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Analyzing Change in Nursing Home IT Sophistication: A Two Year Survey

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Abstract

Nursing home health information technology (IT) is becoming more prevalent across the country. In this research, investigators are surveying a national sample of nursing homes for three consecutive years to determine trends in nursing home IT sophistication. Nursing home IT sophistication includes measures of IT capabilities, extent of IT use and IT integration with internal and external stakeholders. IT sophistication is measured in resident care, clinical support and administrative activities. This report provides details of the differences in nursing home IT sophistication reported by administrators completing Year 1 and Year 2 surveys. IT in clinical support (laboratory, pharmacy, and radiology) appear to have the greatest differences. This is expected since these areas typically require external contracts, making it difficult to fit IT with existing workflows, which is important for sustained adoption.

Keywords

Health Information Technology; Nursing Homes; Clinical Informatics; Surveys and Questionnaires

INTRODUCTION

One hope for better nursing home (NH) quality is health information technology (IT). Millions of dollars have been spent incentivizing IT implementation since 2009 (Department of Health and Human Services, 2016) in acute and ambulatory healthcare markets, but NHs have been ineligible for the same incentives. However, according to preliminary national studies even without incentives, NH IT use is becoming more prevalent. (Alexander et al., 2016) For example, use of health information exchanges between hospitals and NHs to support secure encrypted data exchange during care transitions are gaining traction. (Alexander et al., 2015) Nevertheless, current models tracking health IT adoption nationally,

called Maturity Models, are insufficient because they only capture information from acute care organizations, resulting in partial estimates of the real impact of regulated incentives. (Vidal Carvalho, Rocha, & Abreu, 2016; Rocha, 2011)

IT Maturity Assessments in Nursing Homes:

The concept of IT Maturity originally developed from Nolan's stage theory, proposed in 1973.(Nolan, 1973) Nolan's stage theory "is based on a premise that elements in a system move through a pattern of distinct stages over time and that these stages can be described." (Nolan, 1973) There are 6 stages of growth proposed in Nolan's stage model.(Nolan, 1979) The first, initiation, occurs as IT is introduced into the organization. The second, contagion, is characterized by intense system development, greater innovation, and technological penetration into operations. The third stage is control. This stage, brought on by increasing chaos and perhaps uncertainty, introduces formalized project management and management reporting systems to manage IT growth. Integration, the fourth stage, occurs as users become more adept at using technology and perceive real value from the technology. Stages 5 and 6 are data administration and maturity, respectively. During these latter stages, technological structure and processes reflect organizational workflows, increasing data ownership by end users and stability commensurate with vision and mission.(Hollyhead & Robson, 2012) The concept of IT maturity and maturity stages are relatively recent developments in healthcare(Rocha, 2011). A recent literature review concluded that 14 health IT maturity models have been developed for national and international settings. These models were developed using a variety of methods including surveys, interviews, focus groups, and observation. The 14 health IT maturity models were developed to assess the general health care environment, mobile health, electronic medical records, interoperability, telemedicine and usability. No IT maturity model identified focused on NH IT maturity or maturity stages. The purpose of this study was to describe trends in NH IT adoption over a period of two years using data collected during an ongoing national study that used a NH IT survey measuring IT adoption.

METHOD

Design

A national survey of US NHs to determine trends in IT adoption, called IT Sophistication in Nursing Homes, began in 2014 and will continue for three years. IT Sophistication scores will be analyzed across all the facilities participating across the three years. The research reported here includes an analysis of differences in NH IT adoption scores between Year 1 and Year 2 (2014–2015) reported by administrators on IT sophistication surveys. Using findings describing differences between Year 1 and Year 2 scores, administrators were contacted who reported the largest changes in their survey scores (at least a 50 point change in IT Sophistication survey score between Year 1 and Year 2) to participate in an interview. The specific aim and research question for this study are:

Specific Aim: Describe the pattern of changes in NH IT Sophistication over time.

- Research Question 1: Are there changes in overall IT Sophistication from Year 1 to Year 2?

- Research Question 2: What is the pattern of change from Year 1 to Year 2 in NH IT Sophistication in a national sample?

