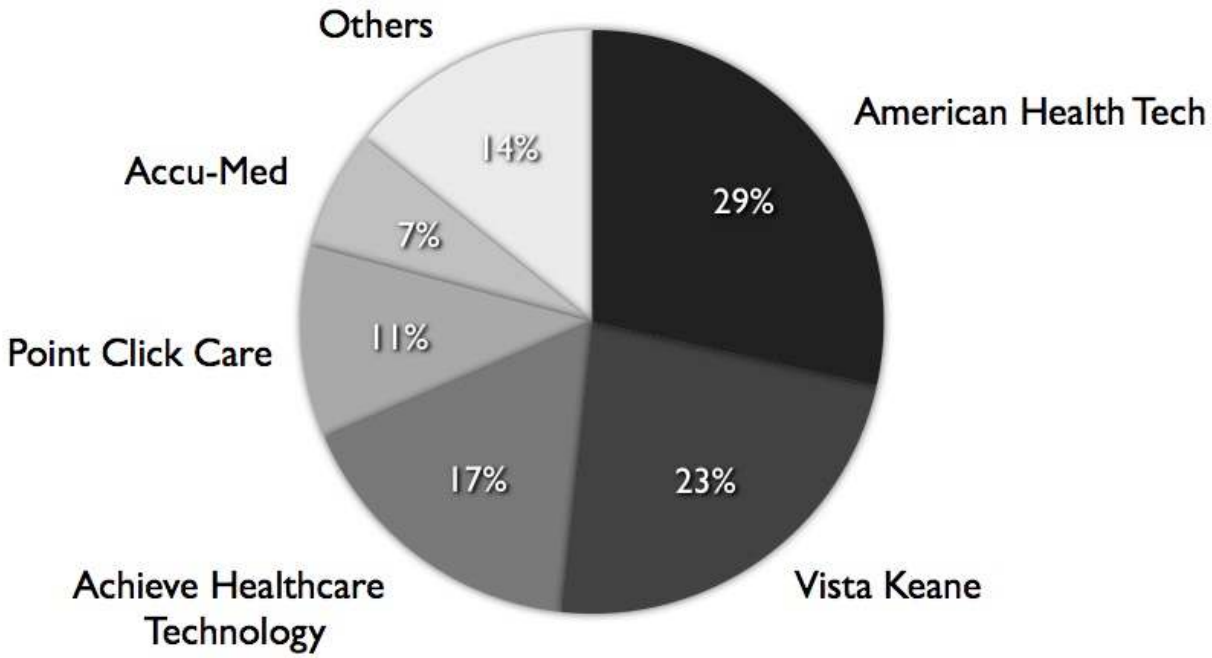


Figure 2 Most Frequently Used Minimum Data Set Software Packages by Surveyed Nursing Homes

Note. The survey questions include the manufacturer and product name of the commercial Minimum Data Set system they purchased. There were 1878 nursing homes available for this analysis.

Table 3-2 Availability, Use, and Frequency of Use of Each Advanced Feature in Commercial MDS Systems

	Availability	Any Use	Frequency of Use	
Feature	n (%)	n (%)	All the time n (%)	Some time n (%)
1.Lists MDS assessments due or incomplete	2364 (98.6)	2193 (92.8)	913 (41.6)	1280 (58.4)
2.Allows user defined assessments	2238 (93.4)	2170 (97.0)	772 (35.6)	1398 (64.4)
3.Resident Assessment Protocols (RAPs)	2224 (92.8)	2179 (98.0)	1045 (48.0)	1134 (52.0)
4.Providers suggested care plan templates for clinical issues	2264 (94.5)	2191 (96.7)	1223 (55.8)	968 (44.2)
5.Providers suggested care plan templates for behavioral issues	2264 (94.5)	2194 (96.9)	1143 (52.1)	1051 (47.9)
6.Tracks target and resolve dates for each need, goal, and approach	2125 (88.7)	2026 (95.3)	650 (32.1)	1376 (67.9)
7.Tracks all medications and orders	2098 (87.5)	1928 (91.9)	584 (30.3)	1344 (69.7)
8.Progress notes	2166 (90.4)	1476 (68.1)	552 (37.4)	924 (62.6)
9.Integrated with financial management system	2129 (88.8)	1880 (88.3)	564 (30.0)	1316 (70.0)
10.Quality improvement/ quality assurance (computes quality indicators)	2174 (90.7)	2074 (95.4)	658 (31.7)	1416 (68.3)
11.Tracks facility trends for QI/QA	2174 (90.7)	2102 (96.7)	708 (33.7)	1394 (66.3)
12.Accident and incident assessment	2135 (89.1)	1574 (73.7)	236 (15.0)	1338 (85.0)

Note. N=2397. 2397 out of 2899 responded nursing homes (82.7%) indicating that they had purchased third party MDS software. The figures displayed in this table were based on the prior number in the order of *available, use, frequency*, respectively. For example, among 2397 nursing homes, 2364 (98.6%) indicated their software including a feature of "Lists MDS assessments due or incomplete", while 2193 (92.8%) of those who indicated such feature available had actual use of it. 773 (35.6%) indicated they used it "all the time".
MDS= Minimum Data Set

Table 3-3 shows the 12 surveyed HIT features by seven facility characteristics. For each feature, we examined the facility characteristics by the frequency of use defined as (a) all-the-time use (score = 10) or (b) sometime use (score = 2 to 9). We divided the frequency of use into these two groups because the reported scores were not evenly distributed, with many respondents reporting "all-the-time use" (i.e., scores of 10). The distribution of scores can be seen in Figure 3. This distribution pattern applied to all 12 HIT features. The significance tests show many facility characteristics had significant associations with the frequency of use of HIT features. For example, the chi-square tests show significant associations between five of the HIT features and bed size and between six of the HIT features and chain status. In addition, the *t* tests show significant associations between nine of the HIT features and the Herfindahl index (a measure of competition) and seven of the HIT features and occupancy rate. However, there were no significant differences between number of citations and frequency of use.

Figure 3 shows the frequency with which respondents reported using each feature in their MDS software package. The frequency of use was grouped into four categories: (a) *not at all*, (b) *less than half of the time*, (c) *more than half of the time*, and (d) *all the time* (with the scores of 1, 2 to 5, 6 to 9, and 10, respectively). As can be seen, "progress notes" and "accident and incident assessment" were the only two features for which the proportion of respondents reporting "not at all" exceeded "all the time." "Provides suggested care plan templates for clinical issues" and "for behavioral issues" were used all the time by 55% and 51% of the respondents, respectively. Financial management has long been considered an important aspect of day-to-day management in nursing homes (Poon, et al., 2006). Our study shows more than three fourths of the facilities (78.3%) reported using the feature integrated with a financial management system more than half of the time (i.e. with a frequency of 6 to 10), and one fourth of them (26.5%) reported "all the

time" use. Overall, more than 80% of facilities reported "more than half of the time" use (with a score of 6 to 10) on eight HIT features.

Table 3-3 Facility Characteristic by Frequency of Use of Each Advanced Feature in Commercial MDS Systems

Feature	Freq. of use	N	Size (Number of Beds) 30-49 N (%)	50-99 N (%)	100-199 N (%)	>200 N (%)	*P value*	Medicaid census N (%)	*P value*	Chain N (%)	*P value*
Lists MDS assessments due or incomplete	A	913	36 (3.9)	267 (29.2)	554 (60.7)	56 (6.1)	.000***	66.4 (21.7)	.478	376 (41.2)	.095
	S	1280	71 (5.5)	506 (39.5)	635 (49.6)	68 (5.3)		65.7 (23.1)		573 (44.8)	
Allows user defined assessments	A	772	30 (3.9)	276 (35.8)	418 (54.2)	48 (6.2)	.432	66.6 (22.2)	.408	320 (41.5)	.143
	S	1398	74 (5.3)	482 (34.5)	765 (54.7)	77 (5.5)		65.8 (22.5)		625 (44.7)	
Resident Assessment Protocols (RAPs)	A	1045	49 (4.7)	324 (31.0)	606 (58.0)	66 (6.3)	.000***	66.2 (21.9)	.543	426 (40.8)	.017*
	S	1134	56 (4.9)	447 (39.4)	575 (50.7)	56 (4.9)		65.7 (23.1)		520 (45.9)	
Providers suggested care plan templates for clinical issues	A	1223	46 (3.8)	345 (28.2)	754 (61.7)	78 (6.4)	.000***	65.4 (22.0)	.232	523 (42.8)	.696
	S	968	61 (6.3)	425 (43.9)	436 (45.0)	46 (4.8)		66.6 (23.3)		422 (43.6)	
Providers suggested care plan templates for behavioral issues	A	1143	38 (3.3)	318 (27.8)	714 (62.5)	73 (6.4)	.000***	64.8 (22.6)	.016*	458 (40.1)	.004**
	S	1051	69 (6.6)	452 (43.0)	479 (45.6)	51 (4.9)		67.2 (22.4)		485 (46.2)	
Tracks target and resolve dates for each need, goal, and approach	A	650	23 (3.5)	229 (35.2)	363 (55.9)	35 (5.4)	.225	66.2 (22.6)	.922	259 (39.9)	.032*
	S	1376	77 (5.6)	487 (35.4)	734 (53.3)	78 (5.7)		66.1 (22.6)		618 (44.9)	
Tracks all medications and orders	A	584	24 (4.1)	188 (32.2)	326 (55.8)	46 (7.9)	.007**	66.9 (22.2)	.599	261 (44.7)	.593
	S	1344	67 (5.0)	490 (36.9)	721 (53.7)	60 (4.5)		66.3 (22.2)		583 (43.4)	
Progress notes	A	552	25 (4.5)	168 (30.4)	323 (58.5)	36 (6.5)	.219	65.9 (22.2)	.257	244 (44.2)	.504
	S	924	43 (4.7)	329 (35.6)	493 (53.4)	59 (6.4)		67.3 (22.2)		392 (42.4)	
Integrated with financial management system	A	564	19 (3.4)	188 (33.3)	321 (56.9)	36 (6.4)	.280	65.1 (23.3)	.261	225 (39.9)	.028*
	S	1316	62 (4.7)	476 (36.2)	705 (53.6)	73 (5.6)		66.4 (22.0)		597 (45.4)	
Quality improvement/ quality assurance (computes quality indicators)	A	658	24 (3.7)	226 (34.4)	371 (56.4)	37 (5.6)	.239	66.1 (23.2)	.979	269 (40.9)	.123
	S	1416	77 (5.4)	509 (36.0)	751 (53.0)	79 (5.6)		66.1(22.2)		630 (44.5)	
Tracks facility trends for QI/QA	A	708	27 (3.8)	238 (33.6)	407 (57.5)	36 (5.1)	.100	66.5 (22.4)	.597	274 (38.7)	.003**
	S	1394	73 (5.2)	513 (36.8)	727 (52.2)	81 (5.8)		65.9 (22.4)		635 (45.6)	
Accident and incident assessment	A	236	15 (6.4)	73 (31.0)	133 (56.4)	15 (6.4)	.332	66.1 (25.5)	.990	91 (38.6)	.047*
	S	1338	67 (5.0)	492 (36.8)	707 (52.8)	72 (5.4)		66.1 (22.0)		609 (45.5)	

Note. Group A indicating the frequency of "all the time use" with scores=10, while Group B indicating the frequency of "some time use" with scores=2 to 9. QI=Quality Improvement; QA=Quality Assurance. *Significant at $p \leq .05$; **significant at $p \leq .01$; ***significant at $p \leq .001$

Table 3-3 (Continued)

