In this issue:

Incorporation of Information Technology into Assisted Health Care: An Empirical Study

Michelle (Merrill) Delmonico
Quinnipiac University
Hamden, CT, 06518

Bruce A. White
Quinnipiac University
Hamden, CT, 06518

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Keywords: Assisted living facilities, information technology, monitoring and sensor devices, electronic health records, strategic and financial planning, activities of daily living, barriers to technology, older population, quality of healthcare.

This issue is on the Internet at **http://jisar.org/3/9/**

This paper was selected for inclusion in the journal based on blind reviews from three or more peers placing it in the 30% acceptance rate category for papers submitted to CONISAR 2008.

Incorporation of Information Technology into Assisted Health Care:
An Empirical Study

Michelle (Merrill) Delmonico
Michelle.merrill@quinnipiac.edu
MBA Graduate

Bruce White
Bruce.white@quinnipiac.edu
Information Systems Management

Quinnipiac University
Hamden, Connecticut 06518 USA

Abstract

Information Technology has made a major impact on almost all aspects of life. Supply chain systems monitor and control goods; online purchases continue to grow; almost all businesses have web pages; even healthcare institutions have embraced new technologies. But, has information technology affected how assisted living facilities function? This paper identifies the different types of information technology being utilized in assisted living facilities to help the aging population maintain their independence and safety. It also analyzes the current impact information technology has on assisted living facilities and how it will continue to shape the future of our increasingly aged population. The paper also describes barriers to technology implementation and the leading priorities behind the implementation of information technology assisted living facilities in two American states.

Keywords

1. OVERVIEW

We are in an information age. Electronic commerce continues to grow, e-mail becomes our standard communication method, cell phones are ubiquitous, but … has the information age hit senior health care yet? This paper explores some uses of technology in assisted living facilities, with statistical analysis of a survey of the uses of technology in assisted living facilities. Our findings are that technological advances in assisted living lag behind the use of technology in other health care facilities and also lag the use of technology in general.

2. BACKGROUND

Baby boomers are the generation of Americans that consistently dominate the market place. They are the generation that will drive market demand for technological advancements in healthcare. Why? By the year 2026, the population of Americans over the age of 65 and older will double to 71.5 million people; this is largely due to the fact that most of the baby boomers will be 65 and older and in general, people are living much longer. [AAHSA, 2008] These 71.5 million people will represent 20% of the population; they will control 40% of the nation's disposable income and 77% of private

investments. [Bayles, 2003] The baby boomers are the ultimate consumer and they will need advanced technological resources to help them maintain their independence as they continue to experience an increase in disabilities during a time when less traditional care is available.

The incidence of disabilities among the elderly- everything from arthritis to Alzheimer's – doubles every five years after the age of 65. Walking, driving, climbing stairs become harder tasks. . . Worse, traditional care for the elderly will not be there. Finances are forcing nursing homes to close. Baby boomers had smaller families; that means fewer children to care for them. And the age group that follows the boomers, the so-called baby bust generation born from 1964 to 1983, is much smaller. It will provide fewer nurses and workers to care for the elderly. [Bayles, 2003]

Older populations will always struggle to maintain a level independence as they age. 'The aging mind is slower and more prone to error when processing information. It is less adept at considering old information in novel ways. Memory suffers. In particular, working memory – the ability to keep multiple pieces of information in mind while acting on them- declines with age'. [Carstensen, 2007] The ability to remain independent whether that means living alone, driving a car, making oneself a meal or taking one's medication, etc. is a aspect of life that most people assume with always be there, and if someday it is gone, it can be devastatingly difficult to cope with. The reality is for most individuals who do live into their "golden years", there may very well come a day when they can no longer successfully and completely care for themselves and complete their activities of daily living (ADLs) without an increased risk of harming themselves and/or others. The result is a loss of inherent independence, the need for assistance from another person. Most often, help comes from an informal caregiver such of a family member or friend, and when those informal caregivers are not accessible, older people will increasingly grapple with the reality of moving into an assisted living facility.

3. STUDY METHODOLOGY

A paper based survey with web address accessibility (see Appendix A) was designed focusing on how information technology plays a role in caring for our aging population, as well as future aspects for increased and planned utilization within assisted living facilities in Pennsylvania, Connecticut and Massachusetts. The authors had looked at using an electronic survey (such as Surveymonkey or Zoomerang), but after research found that few assisted living facilities had websites, and even fewer had e-mail access to their IT staff person listed on their website. Likewise, we approached state-wide organizations for assisted living facilities and were informed that they did not use e-mail contacts with their members.

