Towards Effective and Efficient Health Information Technology Adoption in Home Care[1]

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Structured Abstract

Purpose: To increase the effectiveness and efficiency of health IT adoption in home health agencies (HHAs)

Scope: A qualitative study was conducted to obtain rich contextual information strengthening the evidence base about the (i) HHAs' challenges and opportunities related to delivering care and conducting business, which should derive health IT adoption strategies and decisions to achieve effectiveness (ii) contextual determinants of health IT adoption that should be managed to achieve efficiency by minimizing overheads

Methods: Semi-structured interviews were conducted with the related professionals from Maryland HHAs. The topical areas were based on (i) a number of established systems analysis techniques such as problem analysis, duration analysis, activity-based costing, outcome analysis, and technology analysis to document the HHAs' challenges and opportunities (ii) the constructs in the Rogers' diffusion theory to uncover the contextual determinants of adoption. The interview transcripts provided the raw data analyzed using the Framework method. The analysis of qualitative data included constructing an index, open coding, summarizing and sorting, and eliciting descriptive and explanatory accounts.

Results: For effectiveness, health IT adoption needs to focus on addressing the (i) coordination of clinical and administrative workflows (ii) exchange of health information (ii) hiring and training clinicians (ii) educating and training patients and caregivers. For efficiency, HHAs should define and follow organizational processes. Complexity of health IT is a challenge but training typically addresses the important problems. Generally, the attitudes and beliefs are positive towards health IT adoption in HHAs.

Key Words: Home health care, health information technology, diffusion of innovations, technology acceptance, process and quality improvement.

1 PURPOSE

The triple aims, higher quality of care, improved health outcomes, and reduced costs become important targets in home health care due its increasing utilization and expenditures. Successful adoption of health information technology (IT) by home health agencies (HHAs) is a critical tool for achieving those targets. Rather than being an end in itself, health IT should be viewed as a vehicle that facilitates a contextual shift which can close the gap between the current context and a more desirable context in the future, which is depicted in Figure 1. This view of health IT as a *tool* or *vehicle* has permeated the conceptualization, design, and execution stages of this research project.
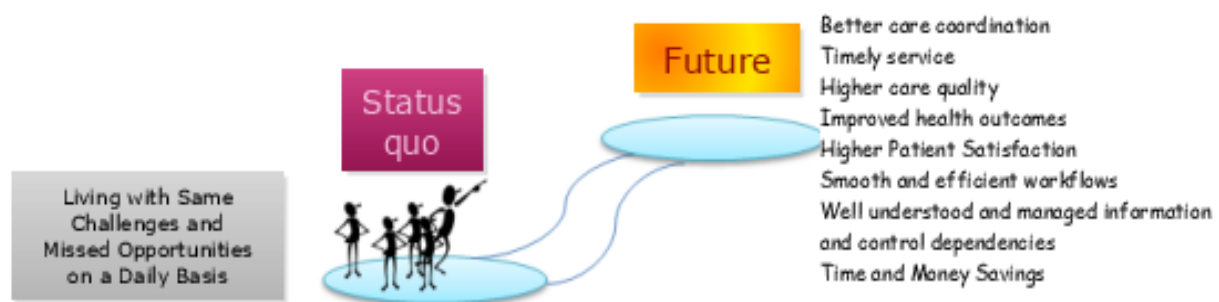

Figure 1: A pictorial depiction of the existing gap between the current context of HHAs and a more desirable level in the future.

The purpose of this research was to contribute to the evidence base about how HHAs can leverage health IT more effectively and more efficiently. In this context, effectiveness means creating the maximum advantage towards reaching the triple aims through health IT adoption given limited resources; efficiency means reducing the overheads incurred due to health IT adoption. Both effectiveness and efficiency are important for HHAs when it comes to health IT adoption; while the first one ensures that health IT creates value, the latter ensures the on-going feasibility of health IT solutions.

Figure 2 depicts the high-level strategic goal of the research project. The project involved qualitative research methods to obtain rich information from the Maryland HHAs. The aims of the project were as follows:

- To support effective health IT adoption, the pressing and important challenges and opportunities of HHAs were investigated in depth. Building evidence about those challenges and opportunities can inform the decisions made by HHAs' at various stages in their health IT adoption projects often tackled with limited resources, thus increasing the chances for success.
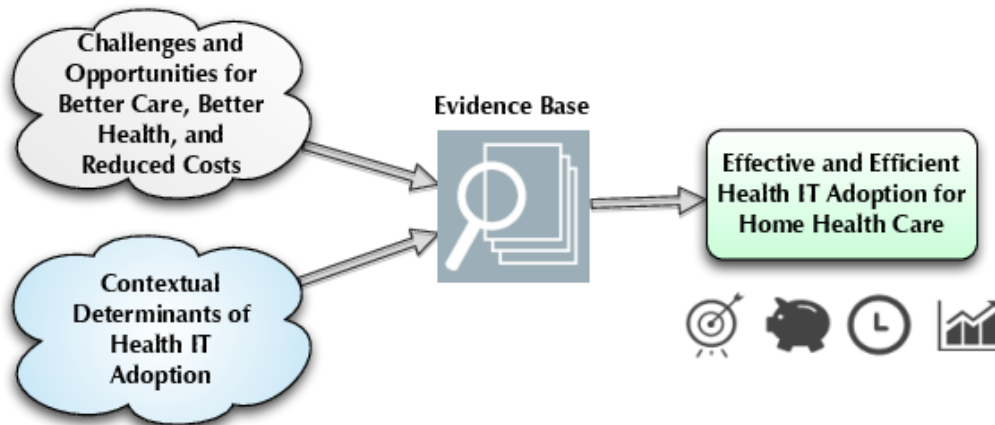
Figure 2: Project Strategy to Derive Sustained Benefits from Health IT for HHAs