Feature	Freq. of use	N	Ownership			Occupancy		Number of Citations		Certificate of Need		Herfindahl Index	
			Nonprofit N (%)	For Profit N (%)	*P value*	Mean (S.D.)	*P value*	Mean (S.D.)	*P value*	N (%)	*P value*	Mean (S.D.)	*P value*
Lists MDS assessments due or incomplete	A	913	155 (17.0)	758 (83.0)	.029*	85.2 (15.9)	.123	4.0 (2.0)	.160	728 (79.7)	.575	2319.3 (2216.6)	.000***
	S	1280	174 (13.6)	1106 (86.4)		86.2 (13.5)		3.8 (2.1)		1008 (78.8)		1803.2 (2092.0)	
Allows user defined assessments	A	772	116 (15.0)	656 (85.0)	.967	84.0 (17.1)	.000***	3.8 (2.0)	.209	624 (80.8)	.181	2342.2 (2306.5)	.000***
	S	1398	211 (15.1)	1187 (84.9)		86.7 (13.0)		3.9 (2.1)		1096 (78.4)		1841.0 (2055.6)	
Resident Assessment Protocols (RAPs)	A	1045	156 (14.9)	889 (85.1)	.967	85.4 (15.9)	.231	3.8 (2.0)	.279	840 (80.4)	.179	2199.7 (2229.5)	.000***
	S	1134	170 (15.0)	964 (85.0)		86.2 (13.2)		3.9 (2.1)		855 (78.0)		1842.8 (2079.4)	
Providers suggested care plan templates for clinical issues	A	1223	200 (16.4)	1023 (83.6)	.078	85.6 (15.3)	.430	3.9 (2.1)	.754	961 (78.6)	.465	2058.8 (2080.8)	.291
	S	968	132 (13.6)	836 (86.4)		86.1 (13.6)		3.9 (2.1)		773 (80.0)		1960.9 (2251.8)	
Providers suggested care plan templates for behavioral issues	A	1143	184 (16.1)	959 (83.9)	.188	85.4 (16.0)	.172	3.9 (2.1)	.931	905 (79.2)	.963	2187.5 (2102.4)	.000***
	S	1051	148 (14.1)	903 (85.9)		86.3 (12.9)		3.9 (2.1)		833 (79.3)		1838.0 (2202.6)	
Tracks target and resolve dates for each need, goal, and approach	A	650	94 (14.5)	556 (85.5)	.523	83.9 (17.1)	.000***	3.8 (2.0)	.123	520 (80.0)	.656	2399.5 (2228.0)	.000***
	S	1376	214 (15.6)	1162 (84.5)		86.6 (13.2)		3.9 (2.1)		1089 (79.1)		1870.5 (2127.3)	
Tracks all medications and orders	A	584	92 (15.8)	492 (84.3)	.508	85.1 (16.1)	.016*	3.8 (2.1)	.689	458 (78.4)	.659	1994.4 (2115.5)	.838
	S	1344	196 (14.6)	1148 (85.4)		86.7 (12.7)		3.9 (2.1)		1066 (79.3)		1972.8 (2130.4)	
Progress notes	A	552	84 (15.2)	468 (84.8)	.568	86.0 (14.7)	.710	3.9 (2.0)	.933	428 (77.5)	.243	1973.7 (2012.8)	.473
	S	924	151 (16.3)	773 (83.7)		86.2 (13.6)		3.9 (2.2)		740 (80.1)		1892.9 (2135.3)	
Integrated with financial management system	A	564	95 (16.8)	469 (83.6)	.168	83.2 (18.5)	.000***	3.9 (2.0)	.654	464 (82.3)	.045*	2420.4 (2258.0)	.000***
	S	1316	189 (14.4)	1127 (85.6)		86.8 (13.0)		3.9 (2.1)		1029 (78.2)		1873.5 (2099.7)	
Quality improvement/ quality assurance (computes quality indicators)	A	658	101 (15.4)	557 (84.6)	.602	83.4 (18.4)	.000***	3.9 (2.0)	.918	536 (81.5)	.100	2403.7 (2314.2)	.000***
	S	1416	205 (14.5)	1211 (85.5)		86.7 (12.5)		3.9 (2.1)		1109 (78.3)		1867.6 (2086.1)	
Tracks facility trends for QI/QA	A	708	104 (14.7)	604 (85.3)	.853	83.8 (17.6)	.000***	3.8 (2.0)	.464	572 (80.8)	.203	2478.2 (2314.7)	.000***
	S	1394	209 (15.0)	1185 (85.0)		86.8 (12.8)		3.9 (2.1)		1093 (78.4)		1788.7 (2038.0)	
Accident and incident assessment	A	236	34 (14.4)	202 (85.6)	.829	83.0 (17.0)	.000***	3.9 (2.0)	.603	186 (78.8)	.867	2144.3 (2175.9)	.019*
	S	1338	200 (15.0)	1138 (85.1)		86.9 (13.0)		3.8 (2.1)		1048 (78.3)		1796.8 (2088.6)	

Note. Group A indicating the frequency of "all the time use" with scores=10, while Group B indicating the frequency of "some time use" with scores=2 to 9. QI=Quality Improvement; QA=Quality Assurance. *Significant at $p \leq .05$; **significant at $p \leq .01$; ***significant at $p \leq .001$

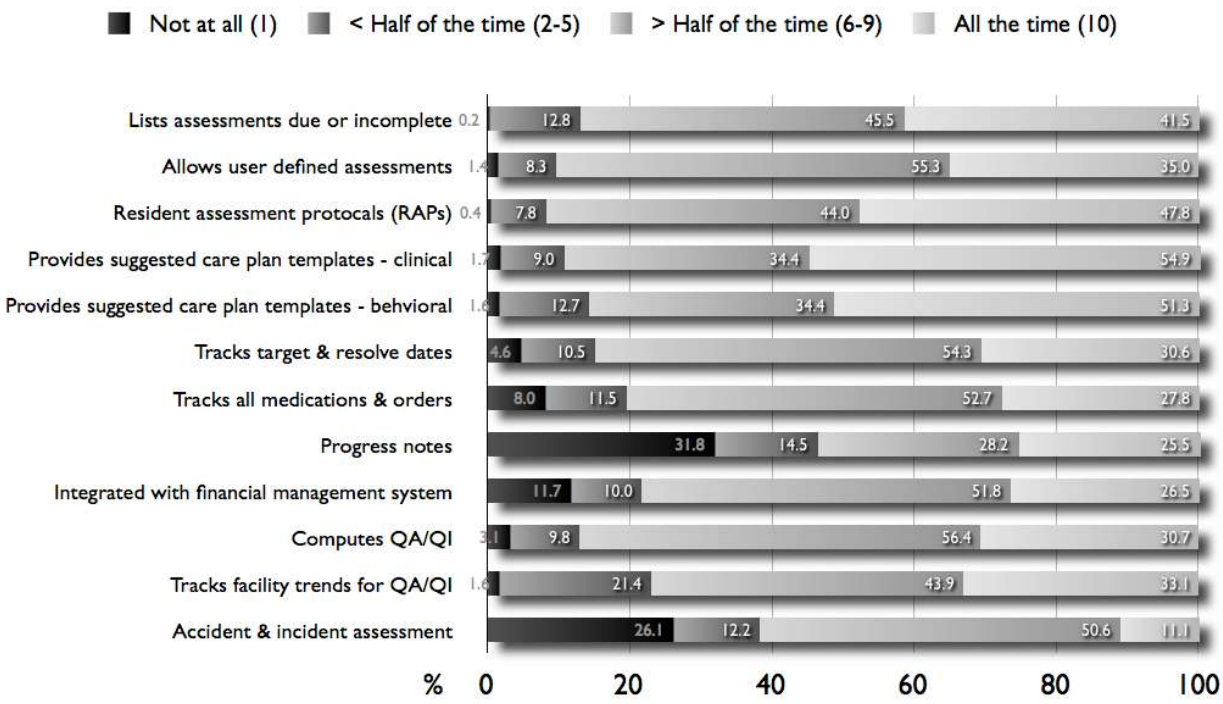


Figure 3 Frequencies that Facilities Report Using Each Feature of the MDS Software

Note. This table shows the number of facilities corresponding to the number of listed features available in their purchased Minimum Data Set software. The sample size for each feature was the number of nursing homes with such feature available (see Table 2). For example, the sample size for "List assessments due or incomplete" is 2364. There were 2193(92.8%) facilities indicating such feature available and having actual use of it. Among those, 41.5% used it all the time; 45.5% more than half of the time; 12.8% less than half of the time, while 0.2% facilities indicated such feature available but do not use it at all.

3.8 DISCUSSION

There is increasing attention being paid to the potential for HIT to transform health care delivery. The use of electronic systems to record, store, and transmit clinical and financial data offers a range of opportunities to reduce cost and improve quality. In the long-term care (LTC) sector, nursing homes have been required, under federal regulations, to use a standardized clinical data collection form, enter those data into an electronic data system, and transmit those data electronically to state and federal governments. All nursing homes are required to have at least one person trained and assigned to this task. It would thus seem that nursing homes would have an advantage over other health care delivery sectors in the adoption of HIT. The conventional wisdom, however, has been that nursing homes are not likely to be early adopters of advanced HIT because the expense and complexity of such systems exceed the financial and personnel resources of most providers. We found that the overwhelming majority of nursing homes surveyed had already purchased software systems capable of advanced HIT functionality.

MDS data have been used by CMS since 2002 to compute quality measures that are publicly reported on the Nursing Home Compare website (http://www.medicare.gov/NHCompare). Nursing home administrators should therefore have an incentive to use these measures to focus their internal quality improvement activities. Having an advanced MDS software system should facilitate such efforts. However, we found that even when such a feature was available, only about one third of facilities (i.e., 30.7% and 33.1%, respectively) reported using data systems to compute quality indicators or track facility trends (see Figure 3). Further research is needed to determine whether facilities that make use of these features actually have better quality of care.

Efforts to encourage top management to learn the capacities of their MDS software might be rewarded; however, the incentive to actually use the data for quality improvement might be weak, without financial rewards for better scores.

The potential to link MDS data to financial management would seem to offer significant benefits. For example, simplified billing could improve reimbursement. Managing supplies and personnel depends on accurate information about the number of residents and their needs. Thus, it would seem that facilities would make use of a feature that integrated MDS and financial management systems. The incentive to use advanced MDS software to improve financial performance appears clear. However, 11.7% of nursing homes reported never using such a feature, even when available. It is possible that nursing homes are using financial management software that requires manual entry of resident data or even pulls data directly from the MDS system, instead of an MDS system that also provides financial management functions (as defined in our survey). Further research is needed to determine whether nursing homes are using multiple data systems and whether there are efficiencies to be gained through integration of systems.

Two features studied closely approximate an EHR; that is, tracking medications and orders and progress notes. These features would offer 'real-time' information that could reduce reliance on paper records, reduce medication errors, and improve care coordination across shifts. We found that only about one fourth of facilities (i.e., 27.8% and 25.5%, respectively) used these features all the time, in which one third of them (i.e., 31.8%) did not use the "progress notes" feature at all. Further research is needed to determine which categories of staff actually use these features of the MDS system, and whether the data are available at the POC. The wide availability of these features suggests that significant strides toward EHR type functionality are possible given the currently deployed systems. Further research is also needed on whether these features

are user friendly or whether they are "features" that are, in reality, cumbersome to implement. In addition, if there is only one computer terminal for the MDS system, or if it is available only in administrative offices rather than across all clinical care areas (i.e., nursing stations), then the availability of the feature is relatively unimportant.

Facility characteristics are often considered to be associated with operational characteristics of the institution and quality of care. For example, it is often stated that for-profit nursing homes may provide lower (i.e., worse) quality of care compared to nonprofit facilities (Harrington, et al., 2001; Hillmer, Wodchis, Gill, Anderson, & Rochon, 2005; O'Neill, et al., 2003). Moreover, facility characteristics often provide some context as to which nursing homes are (and are not) providing services, amenities, or innovations (Castle, 2001). The findings of this study, although only descriptive in nature, suggest that the association between having commercial MDS software and not is related to the number of deficiency citations, staffing characteristics, and market characteristics (see Table 3-1). For example, facilities with a lower number of deficiency citations are more likely to have commercial MDS software.

In addition, for those facilities with commercial MDS software systems, facility characteristics would seem to be associated with availability, use, and frequency of use of advanced features (see Table 3-2). For example, the association between nursing home occupancy rates and frequency of use of MDS software is strong. That is, for seven HIT features, a lower occupancy rate was associated with all-the-time use of advanced HIT. Clearly, no causality can be ascribed to this relationship, but we speculate that facilities may be using advanced HIT as a means to increase occupancy rates. In addition, competition levels (measured using the Herfindahl Index) were associated with use of MDS software. That is, with higher levels of competition (i.e., more competitors in the market area), facilities tended to use the

advanced HIT all the time. Again no causality can be ascribed to this finding, but it is consistent with the hypothesis that facilities in more competitive areas compete with respect to operational characteristics.

Several limitations of this investigation need to be noted. First, due to space constraints on the survey and concerns for respondent burden, we collected data on only 12 selected HIT features in nursing homes. There is a wide range of features available in different third-party MDS software applications, so some nursing homes might make extensive use of other HIT features that we did not measure. Second, our measure of "use" is based on self-report by the facility administrator. However, the administrator may not be cognizant of the actual frequency of use in the facility. Many of the features we studied were related to managing the MDS assessment process. This is not part of the typical administrators' daily responsibilities; thus, he or she may not know exactly how the assessment coordinator is using the system. A further limitation is our use of "all-the-time use" versus "sometime use" of advanced features in MDS software. That is, our use of these categories is somewhat arbitrary. We do not know whether there is a clinical difference among facilities in these categories. This clearly represents an area for future research. In addition, the administrator may overestimate the frequency of the use of MDS software because of a possible social response bias.

3.9 CONCLUSION

In conclusion, we conducted a nationally representative survey of nursing homes, documenting the availability and use of selected HIT features as part of the MDS software. We found that the majority of nursing homes had many advanced HIT features available; however, administrators

reported that most of these features were not being used all the time. There is a need for further research, to understand why features are not being used – whether the software needs to be improved or whether providers require some incentive to make greater use of systems they have already purchased. Further research is needed to determine whether use of advanced HIT is associated with better quality of care.