Many assisted living facilities are small enterprises and did not seem to have the same technological resources that one might find in acute care hospitals or other more 'main stream' health facilities. The survey placed an emphasis on electronic health records, sensor and monitoring devices, wireless emergency response systems, web based software programs, robotic assistants, and strategic and financial planning.

Different question formats were utilized throughout the survey including: multiple choice answer response, questions with one specific answer and open ended questions. Respondents were also provided free text areas after each question, allowing them to add any additional comments. Respondents who opted to complete the paper based survey, had the ability to skip questions that were not relevant to their facility.

Respondents did not have the ability to skip any questions if they chose to complete the survey on the web. A letter containing the purpose of the survey, a hard copy of the survey, and the survey web address was mailed to 100 assisted living facilities in Connecticut and Pennsylvania. 18 surveys were completed by hard copy and three surveys were completed with the provided online web address; this resulted in a 21% completion rate.

The authors were disappointed with the completion rate, but feel that it may have been due to a variety of factors. The authors sensed: (a) lack of technology use in general (that is, the administrator receiving the questionnaire felt inadequate to complete it and send it back); (b) lack of direct e-mail contact with an appropriate technology minded individual; and (c) the indepen-

dent management nature of assisted living facilities. (See also the comments from CAST – the Center for Aging Services Technologies in the summary area).

Survey Demographics

Possible Surveys	Total Received	Completion by Web
100%	21	3

21% of 100 identified Pennsylvania and Connecticut assisted living facilities completed the survey.

4. TECHNOLOGIES

Electronic health records:

As the number of medical errors and health care costs continue to expand in conjunction with our increasingly aged patient population, the Federal Government has identified the need to set a national goal for improving these challenges by making health information technologically available. On April 27, 2004, President issued, 'an Executive Order establishing the position of the National Coordinator for Health Information Technology within the Office of the Secretary of HHS. The primary purpose of this position is to aid the Secretary of HHS in achieving the President's Goal for most Americans to have access to an interoperable electronic medical record by 2014 [Health Information Technology, 2008]:

An Electronic Health Record (EHR) is an electronic version of a patients medical history, that is maintained by the provider over time, and may include all of the key administrative clinical data relevant to that persons care under a particular provider, including demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data and radiology reports The EHR automates access to information and has the potential to streamline the clinician's workflow. The EHR also has the ability to support other care-related activities directly or indirectly through various interfaces, including evidence-based decision support, quality management, and outcomes reporting. [Centers for Medicare and Medicaid Services, 2008]

EHRs are a technology based solution that will help transform the health care industry towards a more accurate knowledge based industry that will help both providers and patients in making well informed decisions. It will also assist in minimizing sky rocketing health care costs by reducing delays in treatment, duplication of tests, and medical errors. [Centers for Medicare and Medicaid Services, 2008]

The need for health care information infrastructure is overwhelming, yet, as a nation we are behind schedule in meeting the national goal of having EHRs for most Americans by 2014. Yet again, as emphasized in Paper Kills, 'The ability of our healthcare system to address disease prevention and treatment has not kept up with the growing challenges of our aging population and complexity of healthcare delivery and financing. If individuals are to receive the information and care they need to improve their own health, having patient data at the point of care through coordinated health information infrastructure is essential.'[Merritt, 2007] Clearly, the adoption EHR systems in assisted living facilities are an integral part of providing improved healthcare delivery to our aging population.

Monitoring and sensor devices:

In general, when monitoring and sensor devices are discussed in terms aiding in caring for the elderly, one might think of an anti-wandering door monitoring system which projects a visual and audible alarm when a person who is wearing a wristband passes through the door that is equipped with a sensory activated door bar monitor. [Smart Care Givers, 2008] An additional example of a recognizable monitoring and sensor device might be a user activated personal emergency response system. Typically, this type of system includes an electronic pendant that a person wears around the neck or wrist, and it is pressed immediately in any emergency situation. Once pressed, the pendant transmits a signal to the phone and automatically dials an emergency agency or individual contact person. [Today's Caregiver, 2008] An example of this type of technological device includes Philips Lifeline Systems:

Philips Lifeline:

Philips Lifeline is an easy-to-use medical alert service designed to reduce the risk of living alone. Lifeline's advanced technology is ours alone, and every piece of

equipment is assembled and tested by Lifeline here in the United States.

In the event of an emergency, help is available at the push of a button. The Lifeline Personal Help Button connects you to a trained Personal Response Associate who can send help quickly - 24 hours a day, 7 days a week. [Philips Lifeline, 2008]

Electronic tracking devices

Unlike the monitoring and sensor devices that are described above, the devices of the future are destined to be more high tech and more widespread in their use. Why? Well, as stated by Andrew Carle in the USA Today article, 'Assisted living facility gets technology assist; Monitoring devices have human touch', "there are is not going to be enough labor to take care of the 20 million 85-year-olds in their homes," but technology "can enhance our productivity and make us better at our jobs."

