

A State Profile of IT Sophistication in Nursing Homes

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Abstract

In healthcare, IT sophistication has been defined as the diversity and maturity of information system hardware and software that support clinical services. Clinical services relevant to this study include resident care management, clinical support and administrative activities in nursing homes. An IT sophistication survey previously validated in acute care settings and adapted for nursing homes was used to develop a state profile of Missouri nursing homes. The IT survey was disseminated via paper and electronic methods as chosen by a selected responder that had IT oversight and knowledge of IT stakeholders. A census of 199 respondents completed the survey, representing a 41% (199/491) response rate. Findings support recent literature indicating a higher percentage of nursing homes are still using technology for administrative purposes; however, there is growing recognition that technologies with greater functionality, is used more extensively for electronic and automated transfer of resident care information.

Key words: Nursing home, Information technology

Introduction

Policy makers expect the implementation of information technology (IT) in healthcare to improve quality, reduce medical errors and to advance the delivery of evidenced based care¹. Therefore, there is a sense of urgency about getting a national technology infrastructure developed to support the interoperability, coordination and transfer of health information. The adoption of IT is occurring much more slowly than anticipated across the USA. No where is this more evident than in the long term care sector². Clinical information systems have rarely been implemented in nursing homes. Although initiatives to bolster technology implementation, recognize key developmental barriers, and discuss adoption strategies for IT have been earmarked as a high priority for long term care organizations³.

The potential uses of sophisticated technologies in nursing homes are similar to other types of organizations, including: decision support opportunities to enhance and tailor patient care delivery at the point of care, financial opportunities to improve collections, billing, and documentation of services, and finally, opportunities for safety and quality improvement via better risk reporting, error identification, and trend analysis⁴. IT sophistication

is the level of diversity and maturity in technology hardware and software used to support resident care, clinical support and administration⁵. Various levels of IT sophistication have been found across healthcare settings. In acute care, IT sophistication has been found to positively affect quality of care⁶. Unfortunately, similar research on IT sophistication has been rarely conducted in nursing homes. The purpose of this paper is to present a state profile of IT sophistication taken from a census of nursing homes in Missouri.

Background

IT sophistication was derived from early business models for exploiting computer resources used for logistic and financial systems, and to a lesser degree for strategic and higher level decision making⁷. Three dimensions of IT sophistication have been defined in the literature including: 1) Functional, 2) Technological, and 3) Integration sophistication⁵.

Functional Sophistication. This level of sophistication specifies types of computerization used in resident care, clinical support and administrative processes⁸. In resident care, increased functional sophistication would be found in nursing homes that use computers for procedures such as admissions, discharges, and transfers. Additionally, facilities that use computers to estimate bed availability, to generate discharge summaries or to monitor waiting lists would have greater levels of IT sophistication than facilities that don't use the same technology.

The uses of computers in nursing home clinical support areas such as the laboratory, radiology and pharmacy assist in defining functional sophistication. In nursing homes with a laboratory, functional sophistication could be effected by the use or non-use of computerized specimen archiving, recurrent tests management, and results capturing from analyzers. Nursing homes with a radiology center that use computers to generate labels or to capture results of computerized tomography scans, ultrasounds and other x-rays have higher functional sophistication than those facilities that do not have access. Functional sophistication is also measured by the use of computers in pharmaceutical settings. Functional sophistication increases when computers are used for such procedures as drug interaction checking, generating drug refill reports, checking for duplicate drug orders, and medication purchasing.

Finally, functional sophistication is supported by the use of computerized systems in administrative processes. For example, the incorporation of an IT help desk to take IT requests and a system to track the IT issues would all produce greater sophistication levels when compared to facilities that don't.

Technological Sophistication. This type of IT sophistication establishes the extent of use of computerized technologies in resident care, clinical support and administrative processes⁸. Resident care processes that can be measured in this category would be the extent to which electronic tracking of medical records or resident identification is used, scanning of medical records for archiving, centralized scheduling, and dictation/voice recognition systems. Additionally, the extent that expert systems and telemedicine devices are used in resident care processes is a measure of technological sophistication.

Functional sophistication in clinical support areas is represented by the extent to how much different types of equipment are used in these areas. For example, personal computer devices located in the hallways, on medication carts, on nursing stations, or at the bedside may increase sophistication and access to clinical support services such as physical or occupational therapy. In clinical support areas the extent of use of the functional components previously described, is a measure of technological sophistication. Administrative activities that reflect greater technological sophistication include extensive use of databases to support resident and clinical management, the use of networks for connectivity, operating systems, fiber optics, and wireless data exchange systems.

Integration Sophistication. This type of IT sophistication reflects the amount of internal and external integration of computerized technologies⁸. Specifically, in this study, integration addresses the amount of electronic and automatic transfer of resident information among nursing home IT systems. Greater IT integration can be achieved in resident management and clinical support by striving for higher percentages of intensive users of the IT system. In nursing home settings, intensive users include those knowledgeable of the connections between different systems such as resident admissions, scheduling, or resource management; intensive users might also have specialized knowledge of other computerized systems such as how pharmacy systems integrate with internal (nursing, PT/OT, or lab) or external entities (ie pharmacies, other hospitals, nursing homes or the IT department). To conclude, improved integration can be achieved in administrative activities through the deployment of IT that enables environmental protection systems to operate such as fire alarms, security access to

prevent elopement, disaster recovery plans, and improved communication through e-bulletin boards and internet applications.

The promise of using sophisticated information technologies is in its ability to transform and achieve certain specific aims, including: resident safety, efficiency of care delivery, timeliness of care delivery, and connectedness among nursing home systems. Identification of IT sophistication profiles in this study will be used to characterize homes exhibiting high and low IT sophistication and to eventually disseminate lessons learned from early adopters of technology.

Methods

All methods were approved by the universities internal review board before the study began. Investigators used a descriptive, exploratory cross-sectional design to investigate IT sophistication as it related to resident care, clinical support and administrative processes.

Sample. All 491 nursing homes in Missouri were asked to participate in the survey. Homes that responded were stratified into Metro-Urban-Rural regional status which was determined by using Beal codes to identify three county continuum codes based on population⁹. Metro included total facilities in central, fringe, and metro counties with 250,000 people or more; urban status designation was given in counties adjacent and not adjacent to metro areas with between 2,500 to 250,000 people; finally, rural status was assigned to facilities in rural counties with less than 2,500. Nursing homes were also stratified by bedsize and ownership type; bedsize was classified into facilities with less than 60 homes, medium sized homes between 60-120 beds and larger homes greater than 120 beds. Facilities were classified into two ownership types, investor owned and non-investor owned.

Data Collection.

Survey Methodology. A survey, which had been validated for acute care environments¹⁰ was adapted for nursing homes¹¹ and used to create an IT sophistication profile. The survey was conducted from December 2006 to August 2007.

Administrators were contacted by phone and informed of the purpose of the study and how it would be conducted. Administrators that agreed to participate were given a choice of two separate methods to complete the IT sophistication survey, including online or paper methods. If the administrator wanted an online survey a link was sent to the administrators email address which was verified during the initial contact. www.freesurveysonline.com was used to develop the online survey. Administrators who wanted paper surveys were sent a survey with a cover letter describing the procedure and a self addressed

Table 1: Summary Information on IT Sophistication Variables (%)

Variable	N	Mean	Lower Quartile	Median	Upper Quartile	Std Dev	Minimum	Maximum
rfun	188	30.98	17.21	27.20	41.18	19.84	0.00	93.03
rtech	188	11.19	1.79	6.25	14.66	13.58	0.00	62.35
rint	188	20.29	4.79	14.13	27.67	21.93	0.00	100.00
cfun	188	11.43	0.00	0.00	19.05	18.68	0.00	84.98
ctech	188	8.57	0.00	0.00	11.90	14.99	0.00	71.43
cint	188	7.03	0.00	0.00	2.78	17.61	0.00	88.89
afun	188	15.16	0.00	10.00	20.00	16.63	0.00	90.00
atech	188	29.61	19.54	30.53	38.69	12.71	0.00	63.64
aint	188	35.40	24.02	34.18	44.84	15.99	3.33	80.88

envelope. Administrators were informed they could choose any respondent who had oversight of IT functions within the nursing home facility and that had knowledge of key IT stakeholders in the organization. To increase response rates, two follow up phone calls were made at one week intervals to the administrator and if needed, the surveys were resent. Additionally, to increase response rates and participation respondents received a small incentive for taking the time to complete the survey.

Data Analysis

Each of the dimensions of IT sophistication (functional, technological and integration) were used to describe the clinical domains being investigated including resident care, clinical support, and administrative activities. To explore the range and distribution of IT sophistication a descriptive analysis of the organizational characteristics of nursing homes based upon size, ownership and regional status was conducted. To explore the association of variables measuring IT sophistication with nursing home size, ownership and regional status a three way factor design was used. In theory, there could be 18 combinations of the three factors being considered in this evaluation. In this paper, overall findings from factor combinations of IT sophistication dimensions and three clinical domains including resident care, clinical support and administrative activities will be discussed. The effect of size ownership and regional status will not be discussed here.

Statistical inference was not deemed appropriate in this study since a census was taken of all the homes in the state of Missouri who were willing to respond to the survey. However, to judge whether an observed difference between combinations was of any practical significance a set of values was established so that when observed group means differed by the given amount or more, that difference was considered to be of practical significance. For each combination of factors, tables were developed specifying the factor levels present and the mean values for a given IT

sophistication variable. Differences in means were compared across all 18 factor levels and if means exceeded the level of practical significance recommended those factors were assigned a value of 1, indicating a difference between the groups was at least as great as the practical significance level. Conversely, if the level of practical significance was not exceeded the assigned value for the factor combination was assigned a 0, indicating that the difference in the means of the two groups was not as great as the practical significance level. Means of factor combinations that exceeded practical significance levels were examined.