- To support efficient health IT adoption, the contextual determinants of health IT adoption in HHA settings were explored from a diffusion of innovations perspective. A better understanding of those determinants can reduce various overheads in health IT adoption, e.g., training costs.
- Finally, the project aimed to contribute to the evidence base by broadly disseminating the its results and to make recommendations about key solutions and strategies that can be implemented by HHAs as well as other parties such as vendors and government agencies.

2 SCOPE

2.1 BACKGROUND

Home health care, also called *home care*, refers to part-time or intermittent (also called episodic) secondary care services provided to *home-bound* patients in home settings which typically involves skilled nursing care, physical therapy, occupational therapy, speech therapy, medical social services, or assistance from a home aide [21]. By receiving home care temporarily, home-bound patients can achieve better recovery, gain strength, regain functionality, and become independent more quickly [29]. In addition, evidence suggests that quality home health care can help decrease overall health care expenditures by reducing avoidable and costly hospital re-admissions and emergency room visits [35, 44].

In the US, home health agencies (HHAs), the providers of home health care, serve a sizable and mostly elderly population. In 2012, there were more than 10,000 medicare-certified HHAs in the US. In the same year, Medicare had 3.46M home care beneficiaries, 93 per 1,000 enrolled. Eighty-six percent of home care beneficiaries were 65 or above [42]. The 2010 Census reported 13 percent of the United States (US) population to be 65 or above with the projections for 2020 and 2030 rapidly reaching to 16 and 19.3 percents, respectively [57].

As the senior population grows, the utilization of the home care services is expected to increase [7]. In addition, the healthcare reform initiatives promoting an integrated continuum of care [15, 38, 31], accountable care organizations [8], and pay for performance [30] encourage hospitals to better coordinate with and utilize the HHAs in their areas. Therefore, it becomes critical that HHAs leverage health information technology (IT) such as Electronic Health Records (EHRs), Health Information Exchange (HIE), and telemedicine successfully.

2.2 CONTEXT

Compared with many acute and primary care health organizations, HHAs have typically fewer resources to support successful health IT adoption. The EHR adoption rate in the home care industry has been traditionally low, only 43% in 2007 [46]. Furthermore, various eligibility issues have prevented HHAs from receiving financial incentives for EHR adoption under the Health Information Technology for Economic and Clinical Health (HITECH) Act [13].

HHAs can easily acknowledge the role and importance of health IT by looking at how IT transformed other industries. However, successful health IT adoption often requires a considerable investment of organizational resources at various stages [6]. Most HHAs, particularly the small and medium ones, are more immediately concerned with the pressing challenges about delivering care and running a business on a day-to-day basis [55]. Therefore, for HHAs, it is crucial that health IT adoption directly addresses their problems by causing only tolerable difficulty and financial burden. Otherwise, health IT adoption may not be considered a viable option resulting in postponements or cancellations of health IT adoption ideas and projects.

Under resource-constrained conditions, leveraging health information technology effectively and efficiently becomes a particularly challenging and important topic for HHAs. While there exist some knowledge about the challenges and opportunities of HHAs and the contextual determinants of health IT adoption within HHAs, evidence-based health IT adoption in home care has been lacking [25]. According to our knowledge, this research study is the first one directly tackling the question of achieving effective and efficient health IT adoption in HHAs.

2.3 SETTINGS

Home care settings and the types of care provided by HHAs present a number of unique characteristics:

- *Post-Acute Nature of Care*: Prior to home health care, most patients receive care at a different facility such as a hospital. Due to its secondary nature, home health care [17] relies on previously-collected information about patients' medical history such as health problems, illnesses, and medication.
- *Off-Site Nature of Care*: Unlike the fixed clinical settings, for HHAs, providing care requires mobility on behalf of the health care practitioners, *clinicians* henceforth, due to the home bound status of patients [4]. Clinicians are typically on their own in patients' home while providing care and making decisions. Patients' home can be less familiar and less controllable compared to fixed clinical settings. Often, medical equipment, devices, and medication have to move to patients' home as well.
- *Interdisciplinary Team*: Home health care typically requires a variety of skills and knowledge. Therefore, HHAs employ an interdisciplinary team of professionals with various degrees such as

nurses, therapists, social workers, counselors, and home aides [9]. These professionals have differences of knowledge, skills, and culture but they need to effectively communicate and coordinate within and outside of the HHA [4, 32].