The article further describes the future of assisted living by describing how technology has become an integral part of Oatfield Estates, a high-tech assisted living facility in the Portland suburb of Milwaukee. Oatfield Estates provides a real world glimpse at how technology can and will increasing help assisted living facilities in the future. Oatfield electronically measures and monitors residents 24/7 and family members can visit a website and check on their loved ones at any time. This is achieved by:

> Residents and staff wearing small black infrared badges that send invisible signals to sensors scattered around the property. The sensors can pinpoint the location of the badge wearer. Employees can access the information on the computer network through a password-protected website; family members have password-protected access to their loved ones' information. When residents need help, they can just push a button on their badge and staff members get an alert. Bed sensors can be programmed to monitor weight and alert staff when someone gets out of bed. . . This technology also can help track the health of residents less intrusively than humans do. Sensors track how social a resident is, how often he goes out, how much time he spends alone, how much weight

he has gained or losses, or how restless he is. Families and staff can use that information to notice possible problems, such as a resident spending more time sleeping or getting up at night more often. [Kornblum, 2006]

Clearly, the goal of assisted living is to allow our aging population to living as independently as possible for as long as possible, and this cannot be achieved without technology. As noted above, Oatfield Estates has been employing such technologies for the past few years, yet, one might wonder how obtrusive is this technology? The reality is that advanced technologies are often less cumbersome. For example, at Oatfield Estates: 'there are no visible wires; the telltale signs that this might be a high-tech facility are largely unobtrusive. But the technology is there. One just has to know where to look: a closet door where wires connect with servers; a basement where generators and gray metal utility boxes are mounted on the walls; a bell that chimes from a computer in the kitchen, prompting the cook to walk over to the screen to see who needs help.' [Kornblum, 2006]

Electronic medication reminders

As a person becomes older in age, the incidence of chronic diseases and vulnerability to acute illness also increases. Thus, the administration of prescription medications is more prevalent in our older population and medication reminders can help facilitate the appropriate dispensing of these medications.

Electronic medication reminders are technologies that have reminding, monitoring and dispensing features with the goal of ensuring accurate and safe medication for its users. There are numerous types of medication reminders with varying features; these reminders are oftentimes manufactured with the needs of the older person in mind.

**Examples of medication reminders include:**

The Monitored Automatic Pill Dispenser: MD2 is a monitored Automatic Dispenser for tablet and capsule pills and reminder system for non-oral medications, and will call the caregiver if the medications are not taken on time. [E Pill, 2008]

Medtime XL Automatic Medication dispenser/pill organizer/pill box: The E-pill electronic "pill" is a reminder and dispenser system that assists in the on-time and appropriate (pill identification) administration of pill medications. The system simply needs to be loaded with medication and programmed for an alarm to go off at specified times. When this system is alarm activated, its users will only have accessibility to the medications that are identified to be taken at that time, thus, ensuring safety and accuracy of dispensing. [E Pill, 2008]

CADEX Medication Reminder Watch & Medical ID: The CADEX medication watch and medical id bracelet is programmed to set off up to 12 daily sound and optional text alarms notifying its wearer when it is time to take a specified medication. This watch has a medical snooze button that goes off every 3 minutes until the medication is taken. The watch also serves as a database for storing critical information including patient medical information, medications, allergies, insurance and emergency and physician contact information. [E Pill, 2008]
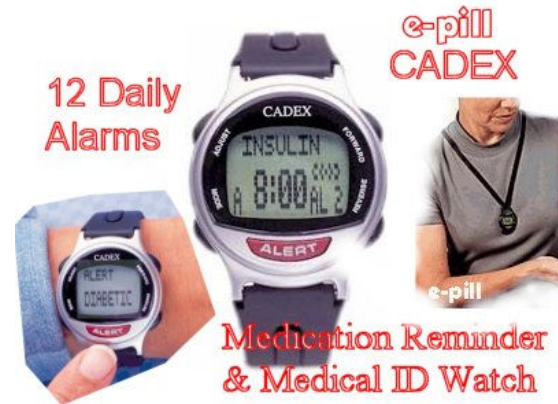
Anti-wandering door monitor systems

The purpose of an anti-wandering door monitoring system is to notify caregivers when a resident is wandering near or exiting through a specified doorway. The industry leader which provides low priced anti-wandering door monitor systems is Smart Caregiver Corporation. [Smart Caregiver, 2008]