Sample

During Year 1 of the survey, 815 administrators participated (Alexander et al., 2016). During Year 2, as of Oct 2016, 431 administrators have completed surveys (53% response rate). The 431 administrators represent NHs from each state in the US, including Alaska and Hawaii. Guam, Puerto Rico, and Virgin Islands were excluded. Also excluded were facilities designated as specialty focus facilities. Specialty focus facilities are designated as having quality problems in NH Compare. NH Compare is a national, publically available, database used by the researchers to create NH recruitment lists. Only the 431 facilities who had two years of survey data were included in the analysis reported here. NH administrators from the facilities with the largest reported changes in IT sophistication were then contacted to participate in an interview to validate survey scores.

Measures

The survey used in this study, IT Sophistication in NH, measures three dimensions: IT capabilities, extent of IT use, and degree of IT integration. Dimensions are measured in three domains of NH care: resident care, clinical support, and administrative activities. Each dimension and domain is combined into 9 subscales that each have a maximum score of 100 (Alexander & Wakefield, 2009). Total IT Sophistication, which combines all 9 subscales, has a maximum score of 900. For example, IT capabilities in resident care is measured using a dichotomous variable describing the types of IT being adopted in resident care, such as tablets, electronic health records, and electronic medication administration records. To calculate IT Sophistication scores for IT capabilities in resident care each variable that is checked by an administrator is given a score of 1, unchecked variables are 0. Responses for each subscale are summed to provide a maximum total IT sophistication score. We looked at trends in each of the 9 subscales to determine the largest differences occurring between Year 1 and Year 2.

Qualitative Interviews about IT Scores with NH Administrators

The survey has been extensively tested and has been determined to be valid and reliable at measuring NH IT Sophistication (Alexander, Madsen, & Wakefield, 2010; Alexander, Steege, Pasupathy, & Strecker, 2015). However, further validation is required to determine if the instrument can successfully detect true changes in IT adoption over time, which will eventually be used to identify stages of NH IT maturity in subsequent versions of the survey and future studies. Qualitative interviews were conducted by the primary author with 22 NH administrators reporting the largest differences between Year 1 and Year 2 surveys to validate specific information about the differences reported. Individual survey scores and survey questions from each subscale were shared in a feedback report to each administrator prior to the interview. This feedback report served as a topic guide to focus the interview on the large differences reported. The topic guide approach is advantageous because it promotes spontaneity during the interview allowing participants to use rich colloquialisms or jargon to describe the topic (Krueger, 1994). Administrators were asked to recall and describe specific changes that occurred between Year 1 to Year 2 that would account for the large differences

in scores. To account for regional variations among facilities administrators were purposefully recruited that reported large differences in Year 1 and Year 2 IT scores from Pacific/West (3), Midwest (7), Northeast (2), and Southeast (3) regions of the US. Researchers also interviewed administrators reporting both gains and losses in IT scores.

Data Analysis

The team compared characteristics (location, bed-size, and ownership) of the NH sample completing Year 2 surveys with national NH characteristics obtained from NH Compare. Differences in the Year 1 and Year 2 scores for each of the 9 subscales and total IT Sophistication reported by administrators on the IT sophistication instrument were calculated (See Table 1). Facilities with the largest differences, or those with the greatest decrease in IT Sophistication score or greatest increase in IT Sophistication score, in any of the 9 subscales were operationalized as follows: [≤ -50] and [≥ 50]. Changes in Total IT Sophistication were also assessed.

Qualitative interviews with NH administrators were documented verbatim in a Word file that contained the feedback report at the time of the interview. Oftentimes, the large differences in IT sophistication scores noted on feedback reports triggered administrators to be very specific about the types of changes that had occurred from Year 1 to Year 2. In the analysis, we considered specificity of responses by administrators based on their experience with change in IT systems and reasoning for large IT Sophistication score changes over two years to arrive at our results and conclusions (Krueger, 1994).

RESULTS

Sample Characteristics

Researchers compared characteristics of the 431 NH in the Year 2 sample to the remaining (15224) NH nationally. The sample had only slight differences relative to ownership, size, and location. The sample homes tend to be smaller (more in the 60–120 bed-size range and fewer in the large bed-size (>120) range) and more from small town/rural areas.