Combination variables were given shortened code names for ease of use and are displayed in Table 1. The code name rfun corresponds to the combined clinical variable residential management (r) and functional sophistication (fun). The code name cint identifies that combined means for clinical support services (c) and integration sophistication (int). A final example illustrated in Table 1 is the atech variable corresponding to clinical administrative processes (a) and technological sophistication (tech).

Results

A total of 71% (349/491) of the administrators indicated they would participate in the survey; after all follow-up calls were complete the response rate was 41% (199/491). Respondent characteristics are described elsewhere¹² but were representative of the nursing homes in the state of Missouri and across the United States. A larger portion of the homes (59.3%) completed online surveys compared to (40.7%) those completing paper surveys. Eleven homes did not self identify on returned surveys; therefore, they could not be classified and were not included in the summary analysis of IT sophistication. As a result, 188 facilities were included in the final analysis (see Table 1). The following results are described using the clinical variables resident care management, clinical support, and administrative activities.

Resident Care Management. Mean IT sophistication levels in resident care management were highest in functional and lowest in technological sophistication variables, ranging from 30.98% to 11.19% respectively. A wide range of IT sophistication was also found in combined variables; *rfunc* ranged from homes that reported 0% to 93.03% of resident care management functional sophistication. In our sample, resident technological sophistication had the lowest range with homes rarely reaching a level of 62.35%, as evidenced by the mean of the upper quartile of homes which was 14.66%.

Clinical Support Activities. Clinical support variable distributions are highly skewed in our sample with over half the variables values being 0%. There appears to be quite a disparity between facilities reporting clinical support IT functionalities in Table 1. Mean values for functional sophistication across all homes was a low 11.43%, however none of the lower quartile of homes had clinical support systems available versus homes in the upper quartile reaching 19.05%. There was a wide range of means (0%-88.89%) in nursing homes reporting IT sophistication levels related to clinical support however, all lower quartiles and median values were 0%.

Administrative Activities. The highest mean levels of IT sophistication reported involved the integration of computerized technologies into administrative activities with a mean of 35.40% (Table 1: *aint*). The maximum range for all variables was 0-100; the combined factors administrative activities and integration ranged from 3.33% to 80.88%. The mean value for the lower quartile was 24.02% vs. upper quartile 44.84% demonstrating the wide range of differences in the amount of integration of administrative activities in this set of nursing homes.

In other measures of IT sophistication related to administrative activities, the functional components responsible for electronic and automatic transfer used in administrative activities are low with a mean of 15.16% (Table 1: *afun*). Although the range of sophistication in this category is diverse (0%-90%) it is rare that a nursing home would have high functional sophistication in administrative areas as evidenced by the median being 10% and the mean of the upper quartile being 20%.

Finally, the last administrative combined variable being evaluated was technological sophistication which measured the extent to which activities associated with administration are computerized. This level of sophistication did not have as high a range among the 188 facilities, 0%-63.64%. However, it had a tightly grouped number of homes situated around the mean as represented by the

value of the lower and upper quartile means 19.54%-38.69% accordingly.

Discussion

A goal of this research was to develop an IT sophistication profile of Missouri using a previously tested survey tool that has been adapted from acute care settings to nursing homes. The significance of completing an IT sophistication profile is to orient researchers to the varying degrees of IT functionality, extent of use of technological instrumentation and integration of information systems in this census of nursing homes. This type of stratification provides a necessary first step toward benchmarking best practices in clinical information system use across multiple nursing homes.

Findings from this study support other literature about nursing home technology that indicates few technological systems are being used in these settings. Additionally findings are consistent with researchers who report that computer use in nursing homes has generally been limited to administrative business applications¹³. However, findings also suggest that there are a growing number of nursing homes who are using sophisticated technologies to support resident care management as well as administrative activities in daily activities. This finding is supported by case studies in a few nursing home systems known to be early adopters of technology used to exchange information across the continuum of care and with reported benefits in patient safety, quality of care and efficiency^{14,15}.

Limitations

As with any study using surveys, responder bias may occur due to non-responders being different from responders. In this study, one concern might be that administrators of nursing homes with low levels of IT sophistication might not feel compelled to complete the study because they view their situation as irrelevant and not important for the study. Another concern for bias could be that even though responders might be responsible for technology they might not understand about all the items being questioned about in the study leading to missing, incomplete or erroneous data in the survey. To overcome these limitations researchers made every effort to provide clear communication about the importance of every responders input in order to provide accurate reflections of IT sophistication in Missouri. Investigators responded to several questions from responders who called and had questions during the study in an attempt to decrease bias introduced.

Conclusions

In Missouri, there is a wide and varied level of sophistication in nursing home technologies being implemented, the extent to which they are being

used, and the degree in which they are being integrated across the systems. Consistent with previously cited literature, higher levels of IT sophistication are noted across systems adopting systems for administrative purposes and to a lesser degree resident care management activities. There are few homes with sophisticated IT systems in clinical support areas. Through the use of state profiles demonstrating the diversity of IT sophistication present in nursing homes, policy makers, researchers and even consumers interested in these types of services could draw comparisons of best practices in implementation use that also are responsible for improving patient safety, quality, and efficiency of care delivery.

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