Smart Caregiver Corporation's door monitoring system projects a visual and audible alarm when a person who is wearing a wristband passes through the door that is equipped with a sensory activated door bar monitor. Their system also provides the option for a LED display board (4 inches by 3 feet) that can be programmed to display the residents' name, a wireless key pad that allows staff members to reset the door alarm as needed and easily visible from main recreation room and a central monitoring control unit. [Smart Caregiver, 2008]

Automatic fall detection systems

Automatic fall detection systems are often weight-sensing pressure pads for bed fall alarms or chair fall alarms and weight-sensing floor mat fall alarms. These detection pads or mats signal a fall alarm when weight is placed on them. These pads may set off an alarm or trigger a central monitoring unit thru a wireless transmitter. A facility may place a floor mat next to the bed or at the door to notify the staff when a resident

has gotten out of bed or is attempting to exit a doorway. [Smart Caregiver, 2008]

Another example of an automatic fall detection system may include an infrared field motion sensor that detects movement interruption in the specified detecting area and sets off an alarm or notifies staff thru a transmitter. [Smart Caregiver, 2008]

Wireless emergency response devices:

Wireless technology has and continues to transform many industries throughout our society including the delivery of care to our elderly population.   AMS Homecare Inc. whose mission is: 'We provide security and safety to individuals and the elderly' [AMS Homecare, 2008], provides this type of technology with their Integrated Emergency Response Systems (IER). 'IER is a software system that integrates all communicative systems within a facility. It coordinates the telephone system, intercoms, video cameras, and staff paging. It also logs all data so that companies can track records and look for trends that affect their business. This system connects hardware devices such as wireless smoke detectors, wireless long-range telephones, pocket pagers, staff and resident pendants and bathroom and bedside stations.' [AMS Homecare, 2008]

An example of how integrated wireless technology has been helping out senior living facilities can be illustrated at Brighton Gardens of Towson, a Sunrise Senior Living facility in Towson, Maryland. This facility has integrated their wandering prevention and emergency response systems.   Residents wear pendants or bracelets that allow them to request help if needed. In addition, residents who have a tendency to wander are given an additional pendant or bracelet that notifies the staff when he or she leaves through a monitored door. These systems are monitored by a PC-based control interface displaying information from both the emergency-response network and the wander-prevention system.   In addition, staff members are equipped with pagers, thus, not requiring them to sit in front of the monitor waiting for an emergency. Not only does this integrated system enable the staff to more efficiently monitor the residents, it also allows the facility to generate activity based reports aimed at improving the care

of a specific resident and/or the facility in general. [Elder, 2004]

Although integrated wireless technology is not standardized at assisted living facilities, our nation's impending exponential growth of residents coupled with a shortage of caregivers will enhance the standardized need and increase the benefits of this type of technology.

Web based software programs:

Web based software programs for the elderly and caregivers represents technology aimed at improving quality of life, enhancing social connectedness, and potentially increasing health outcomes. Although, there are not a tremendous number of web based programs geared towards the elderly, the GrandCare System and It's Never 2 Late system are two systems being utilized by to help the elderly remain as independent and empowered as possible:

GrandCare Como System: explores a new frontier in technology using the internet, the senior's television to communicate & wireless sensors to monitor wellness.

Communication: Family and friends can send messages, pictures, reminders, calendar appointments and more to a dedicated, customized channel on the senior's television. Como also offers several general features such as the weather forecast, headline news, famous quotes, word definitions and spiritual offerings that you can select to be shown as well. Grandchildren can even send pictures from their cell phones directly to the TV channel. Family members and caretakers/nursing staff can coordinate schedules and keep the senior up to date by using the Web-based GrandCare Calendar.

Monitoring:
Meanwhile, discreet sensors (motion, door, temperature, etc.) as well as call buttons and tele-wellness sensors (blood pressure cuff, weight scale, glucose meter, etc.) are placed around the home so family members and caregivers can be certain that all is well. They can even set up conditions as to what they'd like to happen if certain parameters are met. For example: if there is not motion for a specified amount of time you might want

to receive a phone call. If the inside/outside temperature is above or below a certain point, you might set up the system to send out an email to all caregivers. If there is motion by the bedside during the night, you might set up the system to turn on a hallway light to prevent a fall and provide a cognitive assist.' [Grand Care, 2008]

It's Never 2 Late: 'It's Never 2 Late's adaptive computer systems have been designed to encourage seniors to interact—with family, friends, the Internet, and customized programs. By striving to provide a whole new level of person-centered care, It's Never 2 Late empowers your residents to self-direct their own activities, therapies and other programming.