Survey Data

A total of 13% percent of the facilities ($n=55$) participating in both survey years had large differences reported in IT sophistication scores in at least one subscale (See Table 1). Among the 55 facilities, IT in clinical support activities including IT reported in laboratory, pharmacy, and radiology settings had the largest differences in scores between Year 1 and Year 2 (ranging from -100 to $+100$). The greatest changes in clinical support IT Sophistication occurred in degree of IT integration. Health IT integration in this sense measures the extent that IT is used to manage NH resident's information with internal and external partners involved in the care. Under clinical support IT and integration, four facilities reported having the maximum possible change between Year 1 and Year 2 (Facilities 1, 49, 50 and 53). However, three of these facilities changed in a positive direction and 1 facility reported a total loss of IT integration in clinical support from Year 1 to Year 2. No facilities reported the maximum total loss or gain in any subscale for resident care and administrative activities between the two years measured.

Total IT Sophistication for the 55 facilities reporting large differences between the two years ranged from a significant reduction in Total IT sophistication by over 600 points, to an increase in IT sophistication of 425 points. The facility with the largest decrease (Facility 1) in Total IT Sophistication reported major losses in all three health domains of NH care, but not in every subscale. The facility with the greatest increase in Total IT Sophistication (Facility 55) reported large differences in three subscales within clinical support IT (IT Capabilities) and administrative activities (IT Capabilities and Extent of IT Use).

Qualitative Interviews

All administrators interviewed provided very specific details when describing reasons for the large differences in IT sophistication. For example, the administrator of Facility 4 reported a loss of IT sophistication between Year 1 and Year 2 in residential care capabilities (−58.7) and integration (−65.35). The administrator reported in Year 1 that the nurse assistants documented care using a kiosk system, but that system was removed by the time the Year 2 survey was completed. This would explain the reason for the drop in resident care capabilities and integration. However, since completing the Year 2 survey, the administrator indicated, *“They have adopted a new technology that allows the nurse assistants to document using a head set”*. The administrator is hopeful that the resident care technology score will be higher in Year 3. The same administrator, in Facility 4, also reported a loss of clinical support technology integration (−50.0). For instance, the administrator stated, *“In some [clinical support] areas, it [technology] is less integrated: dietary and housekeeping area, they have a contract with a different company now. They are not on the home’s computerized system.”* In this case, the loss of clinical support technology was due to a contractual change in the organization, which resulted in lower levels of clinical support integration.

In contrast, another administrator (Facility 30) reported a large 97.4 point increase in clinical support technology capabilities between Year 1 and Year 2. When asked to describe the reason for this change the administrator gave a lengthy history of technology adoption decisions in the organization:

“We went to electronic charting for clinical nursing applications 5 years ago. But, the system could not integrate with pharmacy, lab and radiology. On Aug 1, the NH changed systems. I was part of the build process before the technology was adopted. Business office, medical records, physician order entry, lab, x-rays, and pharmacy were all redesigned. Through the build process I helped design the EHR to integrate their forms into the process. Post Fall huddles and follow-up and physician/family notification are also part of the build in the EHR. The system uses a message manager feature to retrieve email from pharmacy, xrays, and lab, but they don’t have a direct line, such as from the pharmacy into EMAR. Lab and X-ray are ordered on the vendor site, and then results are received in a secure encrypted folder that is incorporated into the health information exchange system in the EHR. Orders can be done remotely by staff and physicians.”

Interestingly, in the same facility, the two dimensions within clinical support IT sophistication including extent of IT use and integration scores did not have a large

difference between Year 2 and Year 1, measuring 26.2 and 8.3 respectively. This small difference could reflect the short period of time between adoption and completion of the Year 2 survey when the capabilities were present, but use and degree of integration into the system was still being negotiated. We hypothesize as systems mature these dimensions of IT sophistication will also increase.

DISCUSSION

The differences in IT sophistication scores and the qualitative remarks detailing the change in adoption between Year 1 and Year 2 provide a good description how some NH administrators are coping with the rapid change in technological possibilities. In many cases in this study, great losses of technology in each dimension of IT sophistication occurred because administrators and staff were not satisfied with existing technologies and were seeking opportunities to increase efficiencies with better technology, to enhance connections between people, and to communicate more effectively about resident care. Depending on the timing of the survey, some facilities had large differences representing losses in technology as administrators were planning to adopt new technologies. On the other hand, some administrators had large positive gains in technology as a result of increasing IT sophistication. The majority of these gains and losses appeared to be in the clinical support domain where laboratory, pharmacy and radiology applications are evaluated. Interestingly, these services are usually contracted outside the facilities, so finding the right fit with the organization and existing technologies could be a factor in sustained adoption.

No other studies exist that detail the changing environment of IT maturity in NHs on a national level. There is a need to capture this level of detail about technologies used in NH resident care for several reasons. It is critical to understand why large differences in IT sophistication are occurring over time. Great losses in IT sophistication could occur because of poor usability of systems designed for resident care, deficiencies in IT workforce that are knowledgeable about sustaining a technology solution, or perhaps a lack of vision for how systems can be integrated together to maximize efficiencies in workflow. Understanding the reasons behind technology loss could help others understand what is required to plan, select, implement, maintain, and sustain a health IT product. Conversely, there is much to be learned from administrators who successfully deploy IT systems and make them work over the long haul.

CONCLUSION

Nursing home IT sophistication is changing. The nation's more than 16000 NH facilities would benefit from large scale policy initiatives and research focusing on how IT sophistication is impacting residents and staff in these facilities. More specifically, there is an urgent need to understand how IT gains and losses are impacting quality measures and other resident outcomes, an area which has had little focus to date on a national scale.

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Table 1:

Large differences in NH IT Sophistication between Year 1 and Year 2

Facility	Residential care			Clinical support			Administrative activities			Total IT
	IT capabilities	IT use	IT integration	IT capabilities	IT use	IT integration	IT capabilities	IT use	IT integration	
1	-58.8	-62.5	-42.2	-94.9	-83.3	-100.0	-47.5	-68.2	-44.7	-602.0
2	-7.4	-16.0	-34.7	-63.6	-66.7	-72.2	-2.5	-5.8	-11.9	-280.7
3	33.1	8.3	18.5	-94.9	-64.6	-80.6	-55.0	-25.9	-18.9	-280.0
4	-58.7	-31.0	-65.5	8.5	-11.4	-50.0	0.0	-11.2	-41.4	-260.6
5	-3.3	-6.7	-42.7	-7.7	0.0	0.0	-70.0	-53.6	-57.3	-241.3
6	3.3	-6.6	13.5	-23.2	-4.8	-30.6	-70.0	-53.6	-52.3	-224.1
7	-8.5	-0.1	0.7	-12.9	-28.2	-27.8	-65.0	-54.1	-1.7	-197.6
8	9.2	-0.2	16.3	-76.2	1.4	-30.6	-50.0	-23.7	-18.3	-172.1
9	-28.8	-0.8	9.3	-73.9	-31.0	-8.3	-25.0	13.0	-3.3	-148.8
10	-16.4	6.4	-9.3	-29.1	-7.8	-8.3	-65.0	3.1	0.0	-126.3
11	-17.2	20.0	-4.4	-92.3	-41.7	-13.9	22.5	13.3	1.9	-111.8
12	7.8	1.9	-16.3	-66.7	19.4	-41.7	0.0	0.2	0.1	-95.1
13	12.8	18.1	13.3	-60.9	-30.3	0.0	-37.5	-6.2	17.7	-73.1
14	21.3	38.6	9.2	0.4	-19.0	0.0	-67.5	-19.5	-13.9	-50.5
15	-19.0	-2.1	-6.8	0.0	0.0	0.0	65.0	-3.5	-14.0	19.5
16	5.0	2.6	-4.5	-45.2	-3.7	5.6	67.5	3.6	11.5	42.3
17	5.7	3.5	-15.5	10.3	25.0	-38.9	67.5	-12.8	3.4	48.2
18	13.7	1.3	12.2	-3.8	8.0	63.9	-22.5	-20.2	-3.4	49.2
19	-5.5	-4.3	18.8	3.4	-16.0	0.0	77.5	14.2	6.2	94.3
20	14.6	2.9	4.3	64.8	31.0	-2.8	10.0	-2.2	-1.7	120.9
21	11.4	-1.7	-3.6	61.9	30.8	2.8	-20.0	25.7	14.5	121.8
22	-1.0	10.0	2.1	81.2	59.5	0.0	-2.5	-13.8	5.1	140.6
23	-1.2	-5.5	11.7	30.8	58.0	83.3	-25.0	-10.1	7.1	149.1
24	62.3	47.9	86.0	0.0	-31.0	0.0	0.0	-18.6	10.6	157.3
25	32.1	25.5	37.2	25.4	9.2	66.7	-30.0	0.9	-9.0	158.0
26	19.3	7.0	30.8	66.7	23.8	0.0	10.0	8.4	6.3	172.1
27	2.3	1.9	-25.1	60.1	10.5	30.6	57.5	28.8	14.1	180.6
28	15.4	-0.8	23.3	15.4	18.7	38.9	67.5	9.4	3.9	191.6
29	-6.2	9.3	-18.3	70.9	18.4	16.7	42.5	44.1	18.1	195.4
30	4.6	27.4	-11.6	97.4	26.2	8.3	20.0	13.0	11.0	196.4
31	24.0	11.3	76.3	-4.8	8.3	8.3	42.5	22.9	9.7	198.7
32	28.2	41.7	66.2	15.9	-27.4	-16.7	57.5	11.7	25.0	202.0
33	4.3	-7.4	13.4	31.4	45.6	72.2	55.0	-11.4	9.1	212.2
34	12.2	-0.8	36.8	45.7	69.0	77.8	-30.0	16.0	-7.9	218.7
35	15.2	-3.7	10.0	68.7	34.5	50.0	65.0	-4.3	-8.1	227.3
36	45.2	32.1	76.8	17.9	6.3	16.7	25.0	1.3	8.2	229.5
37	11.7	7.7	73.8	39.3	18.0	16.7	55.0	0.6	26.5	249.2

Facility	Residential care			Clinical support			Administrative activities			Total IT
	IT capabilities	IT use	IT integration	IT capabilities	IT use	IT integration	IT capabilities	IT use	IT integration	
38	13.5	25.8	3.3	40.8	49.0	75.0	-20.0	32.4	33.7	253.3
39	82.2	30.6	49.1	25.6	8.3	16.7	25.0	13.0	3.7	254.3
40	6.4	13.7	25.8	66.7	78.6	50.0	0.0	9.6	12.2	263.0
41	26.6	25.0	30.1	60.4	48.3	27.8	0.0	51.9	-1.4	268.7
42	13.8	7.1	29.5	28.7	23.3	80.6	45.0	38.8	7.8	274.7
43	34.6	39.5	71.6	15.4	23.8	22.2	17.5	30.7	32.5	287.7
44	41.8	28.9	73.4	12.5	14.3	50.0	47.5	0.8	22.0	291.2
45	27.3	26.9	35.8	45.5	35.4	16.7	75.0	6.0	29.1	297.6
46	5.0	-1.6	19.5	84.1	83.7	44.4	45.0	19.7	15.9	315.8
47	55.3	10.6	33.7	82.1	48.1	44.4	50.0	-1.0	34.1	357.4
48	30.5	32.2	71.9	33.8	53.6	72.2	5.0	12.2	51.8	363.2
49	11.6	10.3	8.0	83.8	93.7	100.0	0.0	33.5	24.4	365.3
50	27.9	15.5	10.6	100.0	91.8	100.0	0.0	11.5	14.7	372.1
51	62.5	41.8	67.3	59.0	62.9	66.7	-10.0	17.9	10.0	378.1
52	49.3	43.6	86.3	67.3	44.9	50.0	10.0	17.7	14.9	383.9
53	34.1	58.0	59.6	63.7	83.3	100.0	-30.0	18.0	10.3	397.1
54	13.5	27.9	57.2	81.0	67.3	83.3	30.0	7.7	30.5	398.4
55	36.8	18.8	43.3	58.2	31.8	83.3	67.5	50.8	34.7	425.2