4.0 DOES THE USE OF COMPUTERIZED MDS SYSTEM IMPROVE QUALITY OF NURSING HOME CARE?

4.1 ABSTRACT

Information technology (IT) has been recommended for improving the quality of healthcare. Nursing homes use very little IT, but they have been required by the federal government to electronically submit resident assessments (via commercial Minimum Data Set [MDS] software). This article examines whether use of the advanced IT features commonly found in commercial MDS software is associated with better quality of care. This study employed a national survey of US nursing home administrators regarding the use of 12 advanced IT features in commercial MDS software (N= 2,397). The effects of using advanced IT features in commercial MDS software on quality overall were highly significant ($p<.01$) when controlling for the prior years quality as well as facility characteristics. Although nursing homes have been slow in IT adoption, the use of the identified IT in MDS software packages appears promising in improving quality of care.

4.2 BACKGROUND

A series of studies and reports have highlighted the use of information technology (IT) as a means of improving health care quality (Gawande & Bates, 2000a, 2000b; IOM, 2001). However, these studies and reports overwhelmingly do not provide empirical information showing that IT can achieve these improvements. Evidence is needed to support the premise that health IT improves quality of care (Chaudhry, et al., 2006; Shekelle, Morton, & Keeler, 2006). In this research, we examine whether more IT use by nursing homes is associated with better quality of care.

Nursing homes tend to lag behind other healthcare providers in the area of IT implementation (American Health Information and Management Association, 2005). Recent qualitative studies, for example, interviewing a panel of health IT stakeholders in two markets (i.e., Denver and Boston) estimated the incidence of health IT adoption in nursing homes, and identified that about 8% of nursing homes used health IT for result viewing; whereas, approximately 1% used inpatient electronic health records (EHR) and computerized physician order entry (CPOE) (Kaushal, et al., 2005; Poon, et al., 2006). In contrast, 53% of hospitals use health IT for result viewing, 11% use inpatient electronic health records, and 7% use computerized physician order entry (Kaushal, et al., 2005).

However, commercial Minimum Data Set (MDS) software, which includes several IT, features (described below) is prevalent in nursing homes. Examining nursing home's use of these systems, a recent analysis found that more than 82% of nursing homes were using commercial MDS software systems in 2005 (Liu & Castle, 2009). Therefore, we examined health IT uses as

a component in commercial MDS software use, and determined whether this was associated with 14 Nursing Home Compare quality measures (QMs).

4.2.1 The Potential Importance of Health IT

There are a number of reasons that IT adoption could be beneficial in nursing homes. First, nursing homes could benefit from efficient transfer of medical information among facilities. This transfer of information could occur between nursing homes, among providers or across levels of care (such as hospital, clinic, nursing home, and rehabilitation sites). The type of data exchanged could include substantial information ranging from personal profiles, physician order entries, diagnostic imaging, laboratory tests, and treatment procedures. Health IT can serve as a role to "facilitate interinstitutional and interpractioner communication and collaboration" (Coleman & Boult, 2003).

Second, IT can detect anomalies through real-time monitoring and assurance processes using tools like CPOE (i.e., computerized physician order entry) and CDSS (i.e., clinical decision support system) (Agency for Healthcare Research and Quality, 2001). For example, the frequency and consequences of errors including adverse events such as drug-drug interaction or other medical errors can be reduced using advanced IT packages. Adverse events frequently identified in nursing homes have been estimated to cause approximately 20,000 fatal or life-threatening events annually (Gurwitz, et al., 2005). By using health IT systems, nursing homes could respond to these critical events in a timely and efficient manner.

Finally, we can apply health IT to assess quality of care and cost control using standardized measurements such as the quality-reporting systems for health plans. For example, health plans use the Health Plan Employer Data and Information Set (HEDIS) to gather clinical

outcome information on the performance of their physicians (Spoeri & Ullman, 1997). Likewise, nursing homes could use MDS systems to generate reports for resident care management and quality of care feedback (Mor, 2004). As Pasupathy (2006) discussed regarding the importance of IT in LTC, "with knowledge management system, nursing homes can more proactively manage the quality of care delivered".

4.2.2 Nursing Home Reporting System

Today, all Medicare- or Medicaid-certified nursing homes are required to use the MDS as a uniform resident-reporting system. MDS is part of the Resident Assessment Instrument (RAI) developed in the late 1980's (Mor, 2004). Upon admission, nursing homes are required to record MDS assessment information detailing the resident's clinical performances within 14 days; also, a 90-day assessment, and later follow-ups are required. The assessment includes information such as cognition, hearing, vision, mood and behavior patterns. MDS evaluations are conducted to facilitate resident assessment and to ensure that all relevant clinical procedures are performed. As a uniform reporting system, it also enables comparisons of quality of care across nursing homes (Mor, Angelelli, et al., 2003).

Very few nursing homes have a fully integrated computerized information system that simultaneously incorporates the MDS assessments. One of the few exceptions is the Veterans Health Administration (VHA) that uses the Veterans Health Information Systems and Technology Architecture (VistA) based assessment instrument (Perlin, et al., 2004). In addition, very few nursing homes have used IT to facilitate resident care. A report (Kramer, et al., 2004), for example, examining the current use of EHRs in four nursing homes found that all of the facilities only used stand-alone MDS systems for quality monitoring.

It is likely that MDS software is primarily used for quality improvement in nursing homes. A study (Liu & Castle, 2009) determined from a nationwide survey of nursing home administrators that about one-third of facilities reported using quality related IT features all of the time, such as computing quality indicators or tracking quality trends. Given that commercial MDS software is commonly available in nursing homes, we believe that many homes are using IT that comes with these software systems.

A recent national survey of nursing homes conducted by CMS in 2004 included questions regarding electronic information systems (EIS) (National Center for Health Statistics, 2007). This survey examined diverse health IT functions used by nursing homes. For example, functions associated with IT included three categories in management (i.e., billing, staffing, and human resources) and nine categories in resident care (i.e., MDS, admission/discharge/transfer, physician orders, medication orders, laboratory, patient medical records, medication administration information, dietary, and daily personal care). This nationally representative data provides information on electronic information system used in U.S. nursing homes; however, the complexity of use and its link to quality of care are still unaddressed.

4.2.3 Commercial MDS Software

About a decade ago, when the CMS launched a mandatory MDS system in nursing homes, computer software vendors developed software that would allow for the integration of the data. Nursing homes, accordingly, were forced "to enter the information age by purchasing, installing, and using computer software" (Gilbert, 1999, p. 73).

Commercial MDS software has been marketed as licensed versions or as a service agreement with facilities. Licensed versions were usually bundled with Pocket PC, desktop PC,

workstations, or sold as stand-alone systems. The systems can be used under a variety of circumstances such as at the point of care, via wireless transmission, or off-line. The systems are expected to facilitate transmission of MDS reports to state government offices, improve review of quality of care statistics, and to allow better communication within nursing homes.

The commercial MDS software offers a variety of features beyond data entry and transmission. For example, these products include a number of functionalities covering different domains, such as financial transactions, administration, ancillary care, support, and resident care (these are summarized in Table 4-1). Such features were usually sold in a bundle with the basic function of MDS assessments.

Table 4-1 Summary of Features in Commercial MDS Software by Category

Category	**Selected features**
Financial	Bank Reconciliation, Consolidated billing, Managed Care, Prospective Payments, Account Payable, Billing/Accounts Receivable, Budgeting, Electronic Billing, Payroll, etc.
Resident care	MDS 2.0 Assessments, PPS case-mix Program, Care Planning, Medical Records, Medication Sheets, Nurses' Notes/Progress Notes, etc.
Administration	Employee Scheduling, Facility Maintenance, Payroll, Human Resources, etc.
Ancillaries	Hospice, Adult Day Care, Assisted Living, etc.
Support	Classroom Training, Online Support, Online User Manual, On-site Visits, On-site Training, User Group Meeting, Video Training, etc.

Source. McKnight's Long-Term Care News July 2005 p.42 (2)

Results from a report by Harris et al. (2003) show that the some systems did not capture information required to measure nursing home quality while another report (Kramer, et al., 2004) shows that the lack of standards and the limitation of interoperability may hinder the use of health IT in LTC settings. Given that IT has the potential to greatly improve the quality of health care, it is surprising that there is limited evidence of IT use leading to better health outcomes. In addition, we found that no study has examined the use of commercial MDS software in relation to quality of care. Thus, the goal of this study was to assess whether the use of commercial MDS software (i.e., health IT) is associated with quality of care in nursing homes.

4.3 METHODS

4.3.1 Data Source

This study is based on a survey conducted in early 2005, including the use of 12 advanced IT features in MDS software (Liu & Castle, 2009). This survey is relatively recent. However, it should be acknowledged that changes in health IT are occurring rapidly, and may not be represented in the findings. For example, a relatively new driver of IT in nursing homes is Medicare Part D. Information, about the intersection of Medicare Part D and nursing home IT was not collected as part of this 2005 survey. Still, this is unlikely to influence the analyses reported here that examine whether use of the advanced IT features commonly found in commercial MDS software are associated with better quality of care.

This survey collected information from the previous year. To match the timeframe, we used the 14 QMs (i.e., quality measures) available from the Nursing Home Compare website in

both 2004 and 2005. We also linked the data with facility and market characteristics in the 2004 On-line Survey, Certification and Reporting (OSCAR) system, so that we could use them as control variables.

Our measures of 'advanced IT features' came from a literature review of trade journals. This approach was used because we could not identify any previous empirical research examining such features with MDS software. The same 12 IT features have been used in a previous study (Liu & Castle, 2009). The IT questions in the survey confirmed that the facility had purchased commercial MDS software and the frequency of use of each feature. All questions regarding the frequency of use had a 1-to-10 visual-analog rating scale, assigning 1 for minimum usage (i.e., not at all used) and 10 for maximum usage (i.e., use all of the time).

The QMs (i.e., quality measures) from the Nursing Home Compare website (http://www.medicare.gov/NHCompare/) are based on the current MDS version 2.0. Nursing Home Compare was designed to provide detailed information to guide consumers in choosing a nursing home. The user can perform an online search by geographic area (i.e., state, county, city, or zip code) or facility name. The search results are presented as a table with detailed data, such as inspection results, facility characteristics, staffing levels, and QM scores (as well as histograms displaying the QMs).

Information (i.e., data) are downloadable from CMS's website. The QMs differ depending on the year in which they were downloaded due to expansion of QMs each year. For example, there were initially 10 QMs in 2002 and later this expanded to 19 in 2008. We used 14 QMs with which the quality information was fully available in both 2004 and 2005.

4.3.2 Measures

Advanced IT features. The research interest of this study is the use of advanced IT features that were defined as the features in commercial MDS software beyond the basic MDS functions. In reviewing the available information, we wished to target advanced IT features with the greatest impact on quality of care. To identify these features, we utilized the categories from a recent survey (McKnight's LTC News, 2005, p. 42) from a trade journal, which had categorized the majority of functions from the marketing packages into five broad domains: (a) financial transactions, (b) administration, (c) ancillary care, (d) support, and (e) resident care.

In our study, we targeted only functions related to resident care and refined the features into 12 explicit items (see table 3). These features were selected because they were available to most commercial MDS software and were considered as the most significant IT features for resident care. We also included a feature relating to "financial management system" because financial functions (e.g., submission checking, billing) have been used as part of HIT features in LTC facilities (Poon, et al., 2006). All items used a score of 1 to 10 to represent its frequency of use, assigning 1 for minimum usage (i.e., not at all use) and 10 for maximum usage (i.e., use all of the time). In addition, aggregate usage on IT features were created to indicate the complexity of use including four variables:

a) *Number of features used (0 to 12)*: a categorical variable with three groups by categorizing the number of features used by each facility - zero usage (i.e., used no item), low to median usage (i.e., used 1 to 9 items), and high usage (i.e., used 10 to 12 items);
b) *Use of all 12 features (yes or no):* a binary variable referring to whether the facility used all 12 features or not;

c) *Use of any features (yes or no):* a binary variable referring to whether the facility used any feature or not (i.e., used at least one feature); and,

d) *Number of features used all the time (0 to 12)*: a continuous variable by counting the number of features used all the time by a facility (i.e., rating 10 on the scale as described in the Data Source section).

Control variables. The control variables were drawn from the 2004 OSCAR dataset, which have been consistently used in many nursing home investigations of quality of care (such as: Castle, 2003; Harrington, et al., 2001; Harrington, et al., 2000; Konetzska, Stearns, & Park, 2007; O'Neill, et al., 2003). These variables included facility characteristics (e.g., for-profit, chain membership, number of beds, average Medicaid occupancy, Herfindahl index, and average occupancy). The Herfindahl index is a measure of competition with scores from 0 to 1 indicating its market competition from high to low. The occupancy rate is the number of residents divided by the number of beds. In addition, these models also controlled for the former year's quality (i.e., using the 2004 QMs). The control variables were included to address the confounding effects on the relationships of interest (i.e., the use of IT and quality of care). Confounding refers to the existing effect of an exogenous variable with the effects of the examined relationships (Greenland & Brumback, 2002). These exogenous variables must be controlled to reduce confounding.