Each of your residents will enjoy:A full program of activities adapted to is or her unique abilities and interests

A unique and versatile user profile that can be modified as the resident's abilities, interests, or computer abilities change

True personalization—no two residents will have the same activity portfolio

Only IN2L offers life-changing adaptive systems you can utilize to:

Engage individuals and create excitement in order to maximize community participation

Promote independence and lifelong learning

Connect individuals with the greater community

Enhance the communication and relationships of individuals with their families and friends' [In2L, 2008]

Robotic assistants:

Robotic assistants vary by definition, appearance and capabilities. Nonetheless, they all share the common characteristics of a movable, mechanical structure which operates under some degree of autonomous control. [Wikipedia Robotics, 2008]

Today, robotic assistants do not play a notable role in the delivery of care to our aging population. Yet, as our aging population continues to exponentially increase and the

gap of available and needed caregivers continues to widen, alternative modes for augmenting the responsibilities of the caregiver will be progressively studied, tested, and implemented. Robotic assistants are one of these alternative solutions.

The Nursebot project is a multi-disciplinary and multi-university effort focused on constructing mobile robotic assistants for our aging population. In 1998, the Universities of Michigan and Pittsburg, and Carnegie Mellon University developed a research team ambitiously focused on developing robotic assistants to assist our increasing aged population. As this project advanced, its goals were expanded to include assistants for the elderly in other settings, most notably, assisted living and nursing homes. [Pollack et al., 2002]

This team of investigators has created and tested a robot named Pearl. How does Pearl work? Pearl is an autonomous mobile robot that has software systems that enable her to assist the elderly. These systems include: 'a differential drive system, two on-board Pentium PCs, wireless Ethernet, SICK laser range finders, sonar sensors, microphones for speech recognition, speakers for speech synthesis, touch-sensitive graphical displays, actuated head units, and stereo camera systems.' [Pollack et al., 2002] Overall, Pearl is focused on two tasks: reminding people about their activities of daily living such as eating, drinking, taking their medicine, using the bathroom and physically guiding them within their environments. One of the test settings for Pearl was at the Longwood Retirement Community in Pennsylvania. Here, Pearl was able to demonstrate her effectiveness and affirm the Nursebot project's vision of robotic assistants helping the elderly. [Pollack et al., 2002]

Another example of how robotics already provides caregiver assistance to the elderly includes a feeding robot in Japan. Secom Corporation has developed, manufactures, and sells My Spoon feeding robot. This robot is joy stick operated, has a swiveling arm and allows the operator to feed himself. As of October 2007, Secom Corporation has sold over 300 My Spoon feeding robots, yet, with almost 25% of the Japanese population over the age 65 and the aged population continuing to rise, the likelihood that sales will grow is probable. [Tabuchi, 2007]

Robotics has begun to aid the elderly with everyday tasks and maneuvering around their environment, yet, clearly, they are not meant to replace the human interaction. Robotic assistants such as Pearl or My Spoon feeding robot are meant to empower the elderly to take care of themselves for as long as possible. They provide a tangible vision for the future of robotics and caring for our aged population that needs assistance, yet, revels in maintaining as much independence as possible.

5. SURVEY RESULTS

a. Electronic health records

Of the assisted living facilities represented in the survey, 9.5% have implemented electronic health records. The remaining 90.5% do not utilize an electronic health record system, although one facility is considering a system.

EHR Implementation
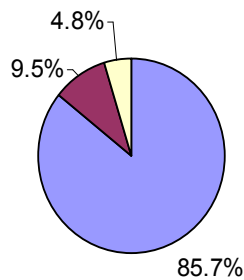
### b. Monitoring and sensor devices

76% of assisted living facilities indicated that they have implemented monitoring and motion sensor devices. 52% reported having anti-wandering door system. 19% reported having motion sensor devices. 14% reported having electronic tracking devices and 5% reported having an automatic fall detection system.

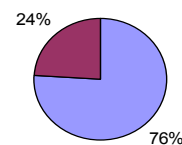Monitoring and Sensor Device Implementation
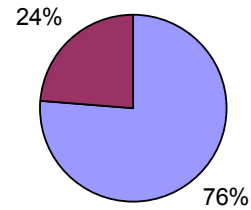
Monitoring and Sensor Device Usage
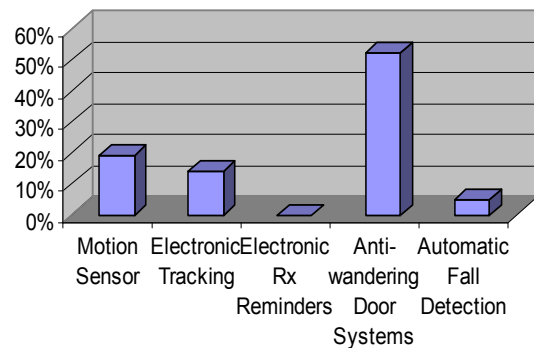
c. Wireless emergency response Systems

76% of respondents reported that their residents wear wireless emergency response systems. The remaining 24% of respondents answered that their residents do not wear any.