- *Intermittent Care*: In its most common form practiced in the US, home health care refers to an intermittent form of care, i.e., there should be start and end dates for each care episode [17]. Indefinitely providing care in home settings does not fall into the Centers for Medicare and Medicaid's (CMS) definition of home care[2] . Each care episode needs to be approved by a physician after meeting with the patient face to face. Although physicians can approve additional episodes for a patient, CMS discourages physicians from continuously doing so since other care alternatives may be more appropriate and may need to be considered.

2.4 PARTICIPANTS

The participants for this study were recruited from the Maryland HHAs. Maryland Health Care Commission (MHCC) and the Maryland-National Capital Homecare Association graciously agreed to help in participant recruitment. Both organizations encouraged the HHA professionals in Maryland to participate in this research. Their generous help played a crucial role in successfully contacting and recruiting the participants from Maryland HHAs. As will be detailed in Section 3.1, the participants were among the HHA executives, directors, and clinicians in Maryland.

3 METHODS

3.1 STUDY DESIGN

The qualitative research involved a series of semi-structured interviews conducted to obtain rich contextual information. The unit of observation in this study was a single HHA. The interviews were based upon (*i*) well-established systems analysis techniques to explore the HHAs' challenges and opportunities (*ii*) Rogers' [49] diffusion elements as they apply to health IT adoption in HHA:

3.1.1 SYSTEMS ANALYSIS TECHNIQUES TO UNCOVER CHALLENGES AND OPPORTUNITIES

The following systems analysis techniques guided the researchers in creating interview questions and probing the participants during the interviews for further information or clarification as it became necessary:

Problem Analysis: This commonly used systems analysis technique explores the problems with the current system together with their root causes and possible solutions [34, 24, 23, 20, 50]. Particular emphasis is placed on the most important, repeatedly occurring, resource consuming, and frustrating problems. Then, the root causes are questioned in order to make sure that the problems are real ones, not the symptoms of other problems.

Duration Analysis: The main purpose of duration analysis [40, 54], a common process improvement technique, is to identify the opportunities in the current system for reducing the times spent for certain tasks perhaps by changing the order of tasks, their timing, or even by parallelizing them by eliminating unnecessary task dependencies.

Activity-Based Costing: Rather than using time as a crude measure of cost as done in the duration analysis, activity-based costing identifies the most expensive tasks in the organization and identifies the opportunities for cost reduction [16, 22, 26, 33, 51]. As a result, high-cost activities can be targeted and focused and prioritized improvements can be performed on them.

Outcome Analysis: Outcome analysis [58, 59, 56] identifies improvement opportunities in the current system by focusing on the desired outcomes. Starting from important outcomes and thinking backwards can identify some improvement opportunities that may not be visible with an inside-out perspective.

Technology Analysis: Technology analysis [36] focuses the discussion on whether or how an organization can take advantage of the existing and new technologies. Technology analysis involves exploring the impact of new technologies on the organizational workflows.

3.1.2 DIFFUSION ELEMENTS UNCOVERING THE CONTEXTUAL DETERMINANTS OF ADOPTION

The study involved HHAs with different stages of health IT adoption, ranging from those who were just considering to adopt EHR systems to those using multiple and more advanced health IT solutions such as telemedicine. The interviews asked questions about Rogers' [49] diffusion elements as they applied to health IT adoption in HHAs. The study elicited information about these elements from the participants to uncover the contextual factors facilitating or preventing health IT adoption.

A large group of the studies on IT adoption in health settings (e.g., [1, 37, 43, 60]) used a variation of the technology acceptance model (TAM) [12]. TAM shows the effects of usefulness and ease of use on the intent to use a technology. A recent review [28] of those studies, however, identified a limitation: Even though each TAM study added or removed some variables, the models were still not contextualized enough, i.e., some important determinants were overlooked or received less attention than they deserved.

Rogers' work on the diffusion of innovations [49] takes an even more comprehensive approach compared to TAM. It includes the elements that can be at force at different stages of adoption: knowledge or awareness, persuasion, decision, implementation, and confirmation. Rogers also considers the characteristics of the innovation itself, communication channels, and social system. The characteristics of innovation include the relative advantage (similar to usefulness in TAM), compatibility, complexity (related to ease of use in TAM), trialability, and observability. Communication channels play an important role because most individuals adopt an innovation based on peer advice. Adoption becomes more difficult as differences in beliefs, education, and social status, increases. Time aspect is related to the diffusion phases: Social norms and structure have also an affect.

It can be noted that the studies modifying TAM ended up adding variables mentioned in the Rogers' diffusion model. In addition, Roger's model has been refined and improved over a longer time period in different domains. In a recent effort to merge Roger's approach with TAM, Morton developed a framework and a model better explaining the EHR attitude [41]: The model variables explained about 73% of the variance in the attitudes towards EHR. Bower [5] observed that many diffusion variables of Rogers were highly relevant when it comes to the EHR diffusion in healthcare. For these reasons, the PI decided to use Rogers' elements in order to uncover the contextual determinants of health IT adoption in HHAs.