4.3.3 Analyses

Descriptive analyses are presented on the QMs and the use of advanced health IT features in commercial MDS software. Means and standard deviations were calculated for each of the 14

QMs in both years as well as in the national averages. We calculated the total QM scores by using the summation of all the QM scores in 2004 and 2005, respectively.

Each of the 12 IT features are listed with frequency of use and detail score distributions showing the percentage of responses for each response question (to determine the centralization or skewness of data distribution in greater detail). In addition, we analyzed the four IT summary scores based on the number and the frequency of use. They are:

(a) *Number of features used (0 to 12)*: by categorizing the features that were used by the facility into 3 groups - zero usage (i.e., used no item), low to median usage (i.e., used 1 to 9 items), and high usage (i.e., used 10 to 12 items);

(b) *Use of all 12 features (yes or no):* yes if the facility used all 12 features, no if not;

(c) *Use of any features (yes or no):* yes if they used at least one feature, no if not; and

(d) *Number of features used all the time (0 to 12)*: by counting the number of features used by a facility if they used it all the time (i.e., rating 10 on the scale as described in the Data Source section).

Finally, the multiple regression analyses are presented to test the hypothesis that facilities with more IT use are associated with better quality of care. We present the analyses in two tables stratified by 12 IT variables and the four IT summary scores.

4.4 RESULTS

Table 4-2 shows the sample (n=2,397) mean scores for each QM in 2004 and 2005 and the national averages of its counterparts. For example, all measures in surveyed nursing homes had decreasing average scores (i.e., better quality in 2005 compared with those in 2004) while seven

national measures showed increasing scores (i.e., worse quality in 2005 compared with 2004). The summarized QMs also showed decreasing trends (i.e., better quality).

Descriptive statistics of the use of IT features are presented in Table 4-3 including availability and frequency of use. Percent availability was based on those who had purchased MDS software (n=2,397). For example, the IT features were available in surveyed nursing homes with a percentage of 87.5% or higher. Frequency of use was grouped into four levels (i.e., never use, less than half of the time use, greater than half of the time use, and all the time use). Graphs of the score distributions show that the uses of IT in MDS software were not normally distributed, with some distributions clustered at the higher end of the scale (i.e., with a scores of 10).

Table 4-4 shows the results from the 12 multiple regression models used to examine the hypothesized association between nursing home IT use and QM scores. Seven of 12 IT features supported our hypothesis (i.e., negative coefficients) whereas two of 12 contradicted the hypothesis (i.e., positive coefficients). These two models contradicting the hypothesis both used IT features for "providers suggested care plan templates" (including clinical issues and behavioral issues respectively).

To examine the influence of the 12 IT features collectively we used summary IT scores to represent the complexity of IT used (see Note in Table 4-3). The frequency and number of IT features were summarized into four scores including: (a) *the number of IT features used,* (b) *the use of all IT simultaneously,* (c) *the use of any IT,* and (d) *the number of IT used all of the time*. Results from the four multiple regression analyses used to examine the influence of IT features used on the QMs are presented in Table 4-5. In all cases, the standard error is presented in parentheses next to the coefficient estimates. All four IT summary scores showed significant

negative relationships with the QMs indicating more frequent use of advanced IT features the better the QM scores (i.e., better quality of care).

Table 4-2 Means and Standard Deviations on each Quality Measure for All Nursing Homes

Quality Measures	2004 (n=2397)	2004 National Average	2005 (n=2397)	2005 National Average
Percent of Residents Whose Need for Help With Daily Activities Has Increased	11.02(5.85)	15.32(8.37)	6.15(4.19)	15.59(8.31)
Percent of Residents Who Have Moderate to Severe Pain	4.73(3.82)	6.37(5.93)	2.40(2.27)	6.41(6.13)
Percent of High-Risk Residents Who Have Pressure Sores	6.89(5.45)	13.41(7.32)	4.28(3.48)	13.68(7.32)
Percent of Low-Risk Residents Who Have Pressure Sores	4.62(3.81)	2.62(2.89)	2.82(2.10)	2.61(2.92)
Percent of Residents Who Were Physically Restrained	4.46(4.19)	7.41(7.90)	2.51(2.49)	6.85(7.60)
Percent of Residents Who Are More Depressed Or Anxious	8.59(7.08)	14.53(9.07)	5.22(4.73)	14.59(9.14)
Percent of Low-Risk Residents Who Lose Control of Their Bowels or Bladder	35.82(12.05)	47.10(14.78)	22.07(8.65)	47.61(14.93)
Percent of Residents Who Have/Had a Catheter Inserted and Left in Their Bladder	9.58(5.57)	5.88(4.16)	5.93(3.66)	6.10(4.23)
Percent of Residents Who Spent Most of Their Time in Bed or in Chair	11.05(5.25)	4.28(5.38)	6.57(3.38)	4.24(5.45)
Percent of Residents Whose Ability to Move About in and Around Their Room Got Worse	11.65(5.66)	12.00(7.02)	7.15(3.70)	12.35(7.16)
Percent of Residents With a Urinary Tract Infection	5.25(4.41)	8.63(5.33)	2.91(2.82)	8.58(5.32)
Percent of Short-Stay Residents With Delirium	4.06(3.78)	3.04(4.40)	2.52(2.46)	2.77(4.23)
Percent of Short-Stay Residents Who Had Moderate to Severe Pain	15.74(6.44)	23.04(14.42)	10.17(4.25)	22.18(14.19)
Percent of Short-Stay Residents With Pressure Sores	19.31(9.18)	19.06(9.46)	12.00(5.96)	19.63(9.79)
Summary of quality measures	152.77(28.61)	--	92.69(20.32)	--

Note: We only presented Quality Measures of those available in both 2004 and 2005. The sample size (n) represents facilities that purchased MDS software. While the sample sizes for each QM of two national averages are based on its actual number in the designated year (not shown in this table), which may be vary by QMs.

Table 4-3 Descriptive Statistics of the Use of Advanced Information Technology in Commercial MDS Software

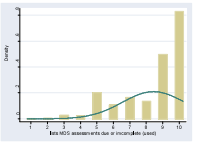
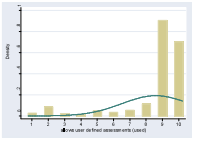
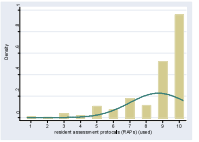
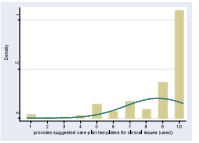
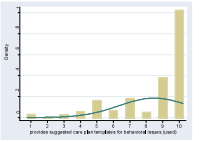
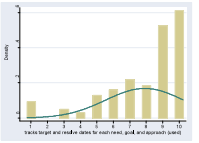
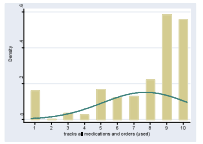
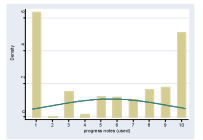
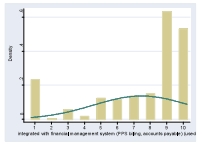
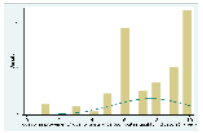
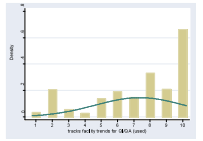
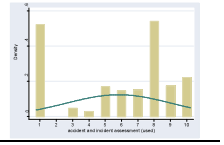
IT Features Total number (%)	Availability[a]	Frequency of Use[b]				Score Distribution[c]
	N(%)	Never use (1)	< Half of the time (2-5)	> Half of the time (6-9)	All the time (10)	
1.Lists MDS assessments due or incomplete	2364(98.6)	4(0.17)	281(11.89)	999(42.26)	913(38.62)	
2.Allows user defined assessments	2238(93.4)	30(1.34)	182(8.13)	1216(54.33)	772(34.50)	
3.Resident Assessment Protocols (RAPs)	2224(92.8)	9(0.40)	171(7.169)	963(43.30)	1045(46.99)	
4.Providers suggested care plan templates for clinical issues	2264(94.5)	38(1.68)	200(8.83)	768(33.92)	1223(54.02)	
5.Providers suggested care plan templates for behavioral issues	2264(94.5)	35(1.55)	284(12.554)	767(33.88)	1143(50.49)	
6.Tracks target and resolve dates for each need, goal, and approach	2125(88.7)	98(4.61)	222(10.45)	1154(54.31)	650(30.59)	

Table 4-3 (continued)

7.Tracks all medications and orders	2098(87.5)	168(8.01)	240(11.44)	1104(52.62)	584(27.84)	
8.Progress notes	2166(90.4)	687(31.72)	314(14.50)	610(28.16)	552(25.48)	
9.Integrated with financial management system	2129(88.8)	249(11.70)	212(9.96)	1104(51.86)	564(26.49)	
10.Quality improvement/ quality assurance (computes quality indicators)	2174(90.7)	66(3.04)	209(9.61)	1207(55.52)	658(30.27)	
11.Tracks facility trends for QI/QA	2174(90.7)	35(1.61)	457(21.02)	937(43.10)	708(32.57)	
12.Accident and incident assessment	2135(89.1)	556(26.04)	260(12.18)	1078(50.49)	236(11.05)	

Note. N=2397 (the total number of nursing homes having commercial MDS software)

a. The availability was the number of nursing homes using commercial software in which the feature was available.

b. The frequency of use is categorized by 4 groups from its original score of 1 to 10, adding up to the total number of availability. It should be noted that we do not include missing of the frequency of use because they were literally low (i.e., 7.1% in the first IT feature and 0.05% to 1.7% in the rest 11 ITs).

c. The score distributions show the original score of the frequency of use for each feature. Summary of IT used: 1) number of IT used: zero(0 item)=7.09%, Low to median(1-9 items)=13.85%, High(10-12 items)=79.06%; 2) use all 12 IT: Yes=72.76%, No=27.24%; 3) use any IT: Yes=7.09%, No=92.91; and 4) mean(S.D.) of all the time use of IT: 4.17(4.75)

Table 4-4 Regression Analyses Examining the Use of Each Information Technology Feature and Quality of Care

	QM2005	**QM2005**	**QM2005**	**QM2005**	**QM2005**	**QM2005**	**QM2005**	**QM2005**	**QM2005**	**QM2005**	**QM2005**	**QM2005**
All the time use of IT features [a]	List MDS assessments	Allows user defined assessments	Resident Assessment Protocols	Care plan templates – clinical	Care plan templates-behavioral	Track target and resolve date	Track all medications and orders	Progress notes	Integrated with financial system	Compute quality indicators	Track facility trends for quality	Accident and incident assessment
	-2.275*** (0.440)	-5.900*** (0.467)	-0.479 (0.426)	2.655*** (0.433)	0.953** (0.433)	-7.241*** (0.513)	0.292 (0.502)	-0.787 (0.512)	-5.315*** (0.554)	-6.293*** (0.498)	-6.146*** (0.494)	-6.901*** (0.735)
QM2004	0.526*** (0.009)	0.494*** (0.009)	0.530*** (0.009)	0.524*** (0.009)	0.532*** (0.009)	0.474*** (0.010)	0.529*** (0.010)	0.559*** (0.011)	0.497*** (0.0103)	0.490*** (0.010)	0.490*** (0.010)	0.505*** (0.011)
For-profit	1.097* (0.609)	1.145* (0.593)	1.264** (0.614)	1.489** (0.601)	1.411** (0.606)	1.153* (0.609)	1.382** (0.646)	1.206* (0.693)	0.839 (0.663)	1.167* (0.617)	1.406** (0.603)	0.981 (0.672)
Chain	-2.263*** (0.438)	-2.183*** (0.428)	-2.271*** (0.441)	-2.346*** (0.434)	-2.319*** (0.438)	-2.177*** (0.441)	-2.532*** (0.468)	-2.033*** (0.514)	-2.306*** (0.478)	-2.225*** (0.442)	-2.480*** (0.433)	-2.086*** (0.476)
Bed sizes												
50-99 beds	-1.647 (1.026)	-1.471 (1.012)	-1.428 (1.040)	-1.862* (1.019)	-1.812* (1.028)	-1.388 (1.032)	-0.799 (1.110)	-0.817 (1.233)	-1.622 (1.183)	-1.464 (1.036)	-1.675 (1.025)	-1.253 (1.098)
100-199 beds	-1.860* (1.011)	-1.717* (0.995)	-1.930* (1.023)	-2.830*** (1.006)	-2.491** (1.015)	-1.547 (1.015)	-1.026 (1.094)	-0.607 (1.207)	-1.811 (1.167)	-1.674 (1.021)	-1.831* (1.010)	-0.483 (1.080)
> 200 beds	-1.231 (1.312)	-0.790 (1.284)	-1.218 (1.327)	-2.071 (1.304)	-1.749 (1.315)	-0.638 (1.323)	-0.333 (1.421)	-0.186 (1.513)	-1.112 (1.482)	-1.177 (1.329)	-1.624 (1.312)	0.720 (1.428)
Herfindahl Index [b]	-0.00086*** (0.0001)	-0.00082*** (0.0001)	-0.00092*** (0.0001)	-0.00090*** (0.0001)	-0.00091*** (0.0001)	-0.00074*** (0.0001)	-0.00100*** (0.0001)	-0.00077*** (0.0001)	-0.00087*** (0.0001)	-0.00081*** (0.0001)	-0.00082*** (0.0001)	-0.00084*** (0.0001)
Average Occupancy	-8.218*** (1.551)	-8.206*** (1.509)	-8.270*** (1.567)	-8.031*** (1.542)	-8.187*** (1.548)	-6.960*** (1.561)	-8.793*** (1.720)	-6.529*** (1.871)	-9.179*** (1.674)	-9.010*** (1.557)	-8.653*** (1.535)	-8.237*** (1.793)
Average Medicaid Occupancy	-0.384 (0.981)	-0.174 (0.967)	-0.293 (0.991)	-0.321 (0.973)	-0.348 (0.984)	-0.491 (0.988)	-1.361 (1.062)	-2.212* (1.174)	-0.557 (1.086)	-0.245 (0.990)	-0.379 (0.978)	-2.985*** (1.077)