Wireless Emergency Response System Usage

d. Web-based software programs

None of the respondents indicated that their facility utilized any type of web-based software that would enable caregivers and family members the ability to track residents.

e. Robotic assistants

None of the respondents indicated that their facility utilized any type of robotic assistant.

f. Adoption rates

As it relates to the importance of adapting technology to the reporting facilities, 42% felt that it was important. 26% indicated that it was somewhat important. 16% reported that it was not very important. While 11% reported that it was extremely important and 5% reported that it was not important at all.

Importance of Adoption
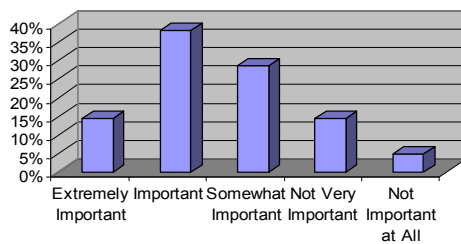
Quality of care purposes was determined to be the number one response to why facilities considered it important to implement advanced technologies, which was selected by 71% of respondents. 24% of the respondents equally indicated that patient and family requests and none of the provided reasons applied. Competitor implementation was selected by 19% of respondents, and accreditation purposes were reported by 5% of the respondents.

Motivating Factors for Adoption Technologies
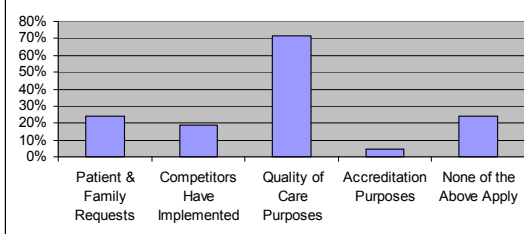
g. Strategic planning

24% of respondents answered that discussions about the pursuit of advanced technologies occurred semi-annually. 19% of respondents equally responded that these discussions occurred on a monthly, quarterly or never. 14% reported that strategic discussion occurred on an annual basis and 5% reported that discussions took place on a daily basis.

Frequency of Strategic Discussions
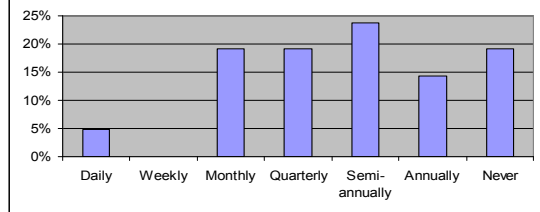
As it relates to having a strategic plan, 76% of the respondents said that their facility did not have a strategic plan; the remaining 24% reported that they do have a strategic plan for implementing advanced technologies.

Strategic Plan Implentation
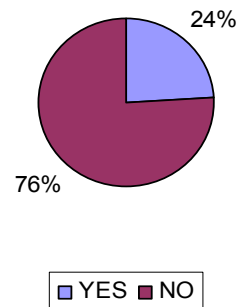
Financial Resource Allocation

When asked what period of time had elapsed since the facilities had budgeted financial resources for the purchase of advanced technologies, 38% reported that they have never budgeted for them. 24% of respondents responded that they had financially budgeted for these expenses for more than 5 years. 19% of respondents indicated that their 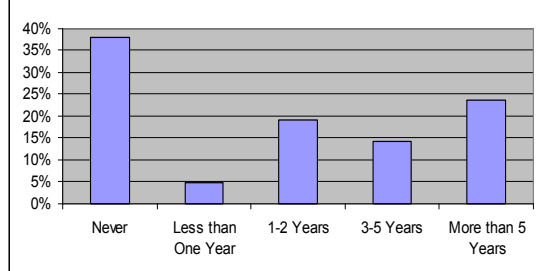facilities had budgeted for advanced and/or new technologies for 1-2 years, while 14% of respondents indicated that they had a budget for 3 -5 years. 5% stated that it was less than 1 year.

h. Barriers to implementation

Cost was perceived to be the biggest barrier to implementing aging service technologies according to 71% of respondents. The second most reported reason to barriers in implementation was lack of user friendliness at 33%. 24% of respondents equally reported that facility infrastructure and lack of training were barriers. 19% reported that provider resistance was a barrier to implementation, while 10% reported that all of the above were barriers to implementation.