3.2 DATA SOURCES AND COLLECTION

3.2.1 SAMPLING

Maximum variation sampling [11], which is a purposeful sampling strategy, was used in the HHA recruitment. In sampling, certain HHA characteristics, which can be related to HHAs' challenges and opportunities, were taken into account to achieve an appropriate mixture of HHAs for the purpose of obtaining the greatest variation, thus a comprehensive understanding of the research topic. These characteristics were size, organization, business model, age, and geographical areas served:

Size: In the home care industry, the size of an HHA refers to the volume of its operations. Smaller and larger operations can present different challenges and opportunities which can be addressed by health IT. Size is also related to the agency budget, including the health IT budget which can affect current health IT adoption levels and future plans. In this research, the number of admissions per year and number of visits per year served as proxy measures for agency size. The histograms plotted for Maryland HHAs revealed that the following characterizations were appropriate:

Small: Less than 10,000 visits or less than 1,000 admissions
Medium: 10,000 to 40,000 visits or 1,000 to 3,000 admissions
Large: Greater than 40,000 visits or 3,000 admissions

Organization: In terms of its organization, an HHA with a provider ID, which can serve patients, can be a stand-alone HHA, a branch of a chain HHAs (e.g., a nation-wide HHA), or a franchise. The organization type can result in certain roles and processes which can affect the challenges and opportunities of an HHA. For example, a franchiser HHA is supposed to implement the processes defined by its franchising entity.

Business Model: HHAs can be for-profit, non-profit, or government-owned agencies. Some local or state governments, for example, can have their own HHAs serving medicaid patients and experiencing specific challenges associated with providing care for disadvantaged groups.

Geographical Areas Served: An HHA can serve rural, suburban, or urban areas. Some HHAs serve multiple types of geographical areas, e.g. suburban and rural. HHAs serving rural areas and those serving urban areas may have different problems.

Age: The age of an HHA could be related to the maturity of its business and care delivery processes. Therefore, our sample of HHAs included a mixture of young (less than 20 years), mid-age (between 20 and 40 years), and mature agencies (older than 40 years).

While there could be other characteristics along which HHAs could be categorized, the researchers and their colleagues in MNCHA and MHCC agreed that the important HHA characteristics were covered for the purposes of this study. At the time of this research, MNCHA had 68 Maryland HHAs as its members; CMS listed 77 HHAs for Maryland. With the support of MHCC and MNCHA, a representative sample of thirteen Maryland HHAs, which showed considerable variety according to the above characteristics, were included in the study.

3.2.2 INTERVIEWS

Based on the analysis techniques explained above, a guideline for semi-structured interviews was designed. This interview guideline was reviewed by MHCC and MNCHA and revised according to the feedback received from them. The feedback process started with email exchanges, continued with a two-hour meeting attended by all parties, and concluded with further email exchanges. Semi-structured interviews provided the flexibility to customize questions ahead of time or during the interviews according to the particular situations. It was possible to probe the participants and divert course by removing, adding, or changing the questions as it became necessary.

Prior to the start of the interviews, the study was reviewed and approved by the Institutional Review Board (IRB) of UMBC for ethical considerations. The interviews were conducted with:

- *Executives and Managers*: Due to their breadth of knowledge about the organizational improvement needs related to both clinical and administrative areas and their decision-making experiences related to health IT adoption, the executives and managers of each selected HHA were interviewed. Each interview involved either two participants, one domain expert and one IT expert, or a single participant provided that the participant is knowledgeable in both areas. Prior to each interview, the participants were contacted to verify that their availability and level of knowledge.
- *Providers*: Due to their clinical knowledge, the clinicians from the HHAs were also interviewed. Due to their important roles in delivering care, we interviewed the visiting clinicians. We also interviewed the in-take clinicians who admit patients to their HHAs by coordinating care transitions.

The interviews were conducted over the phone. During the interviews, the interactions were encouraged to incorporate different views and clarifications. On average, about 75 minutes was spent on each interview to obtain responses to the research questions. Each interview was recorded and transcribed verbatim to ensure accuracy. The transcripts noted times and the initials of the speakers for each turn of the conversation. Each interview conducted was followed up by a member check interview where researchers made sure that their understanding was correct by asking clarification or further questions. Prior to a member check interview, the transcript of the original interview was sent to the interviewee to allow time for review. The interview transcripts provided the raw qualitative data analyzed using the Framework Method. As common in qualitative studies, the interviews were stopped when the researchers observed that a saturation point was reached after which the new interviews did not considerably add to their findings. The researchers regularly met to discuss the results and findings during the analysis phase.

3.2.3 STAKEHOLDER MEETING

The research results were presented to the representatives of the Maryland HHAs at a half-day meeting held at UMBC (Home Health IT Summit 2014) to receive their final comments and feedback. This meeting was in the original research plan. About half of the HHAs participated in the research study were able to attend the summit and about half of the HHAs represented at the summit were among those participated in the interviews. The summit had 27 attendees including two representatives from MNCHA, one representative from the State of Maryland, three faculty members, and four UMBC students.

3.3 FRAMEWORK METHOD

This project followed a qualitative research method called *Framework* [47, 48, 52, 53]. Framework was developed originally for applied policy research where research objectives are typically set by the pressing information requirements of government agencies. Since then, Framework has been used in many areas including health research (e.g. [18, 45, 19, 14]).

Framework is both inductive and deductive: It is grounded and inductive because it focuses on original accounts and observations gathered during research. At the same time, it is deductive because it allows and accommodates initial objectives, observations, and prior knowledge. Framework has a pragmatic nature: The ontological position of the creators of Framework is that it is possible to know about the world objectively because the world exists independently of the researchers' interpretation. Therefore, Framework draws on the aspects of the scientific method but has been adopted to suit the nature of the qualitative data and the goals of the qualitative research.

In this research, the analysis of qualitative data, consistent with the steps outlined for Framework, took place concurrently with interviews:

- *Constructing an Index*: An initial index, also called conceptual framework, was created by the researchers. This initial index consisted of a priori descriptive accounts, understandings, and observations of the researchers. The initial index served as a starting point for the indexing activities applied on the raw data.
- *Labeling the Data*: In Framework, indexing refers the process of labeling (also called coding) the raw data which is performed (*i*) to identify the emerging themes (*ii*) to categorize those themes. The process started with the initial index, and it was an inherently iterative process during which the themes were redefined, refined, and categorized. A manageable index in the form of a two-level hierarchical framework that incorporates a priori concepts of interest and emerging themes was developed. In this framework, the major themes resided at the first level, and they were further categorized by the concepts at the second level.
- *Sorting, Summarizing, and Synthesizing the Data*: The purpose of this step was to put the material similar in content and properties together with minimum interpretation. For every major theme, a chart in the form of a matrix was developed in which the rows corresponded to HHAs and the columns corresponded to the concepts within that major theme. Charting allowed researchers to summarize their understanding of the responses in brief statements within the matrix cells. As a result, charting facilitated the comparisons made across HHAs by visualizing the similarities and differences.
- *Descriptive Accounts*: This step involved interpretations to detect substantive content describing the data, categorization of descriptions, and classification of categories. Different from the hierarchical framework, the categorizations and classification at this level were at the descriptive and conceptual level. This activity was followed by establishing typologies of HHAs which were multidimensional and multifactorial.
- *Explanatory Accounts*: This phase of the analysis aimed at detecting descriptive patterns, associative analysis, and identification of clustering. Verifying the associations in the original data and developing potential explanations were also parts of this step. In addition, the researchers compared their findings with the other studies.

4 RESULTS

4.1 PRINCIPAL FINDINGS

4.1.1 CHALLENGES AND OPPORTUNITIES

Workflows: The participants expressed that their clinical activities are strongly related to other functions performed in their HHAs. When generally asked about the other functions of their HHAs, they mentioned scheduling, quality assurance, training, human resources, inventory and supplies management, billing and payrolls, marketing, and community outreach. There was a strong agreement among participants that, in home health care, the coordination of the business, administrative, and clinical workflows was difficult. Communicating with physicians on a day-to-day basis to receive approvals necessary for reimbursements, medical equipment, and medications was a significant challenge which presents opportunities for improvement.

The physician approvals such as face-to-face approval and medication orders are necessary for both clinical care and for administrative purposes. CMS required HHAs to obtain physician approvals in order to be able to receive reimbursements. For this purpose, the HHA staff communicates with the physician offices by making phone calls followed by sending and receiving faxes. The participants expressed that this manual process is very repetitive and time consuming because some physicians are hard to reach and they do not provide timely approvals. Interestingly, there was one agency which adopted a web portal to allow physicians to provide approvals online. However, the participants of that HHA stressed that they still needed to spend staff time to follow the manual procedures because some physicians did not use the portal at all while others used it occasionally. When probed about possible explanations, the participants mentioned that some physicians may not place enough priority to approvals to spend time logging into yet another system.

Another important challenge was related to the therapy assessment and reassessment requirements set by CMS. These assessments must collect data according to the Outcome and Assessment Information Set (OASIS) defined by CMS; therefore, they are generally referred to as *OASIS assessments*. All participants mentioned that OASIS assessments are lengthy and time consuming. Some participants stated that some OASIS assessments had to be incomplete or inaccurate because of the difficulties associated with obtaining the required information. The HHAs experience difficulties with monitoring and managing the reassessment requirements. The correct timing for a reassessment depends on the type of care needed which requires monitoring; in addition, there are sometimes changes in the schedules of patients and clinicians making it important to manage and revise the previously set reassessment times. The participants from one HHA did require their clinicians to stop by their facility before each visit to check the care plan and make sure that the reassessments will be performed in a timely manner. The participants from another HHA, who mentioned timely reassessments problems, stated that they adopted a computerized scheduling tool but even in that case the changes in the schedules were frequent requiring many modifications done manually.

Most participants agreed that accurately receiving patients' medical history and medication list was an important challenge. Patient admissions take a long time because they largely depend on health information received from external sources such as prior physicians and hospitals. At the time of this research, all HHAs used telephone and fax as the main tools for health information exchange. Many participants stated that medication reconciliation was a challenge due to incomplete information and they preferred also asking questions to patients, caregivers, and family members to obtain more comprehensive information. However, it was also stated that some patients do not have a list of their prescription and non-prescription drugs. In some cases, too much time was spent consulting with family members and examining the medication bags brought by patients.

Administrative and Business Issues: As an important business challenge, HHAs stated that they had problems with receiving reimbursements from CMS due to various issues related to timing, accuracy, and completeness of their documentation. One small HHA particularly complained about that the regulations were changing frequently, and it was difficult to monitor those changes and make adjustments as a small business. The same HHA mentioned that the struggle with preventing fraud might be resulting in strict and changing federal requirements applied.

Particularly smaller HHAs experience difficulties with recruiting and retaining qualified clinicians and staff. Most participants agreed that personnel costs were their biggest cost item. Some participants mentioned that their HHAs hired part-time clinicians; while this approach reduced some costs, those participants expressed, it made the recruitment, training, and scheduling more difficult which could potentially detract from the quality of care and health outcomes.

Obtaining referrals from hospitals for new patients presents an important challenge according to the participants from smaller agencies. Those agencies stated that home-bound patients discharged from a hospital are often admitted to the hospital's own or one of the hospital's partner agencies. A participant from a small HHA named this problem "access to patients problem" and said that smaller agencies should be able to compete for and obtain referrals according to their quality and performance indicators. A participant from a small HHA said that if one of their patients gets readmitted to a hospital, they could easily lose this patient in the future to another HHA that works closely with the hospital.

The participants state that patients and families mostly comply with their hospital's HHA recommendations rather than making their own selections. HHAs spend effort for marketing and outreach in order to obtain referrals. Such efforts include hospital visits to establish contacts, talking with discharge liaisons, and organizing community events and activities.

Quality of Care and Patient Satisfaction: The participants mentioned that they pay attention to the quality measures published by CMS [39] to improve their quality of care. The avoidable emergency-room visits and hospital re-admissions were mentioned as two important outcome measures. Most frequently mentioned challenges to improve the quality were fall risk management and fall prevention, medication adherence, patient education, and enabling patients to be functionally independent at home.

In terms of patient satisfaction, it was mentioned that patients want dependable and reliable clinicians. Patients prefer to receive care from the same clinician during the entire episode of care, and they notice whether their clinician arrives on time and provides the required services within an appropriate time period. In response, the participants state that they try to assign the same clinician because a trust relationship is often established between the patient and clinician. The participants expressed that patients often provide more information and clinicians can better educate their patients when the level of trust is high.

To improve quality, the participants pointed out the need for on recruiting educated and skilled personnel and further training them. The participants stated that training needs to be aligned with carefully designed processes in order to improve the quality of care and outcomes. A couple of participants mentioned that supervised visits result in useful observations leading to process improvement.

Current Health IT Implementations: A couple of participants mentioned home-grown solutions while most others said they implemented various vendor products and modules [10, 2, 3] due to the difficulties

of in-house development. A franchise HHA uses the web-based solutions made available by its franchisor company. Except one small HHA, all HHAs interviewed used Electronic Health Records (EHRs) but they also relied on paper-based records for various purposes. Among them, about half of the HHAs implemented a system to allow their clinicians to collect data at the point of care using laptops, others use paper-based forms to collect data which is entered to the EHR system at a later time.

In addition to EHRs, some HHAs adopted billing and scheduling solutions. About half of the HHAs adopted solutions for payroll and human resources. Customer relationships management, marketing, and outreach solutions were implemented by only a small number of HHAs. HHAs mentioned that using health IT in different functional areas of their organization is crucial to their success. Many HHAs derived hybrid solutions by making different vendors products work with each other. In some cases, the hybrid solutions emerged out of necessity because of the inability to change the existing systems either adopted previously in the same organization, or in the parent or franchising entities.

4.1.2 CONTEXTUAL DETERMINANTS OF HEALTH IT ADOPTION

Relative Advantage: For successful health IT adoption, the clinical and administrative staff of an HHA should perceive that the use of health IT gives them a relative advantage at the individual and organizational levels. The participants mentioned that the executives, administrators, and other staff can see the value of health IT easily. On the other hand, they stated that it can take more time for the clinicians to understand and acknowledge the benefits of health IT.

Perceived Complexity: There was an agreement among the participants that perceived complexity was a barrier for health IT acceptance. The participants agreed on the importance of training and the need to budget for training resources. There was also an agreement among HHAs that there is a generational difference when it comes to learning and using HIT solutions. The participants stated that they have an aging work force and they value the experiences of senior clinicians. There is a general agreement that users from all ages can successfully use health IT as long as they are willing to be trained.

Communication Channels and Awareness: The participants mentioned that they value peer advice. They attend the annual conferences organized by NAHC (National Association of Home Care and Hospice) and MNCHA meetings. The participants typically search for health IT solutions on the Internet as their needs arise. When inquired, no participant reported the use of online communication or networking platforms to increase health IT awareness and knowledge. Some HHAs participate in the online forums organized and managed by their health IT vendors for training and troubleshooting.

Evaluation of Alternatives and Decision Making: The participants from small HHAs stated that they do not follow defined processes for evaluating the alternative solutions and decision making. A couple of participants from large HHAs had specific processes to submit internal proposals evaluated by a steering committee. Two participants, one belonging to a larger nation-wide HHA and another to a franchise HHA, stated that they have central process improvement units in charge of identifying opportunities for improvement and potential health IT solutions.

Measuring Effectiveness: Only some participants performed post-implementation assessments, and only in an informal manner. The participants stated that, if an HHA perceives an increase in organizational productivity and outcomes, this perception is used as the basis for judgment about the HIT effectiveness and quality of decisions leading to health IT adoption.

Trialability: The participants expressed that, in most cases, it is difficult to understand whether an health IT solution will scale up successfully and become useful for their organization. Most vendors do provide trial versions or trial periods. However, sometimes the trial versions or periods are limited by time, number of users, or amount of data stored.

Customization: The participants stated that they can customize their health IT implementations, but only to a certain extent, because of the lack of organizational resources. Rather than extensive changes or additions, the participants found it sufficient to configure the options made available by the vendors of their products. One HHA told us that they would prefer changing their own processes rather than always trying to find a solution that fits their specific need. Most participants worried that their customizations would create problems in terms of working with the future upgrades.

Compatibility: Most participants stated that they prefer to stay with one primary vendor's line of products to prevent compatibility problems. However, they did also mention that primary vendor's prices for additional features can be quite high. However, similar to the concerns with customizations, the participants said they would like to avoid an IT environment that is difficult to maintain due to its many independently evolving parts.

Communication Structures within HHAs: The participants from medium and large HHAs mentioned that they have technical experts who dedicate their time to resolve the issues reported by the system users. The issues can range from feature enhancement requests to problem reports. One HHA mentioned that, they sometimes experience communication problems between clinicians, administrators, and technical experts due to the differences in educational background, familiarity with IT terminology, and the differences in expectations.

Social Norms: When asked about the consistency between the clinicians' ethical values and social norms, the participants agreed that, since using computers ultimately serve and help patients, their clinicians found their interaction with the health IT system purposeful and aligned with their service-oriented culture. This consistency between health IT usage and organizational culture can be viewed as an advantage. For example, in some other settings, it was reported that physicians did not feel that using computers and entering data was consistent with their statue [27].

4.1.3 DISCUSSION AND RECOMMENDATIONS

Health IT Incentives: Unlike physician practices and hospitals, HHAs were in a position to adopt health IT using their own financial resources without receiving incentives under the HITECH Act. Still, there are on-going costs of health IT. As the federal regulations, documentation needs, coding schemes (e.g. ICD-9), etc. change, health IT vendors come up with upgrades which can be expensive to afford for many HHAs. Furthermore, the new health IT releases result in workflow changes and increase training costs for HHAs. Therefore, initiatives to provide incentives to HHAs would be helpful given that HHAs acknowledge the potentials of health IT, and they have already taken the initial steps for health IT adoption. HHAs should also do their part by incorporating both initial and on-going costs of health IT in their budgets.

Health Information Exchange (HIE): Many participants expressed a great need for better HIE capabilities. On the other hand, we also observed that some participants were unaware of the larger HIE initiatives and available HIE capabilities in Maryland, e.g., CRISP, a state-designated HIE entity in Maryland. In the future, developing better HIE capabilities reaching to HHAs along with increasing their awareness can significantly improve the quality of care and health outcomes. Also, as the health data

standards (e.g., HL7) further develop and mature in responding to the longitudinal aspects of patient-centered care, if HIEs and vendors conform with those standards, HHAs would be able to acquire health IT systems that can communicate with the external entities even more effectively and seamlessly.

Successful Integration: Considering our results, HHAs should be encouraged to consider integration issues before spending their resources for the acquisition of HIT systems. Many participants expressed a need to achieve a successful integration of their EHR solution and other solutions such as administrative systems (e.g., scheduling and billing), inventory and supply management, human resources, marketing and community outreach, and patient relationships management.

Documentation Requirements and Procedures: The participants brought up the excessive time and effort spent to fulfill the assessment and reassessment requirements set by CMS. The current health IT products offered by vendors have the features to perform some of these tasks on the computer. However, the participants stated that automation can help only to a certain extent. By taking a multi-stakeholder perspective, the federal agencies such as CMS may want to re-evaluate their documentation requirements to ensure that the benefits outweigh the associated overhead costs.

Consumer Education and Training: Educating and training of home care patients, caregivers, and families about treatment plans, medications, and their provider alternatives are important. Computer-based and online learning modules can be implemented for this purpose. CMS has recently implemented a website, Home Health Compare, which allows consumers to compare HHAs in terms of their quality outcomes. Through various programs, governments might be able to facilitate further development of educational and training resources and their use.

Clinician Education and Training: Some HHA clinicians are in need of training to increase their health IT literacy and to learn about using EHR systems in the field. First, such education and training would increase familiarity with EHRs and, then, allow them to learn about an example EHR system. Expectedly, these professionals might not use the same system in their daily professional lives, however, it can be argued that self-confidence gained in one system will result in a more positive attitude towards other systems by reducing the "fear of unknown" (phrase mentioned by one HHA).

Establishing a Knowledge Repository: One participant suggested that a knowledge repository with appropriate communication tools (e.g., online forums or social network) would be beneficial. It would enable knowledge sharing among HHAs about which processes, tools, strategies work. It was mentioned that, out of such an environment, best practices could emerge naturally over time.

Engaging Vendors: HHAs experience difficulties with trialability, customizability, and compatibility. Vendors need to make their products easier to experiment with and they need to be concerned about compatibility issues. Furthermore, they should offer customizable products so that providers can fit the products to their needs more easily. It is notable that the quality of vendors' products can directly affect care quality, costs, and outcomes. Usability (ease of use) should be a major quality attribute the vendors need to focus on because it is strongly linked to health IT adoption. Usability is even more important for the home health clinicians who work in the field. For these reasons, government organizations can engage the vendors and try to understand the process and quality improvement challenges experienced on the vendor side to achieve the above objectives.

Conducting Research on Health IT for HHAs: Arguably, an effective approach to increasing health IT adoption in HHAs is to present sound evidence about its benefits demonstrated through the application

of solid research methods. So far, some white papers on health IT adoption in home health care written by consulting companies and health IT vendors have been published. However, academic research supporting evidence-based health IT adoption should increase. Empirical studies providing evidence would be highly useful for the decision makers and policy makers in this area.

4.1.4 CONCLUSION

Overall, this research found that there is a plausible environment for health IT adoption in HHAs. Despite limited resources, the HHAs represented in the study made some progress to leverage health IT. This research found that integrating health IT into the daily clinical and administrative workflows of HHAs was a significant challenge. Within an HHA, a strong coordination of clinical and administrative functions is necessary for improvement. This challenge is exacerbated by the external dependencies: A typical HHA has strong information and operational dependencies to external entities. Given that all of the HHAs represented in our study, except one, used health IT solutions, it can be concluded that the current solutions do not adequately address workflow coordination problems. Such problems require a stronger focus in the future health IT products and health IT adoption projects. Cost is and will be an important consideration for HHAs. Small HHAs could benefit from web-based solutions or services (i.e., some small solutions addressing specific needs) if they reduce their overall health IT costs.

This research found that the contextual determinants of health IT adoption in HHAs generally draw a favorable picture. The patient-centered social norms of the HHA clinicians are well-aligned with the purpose of deriving effectiveness by leveraging IT. There is belief about that health IT provides competitive advantage though usability issues continue to present some challenges during field operations. Overall, it seems that the HHAs we interviewed were able to train their clinicians to use health IT systems. In the future, successful adoption could be achieved more easily if health IT solutions become more compatible with each other, easier to try and customize, and easier to use.

This research study allowed us to make a set of recommendations outlined in Section 4.1.3 based on the qualitative evidence obtained from Maryland HHAs. We believe that these recommendations can be immediately useful to the decision makers in various organizations who should consider them along with their own purposes, experiences, and context. Future research studies can test the generalizability of our findings at the national level by obtaining quantitative data through various mechanisms such as surveys.

5 LIST OF PUBLICATIONS AND PRODUCTS

The preliminary, intermediate, and complete results of this study were presented in the following meetings by giving either a poster or a podium presentation.

- Poster presentation, Summer Institute for Nursing Informatics, July 2013
- Poster presentation, Annual Meeting of Maryland-National Home Care Association, September 2013
- Podium presentation, Annual Long Term & Post-Acute Care Health It Summit, LTPAC 2014, July 2014
- Podium presentation, Home Health IT Summit, May 2014
- Podium presentation, Summer Institute for Nursing Informatics, July 2014
- Podium presentation, Annual Meeting of Maryland-National Home Care Association, September 2014

- Podium presentation, H3IT 2014, Home Healthcare and Hospice Information Technology Conference, November 2014
- Poster presentation, AMIA 2014, American Medical Informatics Association, November 2014

The PI also expects that there will be journal papers accepted within a year and published within 18 months of the project completion date.

In terms of the by-products of this research, the interview protocol developed and used in this research proved to be effective, therefore, it can be potentially useful to the other health IT researchers or practitioners. Another important by-product of this research was the synergy created on this topic inside and outside of the PI's institution. At the departmental level, a growing number of MS and PhD students have started to tackle health IT research problems in their thesis and dissertation work. Two students, Dari Alhuwail and Ahmad Alaiad, are now PhD candidates with the expected graduation dates in 2015. Mr. Alhuwail is conducting a case study in a prominent home health agency in Maryland. He spends three days a week in this agency for data collection in Fall 2014. Mr. Alaiad is analyzing multiple stakeholders' perceptions on using emerging technologies (e.g., sensor and robotics) in home health care. Also, the PI has worked with six MS students who took an independent study course related to health IT adoption in home care. Within the institution, AHRQ's support further increased the weight of health IT education and research. UMBC now offers a Professional Master's degree in Health IT for which the PI served as the first and interim graduate program director. With the new GPD on board starting from Nov 15th, this program is expected to grow and create synergy between teaching and research. Outside the institution, the research project increased the PI's activities in the scientific community and led to some discussions to organize a conference. H3IT 2014, Home Healthcare and Hospice Information Technology, conference will be held on Nov 15th for the first time in Washington - D.C. (http://h3it.org)

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