Table 4-4 (continued)

FTE RNs/100 Residents	0.376*** (0.047)	0.355*** (0.046)	0.390*** (0.047)	0.427*** (0.047)	0.412*** (0.047)	0.338*** (0.047)	0.353*** (0.050)	0.371*** (0.055)	0.348*** (0.051)	0.354*** (0.047)	0.328*** (0.047)	0.292*** (0.051)
FTE LPNs/100 Residents	0.345*** (0.049)	0.347*** (0.047)	0.349*** (0.049)	0.368*** (0.048)	0.348*** (0.048)	0.351*** (0.049)	0.411*** (0.052)	0.356*** (0.057)	0.335*** (0.052)	0.321*** (0.049)	0.313*** (0.048)	0.369*** (0.054)
FTE NAs/100 Residents	0.120*** (0.021)	0.112*** (0.021)	0.127*** (0.021)	0.134*** (0.021)	0.126*** (0.021)	0.117*** (0.021)	0.118*** (0.023)	0.141*** (0.025)	0.132*** (0.023)	0.115*** (0.022)	0.126*** (0.021)	0.105*** (0.023)
Constant	5.584*** (2.069)	11.44*** (2.075)	3.611* (2.067)	1.838 (2.025)	2.537 (2.047)	13.31*** (2.168)	3.859* (2.258)	-1.199 (2.432)	11.44*** (2.312)	12.870*** (2.143)	13.230*** (2.127)	12.120*** (2.416)
Observations [c]	2193	2170	2179	2191	2194	2026	1928	1476	1880	2074	2102	1574
Adjusted R-squared	0.720	0.739	0.717	0.726	0.722	0.742	0.726	0.772	0.731	0.735	0.739	0.762

Note. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

a. The ITs features used here were referred to binary data derived from its 1-to-10 visual-analog rating scale. It includes 0=some time use (2-9) and 1=all the time use (10).

b. Herfindahl index is an indicator of market competition. A higher value for a nursing home indicates it is operating in a less competitive market.

c. The samples were based on those who had used such IT feature (i.e., the rating score from 2 t o10).

Table 4-5 Regression Analyses Examining the Use of Information Technology and Quality of Care (2004)

COEFFICIENT	QM 2005	QM 2005	QM 2005	QM 2005
Use of Its	-13.01(1.006)*** [a] -11.59(0.869)*** [b]	-2.38(0.476)*** [c]	-11.76(0.867) *** [d]	-0.35(0.046) *** [e]
QM 2004	0.52(0.009)***	0.56(0.009) ***	0.52(0.009) ***	0.55(0.009) ***
For–profit	1.27(0.573)**	1.05(0.592) *	1.26(0.574) **	0.81(0.598)
Chain	-2.10(0.418) ***	-2.10(0.432) ***	-2.09(0.418) ***	-2.09(0.435) ***
Bed sizes				
50-99 beds	-1.77(1.000) *	-1.35(1.033)	-1.70(1.001) *	-1.39(1.036)
100-199 beds	-2.34(0.982)**	-1.80(1.014) *	-2.28(0.983) **	-1.38(1.018)
>200 beds	-1.74(1.269)	-1.78(1.311)	-1.67(1.270)	-1.33(1.321)
Herfindahl Index [f]	-0.00084(0.000)***	-0.00086(0.000) ***	-0.00084(0.000) ***	-0.00078(0.000) ***
Average occupancy	-7.81(1.500)***	-8.75(1.546) ***	-7.66(1.500) ***	-8.65(1.554) ***
Average Medicaid occupancy	0.012(0.944)	-0.20(0.974)	0.12(0.944)	-0.26(0.977)
FTE RNs/100 residents	0.40(0.045)***	0.40(0.046) ***	0.41(0.045) ***	0.37(0.047) ***
FTE LPNs/100 residents	0.36(0.047)***	0.30(0.048) ***	0.35(0.047) ***	0.32(0.049) ***
FTE NAs/100 residents	0.11(0.020)***	0.10(0.021) ***	0.12(0.020) ***	0.10(0.021) ***
Constant	16.71(2.278)***	2.23(2.045)	16.32(2.274) ***	4.20(2.079) **
Observations	2397	2397	2397	2363
R-squared	0.770	0.754	0.770	0.756

Note. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

(a) & (b) are the coefficient for *the number of ITs USED* (Zero/Low to median/High) using zero as reference group; in which *a* indicates low to median number of ITs used (1-9); (b) indicates high number of ITs used (10-12); (c) refers to the coefficient for *use all 12 ITs*; (d) refers to *use any IT*; and (e) indicates *the number of ITs used all the time* (scores of 10=all the time use) using some time use (scores from 2 to 9) as reference group; (f) is Herfindahl index, an indicator of market competition (i.e., a higher value for a nursing home indicates it is operating in a less competitive market).

4.5 DISCUSSION

Many IT features are included in commercial MDS software that nursing homes could use to improve quality of care. This study focused on the influence of 12 such features. Our hypothesis was that greater use of these 12 IT features would be associated with better quality of care (measured using QMs). In general, our study findings supported this hypothesis.

In our models, we found that the use of seven IT features were highly significant in relation to better quality of care. Given that we used an extreme definition of the frequency of use of IT use (i.e., *all of the time use* vs. *some of the time use*), the question arises of what level of use of these IT features is beneficial. We are unable to fully adequately answer this question, but in sensitivity analyses, our findings suggest that the IT would still improve quality even if used some of the time at lower levels, like 'some of the time'. That is, significant findings were found when using a more lenient definition of use of IT (i.e., score >1 and < 10).

We should also note that two IT features with highly significant associations were observed but in the opposite direction to that hypothesized. These two IT features were "providers suggested care plan templates" (including clinical issues and behavioral issues respectively). We do not know whether this result can simply be attributed to these two specific uses of IT (since these two features are similar to each other) or whether these results are due to confounding by a third variable. Further exploration is needed to examine these associations further.

Our results show that three IT features without significant associations were "resident assessment protocols" (RAPs), "track all medications and orders", and "progress notes". First, the RAP is related to clinical treatment guidelines designed to help identify resident problems.

However, as noted by Mor (2004), only a couple of RAPs were validated to be able to identify patients who are at risk. That is, we do not know which RAP was used the most (e.g., there were more than 18 RAPs available); therefore, the use of a single IT measure on the combination of RAPs in different degrees of validation could lead to the dilution of its association with quality of care. Further research is needed to clearly define IT feature for each RAP. Second, many nursing homes may use other commonly found IT (such as CPOE) that approximates "track all medications and orders". This may have influenced our findings. Third, "progress notes" in a nursing home could be used for resident care (Schnelle, Bates-Jensen, Chu, & Simmons, 2004); however, we found, that use was most commonly reported as "not at all". We thus postulate that the usability of "progress notes" in commercial MDS software may need some further refinement for use. That is, to capture the dictated notes by using standards or translating free-text notes into computer readable codes (McDonald, 1997).

Although our findings suggest that use of commercial MDS software is beneficial to nursing homes, nursing home IT can be further refined. Current literature in this area suggests that a good reporting system should have tracking capability of all medical information and to flag potential medical and data entry errors. This could help to reduce medical mistakes, improve patient safety, and advance quality of care (Leape, et al., 1998). The commercial MDS software is promising in this regard, but still cannot fully inform the functionality of other health IT packages (e.g., such as EHR or CPOE that can be implemented with comprehensive patient information and a real-time technique) because of interoperating issues with other systems.

Recent work focusing on the functionality of health IT includes an initiative from the National Health Information Infrastructure (NHII). The NHII was proposed to serve as a

communication system linking information into workflow (Stead, et al., 2005). As defined by the Workgroup's official charge, NHII is:

> "… a set of technologies, standards, and applications that support communication and information to improve clinical care, monitor public health, and educate consumers and patients. It is not a unitary database. The broad goal of the NHII is health knowledge management and delivery, so that the full array of information needed to improve the public's health and health care is optimally available for professionals, policy makers, researchers, patients, care givers, and consumers (National Committee on Vital and Health Statistics, 2007, p. 1)."

Two studies commissioned by the NHII concluded that the most significant challenges thus far were "the lack of standards for electronic patient medical record information (Harris, et al., 2003)" and "the government-mandated assessments exist (e.g., MDS) that may not readily interface with an EHR (Kramer, et al., 2004)." To adopt health IT, an interactive method must be used to target the unique needs of LTC IT as opposed to "by creating sector-specific solutions that do not align with our healthcare system as a whole (Martin, Brantley, & Dangler, 2007, p. 12)."

A recent report also suggested that "linking MDS with health IT content and messaging standards is one step towards interoperability with other care processes (Carter, White, Harvell, & Shipley, 2006)." Such standards widely used in health care sectors can include: Health Level Seven Standards (HL7) (Health Level Seven. version 2.4, 2002), The Logical Observation Identifier Names and Codes (LOINC) (McDonald, et al., 2003), Systematized Nomenclature of Medicine Clinical Terms (SNOMED-CT) (Systematized Nomenclature of Medicine Clinical Terms, 2006). Given that MDS is a uniform data system in nursing homes, it is imperative for nursing home information systems to interface with other systems in order to transfer clinical

data to other providers such as hospitals, physician offices, or other nursing homes. This capacity, referred to as 'interoperability', requires systems to follow standards for data format, transmission and medical terminology, as well as privacy and confidentiality (Brailer, 2005). Despite the flaws of the current system, notable health IT products in this area have already included several features to link health IT and MDS. Specifically, some products support CPOE, EHR, financial management, educational training, etc. (Accu-Med Services, 2007; American HealthTech, 2007)

Other aspect like the transition to Medicare Part D program has been a challenge for nursing home IT. Medicare Part D, known as prescription drug plans (PDPs), was introduced on January 1, 2006 as required by the Medicare Prescription Drug, Improvement and Modernization Act of 2003 (MMA). Nursing homes present an environment with complex and extensive drug use (Stuart, Simoni-Wastila, Baysac, Shaffer, & Shea, 2006). However, the lack of integrating information systems to ensure communication between nursing homes and PDPs remains a significant issue in information exchanges among these settings (Stevenson, Huskamp, & Newhouse, 2008). For example, the current systems supporting Medicare Part D are fragmented, which may result in the beneficiary's difficulty in filling medications at the pharmacy. The most recognized example is a time lag that happens when pharmacies receive Medicare Part D information from beneficiaries who are Medicare beneficiaries and who subsequently qualify for Medicaid or vice-versa (known as dual-eligible beneficiaries) (GAO, 2007c). In response to these problems, the CMS has plans to piece together the existing information systems across agencies to efficiently facilitate the enrollment and billing process (GAO, 2007c, p. 31).

Finally, many nursing homes encounter a tough decision when choosing a new computerized system for managing MDS. Commercial software can be effective (as our results

show); yet, there should be greater focus on organization culture and staffs' knowledge associated with the use of IT because "the culture of an institution and the quality of the software implementation affect the successful adoption of clinical automation more than whether the product was self-built or purchased" (Halamka, 2006). Nursing homes should examine who will use the system and whether the facility is capable of training their staff to use the system. Further research is necessary to clarify the impact of organization culture and staff training when studying IT use and quality of care.

4.5.1 Limitations

The use of IT features denoted in this analysis was intricate, involving the elements as to what features were used and how frequently were they used. Quantifying this intricacy represents a limitation of this study. Our study used relatively arbitrary measures since there was no clear definition of health IT available to nursing homes (i.e., 12 advanced IT features). We found these IT features in commercial MDS software were not required as part of the MDS assessments, but these IT features may be important for better operations (Liu & Castle, 2009). We applied a conservative method to analyze the data by using extreme scores (i.e., use IT feature all of the time).

Second, it should be noted that the assumed associations during the time frame between health IT used in 2004 and QMs in 2005 may not be sufficient to make inference for our research hypothesis since it may take a longer time period to observe the effects of IT use on these QMs. In addition, these QMs have been found to be simply getting better over time (Castle, Engberg, & Liu, 2007). That is, the increasing trend in QM scores may not reliably reflect the actual level of quality.

We also note above that health IT is changing rapidly, and this may not be represented in our findings. Nevertheless, as we also note, nursing homes have been slower to adopt health IT than other settings. Thus, it is uncertain how much our results would be influenced if the analyses were conducted with more current information. One example is the influence of Medicare Part D. This was not included in our survey. But, the influence of this on our analyses on quality of care is uncertain.

Finally, we used nursing home administrators as informed respondents to report on IT use in nursing homes. The survey was pilot tested with face-to-face interviews with 12 administrators, and a mail survey with a further 100. Moreover, the validity of the questions used was assessed using interviews at 152 nursing homes and via crosschecking survey responses with existing nursing home records (resulting *kappa* statistics were all high, and all greater than .95). In these interviews (n=152), all nursing home administrators also indicated that they understood the questions, and could answer them appropriately. That is, it was determined that nursing home administrators were able to fully answer the questions regarding health IT. In many cases, nursing home administrators were able to use the health IT systems and were involved in their purchase. However, the possibility still exists that some nursing home administrators may have provided unreliable information on the use of the MDS software because they were unfamiliar with the routine tasks performed by nurses or other clinical staff who more frequently interact with MDS software. This may be especially true for large nursing homes or those with relatively new nursing home administrators. In sensitivity analyses, however, our results were not significantly different when outliers (i.e., the largest facilities and nursing home administrators with short tenure) were excluded.

4.6 CONCLUSION

There is little information about the association between use of health IT and nursing home quality. Also, results from prior studies are mixed, meaning use of health IT may not necessary improve quality of care. This study used 12 IT features in commercial MDS software. The findings support our hypothesis that use of health IT positively influences nursing home quality of care.

5.0 DISCUSSION

This chapter summarizes the major finding from previous chapters, including the background of HIT, the IT features in commercial MDS software that are used by surveyed nursing homes, and how these may actually relate to quality of care. In addition, this chapter also discusses the appropriate number of subjects for nursing homes to adopt HIT and ends with a three-phase model for HIT adoption.

5.1 SUMMARIES OF STUDY FINDINGS

5.1.1 The first paper

Literature Review

In our review in the first paper, the standards for health information exchange between nursing homes and other health care facilities are still incomplete. This phenomenon may explain the reason why there are always slow IT adoptions in post-acute care. Without these standards, nursing homes would not attain the goal of interoperability because they are venues that required highly inter-professional co-operation. In addition, IT applications would enable care providers immediate access to information for decision-making during the care of residents. IT facilitates

communication across the spectrum of healthcare delivery system and inter-professional term works, empowering real-time sharing of health information and monitoring of potential hazards.

Recently, several private sector LTC groups have teamed up to review the health information exchange standards (The University of Colorado at Denver, 2007b). Although a number of standards exist, there is more to be done to ensure that data sharing to and from nursing facilities is kept accurate. Moreover, the nature of health information in nursing homes particularly differs from those in acute care settings. For example, nursing homes need extensive information regarding patients' past treatment history, medication, and progress notes, while acute care settings focus more on information regarding diagnosis and treatment of diseases.

Although nursing homes may have adopted some types of HIT (e.g., CPOE, EHR, etc.), most of them still lag behind significantly (Poon, et al., 2006). The reason for this lag lies in the characteristics of nursing homes; that they provide a broad array of services to vulnerable populations. That is, the nursing homes require the maintenance of close ties with other institutions (i.e., such as pharmacies, and rehabilitations), and would involve more HIT applications than other health care settings do. Many believe that the main driving forces for nursing homes to adopt HIT are to meet regulatory and payer demands. Specifically, nursing homes have been required to submit Minimum Data Set (MDS) data to the state and federal government (Mor, 2004). This requirement was known as resident assessments, which must be done electronically on a regular base during their stay at this home.

Health information should allow retrieval in several formats providing consumers with more choices in selecting a nursing home. On the one hand, the person involved in the nursing home placement process would be able to use this information to guide them through the searching process. That is, it is the hope that the consumer information seeking behavior could

shift from word-of-mouth to information technology, so that they can get the information best suited to their needs. On the other hand, providers may use this information to monitor ongoing care and promote their quality change. As a result, the homes with better quality performance would appeal to more consumers.

5.1.2 The second paper

Health Information Technology in Nursing Homes (Liu & Castle, 2009)

The aim of this paper is to identify features that are available in the most commonly used MDS software packages. Although this study only selected the IT features from commercial MDS software, the results are applicable to nursing home facilities.

This study is not intended to provide examples of IT features for use in nursing homes but rather to evaluate how such features are actually being used along with commercial MDS software. The features listed, however, can be used to demonstrate how nursing homes have used certain IT features that approximate to real HIT.

While this study has shown that a number of HIT features in the commercial MDS software are used frequently by surveyed nursing homes, it is clear that the list includes many approximate HIT features but is not exhaustive.

5.1.3 The third paper

Does The Use of Computerized MDS System Improve Quality of Nursing Home Care? (Liu, Castle, & Diesel, *In press*)

The goal of this paper is to evaluate whether the surveyed nursing homes, using more of such IT features, would have better quality of care. In this paper, we conducted quantitative data analyses by linking the survey data to 14 quality measures from the nursing home compare web site. Our study provides primary evidence of positive effect between nursing homes' actual use of HIT features in MDS software and better quality of care.

This study uses information from MDS 2.0. The current MDS 2.0 has been argued by its failure to include information that rely on direct resident interview (Centers for Medicare & Medicaid Services, 2009b). This can be due to the lack of HIT in LTC facilities. The new proposed MDS 3.0 is a revision of 2.0 and is expected to take effect on October 1st, 2009. MDS 3.0 will include most items from 2.0 with only wording changes and apply a new HIT platform without major changes to the current data submission format (Centers for Medicare & Medicaid Services, 2009b). The MDS 3.0 also plans to facilitate a decrease in provider burden by linking the CMS data via a secure internet, standardizing MDS terminology and scales, and linking to other CMS initiatives (e.g., STRIVE). STRIVE is a time study providing data and analysis to update the Medicare Skilled Nursing Facility Prospective Payment System (SNF PPS) (QIES Technical Support Office, 2007).

To better understand the possibility for implementation of LTC and HIT, the HHS has initiated a project to identified interoperation issues between the MDS 2.0 and the CHI certified standards (e.g., SNOMED CT, HL7, and ICD-9-CM) (Carter, et al., 2006). Those standards would contain most of the concepts needed to standardize the intent of MDS 2.0. Some significant results from this project include some achievable steps towards a nationwide interoperable health information infrastructure. For example, using Clinical LONIC to support standardized HL7 messaging.

5.2 NURSING HOME CONSUMERS AND HIT

It has been assumed that giving more information about quality of care to consumers will help them make better decisions for care (Gawande & Bates, 2000c). This is important because, as Bishop (1988, p. 343) describes, "a competitive market for nursing home care would lead to the allocation of resources to the amount and type of nursing home care that consumers judge to be worth paying for". The fundamental for this theory is that market would compete for residents and thus force poor-performing providers to improve their quality of care. With advanced technologies, patients have been able to compare and choose health care using the Internet and to monitor their own health (Gawande & Bates, 2000c).

Nursing home information seeking is usually associated with short-term decisions. Information seeking behavior has been studied in the information retrieval discipline to evaluate how a user navigates a given system and what information he or she could use during the searching process. Information seeking behavior can be defined as: "the purposive seeking for information as a consequence of a need to satisfy some goal. (Wilson, 2000)" For example, during the course of seeking health information, the processes can be complicated and are associated with several factors such as: health of the individual, decision makers, and available resources. These factors can be referred to as the information need of the goal.

Salisbury (1989) studied people's health information seeking behavior regarding how they found doctors, what reasons they had to change doctors, and what were the factors that influence their choice of general practitioner. Subjects were from five general practices in the United Kingdom, that they were registered with. The most important result from this study is that people tended to ignore the importance of health information seeking until they were already ill. Similar results were also found by Castle (2003b) in a study of selecting a nursing facility. The

author examined the factors associated with both the search for and selection of a nursing facility and concluded, "very few proactive nursing facility choices were made by either residents or family members (2003b)."

With the advanced IT today, several health care areas have developed report cards for public disclosure of health information. For example, the National Committee for Quality Assurance (NCQA) distributed a statewide report card, known as the Health Plan Employer Data and Information Set (HEDIS), to collect information for comparing patient satisfaction and performance measures. Most of the existing health care report cards contain the HEDIS measures (Hibbard, Slovic, & Jewett, 1997). Also, the Nursing Home Compare web site (http://www.medicare.gov/NHCompare/home.asp) took effect in 2002 and now provides consumers assistance in searching for nursing homes that best suit their needs (Fermazin, Canady, Bauer, & Cooper, 2003).

Since 2009, this site added a new five-star ranking system to the existing online system (Centers for Medicare & Medicaid Services, 2008a). The ranking displays stars for each scope (i.e., health inspections, staffing, and quality measures), and stars for overall rating. In addition, some third party web sites also provide similar services that use CMS data to rank homes in a list. For example, California Nursing Home Search web site (http://www.calnhs.org/nursinghomes/) provides nursing facilities rating in four areas (i.e., staffing level, quality of facility, quality of care, and finances and cost). This or some other commercial web sites also include the same information that NHC web site does but provides alternative interfaces assuming better usability.

5.3 TECHNICAL ISSUES IN NURSING HOME COMPARE WEBSITE

There have been several concerns in relation to providing online information to nursing home consumers. Most of these concerns are associated with the unattainable ideal of the current IT status quo. Many data types especially of interest to consumers are not yet available (e.g., staff turnover rates, cost, and resident characteristics). These types of data are important because the decision about nursing home placements are usually made in a limited time and the influences can be highly related to the cost and the quality of care. However, the current nursing home compare data fails to provide real-time staffing information because it only includes staffing levels, which is self-reported on a yearly basis. Moreover, the nursing home inspection information may present observational bias because it was not based on unannounced visits or unless there is no notification that there will be inspections. The aforementioned concerns can be seen as gaps between the current and future IT system.

The new five stars rating system for nursing home consumers was based on the same premise that the power of consumers' reaction will motivate facility owners and associated staff to strive for better ratings through providing better quality of care. However, professionals did not advocate a rule-out-one-star strategy and suggested that the consumers should "think carefully before choosing a one-star home. They should try to understand why that home has one star."(Comarow, 2008)

With the new rating system, some descriptive information regarding nursing home quality related performance would somewhat be ignored. Although it would seem that consumers have been able to take advantage of this nursing home system, it is still under debate whether quality information provided can be used for quality improvement or whether it simply serve as a rating system for consumers in searching a nursing facility (Weiner, et al., 2007, p.

29). As noted by Stevenson (2006, p. 774), the concerns remain in relation to whether a web site provides reliable data and what information should be included in the reporting system.

In addition, it is also important for HIT developers to ensure the usability issues when developing an information system because this would ensure the interface for use meets certain criteria. Usability testing refers to the evaluation of information systems that involves users. The International Standards Organization (1994, p. 6) defined that usability is "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use." In addition, Nielsen (Nielsen, 1993) proposed five attributes for the component of usability. They are: (1) learnability – whether the interface is easy to learn, (2) efficiency – whether the users can perform required task easily using the designed interface, (3) memorability – whether the users can reestablish proficiency easily after a period of not using it, (4) errors – whether the designs have a low error rate including the number of errors it is likely to make, the severity of these errors, and whether it can recover from the errors easily, (5) satisfaction – whether the users are satisfied with the experience of using the designs.

In summary, these is little information about the usability of Nursing Home Compare website. The national movement toward publicly reporting information on nursing homes' quality of care will continue to gain momentum. Questions regarding the validity of the quality measures and how these measures could possibly be drawn from future IT system would definitely need a special concern when developing health IT.

5.4 THE PATHWAY TO HIT ADOPTION

In this section, I summarize the pathway to future HIT adoption according to the review in previous chapters. In figure 1, I illustrated the process of HIT adoption, which goes from the phase I (i.e., preparation) to the phase III (i.e., Integration) with *incentives* as motivator and *redesigns* as feedback.

First, in *phase I*, the health care stakeholders need to develop tools and standards for HIT adoption. The development of associated tools and standards is critical because the standards provide links to the relevant tools so that the tools can be used. The tools are those designed to facilitate the health information exchange.

Second, a move to *phase II* can be motivated by incentives as denoted by two solid arrow lines above the three boxes. In this phase, several tools and standards are ready to go but issues remain in relation to interoperability, usability, and confidentiality. It should also be noted that there are two solid arrow lines (i.e., redesigns) under the three boxes. These lines reserve the opportunities for redesigning the inappropriate elements.

Third, the goal for *phase III* is to create a National Health Information infrastructure (NHII). In this phase, the NHII need to include certain health care facilities ranging from acute care to post-acute care. These systems may have something in common with today's systems but the bottom line would be the interoperability of systems among all levels of care. In conclusion, we are now at somewhere between phase I and II.

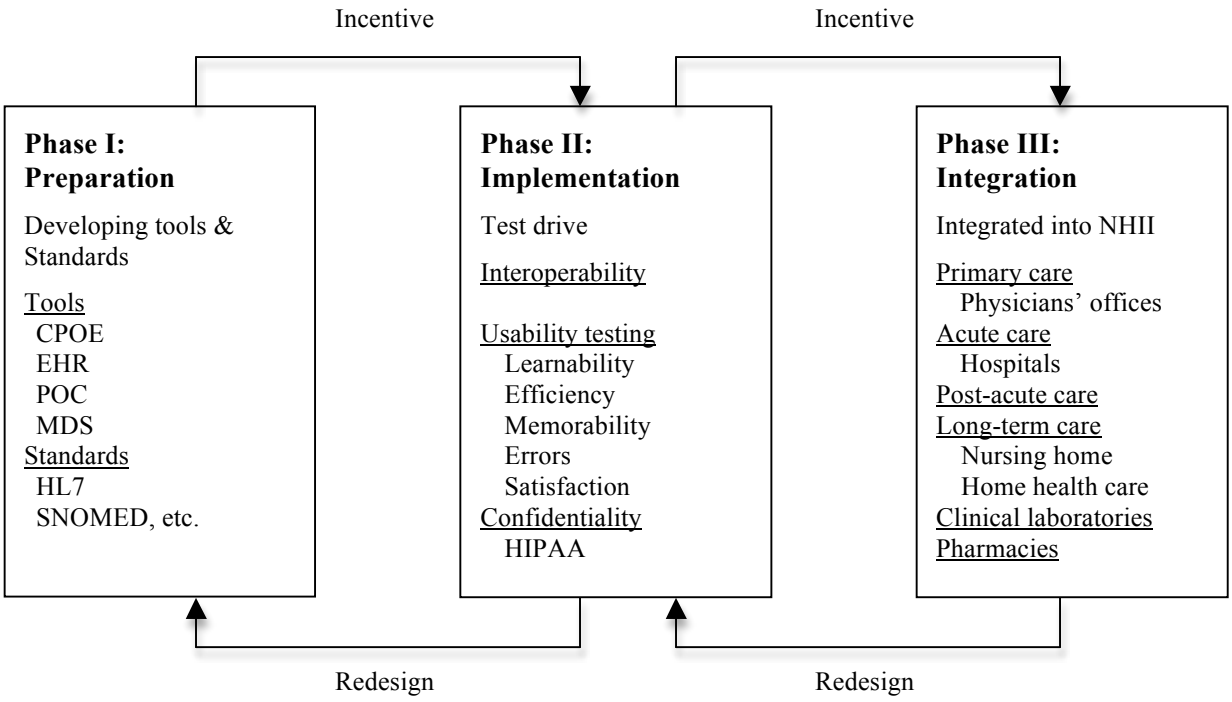


Figure 1 The Three Phases for HIT Adoption

APPENDIX A

SELECTED IOM REPORTS RELATED TO THE HEALTH IT

Year	Page	Abstract or Excerpt
1986[5]	191-193	This book proposed that information system is needed to regulate nursing homes effectively and to facilitate development of sound policies for long-term care. Its recommendations provided the basis for Congress to enact a major reform of nursing home regulations in 1987.
1997[6]	100-137	This is a revised edition of a previous report contenting full text of original report published in 1991. It recommends using the computer-based patient record (CBPR) as an essential technology for patient and envisions of the next generation of CBPR.
2000[7]	87-93	This report focused on the nation's attention on medical errors. *"...A nationwide mandatory reporting system should be established that provides for the collection of standardized information by state governments about adverse events that result in death or serious harm."*
2001[8]	111	*"...The notion that information about care recipients and care providers, all linked into a single database, can be used to monitor and improve care is consistent with the extensive literature emanating from the continuous quality improvement field."*
2001[9]	164-180	*"...Health care should be supported by systems that are carefully and consciously designed to produce care that is safe, effective, patient-centered, timely, efficient, and equitable."*

5 Institute of Medicine. (1986). Improving the quality of care in nursing homes. Washington, DC: National Academy Press

6 Institute of Medicine. (1997). The Computer-Based Patient Record: An Essential Technology for Health Care, Revised Edition. Washington, DC: National Academy Press

7 Institute of Medicine. (2000). Too Err Is Human: Building a Safer Health System. Kohn LT, Corrigan JM and Donaldson MS. Washington, DC: National Academy Press

8 Institute of Medicine. (2001). Improving the Quality of Long-Term Care. Wunderlich GS and Kohler PO. Washington, DC: National Academy Press

9 Institute of Medicine. (2001). Crossing the Quality Chasm: A New Health System for the 21th Century. Washington, DC: National Academy Press

2003[10]	1-19	This letter report was made to respond the request from the Department of Health and Human Services (DHHS). It provides guidance on the key care delivery-related capabilities of EHR system.
2004[11]	53-58	This book suggests that patient safety is center of health care and, therefore, need to be addressed by a comprehensive approach. It also provides a general overview of the national health information infrastructure and a conceptual model of standards-based integrated data systems to support patient safety.
2005[12]	147-190	There are few pages suggest using information technology as a tool to redesign the health care delivery system.
2007[13]	286	"... Information technology systems and applications are valuable tools that can improve the safety and quality of care across the medication-use continuum. Some drug-related technologies are already in use, including..."

10 Institute of Medicine. (2003). Key Capabilities of an Electronic Health Record System. Washington, DC: National Academy Press

11 Institute of Medicine. (2004). Patient Safety: Achieving a New Standard for Care. Washington, DC: National Academy Press

12 Institute of Medicine. (2005). Quality Through Collaboration: The Future of Rural Health Care. Washington, DC: National Academy Press

13 Institute of Medicine. (2007). Preventing Medication Errors: Quality Chasm Series. In: Aspden P, Wolcott JA, Bootman JL, Cronenwett LR editors Washington, DC: National Academy Press.

APPENDIX B

SIGNIFICANT MILESTONES FOR HEALTH INFORMATION TECHNOLOGY IN CHRONOLOGICAL ORDER

Date	Event Title	Brief Description
March 21, 2003	Consolidated Health Informatics (CHI) initiative	The first portfolio of uniform standards for the electronic exchange of clinical health information was announced and to be adopted. http://www.whitehouse.gov/omb/egov/c-3-6-chi.html (accessed January 30, 2008)
July 01, 2003	SNOMED Clinical Terms (SNOMED CT) was made available to U.S. users at no cost through NLM's Unified Medical Language System (UMLS)	SNOMED Clinical Terms (CT) have terms for more than 344,000 concepts and is the most comprehensive clinical terminology available. http://www.nlm.nih.gov/research/umls/Snomed/snomed_announcement.html (accessed January 30, 2008)
December 08, 2003	The Medicare Prescription Drug Improvement and Modernization Act (MMA) were signed into law.	The provisions MMA are intended to foster electronic prescribing by requiring standards for interoperability and by permitting third parties to offset implementation costs. http://www.whitehouse.gov/news/releases/2003/12/20031208-2.html (accessed January 30, 2008) See also Bell, D. S., & Friedman, M. A. (2005). E-prescribing and the Medicare Modernization Act of 2003. Health Affairs, 24(5), 1159-1169.
January 20, 2004	State of the Union Address 2004	… "By computerizing health records, we can avoid dangerous medical mistakes, reduce costs, and improve care." *George W. Bush* http://www.whitehouse.gov/news/releases/2004/01/20040120-7.html (accessed January 30, 2008)
February 25, 2004	Barcodes required for most prescription drugs	The Food and Drug Administration (FDA) issued a rule that requires barcodes on most prescription drugs. http://www.fda.gov/oc/initiatives/barcode-sadr/fs-barcode.html (accessed January 30, 2008)

April 27, 2004	Executive Order 13335: Incentives for the Use of Health Information Technology and Establishing the Position of the National Health Information Technology Coordinator.	This order was to provide leadership for the development and nationwide implementation of an interoperable health information technology infrastructure to improve the quality and efficiency of health care. http://www.whitehouse.gov/news/releases/2004/04/20040427-4.html (accessed January 30, 2008)
May 06, 2004	Appointment of Dr. David Brailer	The first director of Office for the National Coordinator for Health Information Technology (ONCHIT).
July 21, 2004	Government laid out IT vision and a strategic direction for a national interoperable health care system	SOURCE: Thompson TG and Brailer DJ: The Decade of Health Information Technology: Delivering Consumer-centric and Information-rich Health Care: Framework for Strategic Action. U.S. Department of Health and Human Services, 7/21/04. Available at http://www.hhs.gov/healthit/documents/hitframework.pdf (accessed January 30, 2008)
February 02, 2005	State of the Union Address 2005	"I ask Congress to move forward on a comprehensive health care agenda …, improved information technology to prevent medical error and needless costs,…" *George W. Bush* http://www.whitehouse.gov/news/releases/2005/02/20050202-11.html (accessed January 30, 2008)
January 31, 2006	State of the Union Address 2006	"We will make wider use of electronic records and other health information technology, to help control costs and reduce dangerous medical errors…." *George W. Bush* http://www.whitehouse.gov/news/releases/2006/01/20060131-10.html (accessed January 30, 2008)
May 17, 2006	American Health Information Community (AHIC) approves first set of recommendations.	The Community provided 28 recommendations on how to make health records digital and interoperable while protecting patient privacy and the security of those records. http://www.hhs.gov/news/press/2006pres/20060517a.html (accessed February 10, 2008)
August 01, 2006	New regulations to facilitate adoption of HIT (i.e. 71 FR 45110).	The rules finalize an exception and safe harbor for the provision of electronic health records information that is more expansive than the exception and safe harbor proposed by CMS and Office of Inspector General (OIG) on Oct. 11, 2005. http://oig.hhs.gov/publications/docs/semiannual/2006/Semiannual%20Final%20FY%202006.pdf (accessed January 30, 2008)
August 22, 2006	Executive Order: Promoting Quality and Efficient Health Care in Federal Government Administered or Sponsored Health Care Programs.	It was ordered to ensure the interoperability of HIT so that the health information between public and private sectors is able to communicate and exchange accurately. http://www.whitehouse.gov/news/releases/2006/08/20060822-2.html (accessed December 20, 2007)

January 23, 2007	State of the Union Address 2007	…"We need to reduce costs and medical errors with better information technology."… *George W. Bush* http://www.whitehouse.gov/news/releases/2007/01/20070123-2.html (accessed January 30, 2008)
October 15, 2008	Medical Identity Theft Assessment	A Town Hall meeting was hold today focusing on the intersection of Health IT. http://www.hhs.gov/healthit/privacy/theft.html (accessed December 11, 2008)
March 6, 2009	American Recovery and Reinvestment Act	The ARRA is a historic health care legislation. Its most profound effect on doctors and patients will result from its unprecedented $19 billion program to promote the adoption and use of health information technology (HIT) and especially electronic health records (EHRs) http://www.recovery.gov/ (accessed March 31, 2009)

APPENDIX C

University of Pittsburgh

Annual National Nursing Home Study

FACILITY NUMBER _____ (for tracking purposes only)

About You

1. Gender?

[1]☐ Male
[2]☐ Female

2. Age?

_____ **years**

3. Highest level of education?

[1]☐ High School
[2]☐ Associates degree
[3]☐ Bachelors degree
[4]☐ Masters degree (or higher)

4. How long have you been an administrator at this facility?

_____ **years**

5. How long have you been a nursing home administrator?

_____ **years**

6. Are you a member of a professional society / organization?

[1]☐ Yes
[2]☐ No

About Turnover

7. Not including yourself, how many administrators have worked at this facility during the past 3 years?

[1]☐ One
[2]☐ Two
[3]☐ Three
[4]☐ Four
[5]☐ Five
[6]☐ Six
[7]☐ Other _____(number)

8. Not including the current DON, how many DON have worked at this facility during the past 3 years?

[1]☐ One
[2]☐ Two
[3]☐ Three
[4]☐ Four
[5]☐ Five
[6]☐ Six
[7]☐ Other _____(number)

9. How often do you examine staff turnover?

[1]☐ Never
[2]☐ Monthly
[3]☐ Quarterly
[4]☐ Every six-months
[5]☐ Yearly

10. Including both full time and part time RNs, and RNs across all shifts – per FTE what is the turnover rate for each of the following periods?

1st Quarter 2003 _____%
2nd Quarter 2003 _____%
3rd Quarter 2003 _____%
4th Quarter 2003 _____%
1st Quarter 2004 _____%
2nd Quarter 2004 _____%
3rd Quarter 2004 _____%
4th Quarter 2004 _____%

11. Including both full time and part time LPNs, and LPNs across all shifts – per FTE what is the turnover rate for each of the following periods?

1st Quarter 2003 _____%
2nd Quarter 2003 _____%
3rd Quarter 2003 _____%
4th Quarter 2003 _____%
1st Quarter 2004 _____%
2nd Quarter 2004 _____%
3rd Quarter 2004 _____%
4th Quarter 2004 _____%

12. Including both full time and part time Nurse Aides, and Nurse Aides across all shifts – per FTE what is the turnover rate for each of the following periods?

1st Quarter 2003 _____%
2nd Quarter 2003 _____%
3rd Quarter 2003 _____%
4th Quarter 2003 _____%
1st Quarter 2004 _____%
2nd Quarter 2004 _____%
3rd Quarter 2004 _____%
4th Quarter 2004 _____%

13. During 2004, what was the involuntary turnover rate?

RNs _____%
LPNs _____%
Nurse Aides _____%

14. During 2004, what was the average FTE staffing level?

RNs _____
LPNs _____
Nurse Aides _____

15. During 2004, what were the average FTE staffing levels of agency staff?

RNs _____
LPNs _____
Nurse Aides _____

16. How many full-time staffs have worked at your facility for 5 years or more?

RNs _____
LPNs _____
Nurse Aides _____

17. How many full-time staffs have worked at your facility for 10 years or more?

RNs _____
LPNs _____
Nurse Aides _____

Resident Safety

This section of the survey asks for your opinions about resident safety issues, medical error, and event reporting in your facility.

An "event" is defined as any type of error, mistake, incident, accident, or deviation, regardless of whether or not it results in patient (resident) harm.

"Resident safety" is defined as the avoidance and prevention of patient injuries or adverse events resulting from the processes of health care delivery.

SECTION A: Your Facility

Think about your facility	Strongly Disagree ▼	Disagree ▼	Neither ▼	Agree ▼	Strongly Agree ▼
1. People support one another in this facility	①	②	③	④	⑤
2. We have enough staff to handle the workload	①	②	③	④	⑤
3. When a lot of work needs to be done quickly, we work together as a team to get the work done	①	②	③	④	⑤
4. In this facility, people treat each other with respect	①	②	③	④	⑤
5. Staff in this facility work longer hours than is best for resident care	①	②	③	④	⑤
6. We are actively doing things to improve resident safety	①	②	③	④	⑤
7. We use more agency/temporary staff than is best for resident care	①	②	③	④	⑤
8. Staff feel like their mistakes are held against them	①	②	③	④	⑤
9. Mistakes have led to positive changes here	①	②	③	④	⑤
10. It is just by chance that more serious mistakes don't happen around here	①	②	③	④	⑤
11. When one area in this facility gets really busy, others help out	①	②	③	④	⑤
12. When an event is reported, it feels like the person is being written up, not the problem	①	②	③	④	⑤
13. After we make changes to improve resident safety, we evaluate their effectiveness	①	②	③	④	⑤
14. We work in "crisis mode" trying to do too much, too quickly	①	②	③	④	⑤
15. Resident safety is never sacrificed to get more work done	①	②	③	④	⑤
16. Staff worry that resident safety mistakes they make are kept in their personnel file	①	②	③	④	⑤
17. We have resident safety problems in this facility	①	②	③	④	⑤
18. Our procedures and systems are good at preventing resident safety errors from happening	①	②	③	④	⑤

SECTION B: Communications

Think about your facility	Never ▼	Rarely ▼	Some-times ▼	Most of the time ▼	Always ▼
1. We give feedback about changes put into place based on event report	①	②	③	④	⑤
2. Staff will freely speak up if they see something that may negatively affect resident care	①	②	③	④	⑤
3. We inform staff about errors that happen in this facility	①	②	③	④	⑤
4. Staff feel free to question the decisions or actions of those with more authority	①	②	③	④	⑤
5. In this facility, we discuss ways to prevent errors from happening again	①	②	③	④	⑤
6. Staff are afraid to ask questions when something does not seem right	①	②	③	④	⑤

SECTION C: Frequency of Events Reported

	Never ▼	Rarely ▼	Some-times ▼	Most of the time ▼	Always ▼
1. When a mistake is made, but is caught and corrected before affecting the resident, how often is this reported?	①	②	③	④	⑤
2. When a mistake is made, but has no potential to harm the resident, how often is this reported?	①	②	③	④	⑤

SECTION D: Resident Safety Grade

Please give your work area/unit in this facility an overall grade on resident safety.

Mark ONE answer

○	○	○	○	○
A Excellent	**B** Very Good	**C** Acceptable	**D** Poor	**E** Failing

SECTION E: Your Facility

Think about your facility	Strongly Disagree ▼	Disagree ▼	Neither ▼	Agree ▼	Strongly Agree ▼
1. Management provides a work climate that promotes resident safety	①	②	③	④	⑤
2. Units do not coordinate well with each other	①	②	③	④	⑤
3. Things "fall between the cracks" when transferring residents from one unit to another	①	②	③	④	⑤
4. There is good cooperation among units that need to work together	①	②	③	④	⑤
5. Important resident care information is often lost during shift changes	①	②	③	④	⑤
6. Staff find it unpleasant to work with staff from other units	①	②	③	④	⑤
7. Problems often occur in the exchange of information across units	①	②	③	④	⑤
8.The actions of management show that resident safety is a top priority	①	②	③	④	⑤
9.Management seems interested in resident safety only after an adverse event happens	①	②	③	④	⑤
10.Units work well together to provide the best care for residents	①	②	③	④	⑤
11. Shift changes are problematic for residents in this facility	①	②	③	④	⑤

Leadership

This section of the survey asks some questions about your leadership style

	Strongly Disagree ▼	Disagree ▼	Neither ▼	Agree ▼	Strongly Agree ▼
1. I don't like it when others disagree with me	①	②	③	④	⑤
2. I like quick results	①	②	③	④	⑤
3. I find it hard to accept others' decisions	①	②	③	④	⑤
4. I have a strong ego	①	②	③	④	⑤
5. Once I make up my mind, I stick to it	①	②	③	④	⑤
6. I enjoy giving orders	①	②	③	④	⑤
7. Each unit should determine its own vacation schedule	①	②	③	④	⑤
8. Each unit should determine its own work schedule	①	②	③	④	⑤
9. I feel comfortable being placed in a powerful position	①	②	③	④	⑤
10. I like working in a team situation	①	②	③	④	⑤

	Strongly Disagree ▼	Disagree ▼	Neither ▼	Agree ▼	Strongly Agree ▼
12. Teams usually take up more time than they are worth	①	②	③	④	⑤
13. I often ask for information from subordinates	①	②	③	④	⑤
14. Teams give a deeper analysis of a problem	①	②	③	④	⑤
15. I often use what subordinates have to say	①	②	③	④	⑤
16. No one else can know as much about the problem as I do	①	②	③	④	⑤
17. I usually make my decision before calling a staff meeting	①	②	③	④	⑤
18. Better decisions are made in team situations	①	②	③	④	⑤
19. A team is no better than its best member	①	②	③	④	⑤
20. Team decisions are the worst	①	②	③	④	⑤

Social Workers

This section of the survey asks some questions about Social Workers at your facility

1. Who does your <u>lead</u> social service employee report to?

[0]☐ Administrator
[1]☐ DON
[2]☐ Other

2. Does your facility use social work consultants?

[1]☐ Yes, on contract with facility
[2]☐ Yes, on corporate or regional office contract
[3]☐ No
[4]☐ Unsure

3. Using the highest degree obtained, please provide the number of FTEs employed during the last pay period that provide social services.

Bachelors of Social Work (BSW) _____

Masters of Social Work (MSW) _____

Other Bachelors _____

Other Masters _____

Less than Bachelors _____

4. What is your current vacancy rate (i.e., open positions) for each of these positions?

BSW _____ FTEs

MSW _____ FTEs

Other Bachelors _____ FTEs

Other Masters _____ FTEs

Less than Bachelors _____ FTEs

5. Are you involved in any recruitment or retention efforts for the following staff?

	Social Service staff ▼	RN /LPN LVN ▼	Nursing Assistants ▼	Housekeeping / Dietary ▼
1. Sign on bonus	①	②	③	④
2. Education loan forgiveness	①	②	③	④
3. Training / CEU support	①	②	③	④
4. Transportation assistance / vouchers	①	②	③	④
5. Child care (on site or vouchers)	①	②	③	④
6. Other	①	②	③	④

6. Indicate the extent to which social services is involved with each activity or function

7.

	Have primary responsibility ▼	Helps with this, but others have primary responsibility ▼	Not involved (but in my opinion should be) ▼	Not involved (and do not need to be) ▼
1. Admission process	①	②	③	④
2. Discharge planning	①	②	③	④
3. Recreational activities	①	②	③	④
4. Arrange transportation for health care	①	②	③	④
5. Shopping for residents	①	②	③	④
6. Emotional support for residents	①	②	③	④
7. Emotional support for families	①	②	③	④
8. Emotional support for staff	①	②	③	④
9. Completion of the psychosocial section of the MDS	①	②	③	④
10. Leadership of family council	①	②	③	④
11. Leadership of resident council	①	②	③	④
12. Referrals to specialized services	①	②	③	④
13. End of life care planning and Hospice enrollment	①	②	③	④
14. Keeping advance directives up-dated	①	②	③	④
15. Staff education on resident rights	①	②	③	④
16. Staff education on emotional or psychosocial issues affecting residents and families	①	②	③	④
17. Psychosocial care planning	①	②	③	④
18. Preparation for and participation in annual state survey	①	②	③	④
19. Conduct clinical interventions for behavioral, mental health and cognitive impairment issues	①	②	③	④
20. Identify and address issues for staff, residents and families regarding advanced directives, living wills, powers-of-attorney, and guardianship	①	②	③	④
21. Quality improvement and assurance	①	②	③	④
22. Leadership / coordination of Volunteers	①	②	③	④
23. Resident and family complaint resolution	①	②	③	④
24. Coordination of financial and insurance issues, including application for Medicaid	①	②	③	④
25. Other _____	①	②	③	④

7. In your opinion, what impact do social services in your facility have on improving the quality of life for residents?

- [0] ☐ 0 None at all
- [1] ☐ 1
- [2] ☐ 2
- [3] ☐ 3
- [4] ☐ 4
- [5] ☐ 5
- [6] ☐ 6
- [7] ☐ 7
- [8] ☐ 8
- [9] ☐ 9
- [10] ☐ 10 Extremely positive

8. In your opinion, what impact do social services have on improving quality of care for residents?

- [0] ☐ 0 None at all
- [1] ☐ 1
- [2] ☐ 2
- [3] ☐ 3
- [4] ☐ 4
- [5] ☐ 5
- [6] ☐ 6
- [7] ☐ 7
- [8] ☐ 8
- [9] ☐ 9
- [10] ☐ 10 Extremely positive

Information Technology

This section asks some questions about the software your facility uses for capturing MDS data and transmitting it to the State and CMS

1. What software do you use for MDS?

Manufacturer: _____

Product name: _____

2. Does your MDS software have any of the following features? For each please circle how much the feature is currently used:

	Feature is Available ▼	Currently used ▼
1. Lists MDS assessments due or incomplete	①	Not at All I—I—I—I—I—I—I—I—I—I All the time 1 2 3 4 5 6 7 8 9 10
2. Allows user defined assessments	①	Not at All I—I—I—I—I—I—I—I—I—I All the time 1 2 3 4 5 6 7 8 9 10
3. Resident Assessment Protocols (RAPs)	①	Not at All I—I—I—I—I—I—I—I—I—I All the time 1 2 3 4 5 6 7 8 9 10
4. Provides suggested care plan templates for clinical issues	①	Not at All I—I—I—I—I—I—I—I—I—I All the time 1 2 3 4 5 6 7 8 9 10
5. Provides suggested care plan templates for behavioral issues	①	Not at All I—I—I—I—I—I—I—I—I—I All the time 1 2 3 4 5 6 7 8 9 10
6. Tracks target and resolve dates for each need, goal, and approach	①	Not at All I—I—I—I—I—I—I—I—I—I All the time 1 2 3 4 5 6 7 8 9 10
7. Tracks all medications and orders	①	Not at All I—I—I—I—I—I—I—I—I—I All the time 1 2 3 4 5 6 7 8 9 10
8. Progress notes	①	Not at All I—I—I—I—I—I—I—I—I—I All the time 1 2 3 4 5 6 7 8 9 10
9. Integrated with financial management system (PPS billing, accounts payable)	①	Not at All I—I—I—I—I—I—I—I—I—I All the time 1 2 3 4 5 6 7 8 9 10
10. Quality improvement / quality assurance (computes quality indicators)	①	Not at All I—I—I—I—I—I—I—I—I—I All the time 1 2 3 4 5 6 7 8 9 10
11. Tracks facility trends for QI/QA	①	Not at All I—I—I—I—I—I—I—I—I—I All the time 1 2 3 4 5 6 7 8 9 10
12. Accident and incident assessment	①	Not at All I—I—I—I—I—I—I—I—I—I All the time 1 2 3 4 5 6 7 8 9 10

Thank you very much for your participation!

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