Barriers to Implementation

Implemented Strategies
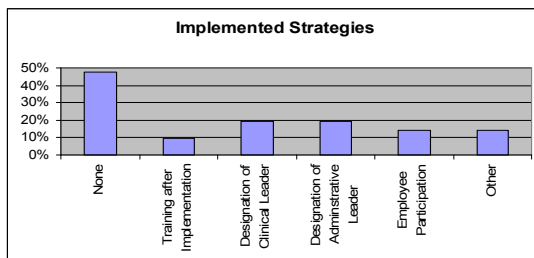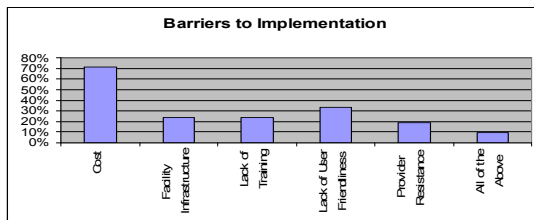
48% of respondents indicated that have not implemented any strategies to overcoming these barriers.

19% equally reported that they have designated a clinical leader and an administration leader to overcome barriers. 14% of respondents equally indicated that they have employed other actions and employee participation to overcome these barriers. One anonymous respondent indicated that they had utilized their IT department, and another anonymous respondent listed budgeting

as an action to overcome these barriers. 10% of respondents indicated that they provided training after adopting new and/or advanced technologies.

6. SUMMARY OF SURVEY

The authors were encouraged by some results, extremely dismayed by others and interpreted other results as being about what was expected.

Positive results:

The authors were very impressed with the results on monitoring and sensing devices – where 76% of respondents indicated they had implemented such devices. Of these, the most frequent implemented were anti-wandering devices. Another positive result was that of implementation of wireless devices, such as pendants or other devices that could be activated in case of a fall or other emergency.

Negative results:

The authors were disappointed that 87.5% of the respondents indicated that their assisted living facility did not have electronic health records. Likewise, the authors were disappointed that 76% of respondents indicated that their facilities did not have strategic plans for implementing information technologies – and that 38% of the respondents indicated that their facility has never budgeted for information technologies. The authors also were disappointed that 48% of the respondents indicated their facilities had no technology implementation strategies. In an age where government is pressing hospitals to adapt electronic health records that assisted living facilities seem to exist in a back-water pond.

Results as expected:

71% of the respondents indicated that cost was the major problem in implementing information technologies.

The investigators were pleased to confirm that 76% of assisted living facilities have already adopted wireless emergency response systems that enable residents to maintain independence with the capability of notifying formal caregivers if additional aid or emergency assistance is needed. In addition, the investigators were pleasantly surprised to learn that 76% of these assisted

living facilities have implemented some sort of monitoring and motion sensor device(s). Anti-wandering door systems which are being utilized by 52% of the responding facilities are the most prevalent type of monitoring and motion sensor device that has been accepted.

Although, the investigators were not surprised to learn that survey responders have indicated that information technology is playing a role in providing quality care in assisted living facilities, they did not expect to learn that **only** 9.5% of facilities have incorporated electronic health records into their facility infrastructure. The researchers had hoped that the number of facilities that have adopted electronic health records would have been higher given the federal government's endorsement for national adoption of EHR by 2014. [Health Information Technology, 2008] And since medical errors are a tremendous financial burden to the health care industry, it will be interesting to learn if assisted living facilities work in tandem with other health care entities as they increasingly adopt paperless medical documentation that can be seamlessly transmitted from one caregiver to another.

It was encouraging to determine that 53% of responders believed that adopting information technology is either important or extremely important. At the same time, it should be noted that the vast major (76%) of facilities do not have a strategic plan for implementing new and/or advanced technology, and 38% have never budgeted financial resources for the purchase of these technologies.

Overall, these study findings reinforce the challenges that the Center for Aging Services Technologies (CAST) summarizes in their March 2008 report, "State of Technology in Aging Services":

> 'Lack of awareness and usability challenges, both perceived and real, on the part of older consumers tops a list of barriers that stand in the way of information management related technology adoption in aging services. Equally troubling is a lack of consensus regarding the value of technology in "aging in place" care, the absence of adequate financial and other incentives to encourage investment in this technology, and critical gaps in connectivity and interoperability among ex-

isting technologies and information systems. To overcome these barriers, decisive action is needed to educate a variety of audiences about technologies that support independent aging and how they can best be designed, implemented and used.' [CAST, 2008]

Even with these barriers, the researchers for this study agree with CAST about the increasing role of technology in caring for the elderly population, and they look forward to re-evaluating adoption rates of new and/or advanced information technology at assisted living facilities in the not-too-distant future:

> 'technology has the potential to play a critical role in launching a new model of geriatric care that allows older people to live independently for as long as possible, supports family caregivers in the important work they do and gives health care providers the tools they need to deliver high-quality care at a reasonable cost.' [CAST, 2008]

7. CONCLUSION

This study was intended as an initial analysis of the implementation of appropriate healthcare related information technologies into assisted living facilities. It was intended to establish a baseline for other studies. As such, 100 surveys were mailed out with a response rate of 21%. (One of the authors has done similar healthcare studies with acute health care facilities with a 93% response rate when first distributed online and with a follow direct mail questionnaire to specific CIO's. We attribute the lower response rate to (a) more generic mailed questionnaires, (b) lack of e-mail addresses; and (c) possibly the nature of the assisted living facility industry as being less technology oriented). The authors used Connecticut and Pennsylvania assisted living facilities for our study. The authors are located in these states and had an interest in assisted living in these states. The authors also thought that these two states in the industrial and possibly more affluent northeast might be good harbingers of how information technology has been accepted into assisted living facilities. (And we realized that information technology has generally NOT been accepted into assisted living facilities)

The authors sensed our results are probably typical, but will do additional research. They sensed that assisted living facilities have been slow in adopting technologies – as illustrated by the large numbers of respondents that did not have strategic plans and have not budgeted for information technologies. As the baby boomers approach retirement and the increased probably for assisted living and related healthcare facilities, the authors sense that the adoption of enabling and relevant information technologies are lagging in acceptance.

Limitations and suggestions for future study:

The authors feel this study is significant, as it seems to be an initial foray into studying the acceptance of information technologies into assisted living facilities. The study was limited to 100 mailed questionnaires to managers of assisted living facilities in Pennsylvania and Connecticut. It was further limited in that the study only had 21 respondents. As mentioned earlier, that was a disappointment, but sense that assisted living facilities tend to be on the lower end of the technology adoption scale (as shown by the results) and administrators may have felt inadequate about filling out the questions.

The authors would like to see similar studies in other locations – possibly encouraged and funded by assisted living organizations like the Center for Aging Studies Technologies (CAST) or the National Institutes of Health (NIH). With the expected growth in senior Americans with the baby boom, the authors feel this field is open to study. We feel that this baseline study can be used for comparison in the next ten years as technology adoptions that are more common in other healthcare facilities will 'trickle down' into assisted living facilities.

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APPENDIX A

Assisted Living Questionnaire

This survey is to gather information about the use of technology in assisted living facilities. We appreciate your help with this research!!!

1. In which state is your facility?

Connecticut

Pennsylvania

Other (please specify)

2. Does your facility utilize electronic health records?

Yes

No

3. What types of monitoring and sensor devices does your facility utilize?

Motion sensor systems

Electronic tracking devices

Electronic medication reminders

Anti-wandering door monitor system

Automatic fall detection systems

4. Do your residents wear any integrated wireless emergency response systems?

Yes

No

5. Does your facility have any web based software programs to enable providers, caregivers and/or family members to monitor residents? (like allowing children to check on Dad's blood pressure / medication by the Internet)

Yes

No

Please comment

6. Does your facility have any robotic assistants?

Yes

No

Please comment

7. How important is adapting new or advanced technology to your facility?

Extremely important

Important

Somewhat important

Not very important

Not important

8. Please identify your reasons for your answer in question #7.

9. How frequently is the pursuit of advanced or new technologies discussed at board/management facility meetings?

Daily

Weekly

Monthly

Quarterly

Semiannually

Annually

Never

10. Does your facility have a strategic plan for implementing advanced or new technologies to improve resident care?

Yes

No

11. For how long has your facility planned and budgeted financial resources for the purchase of advanced or new technologies?

Less than one year

1 to 2 years

3 to 5 years

More than 5 years

12. What do you perceive to be the biggest barriers in implementing aging service technologies?

Cost

Facility infrastructure

Lack of training

Lack of user friendliness

Provider resistance

All of the above

13. What strategies have you employed to overcome the barriers to implementing aging service technologies?

None

Training after implementation

Designation of clinical leader/sponsor

Designation of administrative leader/sponsor

Employee participation in decisions to buy/implement

14. Are there any questions / suggestions / concerns about implementing various technologies into assisted living facilities? If so, please enter the comments below.

15. Would you be open to sharing information by e-mail?

If yes, please give your email address: