



U.S. Department of Health and Human Services
Assistant Secretary for Planning and Evaluation
Office of Disability, Aging and Long-Term Care Policy



HEALTH INFORMATION EXCHANGE IN POST-ACUTE AND LONG-TERM CARE CASE STUDY FINDINGS: FINAL REPORT

September 2007

Office of the Assistant Secretary for Planning and Evaluation

The Office of the Assistant Secretary for Planning and Evaluation (ASPE) is the principal advisor to the Secretary of the Department of Health and Human Services (HHS) on policy development issues, and is responsible for major activities in the areas of legislative and budget development, strategic planning, policy research and evaluation, and economic analysis.

ASPE develops or reviews issues from the viewpoint of the Secretary, providing a perspective that is broader in scope than the specific focus of the various operating agencies. ASPE also works closely with the HHS operating divisions. It assists these agencies in developing policies, and planning policy research, evaluation and data collection within broad HHS and administration initiatives. ASPE often serves a coordinating role for crosscutting policy and administrative activities.

ASPE plans and conducts evaluations and research--both in-house and through support of projects by external researchers--of current and proposed programs and topics of particular interest to the Secretary, the Administration and the Congress.

Office of Disability, Aging and Long-Term Care Policy

The Office of Disability, Aging and Long-Term Care Policy (DALTCP), within ASPE, is responsible for the development, coordination, analysis, research and evaluation of HHS policies and programs which support the independence, health and long-term care of persons with disabilities--children, working aging adults, and older persons. DALTCP is also responsible for policy coordination and research to promote the economic and social well-being of the elderly.

In particular, DALTCP addresses policies concerning: nursing home and community-based services, informal caregiving, the integration of acute and long-term care, Medicare post-acute services and home care, managed care for people with disabilities, long-term rehabilitation services, children's disability, and linkages between employment and health policies. These activities are carried out through policy planning, policy and program analysis, regulatory reviews, formulation of legislative proposals, policy research, evaluation and data planning.

This report was prepared under contract #HHS-100-03-0028 between HHS's ASPE/DALTCP and the University of Colorado. For additional information about this subject, you can visit the DALTCP home page at http://aspe.hhs.gov/_/office_specific/daltcp.cfm or contact the ASPE Project Officer, Jennie Harvell, at HHS/ASPE/DALTCP, Room 424E, H.H. Humphrey Building, 200 Independence Avenue, S.W., Washington, D.C. 20201. Her e-mail address is: Jennie.Harvell@hhs.gov.

HEALTH INFORMATION EXCHANGE IN POST-ACUTE AND LONG-TERM CARE CASE STUDY FINDINGS: Final Report

Rachael E. Bennett, MA
Mark Tuttle, FACMI
Karis May
Jennie Harvell, Med
Eric A. Coleman, MD, MPH

University of Colorado
Health Sciences Center

September 18, 2007

Prepared for
Office of Disability, Aging and Long-Term Care Policy
Office of the Assistant Secretary for Planning and Evaluation
U.S. Department of Health and Human Services
Contract #HHS-100-03-0028

The opinions and views expressed in this report are those of the authors. They do not necessarily reflect the views of the Department of Health and Human Services, the contractor or any other funding organization.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	v
I. INTRODUCTION.....	1
A. Overview: What is Unique about this Research	1
B. Project Objectives	1
C. Navigating the Report	2
II. METHODS FOR SELECTION AND RECRUITMENT OF HEALTH DELIVERY SYSTEMS	4
A. Criteria for Selecting the HDS and PAC/LTC Settings for Site Visits	4
B. Inclusion of Site Involvement in a Regional Health Information Organization (RHIO) or Health Information Exchange Network (HIEN)	5
C. Potential Site Visit Locations	5
D. Selected Sites	6
E. Preparing for and Planning the Site Visits	10
F. Development of Discussion Guide	11
G. Analysis of Focused Discovery Data Collection	11
III. RESULTS	12
A. Background	12
B. Exchange of Clinical Information	15
C. Health Information Exchange Areas of Commonality	25
D. Solutions and Future Plans for e-HIE and HIT Implementation	37
E. What Are the Facilitators and Barriers to Health Information Exchange?	39
F. Organizational/Management Issues	42
G. Specifics Regarding Technology Observed During Site Visits	45
IV. SUMMARY AND SUGGESTED NEXT STEPS	54
A. Health Information Exchange by Any Means	54
B. Implementation of HIT including e-HIE	56
C. Interoperable HIT	56
D. Accelerating the Implementation of e-HIE	58
REFERENCES.....	61
ACRONYMS	65

APPENDICES

APPENDIX A: Draft Case Study Plan	
Chapter 1. Introduction.....	A-1
Chapter 2. Sampling Potential Sites.....	A-3
Chapter 3. Conducting the Site Visits.....	A-9
References.....	A-16
Attachment A. Draft Data Collection and Discussion Guides, Clinical Scenarios.....	A-17
Attachment B. Project Abstract/Overview.....	A-29
Attachment C. Site Visit Objectives and Expectations.....	A-30
APPENDIX B: Site Visit Report--Erickson Retirement Communities, Catonsville, Maryland	
I. Overview of the Location/City and Visited Health Settings.....	B-1
II. Specifics on Clinical Data Sharing	B-2
III. Technology.....	B-6
IV. Organizational Issues.....	B-7
V. Conclusion/Final Thoughts.....	B-9
APPENDIX C: Site Visit Report--Montefiore Medical Center, Bronx, New York	
I. Overview of the Location/City and Visited Health Settings.....	C-1
II. Specifics on Clinical Data Sharing	C-2
III. Technology.....	C-8
IV. Organizational Issues.....	C-14
V. Conclusion/Final Thoughts.....	C-16
APPENDIX D: Site Visit Report--Intermountain Health Care, Salt Lake City, Utah	
I. Overview of the Location/City and Visited Health Settings.....	D-1
II. Specifics on Clinical Data Sharing	D-2
III. Technology.....	D-6
IV. Organizational Issues.....	D-9
V. Conclusion/Final Thoughts.....	D-10
APPENDIX E: Site Visit Report--Indiana Health Information Exchange, Indianapolis, Indiana	
I. Overview of the Location/City and Visited Health Settings.....	E-1
II. Specifics on Clinical Data Sharing	E-5
III. Technology.....	E-9
IV. Organizational Issues.....	E-11
V. Conclusion/Final Thoughts.....	E-12

LIST OF TABLES

TABLE ES-1:	Levels of Health Information Exchange.....	ix
TABLE ES-2:	Illustrative Examples of HIE Capabilities by Level.....	xi
TABLE 1:	Levels of Health Information Exchange.....	13
TABLE 2:	Illustrative Examples of HIE Capabilities by Level.....	15
TABLE 3:	Overlap of Clinical Domains and Clinical Information to be Exchanged Between Acute Care Hospitals, Post-Acute, and Long-Term Care Settings.....	22
TABLE 4:	HIE Capabilities by Level With a Focus on Exchange of Information at Times of Discharge/Transfer	27
TABLE 5:	HIE Capabilities by Level Regarding Communication with Physicians and Other Clinicians.....	31
TABLE 6:	HIE Capabilities by Level Regarding Medication Ordering/ E-prescribing	33
TABLE 7:	HIE Capabilities by Level Regarding Laboratory/Radiology Orders and Results	35
TABLE A.1:	Potential Site Visit List.....	A-4
TABLE A.2:	Illustrative Categories of Individuals to be Interviewed/ Observed During Site Visit	A-10
TABLE B.1:	General Information Supplied by Visited Sites	B-9
TABLE C.1:	General Information Supplied by Visited Sites	C-16
TABLE D.1:	General Information Supplied by Visited Sites	D-11
TABLE E.1:	General Information Supplied by Visited Sites	E-13

ABOUT THE DIVISION OF HEALTH CARE POLICY AND RESEARCH

The Division of Health Care Policy and Research is an inter-disciplinary research organization based in the Department of Medicine at the University of Colorado at Denver and Health Sciences Center. The mission of the Division of Health Care Policy and Research is to improve health care services, organization, and policy through research and education. Division faculty conduct health services and health policy research in a range of areas, including: quality of care assessment, assurance, and improvement; Medicare reimbursement and regulations; clinical and system interventions aimed at improving nursing home care, home health care, transitions across sites of care, and end-of-life care; managed care alternatives; telemedicine and health informatics; cognition and behavior; and cross-cultural research to assess interventions aimed at improving health care services to ethnic minorities. Ms. Bennett, Ms. May, and Dr. Coleman are the contributors from the University.

ABOUT APELON, INC.

Many of the world's major standard health care terminologies are maintained with software developed by Apelon. Enterprise deployment of these and other terminologies is supported by an Apelon-built vocabulary server that is now open source. Users of this server include health care providers, government agencies, and biomedical research enterprises. Apelon's TermWorks software is an inexpensive tool that adds functions to Microsoft Excel so that, connected over the web, a term or a column of terms in a spreadsheet can be matched and mapped using the tools and databases not previously widely available.

Apelon employees have been involved with many of the past decade's significant terminology-related projects and continue an active consulting practice. The company also provides subscription content services to assist users of open-source vocabulary tools in handling updates and new releases of standard terminologies. Current development efforts include a web-based Wiki-model tool (and corresponding submission system) aimed at broadening participation in terminology development. Mr. Tuttle was a member of the site visit team and contributor to this report.

ACKNOWLEDGEMENTS

We would like to thank the health settings that participated in the site visits and allowed us to gather information on how they exchange data within and among their provider settings. We also are grateful to the experts in electronic health record systems and data exchange who provided advice on the initial design of the project and recommendations for next steps. Finally, we would like to thank our ASPE Project Officer, Ms. Jennie Harvell, MEd, for her commitment to and valued guidance throughout the project.

EXECUTIVE SUMMARY

STUDY OBJECTIVES

The study, entitled "Health Information Exchange in Post-Acute and Long-Term Care," was sponsored by the Office of the Assistant Secretary for Planning and Evaluation (ASPE), U.S. Department of Health and Human Services (HHS), and conducted from September 30, 2005 through October 15, 2007. The purpose of the study was fourfold: (1) describe the current status of the use of health information technology (HIT) in existing state-of-the-art health delivery systems (HDSs) and how health information is or is not exchanged with "unaffiliated"¹ post-acute care (PAC) and long-term care (LTC) providers and other components of the health care delivery continuum (e.g., physician offices, laboratories, pharmacies, and hospitals) that use HIT; (2) identify the factors that support or deter the timely exchange of needed health information to and from unaffiliated PAC and LTC providers and other components of the health care delivery continuum that use HIT; (3) identify ways in which policy makers can encourage information exchange by HDSs that use HIT with unaffiliated PAC/LTC providers; and (4) summarize and organize information learned and describe the next steps that could be pursued to extend HIT into PAC/LTC.

The study was divided into three phases. The first phase included a review the literature. The second phase involved speaking with stakeholders and national experts in the area of health information exchange (HIE). The third phase built upon these first two phases by conducting four site visits with exemplar health systems to obtain more detailed information to address the stated study objectives. Based on national reputation and willingness to host a site visit, four "hub sites" were selected. The study team then identified both affiliated and unaffiliated providers (i.e., "spoke sites") in each of these geographic areas that received patient referrals from the hub sites. As the four hub sites were not selected at random, the findings and recommendations of this study are limited and may not be representative of all PAC and LTC settings in the United States.

WHY THIS RESEARCH IS IMPORTANT

There is increasing recognition in both the public and private sectors that significant improvements in health care quality, continuity of care, and efficiency of care may be realized through implementation of HIT. The ability to share health data between and among health care providers is critical to providing high-quality, cost-effective, informed health care. The ability of health providers to act on timely information improves workflow efficiencies and may save lives. A paper medical record does not allow for such efficiencies to be fully realized; yet at this time, the vast majority

¹ Unaffiliated, for the purposes of this study was defined as not being owned by the hub site.

of PAC and LTC providers (and other health care settings, also) still use a paper medical record for the authoritative record.

In acknowledgement of the increasing importance of HIT implementation, a number of initiatives have followed the April 2004 Presidential Executive Order 13335. This Executive Order recognizes the need for the development and nationwide implementation of an interoperable HIT infrastructure and established the position of the National Coordinator for Health Information Technology (NCHIT) in the HHS to provide leadership for this effort. Shortly thereafter, the Office of the National Coordinator for HIT released a report, "The Decade of Health Information Technology: Delivering Consumer-Centric and Information-Rich Health Care" (Office for the NCHIT, 2004) that outlines a framework for realizing the goal that most Americans have an interoperable electronic health record (EHR) by 2014.

A previous study also conducted by the University of Colorado at Denver and Health Sciences Center (UCDHSC), entitled "Electronic Health Records in Post-Acute and Long-Term Care" found that health information shared across health settings (e.g., acute care hospitals, physician offices, nursing homes [NHs], home health agencies [HHAs], laboratories, and pharmacies) was inadequate to support high-quality patient care. When information was shared, it often was shared only with "affiliated"² providers. The authors sought to understand if this trend had shifted in the three years since that study had concluded. This current study built upon those findings and posed additional questions: How is information shared across and between health care provider settings? Is information shared differently when shared with affiliated versus unaffiliated settings? Does involvement in a health information exchange network (HIEN) (e.g., a regional health information organization [RHIO]) make a difference in the types of or amount of data shared across health settings?

OBSERVATIONS

Four leading edge sites were chosen as "hub sites" for visitation based on the fact that each provider site: (a) was using a relatively robust electronic health information system; and (b) collaborated with a number of affiliated and unaffiliated PAC and/or LTC settings that treat their patients. Three of the four settings also were involved in some type of RHIO/HIEN.

The four hub sites were: Erickson Retirement Communities (Catonsville, Maryland), Montefiore Medical Center (Bronx, New York), Intermountain Health Care (IHC), specifically LDS Hospital (Salt Lake City, Utah), and the Regenstrief Institute/Indiana Health Information Exchange (IHIE) (Indianapolis, Indiana). Each hub site has earned the reputation for being a leader in promoting HIE, has strong ties to the community, strong local leadership, and an organizational and cultural commitment to enhancing quality of care and increasing efficiencies.

² Affiliated, for the purposes of this study, refers to settings that are owned by the hub site.

Each site visit was comprised of multiple components. On the first day, the site visit team visited a hub HDS (one was a continuous care retirement community (CCRC), two were acute care hospitals, and one was an academic health center). The second and third days of the site visits were spent visiting three or more LTC or PAC settings³ that receive referrals from the hub site. When possible the site visit team visited both affiliated (i.e., owned) and unaffiliated settings. In some cases, names of PAC/LTC settings were obtained from the hub site contact and in other cases the project team independently approached the PAC/LTC settings and requested their participation in the study.

Although there were geographic, socioeconomic, and organizational/structural differences at the four sites, a number of common themes emerged, which are highlighted below.

1. Limited Health Information Technology Adoption in PAC/LTC Settings

In general, the site visits revealed limited adoption of HIT in PAC and LTC settings. This finding is consistent with two studies on HIT adoption in PAC/LTC settings. A 2005 study by Kaushal and colleagues (Kaushal et al., 2005a; Kaushal et al., 2005b; Poon et al., 2006) estimated EHR adoption in 2005 for NHs to be 1% and less than 1% for HHAs. The authors projected that HIT adoption in five years will not increase much for either health sector (14% for NHs, and <1% for HHAs). The other study included a survey that was conducted by the American Health Care Association (AHCA) and the National Center for Assisted Living. Two of the key findings were: (1) paper continues to be the primary communication mechanism in NHs and assisted living facilities (ALFs); and (2) while respondents to this survey express that they are beginning to adopt more HIT, in three years, it is projected that these two settings will still be in the early stages of transitioning to HIT (American Health Care Association, 2006).

Because the project objectives included looking at state-of-the-art delivery systems, the majority of PAC/LTC sites visited were early adopters of HIT in some capacity. However, with a few exceptions, HIT use was generally limited, was not standards-based, and typically did not include data exchange capabilities. The visited PAC/LTC providers used information technology applications that met rudimentary regulatory requirements and billing needs, and were observed to be using HIT applications for some intra-facility functions. However, the use of HIT by PAC/LTC for HIE with other organizations (e.g., hospitals) was observed rarely. In some cases, there was no EHR used, nor were there future plans to implement HIT.

³ In the case of Erickson Retirement Communities, the protocol was turned on its head. That is, because the Erickson campus included a skilled nursing facility and a home health agency, the “referral” sites were places that served the needs of Erickson residents that could not be met on the campus (i.e., acute care and hospice services). Johns Hopkins Home Health also was visited, as they receive a few referrals from Erickson per year, based on the patient’s request.

2. Poised for Interoperability

The Presidential Executive Order of August 2006 defines interoperability as "the ability to communicate and exchange data accurately, effectively, securely, and consistently with different information technology systems, software applications, and networks in various settings, and exchange data such that clinical or operational purpose and meaning of the data are preserved and unaltered" (Federal Register, 2006). At one hospital visited, a representative declared that health care enterprises in his region were "poised for interoperability." The same observation could be made at another hospital visited, and represented an important shift from only a few years earlier when interoperability was not of paramount concern. Although no site presented a schedule for achieving complete interoperability across all settings, each hospital had plans in place for some degree of data exchange outside of its enterprise. Moreover, each expressed some intent to include nearby LTC sites in those plans. The study team found that one of the biggest drivers for health data exchange was a desire to support "anytime/anywhere" access by physicians and other providers who practiced in multiple care settings. Care providers who had such access then wanted to be able to include information from the "remote" or referring system into the "local" or receiving system. Anytime/anywhere access often was supported by dial up connections, and, increasingly, by web interfaces. However, "electronic population" of the local or host system with information from a remote system was rare. Not surprisingly, once providers began having remote access in one care setting, they also wanted access in other care settings. However, staff at the various sites expressed various formidable challenges when they attempted to populate local or host electronic medical records (EMRs) with remote information.

The phrase "data exchange" was typically interpreted by the sites to mean the display of patient information on a local computer that originated from a computer at a remote, unaffiliated care site. Although it is implied that this involves a two-way data exchange method, more often than not, it was simply a one-way transaction.

Two clinical scenarios stood out for their ability to illustrate the demand for HIE and the inherent challenges: the transfer of patients from hospital to PAC or LTC settings, and the transfer of NH residents to the emergency department (ED). Care providers in NHs that receive patients from hospitals, and in EDs that receive patients from NHs want to know certain details about the patient's current status and medical history and they are willing to take the time to read this information on a computer screen if the information is current and trusted. The notion that, for example, the receiving provider's EHR would be able to represent information about the patient in a way that could feed into a decision support feature and influence the care plan was described as a goal by some sites, but not one that was expected to be achieved any time soon.

The three phases of this study helped inform a proposed framework for HIE that is illustrated in Table ES-1. One can think of these different kinds of data exchange arranged on a continuum or spectrum; at one end of the spectrum the phrase "data exchange" implies that computers can act as the informational equivalent of fax

machines only; at the other end of the continuum, "data exchange" implies that information received by a computer can be used in the same way as information entered locally. An example of the latter would be an ability to import a medication list that had been reconciled in the hospital and represented in its EMR into an outpatient EMR that facilitated the local computer to analyze the synthesized list for drug-to-drug and drug-to-disease interactions.⁴

TABLE ES-1: Levels of Health Information Exchange	
Completely Interoperable EHR System Use of HIT Standards	Level 4
EHR Used/Limited Electronic Data Exchange Some HIT Standards Used	Level 3
Combined Paper Record / EHR	Level 2
Paper-based Record / No EHR	Level 1
EHR Description / HIE Capabilities	Maturity Level

Table ES-2 expands upon the Table ES-1 framework by proposing specific features for each level to suggest a progression from less to more sophistication of HIE. This table was constructed based on the literature review as well as the study team’s observations concerning HIE and use of EHRs across the sites selected for the study. Although none of the settings observed have reached Level 4 (i.e., completely interoperable EHR systems, using standards-based applications to share information with affiliated and non-affiliated providers), it is included as the purported “future goal.”

3. Data Exchange among Health Settings, Particularly Post-Acute and Long-Term Care

At every NH and HHA visited, the potential benefit from engaging in activities with external parties to support and increase HIE was observed. At Erickson, the local and national information technology staff are prepared to subsidize the implementation of HIE standards if such standards are available in the near future. In each of the other three visited locations, PAC and LTC enterprises are in a position to benefit from HIE efforts originating outside of their organizations. Although PAC and LTC sites are not leading HIE efforts and are not directly involved as collaborators; they will benefit nonetheless. As all PAC and LTC sites had some Internet connectivity and some local information technology systems (even if only to meet administrative data reporting requirements), the barriers to sending and receiving electronic patient information are lower than once observed. However, because the perceived and actual barriers to the simultaneous re-use of patient information remain high, driven by factors that include implementation and maintenance costs, mistrust of the data, a fear of litigation, and

⁴ In general this is not possible today because different sites use different, usually proprietary, lists of drug names.

Health Insurance Portability and Accountability Act (HIPAA) and other privacy concerns, such interoperability is not yet in sight for any enterprise visited. Nevertheless, once human-readable electronic exchange is in place, the incentives for the automatic population of local systems from remote systems with computer-readable electronic health information will become more clear and measurable. For example, it will be easy to assess the amount of time, and therefore the cost, required to manually re-enter information in a local system that exists in electronic form elsewhere. In this sense, the fact that hospital is "poised for interoperability" will help expedite the incremental deployment of HIE at collaborating PAC and LTC sites.

a. Workflow. The four site visits reinforced the central role that workflow issues play in HIE. Information technology is a cross-cutting issue, an observation that permeated the site visit discussions at many levels. In general, relatively highly-paid professionals in hospitals, PAC, and LTC settings are expending a significant proportion of their time on clerical tasks rather than attending to patients' clinical needs. EHRs did not necessarily provide solutions to this inefficiency. Because of the lack of interoperable EHRs, it was common for sites to report that nurses and physicians read from a computer screen or print out a patient's health data from one electronic health application only to manually enter the information into another electronic health application (such as an EHR). Respondents described manually re-entering laboratory results received electronically into their own EHR system, because the two electronic systems did not have the capabilities of exchanging data. In most cases, the clinicians were not consciously aware of the amount of effort that was being expended. Rather, they had long accepted these tasks as inevitable.

Further probing revealed that manual data re-entry from one system or medium to another may add value in terms of improving quality and safety. For example, the process of printing the medication list from one electronic source and then manually entering into an EMR provided an opportunity for greater scrutiny than what would have been made had the medications been reviewed on a single computer screen. During these discussions, clinicians acknowledged that this manual re-entry activity was not simply a clerical process but rather something that provided an opportunity to cognitively assess whether the medications were in fact appropriate, whether any additional diagnostic testing was required, and whether the patient might be at risk for an adverse drug reaction. Alternatively, this process has the potential to introduce new errors due to transcribing errors (Brody, 2007). Thus, it remains to be determined how these vital tasks will be accomplished once more advanced (e.g., interoperable, standards-based) electronic solutions are forthcoming.

b. Majority of data sharing to and from PAC/LTC is done manually. Independent of the degree of EHR capability in place at the hub sites, the exchange of data between these hubs and affiliated and unaffiliated PAC/LTC settings is largely conducted manually (phone, fax, paper records that are mailed or accompanies the patient at the time of transfer). This information either is filed in a paper record and/or transcribed into the PAC/LTC setting's EHR. Phone, fax, and paper records continue to be used for patient referrals, discharge, and transfer documentation. Although some

implementation efforts were underway, the study team did not witness any electronic transmission of data from PAC/LTC settings directly into the hospital's EHR systems.

TABLE ES-2: Illustrative Examples of HIE Capabilities by Level

	Level 1 Paper-based Record/ No EHR		Level 2 Combined Paper Record/EHR		Level 3 EHR Used/Limited Electronic Data Exchange, Some HIT Standards Used		Level 4 Completely Interoperable EHR System, Use of HIT Standards	
HIE Methods	<ul style="list-style-type: none"> Fax Phone/Voice Photocopy to pass on by hand Face-to-face 		<ul style="list-style-type: none"> Fax Phone/Voice/Face-to-face Print/Photocopy to pass on Limited non-standardized electronic HIE (e.g., e-mail to & from physicians) 		<ul style="list-style-type: none"> Fax, Phone/Voice/ E-mail, Photocopy Some electronic data exchange standards (i.e., messaging standards) in use Increasing use of electronic HIE (e.g., components of EHR may be electronically exchanged) 		<ul style="list-style-type: none"> Electronic fax downloaded into EHR Standards-based data exchange (i.e., use of messaging standards) Standardized content exchanged Standardized e-HIE across key components (e.g., lab results, medication ordering) of care continuum 	
Features/Attributes of Patient Health Information and Electronic HIE¹	No Electronic HIE (i.e., not electronic data)	No EHR	Some e-HIE	Limited use of EHR	Data exchange limited to certain systems	Access to data limited to user role/ discipline	EHR is primary record	Standards-based EHR system (i.e., EHR content is standardized)
	May have software for AR/AP, scheduling	No Anytime/ Anywhere Access	May allow for images to be imported	Clinical information collected on paper & entered into EHR	Continued but limited use of paper record	Some use of standards (messaging &/or content)	Interoperable with internal & external systems	Record can be electronically exchanged/ is transportable
			Meets minimum regulatory requirements ²	Limited Anytime/ Anywhere Access	Decision support features & alerts used	Anytime/ Anywhere Access	Computer Empowered Interoperable System	Anytime/ Anywhere Access
Facilitators of HIE			Limited involved in HIE Network (e.g., admin/claims data)		Some clinical content exchanged within HIE Network		Greater amount clinical information exchanged/shared within HIE Network	
<ol style="list-style-type: none"> These are illustrative examples only and are not necessarily reflective of what was observed during site visits. No site visit has attained Level 4. For example, Outcome and Assessment Information Set (OASIS) and Minimum Data Set (MDS) reporting to CMS. 								

c. Importance of personal relationships in referrals. Although HIT can and will expedite referrals from one setting to the next; it was observed that today, personal relationships superseded any technological advancement in place. In other words, the "human element" is well engrained into the process of data exchange. One observation that crystallized this point was hearing that despite implementation and acceptance of an electronic mechanism to facilitate post-hospital patient placement in skilled nursing facilities (SNFs), discharge planners often finalized these arrangements outside of this mechanism telephonically with admission coordinators with whom they had a personal relationship. They trusted these people more willingly than an "anonymous" source of data.

d. Lack of standards used. Two primary observations regarding adoption of standards-based HIT solutions in PAC/LTC were observed. Firstly, among those PAC/LTC providers that had purchased and implemented an EHR system, the use of standards as a vetting criterion for vendor selection was not considered. Respondents clarified that standards development and adoption are still in the early stages, which is

why most of the systems used by the visited PAC/LTC settings did not use standardized terminologies, messaging standards, or documents for the electronic recording and exchange of health information. They would like to see greater consensus on some of the standards work before they invest the resources necessary to adopt/convert their systems. The other observation is that many PAC/LTC settings visited were unaware of the extent of activity in the standards development community, and therefore did not see the potential value of having a standards-based EHR system to facilitate HIE across health settings.

In other cases, the lack of standards was not synonymous with a lack of sophistication in EHR adoption. In fact, national health care leaders including the Regenstrief Institute, IHC, and the Visiting Nurse Service (VNS) of New York were early adopters of HIT applications that support clinical care, and as a result they developed their own "homegrown" systems prior to the emphasis on using national standards. When asked if they were planning on adopting balloted, Consolidated Health Informatics (CHI)-endorsed standards, representatives from these early adopters indicated that it was financially prohibitive to reconfigure their systems.

e. Lack of financial incentives for HIE. The site visits did not reveal any real or perceived financial incentives for adopting HIT that supports HIE with outside entities. The initial outlays for hardware and software remain prohibitive, training costs can be quite high, particularly considering the historically high staff turnover in PAC/LTC, and ongoing maintenance costs may be difficult to justify when the short-term return on investment is unclear. Furthermore, the benefits of HIE do not necessarily accrue to the institution that makes the investment in hardware/software, including the time to input and maintain the information. These costs and uncertainties regarding the return on investment will likely be particularly problematic for small, independent PAC/LTC settings. The business case for the referring organization that would need to make the HIT investment remains underdeveloped.

RECOMMENDED NEXT STEPS

A significant barrier to widespread electronic exchange of health information with PAC/LTC settings is that the majority of PAC/LTC providers and those health care organizations with which health information must be exchanged, have yet to implement EHR/HIT systems with the capacity to support interoperable HIE. It is not that leaders in those settings do not see the value in obtaining timely, accurate health data from a referring site (or providing it to other settings at discharge). It is possible that the functionality seems so far out of reach at this point, due to the lack of low-cost, reliable, well-supported hardware and software, and the lack of data available on the return on investment of adopting HIT, particularly in the PAC/LTC health sector. Thus, demonstration, dissemination, and education regarding the benefits of adopting an interoperable EHR system relative to the associated costs of not adopting these systems are imperative if providers and vendors are going to invest more heavily in EHRs for PAC and LTC.

The study team recommends that a thorough, targeted national survey of HIT adoption, use, and barriers to adoption in PAC/LTC should be conducted. There have been small-scale studies looking within a specific geographic region or market area (Continuing Care Leadership Coalition, 2006; Hudak & Sharkey, 2007), and the 2007 National Home and Hospice Care Survey includes, for the first time, questions on whether the responding HHA has an EMR, and if so, whether the HHA uses certain EMR functions or whether these functions are either not used or not available (personal communication with Jennie Harvell, ASPE Project Officer). Experts have convened and given their best impressions and projections for HIT readiness in all types of health sectors, including PAC and LTC (Kaushal et al., 2005a; Poon et al., 2006). However, to date, there has not been a scientifically-based, comprehensive survey on the specific types of HIT applications that are currently in use, or that are being considered for future implementation in NHs.

Continued development and adoption of standards-based work needs to take place. Recent developments are promising. For example, an important step forward is the recent letter from the Secretary of HHS to the National Committee on Vital and Health Statistics (NCVHS) that the CHI recommendations for HIT standards for the Functioning and Disability domains will be adopted for use in new federal health information systems and, to the extent possible, as existing health information systems are modified. Likewise, approval by Health Level Seven (HL7) and the Health Information Technology Standards Panel (HITSP) of the Continuity of Care Document (CCD) standard, a harmonized summary record standard is an important needed activity to facilitate interoperable data exchange across settings. These standards-based activities need to be built upon and expanded.

Related to the above point, PAC and LTC provider participation in standards development and encouragement of HIT adoption is paramount. The LTC provider and vendor communities were instrumental in the recent decision by the Certification Committee for Healthcare Information Technology (CCHIT) to include the certification of NH EHRs in its expanded scope of work. CCHIT certification can be a valuable asset for NH providers to reduce their risk when making costly HIT investments. Continued participation in standards development work is necessary to keep the LTC and PAC communities involved in the future directions that will evolve.

PAC and LTC settings' involvement in HIENS/RHIOs should be increased. Given the Federal Government's interest in moving the Nationwide Health Information Network (NHIN) to the next phase, it is clear that HIENS will be key players in that process. Education on the role that HIENS are playing in communities and encouragement of all setting types to get involved is important to ensuring their "voice" is heard in the design and development of HIE strategies.

I. INTRODUCTION

A. OVERVIEW: WHAT IS UNIQUE ABOUT THIS RESEARCH

The Federal Government and many state administrations see the broad implementation of HIT as an important lever by which to improve health care quality and safety, and reduce costs. Implementing HIT will support the exchange of data as patients move between health care settings, and such exchange will measurably decrease errors, enable more timely and productive clinical decisions, and allow for a more comprehensive patient-centric longitudinal electronic record (Coleman, May, Bennett, Dorr, & Harvell, 2007). To this end, hospitals and ambulatory settings are implementing EHRs that are increasingly compliant with national standards. However, adoption of HIT solutions in NHs and HHAs has lagged behind hospitals and ambulatory care settings.

This project set out to identify what information is exchanged between hospitals, physician offices, and ancillary health providers (such as laboratories and pharmacies), and NHs and HHAs. The project also asked how and whether HIT is being used to facilitate HIE with and between NHs and HHA providers. These questions were posed to several early adopters that have implemented HIT to support the exchange of health information as patients change care settings. In particular, this effort focused on whether there were any differences in the types, content, or format of data that were shared with affiliated as opposed to unaffiliated care settings. Further, the project asked whether HIE strategies employed by leading HDSs could be replicated elsewhere and what lessons were learned as implementers developed their information technology solution(s). Specifically, the project team sought to understand what worked and what did not work as expected at the sites visited. More generally, the team wanted to identify what facilitated and impeded both electronic and non-electronic HIE.

Ultimately, the answers to these key questions can provide information to health care leaders and policy makers on: (1) the patient health information that needs to be exchanged with NHs and HHAs; and (2) the use of HIT to support HIE. This knowledge may help to inform a national strategy to promote more widespread interoperability towards the ultimate objective of improving the quality of health care in this country.

B. PROJECT OBJECTIVES

The four goals of this project were to: (1) describe the current status of the use of HIT in state-of-the-art HDSs and how health information is or is not exchanged between "unaffiliated" PAC/LTC providers and other components of the health care delivery continuum (e.g., physician offices, laboratories, pharmacies, and hospitals) that use HIT; (2) identify the factors that support or deter the timely exchange of needed health information to and from unaffiliated PAC/LTC providers and other components of the health care delivery continuum that use HIT; (3) identify the policy levers that could be

used to encourage information exchange by HDSs that use HIT with unaffiliated PAC/LTC providers; and (4) summarize and organize information learned and describe the next steps that could be pursued to extend electronic HIE (e-HIE) technologies into PAC/LTC.

All activities, which included a literature review, stakeholder interviews, site visits, and resultant case studies attempted to answer one or more of the following research questions:

1. In select health care delivery systems:
 - a. What HIT is being used to support the: (1) creation, storage, and exchange of summaries of physician office visits and hospital stays; and (2) computerized provider order entry (CPOE) including medication ordering, and laboratory results reporting?
 - b. What hardware and software are used to support these functions and how do they support these functions?
 - c. To what extent does HIT use nationally-recognized (e.g., CHI-endorsed) HIT vocabulary and messaging standards to create and exchange health information within the HDS?
 - d. What is the health system architecture that supports the creation, storage, and exchange of these summaries, orders, and reports of results?
2. What type of health information is needed for summary documents of hospital stays, physician office visits, medication orders, and laboratory tests?
3. Within selected health care delivery networks, what clinical information is exchanged as part of the summaries of physician office visits and hospital stays, physician orders, and reports of test results?
4. What health information is exchanged between health care providers and unaffiliated PAC/LTC settings and what are the mechanisms used to exchange information?
5. What factors do PAC/LTC providers and representatives from the selected health care delivery systems identify as supporting or creating barriers to the timely exchange (in any form; i.e., electronic, fax, paper, etc.) of physician and hospital summaries, physician orders, and results reporting between HDSs and PAC/LTC providers?

C. NAVIGATING THE REPORT

The audience for this report is broad and varied, including federal and state officials, PAC and LTC providers, standards development organizations (SDOs), and potentially payors, vendors and other stakeholders interested in HIT. As such, the report is written with the expectation that the reader may have little knowledge of the

current state of HIT development and the corresponding policies put forth and planned. Section II explains the methods used to select and recruit the participating sites for the case studies. Section III presents our findings and results, separated into major areas focusing on clinical and organizational/management of HIE and technical issues. The purpose of this division is to make it easier for readers to separate out these related, but different observations and findings from the site visits. Section IV presents our interpretation of the findings, as well as a discussion of possible next steps.

II. METHODS FOR SELECTION AND RECRUITMENT OF HEALTH DELIVERY SYSTEMS

For the purposes of this study, a "health delivery system" (HDS) was defined as an entity that includes a hospital with one or more affiliated or owned physician office practice(s), outpatient clinic(s), laboratories, and/or pharmacies. The goal was to identify up to ten candidate HDSs, from which four would be selected for site visits.

A. CRITERIA FOR SELECTING THE HDS AND PAC/LTC SETTINGS FOR SITE VISITS

The criteria used to select the HDSs was based on the type and scope of electronic health information creation, storage, and exchange believed to be implemented in the system; the anticipated level of effort required to gather data about the information exchange mechanisms at each system; and to the extent possible, how the HDS is representative of those around the country and/or provides an instructive contrast to the other sites selected.

More specifically, the following criteria were used to prioritize candidate sites. The HDS should: (1) have an electronic health information system that allows for the exchange of health information across two or more settings or providers (e.g., hospital and physician offices, laboratory, pharmacy, radiology), and preferably has documentation to explain the clinical/organizational and technical components and capabilities of the health information system; (2) refer patients to unaffiliated PAC and LTC settings (defined as SNFs, NHs, and HHAs) in the same general geographic location (unaffiliated, for the purposes of this screening was defined as not being owned by the HDS);⁵ (3) preferably have at least six months experience with the software application(s) that support information exchange; and (4) be amenable to a site visit by a three-person team of data collectors who would require access to a variety of staff (including clinicians, information technology specialists, and managers).

Although the criteria were established a priori, it was later recognized that provider arrangements often do not fall into neat categories of affiliated and unaffiliated. As noted above, in some cases, organizations may have a preferred provider relationship, although they are not officially affiliated. Rather, provider arrangements continue to

⁵ Although this definition was used for initial screening of candidate sites, the site visits did include a few settings that had some type of relationship with one another. For example, the Visiting Nurse Service, Inc. (VNS) of Central Indiana has gone through a vetting process at some of the local hospitals and after meeting the hospitals' criteria, have established a "preferred provider status" with these referral sources. So although they are not owned or affiliated in a legal sense, this relationship does directly influence their referral stream. Similarly, at Erickson (Maryland CCRC), St. Agnes Hospital receives close to 100% of acute care referrals, although strictly speaking they are unaffiliated.

evolve. For example, physicians with multiple affiliations have proven to be an impetus for data exchange across health settings. In fact, within many situations, physicians "follow" patients across settings muddying the waters as to what constitutes affiliated and unaffiliated relationships.

B. INCLUSION OF SITE INVOLVEMENT IN A REGIONAL HEALTH INFORMATION ORGANIZATION (RHIO) OR HEALTH INFORMATION EXCHANGE NETWORK (HIEN)

Because of the growing impact that RHIOs or HIENs are having in facilitating HIE, the criteria for selection also included sites with RHIO or HIEN involvement. The Healthcare Information and Management Systems Society (HIMSS) defines a RHIO as a group of organizations with a business stake in improving the quality, safety, and efficiency of (health) care delivery (Healthcare Informatics in collaboration with AHIMA and AMDIS, 2005). Because of the multiple issues (e.g., business, legal, legislative, technological, clinical, and cultural) involved in cross-organizational interoperable HIE, support for HIE organizations has become more attractive at both the state and federal levels. While grants are normally used for start-up and planning phases, recent surveys have indicated that additional funding sources for RHIO start-up and continuation is necessary (Healthcare Informatics in collaboration with AHIMA and AMDIS, 2005; HIMSS and the Center for Health Information and Decision Systems, 2006).

In response to this recognized need, federal programs have emphasized and increased the amount of funding for grants and demonstrations for RHIO and HIEN planning and implementation. Over 40 states are in some phase of planning, implementation, or have projects that are focused on HIE organizations (HIMSS and the Center for Health Information and Decision Systems, 2006).

As there are no "best practices" that a RHIO or HIEN can use to start itself, communities often have produced their own design, specific to their own needs, with funding or planned funding coming from a variety of sources, including hospitals; employers; physician groups; non-profit groups; insurers; local, state and Federal Government; user fees; financial incentives; and private investors. As such, involvement in collaboration with other area organizations was viewed as an important factor for inclusion in site selection.

C. POTENTIAL SITE VISIT LOCATIONS

The following list for potential site visits was created and reviewed by the project team and a group of leaders in the field of HIT identified by ASPE. Based on a review of the literature and recommendations from peers and grant-making organizations, 14 organizations were identified as being particularly innovative in the area of HIE. These sites did not ask to be considered, nor were they necessarily aware that their names

had been put forth. Based on the criteria discussed above, the sites originally considered are listed in alphabetical order below:

1. Allina Hospitals and Clinics, Minneapolis, Minnesota
2. Deaconess Billings Clinic, Billings, Montana
3. Erikson Retirement Communities, Maryland
4. Indiana Health Information Exchange (IHIE), Indianapolis, Indiana
5. Intermountain Health Care (IHC), Salt Lake City, Utah
6. Kaiser Permanente, Oregon
7. Maimonides Medical Center, Brooklyn, New York
8. Mercy Medical Center, Rural Iowa Redesign of Care Delivery with EHR Functions, Mason City, Iowa
9. Meridian Health, Jersey Shore University Medical Center, Jersey City, New Jersey
10. Montefiore Medical Center, Bronx, New York
11. Partners Healthcare System, Inc., Boston, Massachusetts
12. PeaceHealth, Eugene, Oregon
13. Rhode Island HIE Project, Providence, Rhode Island
14. Taconic Independent Physicians Association, Hudson Valley, Albany, NY

D. SELECTED SITES

Preliminary information was gathered by the research team through web searches and interviews with informants at each site. The expectation was that the team would gather enough information to determine if each site met the majority of the selection criteria and if they would be amenable to a site visit. This information was then shared with the ASPE Project Officer and together the project team and the ASPE Project Officer prioritized the list of candidates. The final list of sites was selected in January 2006. The approach was to first select the host site, and then determine if the main referral recipients from this site included three or more (affiliated or unaffiliated) PAC or LTC settings. The exception to this approach was Erickson Retirement Communities. Erickson is a CCRC and provides the spectrum of health care to the elderly, with the exception of hospital and hospice care. Therefore, for this site visit, we asked Erickson to provide us with names of hospitals and any community PAC or LTC settings that may serve Erickson residents.

The following four host sites were selected for site visits based on the preliminary background information obtained. More in-depth information was obtained later in the project as the site visit details were confirmed, as well as during the site visit. Specifics can be found for each site visit in Appendices B through E, and are in the order in which the site visits were conducted.

Erickson Retirement Communities

(Site Visit Dates: July 12-14, 2006)

Erickson Retirement Communities, Catonsville, Maryland, owns and operates 13 CCRCs in the United States. Four of their communities are considered "mature campuses" aimed at providing "total care" for retired individuals. One of the mature sites, the Catonsville campus includes a medical center that acts much like a physician's office for Erickson residents, a Medicare-certified HHA, inpatient and outpatient rehabilitation services, a SNF, and an ALF (personal communication with Daniel Wilt, Vice President Information Technology, March 23, 2006). Erickson employs certain medical specialists (e.g., podiatry, dentistry) and allows other independent clinicians to treat patients on campus. However, it does not own or operate most specialty clinics and does not own or operate any acute care centers. Three additional CCRCs are under construction and Erickson plans to establish additional communities throughout the country. Because Erickson's information technology approach is highly centralized--all campuses' EHRs are run out of the central office in Maryland and accessed using high speed network connections--they believe that their per site information technology costs will be reduced as they implement EHRs in new locations.

Erickson uses one EHR (GE Centricity) at the medical center on campus, and another (HealthMEDX) for the SNF (Renaissance Gardens) and the HHA. One forward-thinking, patient-centric advancement made by the information technology team at Erickson is the development of an electronic chart summary, which is generated from their EMR and can be accessed via the web or at any of their facilities' workstations. The chart summary includes, but is not limited to, relevant current and historical clinical information such as advanced directives, medication lists, laboratory results, problem lists, and contact information for patients and caregivers. Care coordination is facilitated as physicians electronically access this information on or off campus and communicate pertinent data in a timely manner to the ED physician when a patient requires acute care. In November 2005, Erickson launched a website⁶ providing residents access to their medial records for no additional cost. This and other online health information services are discussed in greater detail in Section III.G below.

At the time of the site visit, Erickson was not involved in a HIE organization in their area/region, although it is their desire to do so. They have initiated preliminary discussions with providers in their region on this topic.

Unaffiliated HDSs and PAC/LTC sites: St. Agnes Hospital and Hospice, Johns Hopkins Home Health Agency.

Erickson PAC/LTC sites: Renaissance Gardens (SNF and LTC NH), Erickson's on-campus HHA.

⁶ <https://myhealth.erickson.com>.

Montefiore Medical Center

(Site Visit Dates: August 2-4, 2006)

Montefiore Medical Center (Montefiore) is an integrated HDS in Bronx, New York, providing a full range of services, including specialty care to Bronx residents as well as patients outside of this borough. Montefiore serves a medically underserved population, a large number of whom are young, minority, and poor (Greg Burke, Vice President of Planning, Montefiore Medical Center, presentation slides from November 2004). The Montefiore HDS includes an acute care hospital (Montefiore Medical Center), a large HHA, and contracts with a number of SNFs in the area. Montefiore uses IDX's LastWord in both the inpatient setting as well as for ambulatory care at 28 sites. LastWord contains data from every Montefiore encounter for 1.8 million patients; currently this includes laboratory test results, medications, and images, but does not include notes and consults. Some scanned information also is represented. E-prescribing has been in place for close to a year. Montefiore also is one of several acute care hospitals involved in the creation of the non-profit entity called the Bronx Regional Health Information Organization (BxRHIO). At the time of this report, the other collaborators in the BxRHIO include several hospitals, over 40 community-based primary care centers, one NH, two HHAs, payors, physician offices, and laboratories. A month prior to our August 2006 site visit, Montefiore was awarded \$4.1 million from the New York Department of Health for seed money (called HEAL-NY) to commence a data exchange RHIO in the Bronx. The focus of the Bronx RHIO is to facilitate sharing of clinical data among providers with disparate systems and levels of sophistication in using EHR systems (personal communication with Greg Burke, Vice President of Planning, Montefiore Medical Center).

Unaffiliated PAC/LTC sites: Schervier Nursing Care Center (SNF), the VNS of New York (HHA), the Jewish Home and Hospital (SNF).

Affiliated PAC/LTC site: Montefiore Home Health Agency.

Intermountain Health Care

(Site Visit Dates: August 9-11, 2006)

IHC is a non-profit health care system that provides care to residents of Utah and Idaho. This institution is one of the pioneers in HIT, with a long history of excellence in the area of quality improvement. Homer Warner, MD; Stanley Huff, MD; and others at IHC were among the first users and developers of EHR systems. LDS Hospital, one of IHC's hospitals in Salt Lake City was visited. Intermountain provides over 60% of the acute care market in Salt Lake City and has more than 27,000 employees enterprise-wide. LDS Hospital alone has 4,700 employees. Intermountain employs 550 physicians and has another 3,000 affiliated physicians with limited (read-only) access privileges to the electronic health information system (HELP system). Intermountain also has 92 clinics. According to one source, 17,000 people can access (with varying levels of permission) the Clinical Data Repository that is part of the HELP2 system.⁷

⁷ http://intermountainhealthcare.org/xp/public/documents/institute/faculty_clayton_building_system.pdf.

LDS Hospital is a member of the Utah Health Information Network (UHIN), a community health information network that began in 1993. UHIN is a coalition of health care providers, payors, and state government with, initially, the common goal of reducing costs by standardizing the transmission of administrative data, particularly payment data. The network community sets the data standards, using recognized national standards (e.g., HL7 messaging and NCPDP standards), to which providers and payors voluntarily agree to adhere. The UHIN standards are then incorporated into the Utah state rule regarding payment of health care via the Insurance Commissioners Office (UHIN, 2007).

UHIN operates as a centralized secure network through which the majority of health care administrative transactions pass statewide. Nearly all Utah payers and providers are participating in this project. UHIN developed a tool (UHINT), which they provide free of charge to providers for use in submitting electronic claims. The tool is provided so that even the smallest sized provider can submit claims and electronically receive remittance advices.⁸ State officials indicate that the exchange of standardized electronic transactions has drastically reduced the amount of paper processing required for payors and has streamlined the payment of claims and remits, which has resulted in providers receiving payment more quickly. Under an Agency for Healthcare Research and Quality (AHRQ) grant, UHIN is pilot testing the electronic exchange of a limited set of administrative and clinical data (medication history, discharge summaries, history and physicals, and laboratory results with a small number of providers). This pilot involves the exchange of information from payer to hospital only, no PAC or LTC providers are in the pilot. The results of this pilot study are not yet available, but the UHIN developers note informally that health care providers involved in the UHIN are beginning to request and require these clinical and administrative data. For example, UHIN developers are noticing an increase in feature requests from users (e.g., setting a statewide standard for credentialing physicians, account reconciliation). Because of the adoption of emerging technologies such as messaging and web-based connectivity (in place of earlier less nimble, less scalable, and more expensive technologies), UHIN's ability to fulfill those requests is keeping pace (personal conversation with Jan Root, Standards Manager, UHIN).

Unaffiliated PAC/LTC sites: Christus St. Joseph Villa (SNF), Community Nursing Service (CNS) (HHA), Hillside Rehabilitation (SNF), and CareSource (HHA and Hospice).

Affiliated PAC/LTC sites: IHC does not own any PAC or LTC facilities.

Indiana Health Information Exchange (Site Visit Dates: September 13-15, 2006)

The IHIE is a non-profit venture connecting a number of HDSs in Indiana. The IHIE, led by Dr. J. Marc Overhage, comprises over 48 hospitals and has approximately

⁸ A remittance advice or “remit” is an electronic notice received by the provider or biller after Medicare has processed a claim and gives an explanation for the payment.

3,000 physicians who access the network. With AHRQ funding and a variety of other sponsors including BioCrossroads,⁹ regional and local hospitals, and the Regenstrief Institute, the IHIE recently implemented a community-wide clinical messaging project to support e-HIE between physicians and hospitals. Each participating partner has access to a limited amount of patients' clinical results using a single IHIE-controlled electronic mailbox called Docs4Docs (discussed in detail in Section III.G.6 of this report).

The IHIE was a health care market member in one of the four consortia¹⁰ awarded a HHS contract in 2006 requiring the development of four prototypes for a NHIN architecture. All three health care market members within the Computer Science Corporation (CSC) consortia (IHIE, MA-SHARE [Massachusetts], and Mendocino HRE [California]) helped to develop, test, and demonstrate a prototype, based on common, open standards. Of particular interest for this project, required components for all four prototypes: (1) were designed to facilitate HIE using the Internet, not creating a new network; (2) allowed for communication to occur between many different types of EHR systems; and (3) allowed for different types of software and hardware that could be included in the system. As stipulated by HHS, the prototype architectures were submitted to HHS in January 2007 and on February 14, 2007, CSC announced their success with exchanging health information through their NHIN prototype. Health data were securely transferred between MA-SHARE, the IHIE, and the Mendocino Health Records Exchange, as well as local public health departments within those regions (CSC, 2007).

Unaffiliated PAC/LTC sites: Beverly Enterprises at Brookview (HHA), VNS of Central Indiana, Briarwood Rehabilitation, Kindred Long-Term Acute Care Hospital.

Affiliated sites: Lockefield Village Rehabilitation and Healthcare Center (SNF), Wishard Health Services (Hospital).

E. PREPARING FOR AND PLANNING THE SITE VISITS

A case study plan was developed and submitted to the ASPE Project Officer in June 2006, outlining the plan for how the site visits would be conducted (see Appendix A for the complete report).

The site visit team asked for assistance from each selected HDS in identifying which LTC/PAC agencies/facilities received their referrals, and also asked the HDS to provide contact information for these referral sites. The recommendations received

⁹ BioCrossroads is an entity that provides money and support to both existing and new life sciences businesses, expanding collaboration and partnerships among Indiana's life science institutions, expanding science education, and building awareness and marketing Indiana's life sciences industry. See <http://www.biocrossroads.com> for more information.

¹⁰ The four consortia are IBM, Accenture, Northrup Grumman, and CSC.

from the host HDS were supplemented with additional PAC/LTC settings¹¹ that were identified based on national reputation, ASPE Project Officer suggestion, and referral from industry associations (e.g., National Association for Home Care [NAHC], American Association of Homes and Services for the Aging [AAHSA], AHCA) and RHIOs.

Each of the four site visits consisted of multiple locations, which meant coordinating the review of four to five different providers at their separate locations. The site visit team visited an acute care hospital; three or more HHAs, NHs, or SNFs; and often another setting (e.g., a long-term acute care hospital or hospice). Coordination between the UCDHSC Project Director and leaders at each of the four respective sites was crucial for ensuring successful visits.

F. DEVELOPMENT OF DISCUSSION GUIDE

To ensure that salient information was collected at each site while not constraining the site visit team to a single set of questions, discussion guides were purposely designed to be flexible and solicit open-ended responses. The site visit team used a variety of data collection methods to collect information. A "General Information about your Health Care Setting" form was submitted to all sites prior to the site visit. Using this form, we collected background information such as ownership, number of employees, EHR system used, etc. During the visits, site visit team members used in-person observation and formal and informal conversations, and questions and responses using the discussion guides created for this project. A set of the discussion guides and the general information form noted above can be found in the Case Study Plan in Appendix A.

G. ANALYSIS OF FOCUSED DISCOVERY DATA COLLECTION

Common themes and trends emerged as the data were collected and analyzed during the site visits. The site visit team sought to answer certain pre-determined questions at each site, and then observed and collected information on any actual (or potential) data exchange activities. The following narrative in Section III is a synopsis of these themes, which are largely a series of anecdotes. Specific details from each site visit can be found in Appendices B-E.

¹¹ As stated before, in the case of the site visit to Erickson Retirement Communities, the authors asked for referrals to an acute care hospital and any other PAC or LTC settings that may treat the Erickson residents.

III. RESULTS

The four site visits resulted in the findings illustrated in this section. Using all the data collected both prior to the four site visits and during each three-day visit, a compendium of findings for each site was created. Section A reviews the project objectives and background and Section B focuses on the clinical information exchange across the affiliated and non-affiliated PAC and LTC providers. Areas of HIE commonality are explored in Section C, Section D highlights solutions and future plans, and Section E discusses facilitators and barriers to HIE. The organizational and management issues related to HIT adoption are discussed in Section F, and Section G puts forth specific technological issues and observations made during the site visits.

A. BACKGROUND

As noted in Section I, in addition to reporting on the current status of the use of HIT, one of the specific objectives of the visits was to identify the information needed at times of transition, determine how these data were (or were not) exchanged across care settings, and to identify barriers/facilitators to the exchange of data. Project objectives also included investigation of the method by which data are exchanged (electronically and not electronically) and the extent that data are exchanged between physician offices, laboratories, and pharmacies and PAC and LTC facilities.

The sites were not randomly selected, but rather were chosen based on criteria noted in Section II. The findings, therefore, are not necessarily representative for all settings, nor are the sites' HIT solutions replicable without taking into account the nuances of each site (e.g., size of the city, other competitors in the area, involvement of one or more "champions").

All four sites are located in medium to large metropolitan areas. Each site visit had a host or "hub" site and then three or more "spoke" sites. Three of the four host sites had an acute care hospital as the hub site, while the fourth (Erickson in Maryland) had a CCRC as the hub site. Three of the four had HIE organizations in various stages of development (Utah, Indiana, and New York). The fourth site (Maryland) had a well established albeit non-automated data exchange relationship with the local hospital. Thus, all four sites had processes in place that support information sharing across settings, including non-affiliated providers.

As suggested, health information can be exchanged across a variety of providers in a variety of ways. In an early attempt to delineate the different levels employed by different entities in sharing electronic health information, Walker and colleagues developed a four-level taxonomy describing the different stages of health care information exchange and interoperability (Walker et al., 2005). These levels are paraphrased below:

- Level 1: Non-electronic data--no use of information technology to share information (examples: mail, telephone).
- Level 2: Machine transportable data--transmission of non-standardized information using basic technology (e.g., fax or personal computer [PC]-based exchange of scanned documents, pictures, or portable document format [PDF] files). The information being exchanged cannot be electronically manipulated.
- Level 3: Machine-organizable data--structured messages are used to transmit non-standardized data. This requires that the receiving computer "translate" data from the sending computer. This often results in imperfect translations and loss of meaning. Walker provides the following examples of this level of health information and interoperability: e-mail of free text, or PC-based exchange of files in incompatible/proprietary file formats, HL7 messages.
- Level 4: Machine-interpretable data--exchange of structured messages that contain standardized and coded data.

Similarly, we observed the use of HIE applications and tools across many of these levels, including HIE that was completely paper-based, with the use of phone and fax to convey information to entities outside of the setting, to limited observations of standards-based, computer-readable, e-HIE that occurred using EHRs. Further, we found a wide range of HIE applications being used even within individual health care organizations. For example, during the site visits it was observed that organizations had both paper and e-HIE applications. As a result, it was not possible to consistently apply the HIE and interoperability levels described by Walker et al. to describe the levels of HIE and interoperability within a single organization.

The following tables are heuristic guides to frame the site visit team's observations of HIE capabilities found as a result of the four site visits. Table 1 identifies four levels of HIE--where the first level reflects use of less sophisticated, earlier HIE applications (e.g., fax, telephone, mail) and the use of paper-based records, and the fourth level reflects completely interoperable HIE using standards-based EHRs.

TABLE 1: Levels of Health Information Exchange	
Completely Interoperable EHR System Use of HIT Standards	Level 4
EHR Used/Limited Electronic Data Exchange Some HIT Standards Used	Level 3
Combined Paper Record / EHR	Level 2
Paper-based Record / No EHR	Level 1
EHR Description / HIE Capabilities	Maturity Level

Table 2 is illustrative with features described for each level to suggest a progression from less to more sophistication in terms of HIE. This table was constructed based on literature review as well as our observations concerning HIE and use of EHRs across the sites selected for this study. Although none of the settings observed have reached Level 4 (i.e., completely interoperable EHR systems, using standards-based applications to share information with affiliated and non-affiliated providers), it is included as the purported "future goal" for many of these settings. As will be described in more detail throughout this report, in general, we observed that:

- Most HDSs (e.g., hospitals and physician offices) included in our site visits were at Levels 1, 2, and/or 3 for purposes of HIE, and were generally at Level 1 for purposes of HIE with PAC/LTC providers; and
- Most PAC/LTC providers also were at Levels 1, 2, and/or 3. However, there were few instances in which PAC/LTC providers were observed to electronically exchange health information with hospitals, physicians, and other providers/clinicians, and there were a few instances in which the PAC/LTC providers were completely paper-based (Level 1).
- Not unexpectedly, there may be variation within each Level as well so that, for example, a setting may be rather sophisticated in Level 3 for a function such as e-prescribing or laboratory result reporting, but in that same setting they may not have other electronic information sharing. So while they would be categorized as Level 3 using these criteria, they would be at the "low end" of it. Therefore, labeling an entire health setting at a particular level is not yet feasible, and this is why there are four areas of focus that are broken down by level later in the document. This report highlights our observations concerning the levels of HIE for the providers included in the site visits related to four clinical areas:
 - transfer/discharge;
 - communication with physicians/other clinicians;
 - medication ordering/e-prescribing;
 - laboratory/radiology ordering and results reporting.

TABLE 2: Illustrative Examples of HIE Capabilities by Level								
	Level 1 Paper-based Record/ No EHR		Level 2 Combined Paper Record/EHR		Level 3 EHR Used/Limited Electronic Data Exchange, Some HIT Standards Used		Level 4 Completely Interoperable EHR System, Use of HIT Standards	
HIE Methods	<ul style="list-style-type: none"> Fax Phone/Voice Photocopy to pass on by hand Face-to-face 		<ul style="list-style-type: none"> Fax Phone/Voice/Face-to-face Print/Photocopy to pass on Limited non-standardized electronic HIE (e.g., e-mail to & from physicians) 		<ul style="list-style-type: none"> Fax, Phone/Voice/ E-mail, Photocopy Some electronic data exchange standards (i.e., messaging standards) in use Increasing use of electronic HIE (e.g., components of EHR may be electronically exchanged) 		<ul style="list-style-type: none"> Electronic fax downloaded into EHR Standards-based data exchange (i.e., use of messaging standards) Standardized content exchanged Standardized e-HIE across key components (e.g., lab results, medication ordering) of care continuum 	
Features/Attributes of Patient Health Information and Electronic HIE ¹	No Electronic HIE (i.e., not electronic data)	No EHR	Some e-HIE	Limited use of EHR	Data exchange limited to certain systems	Access to data limited to user role/ discipline	EHR is primary record	Standards-based EHR system (i.e., EHR content is standardized)
	May have software for AR/AP, scheduling	No Anytime/ Anywhere Access	May allow for images to be imported	Clinical information collected on paper & entered into EHR	Continued but limited use of paper record	Some use of standards (messaging &/or content)	Interoperable with internal & external systems	Record can be electronically exchanged/ is transportable
			Meets minimum regulatory requirements ²	Limited Anytime/ Anywhere Access	Decision support features & alerts used	Anytime/ Anywhere Access	Computer Empowered Interoperable System	Anytime/ Anywhere Access
Facilitators of HIE			Limited involved in HIE Network (e.g., admin/claims data)		Some clinical content exchanged within HIE Network		Greater amount clinical information exchanged/shared within HIE Network	
<ol style="list-style-type: none"> These are illustrative examples only and are not necessarily reflective of what was observed during site visits. No site visit has attained Level 4. For example, Outcome and Assessment Information Set (OASIS) and Minimum Data Set (MDS) reporting to CMS. 								

B. EXCHANGE OF CLINICAL INFORMATION

1. Introduction

HIE is an integral component of health care workflow and is important in the provision of quality care to patients. When the exchange of health information is performed well, care provision can achieve positive health outcomes. When information exchange is not performed well (e.g., it is untimely, inaccurate, or absent) potentially costly inefficiencies may occur or it may result in adverse events.

HIE across care settings is very complicated, regardless if the mechanism is electronic or manual. Such exchange involves multiple health settings with different information needs and with different levels of HIT adoption and technological sophistication. Ideally, information exchange should be two-way, with an opportunity for the receiving provider to ask clarifying questions or request supplemental information. However, often communication is a one-way transaction. Although information technology will not, nor should it replace face-to-face interactions, HIT can facilitate and augment information exchange. The goal of interoperable HIT has become a national

priority in recent years. HIENs/RHIOs have been identified as important mechanisms in this regard and have experienced prolific growth. One of the requisite tasks for HIEN developers is to formalize who are the network partners and determine what information needs to be exchanged. Often, it seems that there has not been an explicit understanding and agreement about the range of partners that need to be involved in these networks, nor has there been a formal consensus building process for determining the content of information to be exchanged and when. A positive consequence of the push for HIT adoption has been the recognized need to formalize HIE relationships among information "trading partners." Therefore all entities that need information should be included as partners.

Understanding how HIT can be used to facilitate HIE requires a concomitant understanding of the influence of HIT on the daily workflow of health care professionals. In some cases, the workflow issues have been identified to be more challenging than technological issues. Discussions between HIE partners are beginning that further explore this interface and are focusing on questions such as: How can HIE be engineered such that it supports rather than detracts from health care professionals' patient care responsibilities? What information should be exchanged and when in the process of a daily routine should this occur? How can HIT facilitate this exchange?

With this recognition of the mutually dependent relationship between HIE and workflow, the following discussion provides a framework upon which the observations and key issues identified in subsequent sections can be interpreted.

2. What Are the Workflow/Communication Issues?

The four site visits reinforced the central roles that workflow and communication play in HIE and the importance of considering and planning for the desired workflow/communication issues to realize some of the efficiency gains that may be achieved through HIT implementation.

a. Workflow. Information technology is a cross-cutting issue, an observation that permeated the site visit discussions at many levels. In general, relatively highly-paid professionals in hospitals and PAC, and LTC settings are expending a significant proportion of their time on clerical tasks rather than attending to patients' clinical needs. Implementation of EHR solutions did not necessarily provide solutions to this inefficiency. It was common for sites to report that nurses and physicians read from a computer screen or print out a patient's health data from one electronic health application only to manually re-enter the information into another electronic health application (such as an EHR).

Physicians, nurses, and other representatives (admission coordinators, information technology professionals, etc.) from the study sites generally had not considered how the recipient of electronic information could re-use the information to streamline and make workflow processes more efficient. In most cases, the clinicians were not consciously aware of the amount of time and effort that was being expended on multiple

tasks involving the re-entering of data that was otherwise electronically available. In many instances, representatives seemed to simply insert electronic documents into existing workflow processes and as a result perpetuating (unnecessarily) duplicative administrative tasks.

The lack of standardized HIT/HIE applications also contributed to inefficient practices. Because of the lack of interoperable EHRs, for example, respondents described manually re-entering laboratory results received electronically into their own EHR system, because the laboratory and receiving health care setting's EHR systems did not have the capabilities of exchanging this type of data electronically.

However, further probing revealed that the manual re-entry of data sometimes was considered to be of value. For example, the literature reports that manual re-entry of a medication list from one system or medium to another may add value in terms of quality and safety, while risking the introduction of new errors (e.g., transcribing the wrong dosage, misspelling the medication that is similar to another medication that treats something completely different or is contraindicated) (Brody, 2007). During site visit discussions, clinicians acknowledged that this manual re-entry activity was not simply a clerical process but rather something that provided an opportunity to cognitively assess whether the medications were in fact appropriate, whether any additional diagnostic testing was required, and whether the patient might be at risk for an adverse drug reaction. Occasionally, the notion of trust also would arise--clinicians seemed to place greater trust in information that had gone through the manual re-entry process. Thus it remains to be determined how these vital tasks will be accomplished once more advanced (e.g., interoperable) electronic solutions are forthcoming. The authors speculate that there always will be a need for "the human element" in reconciling information such as the medication list--information technology solutions will merely augment and assist them in these care processes.

In a typical workflow process, keeping track of when a particular task (e.g., obtaining physician's signature, orders) was completed so that the next person could do her/his job was reported as something on many people's "wish list" for what they would like their EHR to do for them. Current practice requires a great deal of time spent manually tracking tasks that could easily be automated in the EHR.

b. Importance of interpersonal relationships. The importance of interpersonal relationships among health care professionals cannot be overstated. The site visit team observed how established interpersonal relationships impacted HIE. Typically, patient information sharing occurred among hospital discharge planners and/or social workers, and NH and home health care agency intake coordinators. Interestingly, the importance of interpersonal communication was no less in care settings that had the capacity to share information electronically versus those that primarily shared information on paper. For example, despite the fact that several hospitals and NHs in New York and Utah have invested in a proprietary software program, Extended Care Information Network (ECIN), to facilitate more efficient referrals (described in further detail below), it is not uncommon for disposition discussions to precede the distribution of the ECIN

information. Thus, although this technology was put in place to facilitate hospital referrals to SNFs/HHAs, informal, less technological approaches (e.g., face-to-face discussions, telephone, faxes) often were the primary mechanisms of data exchange, with HIT being a supplement to this data sharing activity. The perceived value of relationships that exists between these professionals was of more importance when compared to the technology. Our site visit team observed that intake coordinators in referred facilities often received the patient's information telephonically from their hospital colleagues in advance and had already accepted the patient by the time the patient's information is distributed in electronic transfer/discharge summaries, such as ECIN.

c. Other issues that impact communication between referring and receiving providers. Communication and information exchange between some of the observed health care settings was not hindered by a lack of technological solutions. For example, in Maryland, Erickson (a CCRC that provides all health care to their residents with the exception of acute care and hospice) and the local hospital (St. Agnes) have a very close working relationship and freely communicate. Erickson physicians are able to treat their patients should they be admitted to St. Agnes, and they have read-only access to the St. Agnes EHR, but still need to print out anything they would like to have in their Erickson health record. St. Agnes also allows an Erickson-employed nurse to work in the hospital to facilitate discharges back to one of the Erickson facilities (e.g., their SNF, Renaissance Gardens).

Clearly communication between these two entities is occurring, as is HIE, of which most at this point is still manual. Technology was not considered a hindrance; in fact, the leaders at St. Agnes commented that technology is a minor issue in solving the problem of e-HIE. Rather, issues such as who is responsible for protecting the privacy of data at the time of e-HIE and who is liable for the accuracy of the data were identified as the barriers to effective information exchange across health care settings, particularly unaffiliated settings. Further, it remains to be determined who should pay to populate the specific data fields that often are idiosyncratic to each referring/receiving provider. Transmitting data requested by the receiving provider likely will create additional costs (including personnel, programming, troubleshooting/maintenance, upgrades, etc.). The multiplicity of formats may be too burdensome and costly for some providers. For example, the development of an interface between St. Agnes and Erickson to facilitate data sharing was reported by Daniel Wilt (Senior Vice President of Erickson Information Technology Department) to initially cost approximately \$50,000, which then would require maintenance and upgrades over time. This interface only benefits this one relationship between these two entities. Creating unique interfaces to support all referring and receiving sources may be unnecessarily costly and inefficient.

In fact, concern about the relatively high cost of an almost unlimited number of needed idiosyncratic interfaces gave rise to the emphasis in recent years concerning the need for HIT standards to support interoperable HIE. For example, it is anticipated that the use of: (i) the HL7 CCD implementation guide and the content standards referenced in that guide; and (ii) standards to support e-prescribing will allow the

exchange and re-use of this information without the need for these costly interfaces. However, as described below, during out site visits we observed very limited use of HIT standards to support the electronic exchange of patient information.

d. *Timeliness of the communication/information exchange.* The element of time permeated through nearly every discussion that occurred during the four site visits. In particular, when hospital staff believe that a patient is ready for discharge and will require short-term placement in a NH or a referral for home health care, receiving providers must be in a position to quickly decide whether or not to accept the patient, often based on incomplete or even inaccurate information. NH staff at Jewish Home and Hospital Agency (JHHA) and Schervier (New York) both commented that information received from local hospitals often is incomplete, and varies depending on the person completing the discharge form at the hospital. As a result, the receiving facilities/agencies may make poorly informed, inaccurate decisions and may not be in a position to meet the patient's needs upon admission.

3. Health Information Exchange Across Care Settings: Hospitals, Post-Acute, and Long-Term Care

Older adults with acute and chronic health conditions often receive care in multiple, disparate settings by a number of care providers (e.g., primary care physician, one or more specialists) who may or may not share (complete) information. The transfer of timely and accurate information across settings and providers is critical to the execution of effective care transitions. Practitioners need an understanding of the patient's goals, baseline functional status, active medical and behavioral health problems, medication regimen, family or support resources, durable medical equipment needs, advanced directives, and ability for self-care (Coleman, 2002; Coleman, 2003; HMO Workgroup on Care Management, 2004). Without this information, service duplications may occur, important aspects of the care plan may be overlooked, and conflicting information may be conveyed to the patient and family caregivers. Incomplete information transfer can result in critical errors, such as the patient returning home without life-sustaining equipment (e.g., supplemental oxygen or equipment used to suction respiratory secretions). The absence of information about an older patient's baseline level of cognitive function may result in an acute decline in cognitive status being mistaken for chronic dementia. Furthermore, a lack of understanding of a patient's functional health status, including both physical and cognitive, may result in transfer to a care venue that does not meet her or his needs. Thus, improved HIE (manual or electronic) is a critical step toward reducing medical errors, improving quality, and increasing efficiencies for patients who receive care across settings.

This section focuses on HIE across affiliated and non-affiliated acute care hospitals, PAC, and LTC providers. Specifically, it examines information exchange between hospitals, physician offices, NHs, home health care agencies, and, in one setting, a CCRC. To frame this discussion, it is important to note that while there are similarities between how care is delivered in each of these settings, there also are key differences that potentially influence both the content and process of information

exchange. Hospitals, PAC, and LTC settings treat patients with different needs, have different staffing ratios, different clinical information needs, different orientations and approaches to assessment and management, and face different regulatory and reimbursement requirements. These disparate requirements translate into different data needs. Further, providers' HIE often is guided by the need for compliance with existing policies and regulations, including required reporting for patient assessment instruments (PAIs) such as the MDS and OASIS, the Pre-Admission Screening and Annual Resident Review (PASARR),¹² the New York State Patient Referral Instrument (PRI),¹³ and Medicare Conditions of Participation (CoPs).¹⁴

This section begins by describing the clinical domains that the literature identifies as needing to be exchanged and then compares these domains with what was observed on the four site visits, including what is not being exchanged. Next, promising new developments that could support improved HIE will be featured. Key aspects of clinical workflow issues then will be described, followed by comparing and contrasting how health information is exchanged among affiliated and unaffiliated providers. This section will conclude with observed facilitators and barriers to HIE, including e-HIE.

a. What is the content of information exchanged. Based on a review of published literature, summaries of large national conferences, and documents produced by professional societies; at present there is no consensus on the content and type of information exchange needed between hospitals, PAC, and LTC settings. Four distinct national efforts that have begun to address this question include:

1. The CCD (HL7 and ASTM, 2006).
2. The Uniform Patient Assessment for Post-Acute Care tool (CMS, 2006). The UCDHSC developed a concept paper for CMS that provided recommendations for developing a uniform assessment tool that would cut across all PAC settings. The Deficit Reduction Act of 2005 requires the demonstration of a comprehensive assessment at the time of hospital discharge to determine appropriate placement and the use of a standardized PAI across all PAC sites to measure functional status and other factors during the treatment and at discharge from each provider. CMS awarded a contract to RTI International to specify the elements of this tool (which has been named the Continuity Assessment Record and Evaluation (CARE) instrument) and perform a demonstration project.
3. The HMO Care Management Workgroup (HMO Workgroup on Care Management, 2004).
4. The Veterans Affairs Geriatrics and Extended Care (GEC) Referral Discharge Planning Tool (Department of Veterans Affairs, 2006).

¹² See, for example, <http://dhfs.wisconsin.gov/forms1/DDES/dde2191.doc>.

¹³ <http://www.health.state.ny.us/nysdoh/hcra/pri.htm>.

¹⁴ <http://www.cms.hhs.gov/CFCsAndCoPs/>.

Each of these efforts evolved separately. A comparison of the individual domains and classifications needed for information exchange from each of these efforts is shown in Table 3. While there are many similarities among the four efforts with respect to the selection and inclusion of key clinical domains, there are also a considerable number of differences observed as well. A detailed description of the first four efforts can be found on the ASPE website¹⁵ (Coleman, et al., 2007). One of the important differences between the CCD and the other activities listed above, is the HL7 CCD identifies not only the pertinent health care domains for which patient specific information may need to be exchanged at the end of an episode of care, but the CCD also specifies the HIE content and messaging standards that enable standardized electronic exchange of a CCD-compliant transfer/discharge document.

While there often was overlap in the clinical domains included in these HIE specification, there was considerable variation in the type of data within each of the domains. For example, each of the efforts identified a problem list and advance directives. However, the GEC (VA) tool does not list allergies and medications because the tool is designed to complement core information available in the VA EHR. The GEC (VA) tool and the Uniform Patient Assessment tool both are more strongly oriented toward PAC and LTC and as a result, have more items that reflect the types of care more typically addressed in these settings such as continence and skin integrity. Some care settings, such as EDs, desire a much smaller subset of core data items as they do not have the opportunity to review much data during the brief clinical encounter.

Within Medicare's regulatory framework, the CoPs include requirements concerning information exchange at the time of transfer for hospitals, NHs, and HHAs (CMS, 2001; Coleman et al., 2007; Hughes, 2003). Where explicitly identified in the CoPs, the required clinical domains at the time of transfer are comparable to those clinical domains specified in the four national efforts described in Table 3.

Responses from those interviewed revealed a high level of consistency in the content of information needed to support HIE at the time of transfer. For example, Wishard Hospital (Indiana) considers the discharge summary, insurance information, medication list, allergies, problem list, and advance directives among the core information needed at the time of transfer from an SNF or HHA to the hospital or vice versa. LDS Hospital in Utah assembled a similar list and added physical therapy (PT) notes. Erickson Retirement Community (Maryland CCRC) regards medications, allergies/intolerances, medical problem list, advance directives, clinical notes, radiology reports, laboratory results, and clinical notes as the highest priority clinical domains. When the JHHA, a New York NH, transfers a patient to hospital, an information packet is prepared that includes a medical summary of recent events completed by the physician, a handwritten medication list, immunization list, EKGs (if available), and recent laboratory tests. Staff at Schervier (New York NH) also send this same set of information with patients who are transferred to the ED or hospital and, in addition,

¹⁵ <http://aspe.hhs.gov/daltcp/reports/2007/HIErpt.htm>.

complete an internally-developed standard transfer form that describes the reason for transfer.

TABLE 3: Overlap of Clinical Domains and Clinical Information to be Exchanged Between Acute Care Hospitals, Post-Acute, and Long-Term Care Settings				
Key Clinical Information to be Exchanged	CCD (HL7, CDA)	Uniform Pt Assessment (CMS)	HMO Care Mgmt Workgroup	GEC (VA)
Purpose (i.e., transfer)	X			
Payers	X			
Advance directives	X	X	X	X
Support (persons/family)/Caregivers Information	X	X	X	
Functional status	X	X	X	
Cognitive	X	X		X
Physical	X	X		
ADLs/IADLs, baseline, current		X	X	X
Problems, Prognosis	X	X	X	X
Family History	X			
Social History	X			
Allergies, Adverse Reactions, Alerts	X	X	X	
Medications	X	X	X	
Medical equipment	X	X	X	X
Suppliers				X
Immunizations	X	X		
Vital signs	X			
Results	X			
Procedures	X			
Encounters	X			
Plan of Care	X	X		
Health Care Providers, PCP	X	X	X	X
Goals of care	X	X		X
Discharge instructions, disposition		X	X	
Pain		X		
Skin integrity		X		X
Sensory deficits	X	X		
Dietary needs		X		X
Continence		X		X
Falls risk		X		
Current services receiving in home		X		X
Capacity to perform self care, educational needs	X	X	X	
Ethnic/cultural considerations/language	X	X	X	X
Self-rated health status		X		
Source of referral				X
Where does patient live, with whom			X	X
Homebound status				X
Additional information (environmental hazards)				X
Weight bearing				X
Referring to which program			X	X
Estimated duration of care				X
Skilled care services needed				X
Behaviors and symptoms				X

In contrast to the states of Indiana, Utah, and Maryland, New York State regulations mandate the information that must be made available to the receiving care team prior to a patient's transfer. The sending institution (typically the hospital) must complete the PRI for all patients being referred for Part A covered SNF care, and New York nursing staff must be certified to complete the PRI. The PRI scores the patient on intensity of care with categories including physical and cognitive function, medications for the last seven days, recent laboratory results, x-rays, PT and occupational therapy

(OT) notes, and wound care. In addition to supporting HIE, this tool facilitates an appropriate match between the patient care needs and the care setting.

b. What information is not being communicated/exchanged. Across all four of the site visits, the most common clinical content not routinely exchanged between the hospital and the PAC/LTC settings was the patients' current mental status and recently exhibited behavioral symptoms. NH staff at Lockefield Village (Indiana extended care facility associated with Wishard Hospital) commented that they rarely receive information about a patient's mental and behavioral status prior to transfer from the hospital. When information is provided, it often is incomplete or inaccurate. These frustrations were echoed by the JHHA and Schervier (New York SNFs/LTC facilities). Staff at both facilities recognized that current financial incentives to discharge patients from hospitals as quickly as is reasonably possible, are not always aligned with full disclosure by the referring hospital of a patient's status. Not only could this information delay a potential transfer or discharge from a hospital, disclosing such information may trigger PASARR screening and require further evaluation by mental health professionals. Consequently, hospitals may not share this information with potential receiving NHs.

While not included on any of the lists described above in Table 3 of clinical domains for which information exchange is needed, the second most cited type of clinical content that is not reliably transferred across settings is PT notes. Despite a relatively high level of integration, Erickson Retirement Communities staff (Maryland CCRC) noted that there is no existing mechanism to ensure that the clinical information charted by the physical therapist in Renaissance Gardens (their SNF) is transmitted to the physical therapist in home health care (which is on the same campus) to which the patient has been referred or discharged. Renaissance Gardens and the Erickson HHA both use the same EHR (HealthMEDX). Similarly, both JHHA and Schervier (New York NHs) identified PT notes as rarely included but nonetheless needed in the transfer information received from the referring hospital.

Patients' wound status was the third most commonly observed clinical data not reliably exchanged, but reported as needed. Briarwood (Indiana NH) staff commented that not having this information left them unprepared to meet a patient's needs, either because they did not have the on-site expertise to evaluate and treat the patient or because care required specialized equipment, dressings, or therapies that was not available in their facility upon admission. Had they known the extent of the patient's need prior to admission, they may not have accepted the patient knowing they did not have the on-site expertise.

Advance directives also were not consistently shared. Providers attributed part of the problem to the fact that these documents often "stand alone" from other health-related information and therefore are more likely to become separated from other transfer documents. Often, family caregivers were asked to provide a duplicate copy of the patient's advance directive, as providers noted that requesting the information from the transferring institution was often unproductive. Although regulatory requirements

mandate that admitting facilities request an advance directive on all patients, the same requirements do not mandate what happens to the actual advance directive document and whether it becomes an integral part of the patient's record. Clinicians at the hospital and PAC/LTC sites visited often noted that advance directives are sometimes misplaced, misfiled, or mishandled by the receiving health setting. The importance of these documents for ensuring patient centered care cannot be overstated. Patients complete these documents to convey to health care professionals what type and duration of treatments that they believe to be either acceptable or unacceptable. The inaccessibility of these documents may result in undesired treatments being administered, desired treatments being withheld, or inexcusable violations of a patient's religious or cultural practices (Morrison, Olson, Mertz, & Meier, 1995).

With regard to medications, staff at JHHA and Schervier (New York NHs) were appreciative that they generally received the medication list and sometimes the Medication Administration Record (MAR) from the referring hospital. However, they expressed a desire to extend the time period that the hospital provides medication reporting to a full 14 days. This would facilitate more accurate completion of documentation required by the MDS (version 2.0 for NH resident assessment and care screening) and used in the calculation of Resource Utilization Groups-Version III (RUG-III) needed for payment. RUG-III categories and appropriate payment rates are based upon the level of nursing requirements, and residents with greater or specialized nursing requirements, therapies, and other conditions are reimbursed at a higher level. Receipt of timely and accurate information from transferring institutions is imperative for accurate assessment (CMS, 2007b).

Members of the site visit team uniformly heard that hospital and PAC settings would stop chronic care medications upon admission and inadvertently not restart them upon discharge. Often, if it were not for the patient or other family member's initiative, these chronic care medications would be forgotten with resulting potential for adverse effects.

Finally, information that describes the roles and contact information for family members was rarely shared across settings. Interestingly, this information was rarely identified during the site visits as key clinical content to be shared at the time of transfer, yet patients receiving home care rely on loved ones and other caregivers to a great extent.

In summary, considerable overlap was observed with regard to the type of health domains for which information was exchanged between the clinical categories addressed by the four national efforts described in Table 3 and the type of health information that was exchanged by providers in the sites that were visited. However, considerable variation in the specific type of data within each of the domains that was exchanged and sometimes reported as needed also was observed. Reasons for this variation include: (1) that the specific types of health information to be exchanged often reflect the idiosyncratic agreements between the sending and receiving providers; (2) providers within health delivery organizations/systems have not reached an agreement

on the type of health information that is needed to be exchanged; and (3) regulations require the exchange of certain types of data; and in some cases, regulatory activity dictated the type of health information that must be exchanged. In addition, during the site visits two clinical categories were observed that had been mentioned in the previously described national efforts as not being the type of information routinely shared across care settings. The first was information that describes the roles and contact information for family caregivers, as they play an essential role in implementing the care plan. Secondly, the patient's physical, cognitive, and behavioral status were not routinely identified as a high priority clinical category by hospital, PAC, or LTC providers, despite the importance of this information in matching the patient's care needs to an appropriate PAC setting.

c. How and what information is exchanged with affiliated and unaffiliated health settings. Although it was anticipated that HIE between affiliated settings would be more complete, efficient, and likely be accomplished electronically, the site visits did not confirm these assumptions. In fact, HIE between affiliated settings was found not to be significantly different from HIE between unaffiliated settings. Generally, HIE was found not to be timely or complete regardless of affiliation between health care providers, and regardless of availability of electronic health information in the referring provider's health information system. What follows summarizes the findings for HIE between affiliated settings and unaffiliated settings, particularly at times of discharge and transfer to a new health entity.

In general, the site visits uncovered relatively few examples where HIE had been formally addressed by affiliated health settings. The receiving providers were rarely asked to articulate their needed clinical information or clinical content and their preferred mode of communication. Rather, the sending provider largely determined these parameters, and this is true regardless of the direction of the transfer. The exception to this is Erickson Retirement Communities; because their employees (e.g., physicians) functioned as both a "sender" and a "receiver" of health information (their physicians treated patients sent to St. Agnes hospital for acute care as well as at all phases of care on the Erickson campus), they were able to design and communicate the needed information.

C. HEALTH INFORMATION EXCHANGE AREAS OF COMMONALITY

The four site visits afforded the opportunity to better understand approaches, and compare and contrast how HIE is (or is not) accomplished electronically or manually between both affiliated and unaffiliated health settings. The following discussion will focus on four areas of commonality addressed at each of the visited sites:

1. Information exchange at times of discharge/transfer.
2. Communication with physicians.
3. Medication ordering/e-prescribing.
4. Laboratory/radiology orders and results.

The illustrative Table 2 will be re-used in the following discussion to display the range of electronic functioning observed during the site visits for each of the focus areas noted above.

1. Information Exchange at Times of Transfer/Discharge

The single document designed to encapsulate a patient's hospital course, the hospital discharge summary, was frequently cited by the receiving care teams as not being available in a timely manner. Several sites confided that the receiving providers (i.e., acute care hospitals, specialists, and EDs) only want specific information, and receipt of "extraneous" information frustrates the sending providers' efforts to care for the patient. For example, PAC/LTC providers sending patients to the ED may include recent laboratory results, a current medication list provided by the NH or HHA, advanced directives, progress notes, and the like. Likewise, those interviewed from hospitals and EDs indicated that they often experienced "information overload," that is, the PAC/LTC settings provided too much detail at ED admission (i.e., information that the attending ED staff do not believe they need to care for the patient).

As Table 4 shows, despite the potential advantages that provider affiliation might suggest for e-HIE at times of transfer, little evidence for interoperability or auto-population of data fields (e.g., in transfer/discharge documents) was found. The site visits confirmed that when exchanging health information either between affiliated or unaffiliated providers, sending paper documents with the patient and/or facsimile transmissions remain the predominant communication approaches to support any type of HIE to and from physician offices, hospitals, PAC/LTC settings, pharmacies, and laboratories. The information sent was primarily in the form of handwritten summaries of electronically available information, supplemented by photocopies of pertinent information such as the MAR, recent laboratory results and diagnostic imaging results, or recent assessments. Medication information was more likely to be sent with the patient while laboratory data and hospital discharge summaries were more likely to be faxed at a later date. In some cases, paper and facsimile information transfer was supplemented by telephone communication. The examples below are illustrative and do not cover every observation found during the site visits.

Indiana -- When patients are transferred from Lockefield Village or Briarwood Health and Rehabilitation (two SNFs) following a Part A covered stay to home health care, communication with the receiving HHA is via phone or fax, or both (Level 1). However, the five participating hospitals involved in the IHIE Docs4Docs portal can remotely access information. Because this is a new technology, they first are starting with hospital discharge transcriptions and laboratory/radiology ordering and reports (not a complete discharge summary, but components of it). At the time of the site visit, medication ordering and monitoring (an integral part of a discharge summary for use at times of transition) were not accessible through the Docs4Docs portal, but the technology would allow for this capability--it is more the issue of when, which is why the

authors rated the exchange of hospital discharge summaries as a Level 2/3 feature in Table 4.

The Wishard Hospital EHR can electronically produce a clinical summary for patients as they enter the ED that includes reason for visit, problem list, medications prescribed by affiliated doctors, recent dictations of affiliated physicians, recent laboratory results, recent radiology results, and immunizations. Advance directives are not part of the summary. For those patients who are not admitted to the hospital, there is an opportunity to update the ED summary and send this information with the patient back to the nursing facility at which the patient is placed. However, this is not done routinely (Level 2).

TABLE 4: HIE Capabilities by Level With a Focus on Exchange of Information at Times of Discharge/Transfer								
	Level 1 Paper-based Record/ No EHR		Level 2 Combined Paper Record/EHR		Level 3 EHR Used/Limited Electronic Data Exchange, Some HIT Standards Used		Level 4 Completely Interoperable EHR System, Use of HIT Standards	
HIE Methods	<ul style="list-style-type: none"> Fax Phone/Voice Photocopy to pass on by hand Face-to-face 		<ul style="list-style-type: none"> Fax Phone/Voice/Face-to-face Print/Photocopy to pass on Limited non-standardized electronic HIE (e.g., e-mail to & from physicians) 		<ul style="list-style-type: none"> Fax, Phone/Voice/ E-mail, Photocopy Some electronic data exchange standards (i.e., messaging standards) in use Increasing use of electronic HIE (e.g., components of EHR may be electronically exchanged) 		<ul style="list-style-type: none"> Electronic fax downloaded into EHR Standards-based data exchange (i.e., use of messaging standards) Standardized content exchanged Standardized e-HIE across key components (e.g., lab results, medication ordering) of care continuum 	
Features/Attributes of Patient Health Information and Electronic HIE	No Electronic HIE (i.e., not electronic data)	No EHR	Some e-HIE	Limited use of EHR	Data exchange limited to certain systems	Access to data limited to user role/discipline	EHR is primary record	Standards-based EHR system (i.e., EHR content is standardized)
	May have software for AR/AP, scheduling	No Anytime/ Anywhere Access	May allow for images to be imported	Clinical information collected on paper & entered into EHR	Continued but limited use of paper record	Some use of standards (messaging &/or content)	Interoperable with internal & external systems	Record can be electronically exchanged/ is transportable
			Meets minimum regulatory requirements ¹	Limited Anytime/ Anywhere Access	Decision support features & alerts used	Anytime/ Anywhere Access	Computer Empowered Interoperable System	Anytime/ Anywhere Access
Facilitators of HIE			Limited involved in HIE Network (e.g., admin/claims data)		Some clinical content exchanged within HIE Network		Greater amount clinical information exchanged/shared within HIE Network	
Discharge/ Transfer²	Indiana							
			Maryland					
			New York					
			Utah					
<p>1. E.g., OASIS and MDS reporting to CMS.</p> <p>2. Range of electronic functioning observed during site visits noted here.</p>								

Maryland -- Erickson Retirement Communities, a CCRC in Catonsville, Maryland, provides all PAC and LTC to their residents that live on campus, with the exception of hospice. Their campus also does not have an acute care hospital or specialists on staff, but their physicians treat their patients if they are transferred to St. Agnes (an unaffiliated hospital that receives the majority of Erickson residents who are hospitalized). Erickson sends an electronically-generated (i.e., auto-populated) transfer summary with all patients who are referred to the unaffiliated ED or acute care hospital, and also to any affiliated specialists. This summary is printed from the Erickson GE Centricity EHR and a paper copy accompanies the patient (Level 2). St. Agnes hospital's ED physicians provided input and feedback during the development of this transfer summary. Such input was considered an important factor to the utility of the transfer document.

New York -- Although the majority of HIE related to discharge/transfer was manual, exceptions also were noted. During the visit, the site visit team learned of the state-mandated PRI. Specifically, the State of New York requires hospitals to use the PRI when patients are transferred from a hospital to a NH or SNF. New York permits either electronic or manual exchange of the PRI form. The PRI and supplemental information are distributed electronically from Montefiore Medical Center (Bronx hospital) to local area NHs using ECIN, a software program that only requires the use of a web-enabled PC. Each provider needs to purchase and install the software and pay a monthly/annual fee for its use.¹⁶ ECIN is an Internet-based automated PRI that claims HL7 compliance. Use of the HL7v2.X standard supports the standardized messaging of the PRI form but the content of the PRI form is not standardized. This level of sophistication would be included in Level 3 of Table 4 above.

Awareness of ECIN capabilities (i.e., a software program that produces and electronically transmits hospital discharge information such as that found on the New York PRI form) seemed widespread among the four cities visited; however, no one at any site, including sites visited in New York, mentioned current or planned expansion of ECIN's use of HL7 messaging standards to support the exchange of additional clinical content such as demographic and clinical information. Instead, those who did use ECIN merely *viewed* the information on a web-display rather than importing this information and using it for other purposes. Information is sent by the referring institution to a list of NHs from a pick-list menu on line. As explained by NH staff in New York, when a referral arrives at the NH, an e-mail or pager alerts the staff. At this point, the receiving NH has the opportunity to e-mail back or call to ask questions and/or indicate its interest in accepting the patient. NHs without ECIN may receive the PRI via fax (Level 2).

According to Montefiore, ECIN helped reduce hospital length of stay (LOS) for NH-bound patients from ten to eight days. For Montefiore, some of the fields (mostly demographic and insurance) of the PRI can be auto-populated, while others (e.g., laboratory results, medications, and PT notes) are copied-and-pasted electronically from the Montefiore EHR (CIS). Representatives from Montefiore reported that prior to

¹⁶ <http://www.extendedcare.com>.

automation, the tool-based PRI completion process required 30-40 minutes to complete whereas after automation, it is completed in 10-15 minutes.

However, e-HIE is not necessarily maximally enabled even when a patient is transferred to an affiliated provider and both the sending and receiving providers have EHRs. For example, if a patient is admitted to Montefiore Medical Center (hospital) while actively receiving home health care, the Montefiore Home Health Agency (MHHA) coordinator based in the hospital will print a transfer summary from the MHHA EHR (which is a Misys product) and place a hard copy in the hospital record. This is particularly valuable as the ED and hospital staff do not have access to Misys and at present, there is no electronic interface between the Montefiore Medical Center EHR (CIS) and the MHHA EHR. MHHA staff have read-only access to the Montefiore Medical Center's EHR (CIS). This is a Level 2 capability. When a patient is discharged from Montefiore home health services, a discharge template in Misys is generated that is populated in part by Misys and in part completed by the nurse who manually types in remaining fields. This summary is sent to the attending outpatient physician in paper form that can then be scanned into the Montefiore Medical Center's EHR (also a Level 2 function).

In these examples, implementations of multiple non-standardized EHR products (the MHHA's use of Mysis, and the Montefiore Medical Center's use of CIS) while most likely decreasing staff time to complete discharge/transfer documents, have created a barrier to electronic exchange.

Utah -- All health settings visited in Utah (including LDS Hospital, two NHs and two HHAs) are at Level 1 or 2 as it relates to discharge/transfer. When patients are discharged from Brookview (NH) to an HHA, information is printed from their EHR or photocopied from the chart and mailed or faxed to the receiving provider setting. At CNS, another HHA in Utah, intake care coordinators manually re-enter information received from the hospital into its EHR (HomeSys) because information received from the hospital is not standardized and does not interoperate with the CNS EHR. Intake coordinators at Hillside Rehabilitation, a NH, scan (digitize) paper-based hospital information as they receive it and upload the digital representations into its EHR (Blue Step).

At LDS Hospital, the discharging physician routinely dictates the complete discharge summary after the patient is discharged. The lag between when the patient is discharged and the dictation is complete varies depending on the physician and ranges from one day to three weeks. The dictated hospital discharge summary is transmitted by fax or mail to the receiving NH/HHA. For example, when admitting a new patient, CareSource, a HHA in Utah, requests a history and physical, demographic sheet, medication list, and current progress notes. On average, they receive this information 75% of the time (in a paper format and it may require up to three follow-up phone calls to obtain (Level 1). This observation confirms an earlier observation about the incentives for e-HIE; whatever the incentives, they do not operate uniformly across patients and across providers. For example, the incentives for a SNF administrator to

move toward e-HIE with a hospital may be that she/he would get timely and accurate information at the time of discharge. For the hospital, the incentive to adopt HIE strategies with a local SNF may be to have the capacity to discharge their patients more quickly and therefore save money and free up a bed for a new patient.

With respect to transfers in the reverse direction (e.g., NH to hospital), the site visits revealed a modest improvement when it came to the completeness and timeliness of HIE. For example, when patients are urgently transferred to the hospital, the staff member in charge of medical records at Brookview NH helps to create a handwritten form that includes a current medication list, recent laboratory results, insurance status, skin status, code status, physician name and contact, and facility contact information. Many of these clinical domains are gathered from the NH's EHR but are handwritten onto the form (this would fall between Levels 1 and 2). The template for this form was not the result of a discussion between Brookview and the receiving hospital.

2. Communication with Physicians and other Clinicians

It is worth repeating that electronic access to an EHR is sometimes limited to certain physicians and other clinicians (e.g., nurse practitioners, physician assistants, nurses, therapists, social workers). As such, Table 5 shows that some sites have fairly sophisticated modes of communication, including electronic means, while others rely solely on phone and/or fax.

Indiana -- As previously mentioned, IHIE has launched the Docs4Docs physician portal. Participating physicians (no other clinicians such as nurses, therapists, or social workers had access at the time of the site visit) and five Indianapolis hospitals can obtain a limited set of information (laboratory and radiology results and discharge descriptions on patients treated by any of the participating hospitals and/or physician practices). Each physician has a unique identifier within the portal, and is able to look at these results for any of their patients being treated at any of the participating health settings. However, currently there are no NHs or HHAs that are part of the IHIE. So access to any health data obtained while patients are being treated in these settings is limited to the ordering physician. Thus, although the range of use puts Indiana at a Level 3 in Table 5 for this function, the electronic capability documented is limited to certain physicians and hospitals.

At Wishard hospital, a computer terminal has been set up in Lockefield Village (an extended care facility that offers both Part A SNF coverage and LTC, and is physically located on the Wishard campus). To some extent, Wishard hospital and Lockefield access the same EHR (at least for Medicare Part A SNF patients), but the amount of data stored in the EHR is limited for Lockefield Village residents. Specifically, some of the daily physician and nurse charting for the Medicare Part A SNF patients at Lockefield Village is entered into the Wishard EHR, but physical therapists only enter their discharge summary into the Wishard EHR (Level 2). Other documentation gathered and entered by the physical therapists for patients in Lockefield Village (e.g., therapy notes) are stored in a paper record maintained by Lockefield. For their LTC

residents (i.e., non-Medicare Part A), no physician and nurse charting is entered or stored in the Wishard EHR. Rather, all medical record information on behalf of all non-Part A covered nursing facility residents at Lockefield Village is paper (Level 1).

TABLE 5: HIE Capabilities by Level Regarding Communication with Physicians and Other Clinicians								
	Level 1 Paper-based Record/ No EHR		Level 2 Combined Paper Record/EHR		Level 3 EHR Used/Limited Electronic Data Exchange, Some HIT Standards Used		Level 4 Completely Interoperable EHR System, Use of HIT Standards	
HIE Methods	<ul style="list-style-type: none"> Fax Phone/Voice Photocopy to pass on by hand Face-to-face 		<ul style="list-style-type: none"> Fax Phone/Voice/Face-to-face Print/Photocopy to pass on Limited non-standardized electronic HIE (e.g., e-mail to & from physicians) 		<ul style="list-style-type: none"> Fax, Phone/Voice/ E-mail, Photocopy Some electronic data exchange standards (i.e., messaging standards) in use Increasing use of electronic HIE (e.g., components of EHR may be electronically exchanged) 		<ul style="list-style-type: none"> Electronic fax downloaded into EHR Standards-based data exchange (i.e., use of messaging standards) Standardized content exchanged Standardized e-HIE across key components (e.g., lab results, medication ordering) of care continuum 	
Features/Attributes of Patient Health Information and Electronic HIE	No Electronic HIE (i.e., not electronic data)	No EHR	Some e-HIE	Limited use of EHR	Data exchange limited to certain systems	Access to data limited to user role/ discipline	EHR is primary record	Standards-based EHR system (i.e., EHR content is standardized)
	May have software for AR/AP, scheduling	No Anytime/ Anywhere Access	May allow for images to be imported	Clinical information collected on paper & entered into EHR	Continued but limited use of paper record	Some use of standards (messaging &/or content)	Interoperable with internal & external systems	Record can be electronically exchanged/ is transportable
			Meets minimum regulatory requirements ¹	Limited Anytime/ Anywhere Access	Decision support features & alerts used	Anytime/ Anywhere Access	Computer Empowered Interoperable System	Anytime/ Anywhere Access
Facilitators of HIE			Limited involved in HIE Network (e.g., admin/claims data)		Some clinical content exchanged within HIE Network		Greater amount clinical information exchanged/shared within HIE Network	
Communication with Physician/ Clinician²								
<p>1. E.g., OASIS and MDS reporting to CMS.</p> <p>2. Range of electronic functioning observed during site visits noted here.</p>								

Maryland -- As described before, Erickson provides care for residents who are independent and may require occasional check ups, PAC SNF care, long-term NH care, and home health services. Their outpatient clinic uses GE Centricity and their SNF/NH (Renaissance Gardens) and home health services use HealthMEDX. The physicians have access to both EHR systems while on campus. Nursing and other clinical staff working at the SNF/NH or HHA only have read/write access to HealthMEDX and, based on role of the staff person, may or may not have read-only access to the outpatient clinic's EHR (GE Centricity). Specifically, Erickson NH and home care nurses and administrators have read-only access to outpatient physician notes, medication list, and recent laboratory tests from the outpatient clinic's EHR (GE Centricity), which is the

same permissions offered to the St. Agnes ED physicians and nurses (Level 2). When an Erickson resident is seen by an Erickson physician in St. Agnes, they have read-only access to the St. Agnes EHR and can print information and bring it back to Erickson where it becomes part of the medical record. (It is manually entered into the EHR of the location that the resident is placed in once they return to the Erickson campus. Erickson physicians also can remotely access the St. Agnes hospital EHR, again with read-only privileges (Level 2).

New York -- Through a recently awarded New York State HEAL NY grant, the VNS of New York is developing a portal for physicians to access health information of VNS patients with a common data presentation. The goal is to improve communication between home care and physicians to reduce re-hospitalizations, complications, and duplication of tests. Portal information will go directly into the physician's EHR as the VNS of New York medical record. At the time of the visit, the VNS of New York was piloting the web portal with seven regional physician practices that all use GE Centricity/Logician EHR (Level 2/3).

The VNS of New York also is participating in a pilot project with Weil Cornell Medical School to develop an electronic CMS 485 (e-485) form, which is the plan of care for home care services. Although the actual use of the e-485 form is no longer required by CMS, CMS does require that the HHA collect and document all of the information found on the form, so many HHAs continue to use the form out of convenience. The project expectation is that using the form will improve communication between the referring hospital, the VNS, and patients' primary care physicians; patient care; and reimbursement processes (Level 3). The hospital physician would begin the process of writing electronic orders on the e-485 at the time of hospital discharge. The outpatient physician would then be asked to sign the original e-485 and any subsequent additions electronically. The original and subsequent e-485 are transmitted to the VNS. This software comes with a timer that can count the number of minutes the start of care clinician spent on home health plan of care oversight to facilitate documentation for billing. Pilot testing conducted in four physician practices has revealed that use of the e-485 led to enhanced data completion. For example, the physical function section went from 28% complete to 94% complete and the mental status section went from 6% complete to 100% complete.

Utah -- In Utah, the NHs and HHAs visited corresponded with outpatient physicians via phone and fax (Level 1). There is no electronic transfer of information with unaffiliated physicians.

3. Medication Ordering/Electronic Prescribing

There is an expanding evidence base that documents serious medication quality and safety problems are occurring during care transfers (Coleman & Berenson, 2004; Forster, Murff, Peterson, Gandhi, & Bates, 2003; Moore, McGinn, & Halm, 2007). Older persons who receive care across multiple settings often are prescribed medications from different physicians who may or may not have knowledge of the complete

medication list. The Joint Commission and the Institute for Health Care Improvement have recognized the scope of this problem and have provided national leadership to providers to support their efforts in counteracting medication problems through reconciliation at each point of transfer.¹⁷ Just as the systematic ordering, tracking, reconciling, and administration of medication are crucial to ensuring that quality and safety, so is the exchange of this information across providers and across settings. Thus, the four site visits explicitly addressed HIE with respect to medications and is shown in Table 6.

TABLE 6: HIE Capabilities by Level Regarding Medication Ordering/E-prescribing								
	Level 1 Paper-based Record/ No EHR		Level 2 Combined Paper Record/EHR		Level 3 EHR Used/Limited Electronic Data Exchange, Some HIT Standards Used		Level 4 Completely Interoperable EHR System, Use of HIT Standards	
HIE Methods	<ul style="list-style-type: none"> Fax Phone/Voice Photocopy to pass on by hand Face-to-face 		<ul style="list-style-type: none"> Fax Phone/Voice/Face-to-face Print/Photocopy to pass on Limited non-standardized electronic HIE (e.g., e-mail to & from physicians) 		<ul style="list-style-type: none"> Fax, Phone/Voice/ E-mail, Photocopy Some electronic data exchange standards (i.e., messaging standards) in use Increasing use of electronic HIE (e.g., components of EHR may be electronically exchanged) 		<ul style="list-style-type: none"> Electronic fax downloaded into EHR Standards-based data exchange (i.e., use of messaging standards) Standardized content exchanged Standardized e-HIE across key components (e.g., lab results, medication ordering) of care continuum 	
Features/Attributes of Patient Health Information and Electronic HIE	No Electronic HIE (i.e., not electronic data)	No EHR	Some e-HIE	Limited use of EHR	Data exchange limited to certain systems	Access to data limited to user role/discipline	EHR is primary record	Standards-based EHR system (i.e., EHR content is standardized)
	May have software for AR/AP, scheduling	No Anytime/ Anywhere Access	May allow for images to be imported	Clinical information collected on paper & entered into EHR	Continued but limited use of paper record	Some use of standards (messaging &/or content)	Interoperable with internal & external systems	Record can be electronically exchanged/ is transportable
			Meets minimum regulatory requirements ¹	Limited Anytime/ Anywhere Access	Decision support features & alerts used	Anytime/ Anywhere Access	Computer Empowered Interoperable System	Anytime/ Anywhere Access
Facilitators of HIE			Limited involved in HIE Network (e.g., admin/claims data)		Some clinical content exchanged within HIE Network		Greater amount clinical information exchanged/shared within HIE Network	
Medication Ordering/ E-prescribing²	Indiana							
	Maryland							
	New York							
	Utah							
<p>1. E.g., OASIS and MDS reporting to CMS.</p> <p>2. Range of electronic functioning observed during site visits noted here.</p>								

Observations on medication ordering and/or electronic prescribing, particularly at the NHs and HHAs visited, indicate that with few exceptions, care settings are at Level

¹⁷ http://www.jointcommission.org/SentinelEvents/SentinelEventAlert/sea_35.htm;
<http://www.ihl.org/IHI/Topics/PatientSafety/MedicationSystems/Tools/Medication+Reconciliation+Review.htm>.

1 or 2. In general, NHs worked primarily with their own LTC pharmacy. Physicians did not send electronic medication orders but rather faxed medications orders to the NH. Staff at these NHs then faxed the order to the LTC pharmacy and manually entered the order into their EHR (if they had an EHR). For those NHs with a more robust EHR (e.g., Erickson Retirement Communities in Maryland), the re-entry of medication information into an e-MAR application was possible.

With respect to home health care patients, physicians prescribed medications directly to the patient who was responsible to have them filled. HHAs do not have an equivalent electronic MAR, but rather are accountable for documenting what the patient reports she/he is taking. This reconciliation in the home is done at the start of care, usually by a start of care nurse or therapist. Of the HHAs visited, most reconciled this medication list on paper and kept it in a paper chart. The list also may have been entered into the EHR either at the point of care (e.g., the VNS of New York has laptops that clinicians use in the home and collect/enter health data during the home visit) or at the end of the day by either the clinician who collected the information or by a clerk at the agency.

Other observations obtained during the site visit related to e-prescribing and medication ordering are discussed by state below, including sites' future plans. (Note, as future plans have not yet been implemented, they are not reflected as an electronic capability in Table 6.)

Indiana -- The site visitors were informed by the host site (IHIE) that the state was close to finalizing a statewide mandate for e-prescribing, but at the time of the visits, this was not required and not widely used. John Pipas, the CEO of the VNS of Central Indiana (HHA), confirmed that the VNS's communication with pharmacies was by fax but that this would change once mandated statewide e prescribing was initiated (date to be determined). In a follow-up communication in July 2007 with Michael Weiner, MD (host at the University of Indiana/Regenstrief), Dr. Weiner mentioned that Wishard Health Services (the hospital visited as part of the Indiana site visit) did move to uniform e-prescribing in early 2007 even though the state has not yet mandated it.

Brookview (NH) uses a single pharmacy that is part of a national chain, Pharmerica. All communications with this pharmacy are via fax.

Maryland -- Erickson Retirement Communities uses Omnicare/Neighborhood Pharmacy (which has a branch located on its campus). Approximately 80% of independent residents and close to 100% of residents receiving PAC and LTC use this pharmacy. All data from Omnicare are sent to Erickson via fax or phone and are manually re-entered into either CareMEDX for Renaissance Gardens (the NH/SNF) or home health patients, or GE Centricity (for the on-campus outpatient clinic). Erickson is developing a pilot e-prescribing program between the physicians who treat residents of the RG facility and Omnicare/Neighborhood Pharmacy, but at the time of the site visit, this pilot study had not been launched.

New York -- The hospital and NHs visited all have a single in-house pharmacy that is used.

Utah -- The skilled NHs visited in Utah also use fax and phone to communicate with their single unaffiliated pharmacy (Level 1).

4. Laboratory/Radiology Ordering and Results

HIE on behalf of patients receiving PAC/LTC services who also require radiology or clinical laboratory services generally were observed to be manual (Level 1), see Table 7. As above, innovative or future plans are highlighted in the discussion below.

TABLE 7: HIE Capabilities by Level Regarding Laboratory/Radiology Orders and Results								
	Level 1 Paper-based Record/ No EHR		Level 2 Combined Paper Record/EHR		Level 3 EHR Used/Limited Electronic Data Exchange, Some HIT Standards Used		Level 4 Completely Interoperable EHR System, Use of HIT Standards	
HIE Methods	<ul style="list-style-type: none"> Fax Phone/Voice Photocopy to pass on by hand Face-to-face 		<ul style="list-style-type: none"> Fax Phone/Voice/Face-to-face Print/Photocopy to pass on Limited non-standardized electronic HIE (e.g., e-mail to & from physicians) 		<ul style="list-style-type: none"> Fax, Phone/Voice/ E-mail, Photocopy Some electronic data exchange standards (i.e., messaging standards) in use Increasing use of electronic HIE (e.g., components of EHR may be electronically exchanged) 		<ul style="list-style-type: none"> Electronic fax downloaded into EHR Standards-based data exchange (i.e., use of messaging standards) Standardized content exchanged Standardized e-HIE across key components (e.g., lab results, medication ordering) of care continuum 	
Features/Attributes of Patient Health Information and Electronic HIE	No Electronic HIE (i.e., not electronic data)	No EHR	Some e-HIE	Limited use of EHR	Data exchange limited to certain systems	Access to data limited to user role/ discipline	EHR is primary record	Standards-based EHR system (i.e., EHR content is standardized)
	May have software for AR/AP, scheduling	No Anytime/ Anywhere Access	May allow for images to be imported	Clinical information collected on paper & entered into EHR	Continued but limited use of paper record	Some use of standards (messaging &/or content)	Interoperable with internal & external systems	Record can be electronically exchanged/ is transportable
			Meets minimum regulatory requirements ¹	Limited Anytime/ Anywhere Access	Decision support features & alerts used	Anytime/ Anywhere Access	Computer Empowered Interoperable System	Anytime/ Anywhere Access
Facilitators of HIE			Limited involved in HIE Network (e.g., admin/claims data)		Some clinical content exchanged within HIE Network		Greater amount clinical information exchanged/shared within HIE Network	
Lab/Radiology Ordering and Reporting²	Indiana							
	Maryland							
	New York							
	Utah							
<p>1. E.g., OASIS and MDS reporting to CMS.</p> <p>2. Range of electronic functioning observed during site visits noted here.</p>								

Indiana -- The Docs4Docs portal, as previously described has the capacity for participating physicians and hospitals to electronically access laboratory results. It is

limited, however, because patients seen at local area PAC or LTC settings that have laboratory or radiology orders/results will not be included. Furthermore, the IHIE's future plans include having laboratory and ambulatory imaging sites included in the network.

Brookview (NH) contracts with a single laboratory and all laboratory orders and results are provided via fax and are filed in a paper record. These results also are entered into their EHR, VistaKeane.

Maryland -- Erickson uses Quest Laboratories and Mobile X Radiology. Data from these two providers are sent to Erickson via fax or phone and in most cases, laboratory and radiology data are manually re-entered into either CareMEDX for Renaissance Gardens (the NH/SNF) or home health patients, or GE Centricity (for the on-campus outpatient clinic) (Level 2). Quest Laboratories are used by the outpatient clinic, home care, SNF and the LTC facility (referred to as the Residents Gardens or RG). As noted earlier in this report, Erickson is developing a pilot e-prescribing program between the physicians who treat residents of the RG facility and Omnicare/Neighborhood Pharmacy.

New York -- Montefiore Medical Center (hospital) has a single clinical laboratory. The JHHA (SNF/NH) and the MHHA also use the hospital's laboratory. JHHA staff have read-only access to laboratory results and must maintain paper copies of the Montefiore laboratory results as part of the JHHA record systems. All MHHA laboratory results go to the Montefiore Medical Center's clinical laboratory. One result of this centralization is that ordering staff physicians or their agents (e.g., physician assistant or nurse practitioner) have electronic access to results in a timely manner if they initiate that access by querying the EHR for the results. In other words, they are not sent a reminder that results are available, but nonetheless, they have access to the results.

Schervier (New York NH) uses a single laboratory, Lawrence Laboratory. Clinicians (e.g., therapists, nurses, social workers) at the Schervier NH may initiate view-only computer access to the laboratory results from Lawrence Laboratory. They are then printed out and stored in the paper record at Schervier.

Utah -- All sites visited in Utah are at Level 1 or 2; that is, all laboratory and radiology information exchange among the sites visited is by phone, fax, or paper accompanying the patient.

LDS Hospital has a robust EHR that has the capability to electronically share information, but when asked why this was not done with any local NHs or HHAs, informants remarked that their information technology department was faced with more pressing priorities that needed their attention.

Interestingly, although St. Joseph's Villa (Utah NH) uses IHC's laboratory, the IHC laboratory sends laboratory results via fax or phone (in the case of urgent results). Nursing staff at St. Joseph's Villa then send results to the attending physician via the

physician's hand-held Blackberry®, and a paper copy of results are maintained as part of the patient record.

Hillside Rehabilitation Center, another NH in Utah, uses Schrieber Laboratory. Physician orders for and results from laboratory services are faxed (urgent results are phoned); and do not populate the EHR (BlueStep). However, Hillside has made a financial investment in a single pharmacy and can electronically send (order) medication information that auto-populates the pharmacist's queue.

CNS, an HHA in Utah, uses multiple laboratories with the specific selection largely governed by insurance or geography. Physician orders for laboratory and radiology services are not received electronically by CNS. These results are sent via fax, with critical values conveyed via phone. CNS maintains paper copies of laboratory and radiology orders and results and also manually enters orders and results into their EHR. The other HHA visited in Utah, CareSource, communicated only with outside parties (e.g., laboratories, pharmacies, physicians, hospitals) via fax or phone.

D. SOLUTIONS AND FUTURE PLANS FOR E-HIE AND HIT IMPLEMENTATION

Few PAC/LTC settings expressed short or long-term plans to either: (1) implement an EHR system if they did not already have something in place; or (2) augment or replace their existing medical record system with something that was standards-based, interoperable, and/or more robust. Likewise, only a few settings (discussed below) had knowledge about the work being planned and conducted with SDOs such as HL7, NCPDP, CCD/CCR,¹⁸ and other standards-related activities (e.g., CHI and HITSP). None of the PAC/LTC settings, with the exception of the VNS of New York and to a lesser extent Erickson Retirement Communities, had representation in any of the SDO workgroups. However, the sites that we visited were more involved and active in participating in local, regional, and especially the national NH and home health organizations. Such professional associations (e.g., AHCA, NAHC, AAHSA) are becoming more connected with SDO activities and it is expected that their involvement will expand in years to come.

Several solutions for advancing e-HIE were observed during the site visits.

1. Portals

a. Patient/family caregiver portals. One possible answer to improving HIE between providers and settings, particularly PAC and LTC settings, is to enlist the

¹⁸ On November 2, 2005, HL7 announced that in collaboration with ASTM, they are developing an implementation guide to express the CCR data set in an HL7 Version 3 (v3) CDA, r2 document. The CCR is snapshot summary of a medical record that is delivered from setting to setting, and could potentially be displayed in an EHR. This collaborative specification effort is referred to as the CCD. HL7 approved and the HITSP has endorsed the CCD. The CCD will map CCR content into a CDA r2 representation, which will enable the exchange of human-readable (text) and/or coded transfer documents.

participation of the patient and family caregivers. Erickson Retirement Community (Maryland CCRC) is developing a resident portal into its EHR (GE Centricity), which includes read-only access to medications, laboratory results, appointments, and problem lists. Once operational, patients can selectively share access to this information with unaffiliated providers. For example, the patient may be out of town and require care from a local ED. The patient could provide the ED staff with the access information to view key clinical information through the portal. Because the patient controls who is allowed to view the data, privacy protections are promoted.

b. Provider portals. Physicians are another potential target for innovative HIE solutions. As mentioned previously through a New York State HEAL NY award, the VNS of NY is developing a web portal for primary care physicians with a common data presentation. The MHHA (New York) also is piloting a web portal project with physicians in its service area with similar intent.

As previously discussed, the IHIE is developing a portal, called Docs4Docs, that will provide physicians and other clinicians with access to admission and discharge transcriptions, laboratory results, radiology, EKGs, and pathology reports across care settings. Using a web-based platform, physicians will be able to access this information from their outpatient offices, from the hospital or NH, or even from their private residence. The portal is supported by five of the large hospitals in the Indianapolis metropolitan area. At present, medication lists are not yet available via the portal. As implementation of this portal is fairly new, information is incomplete. At present, the hospitals do not yet collect all encounter information for all patients. The hospitals collect most of the inpatient encounter information from their own EHR and some information from outpatient or off-site encounters (i.e., one of the other hospitals that feed into the Docs4Docs). While the stated IHIE vision is to facilitate physician access to needed patient information regardless of location of the information, enabling physician access to patient information in NHs is not actively being pursued because at this time the IHIE does not include any representatives from PAC or LTC.

2. Disaster Preparedness

Hurricane Katrina increased awareness for the importance of having timely availability of health information during a natural or man-made disaster. One provider in the four cities included in this study addressed this concern. Hillside Rehabilitation, a NH in Utah, has developed a contingency plan to make available their patients' electronic health information in the event of an emergency. In partnership with its software vendor, BlueStep, Hillside patients' health information could be made available to health care providers in different parts of the country via a secure website.

E. WHAT ARE THE FACILITATORS AND BARRIERS TO HEALTH INFORMATION EXCHANGE?

1. Facilitators

a. Timely Communication. Timely information transfer can financially benefit both the hospital and the PAC/LTC provider. For all Medicare-certified SNFs, the reimbursement for Part A Medicare patients (i.e., the daily payment rate) is based, in part, on the patient's medical problems and co-morbid conditions. To determine whether a facility can meet a patient's care needs under the prevailing rate, timely communication of a patient's PAC needs from the hospital can facilitate a more efficient and clinically appropriate transfer. Ensuring that the receiving provider has comprehensive information on a patient's current needs and plan of care can facilitate appropriate classification under the Medicare payment system. Under the diagnosis-related group payment mechanism, hospitals have an incentive to discharge patients as quickly as possible. To the extent that timely communication translates into a reduced LOS, hospitals stand to benefit financially.

It is worth noting that the four site visits were conducted in geographic regions that have a relatively small penetration of Medicare Advantage (managed Medicare) providers. Thus, the site visit team did not have the opportunity to explore the influence of a health plan on HIE. In other regions of the country, a health plan can require that contracted NHs and HHAs contribute to or update the patient's problem list, allergies, medications, advance directives, and recent diagnostic tests while patients are under their care (Coleman, 2002; Coleman, 2003; HMO Workgroup on Care Management, 2004).

b. Interpersonal Relationships as a Facilitator to HIE. As previously mentioned, good, cross-organization interpersonal relationships are important to ensuring that health information is exchanged and the value of interpersonal relationships in facilitating HIE persists even when HIT solutions are being implemented by the health care providers involved in the information exchange. Clinicians who practice in multiple settings can facilitate timely and accurate HIE across care settings. For example, at Erickson Retirement Communities (Maryland), the primary care physicians follow their patients when they are hospitalized at St. Agnes hospital. This creates opportunities for the physicians to gather more complete information while managing the patient across either care setting. The physicians are responsible for medication reconciliation across sites of care. In addition, Erickson employs a care coordinator who also follows Erickson patients while being treated in St. Agnes hospital, arranges their discharge back to Erickson, and where appropriate, initiates services such as Part A Medicare skilled nursing care. The coordinator collects pertinent information prior to hospital discharge, including the treatment course and discharge information, and faxes it/hand-delivers it to the appropriate clinician at Erickson. Evidence of the importance of this coordinator was a response to many site team questions regarding information exchange--"Our coordinator handles that."

Similarly, a physician practice employed by Montefiore Medical Center (New York hospital) continues to follow discharged patients who require skilled care in selected NHs. Having physician groups employed by the provider creates the opportunity to develop more standardized protocols to patient care, including clinical pathways and expectations for information exchange. MHHA has staff liaisons in Montefiore Medical Center who facilitate home health care referrals. Along with the VNS of New York, MHHA has coordinators who visit two or three of the larger NHs to attend weekly patient reviews and help facilitate referrals from Part A skilled nursing to home care. At Wishard Hospital (Indiana), the VNS of Central Indiana has a staff liaison who is granted limited access to the hospital EHR. The liaison begins the process of entering hospital data into a laptop that provides access to the home health EHR (Misys), and then this information is shared electronically with the home health nurse assigned to the case.

c. Patient Identifiers. Use of HIT to appropriately exchange accurate patient information is facilitated by the ability to identify the patient who is the subject of the exchange, sources of needed information, and the providers and other persons who are the intended recipients of the information. Montefiore Medical Center (New York hospital) recently mandated the use of a single patient identifier to track patients in their electronic health information system. An important advantage of this approach, particularly in an area such as the Bronx that tends to serve the patient from cradle to grave, is that historical data stored in the Montefiore system are more easily accessible. A single patient identifier also helps ensure that the care team is treating the correct patient, particularly when the patients' first and last names are the same or similar. Prior to the single patient identifier, Montefiore used algorithms to develop possible matches, requiring more time for the clinician to verify they were reviewing the chart of the patient currently being treated. The ability to require the use of a single patient identifier and have all participants agree to this is another example of how the establishment and nurturing of interpersonal relationships has helped establish trust and a willingness to be a part of a HIEN.

2. Barriers

a. Lack of interoperability. Once health care partners agree upon the need to exchange information, perhaps the greatest barrier to e-HIE witnessed during the site visits was a lack of interoperability between EHRs and other health information systems. The lack of interoperable health information systems was a leading contributor to the inefficient practice of manually re-entering data, which was observed at all sites. This was observed whether the two EHR systems were owned by the same institution or owned by separate institutions. For example, Erickson (Maryland CCRC) has invested in two EHR systems, GE Centricity and CareMEDX. GE Centricity functions as the primary record for residents in independent living who see physicians in the on-campus clinic, while CareMEDX functions as the primary record for patients in home health care, Part A SNF, and LTC. Erickson staff manually transfer information between its two electronic systems (as well as between paper and electronic systems). At the time of EHR selection, Erickson was not able to identify a single EHR solution that could

address the care needs of the various types of patients treated throughout the campus. Erickson staff noted that because of this, they were forced to purchase two separate systems and plan to pay additional costs to build interfaces to allow the two systems to be interoperable (i.e., allow for electronic exchange and re-use of content). If a viable HIT product that met their needs had been available, they would have readily opted for a single EHR solution.

Similarly, despite common ownership, Montefiore Medical Center's EHR (CIS) and MHHA's EHR (Misys) do not interoperate (i.e., do not: (i) electronically exchange or (ii) re-use content). When a laboratory result appears in CIS, the result has to be manually entered into Misys. Medications also are copied-and-pasted from one screen in CIS to another in Misys. When a home health care patient is admitted to the hospital, there are no fields in CIS that can identify that this patient is actively receiving home health care services. MHHA staff commented that having this information in the ED might influence the decision as to whether the patient should be admitted or could be managed in the home with the HHA's support. Still, in general, providers were pleased that current, reliable information was available electronically "somewhere," even if it required them to copy and paste it into their EHR or local system--an observation that proved common during the site visits.

b. Lack of access to existing systems. A related barrier to HIE identified during all four of the site visits concerned a lack of access to existing EHR systems. In general, the sending institution did not extend user privileges to clinicians in the receiving institution to view, much less edit or add content to their EHR system. In rare instances, physicians, nurse practitioners, and physician assistants practicing in the NH are given privileges to remotely access clinical information in EHRs in either the hospital or ambulatory settings. Under these circumstances, clinicians can care for patients in NHs or in patients' homes with the benefit of the information available from these sources. However, it should be noted that other PAC and LTC health professionals (e.g., nurses, CNAs, physical and occupational therapists) are not usually granted this same access. For example, in Utah, staff in two NHs (St. Joseph's Villa and Hillside Rehabilitation) do not have access to the LDS Hospital HELP2 EHR.

c. Health Insurance Portability and Accountability Act (HIPAA). The site visits confirmed that whether real or perceived, the implementation of HIPAA poses a barrier to information sharing across care settings in general or granting access to information contained in EHRs in particular. HIPAA allows the exchange of patients' health information for purposes of treatment, payment, and health care operations without patient authorization. However, misinterpretations of these HIPAA regulations were common. Clinicians were reluctant to share information or grant access to EHRs for fear of violating HIPAA laws and facing accompanying penalties. The site visitors were unable to determine the degree to which HIPAA concerns masked deeper concerns about competitiveness and liability that information sharing might elicit.

d. The referral process. Finally, the site visits highlighted the fact that in general, NHs and HHAs are dependent upon hospital for referrals. Within this context,

NHs/HHAs expressed a reluctance to confront the hospital when the hospital did not supply necessary information at the time of transfer for fear that the hospital would choose to refer patients elsewhere. These providers acknowledged that a more objective third party might be needed to afford oversight of the referral process to ensure that NH referrals are not at risk should they speak up as to what they need from the discharging acute care hospital.

F. ORGANIZATIONAL/MANAGEMENT ISSUES

1. Organizational Structure

Of the PAC and LTC settings visited, there was a fairly even distribution of agencies/facilities that were part of a larger regional or national chain (e.g., Golden Gate National Senior Care [formerly Beverly Living Centers]) and those that were smaller, privately-held. Similarly, some were hospital-based, while others were freestanding. The majority of SNFs and HHAs visited were non-profit.

In general, there was a higher level of HIT adoption in PAC/LTC settings that were owned by other health settings, including being owned by a local hospital; or being part of a local, regional, or national chain. In addition, it was observed that HHAs that were one of the nation's visiting nurse associations also had higher rates of HIT adoption than other HHAs. Agencies/facilities in these categories tended to have purchased, at a minimum, software allowing them to electronically submit claims and remittances, and administrative data to payers (e.g., OASIS, MDS data). This is in contrast to using free software made available by the CMS, such as HAVEN or RAVEN, which tends to be adopted by smaller providers (not visited as part of this study).

The PAC/LTC settings that were involved with other health entities also tended to have additional reporting capabilities built into their system, including accounts payable/receivable, staff scheduling, clinically-relevant alerts (e.g., drug-to-drug interactions, drug-to-food interactions), quality monitoring reports, and in some cases, trending capabilities. These facilities may have had a paper chart, but much of the chart consisted of computer-generated information that was subsequently printed out and placed in the chart.

On the other hand, the group of PAC/LTC settings that were smaller and/or independent tended to have less information technology capabilities and relied fairly exclusively on a paper record/chart. Much of the record was handwritten, and little automation was in place (again, with the exception of meeting regulatory requirements such as OASIS or MDS reporting). The information technology in use was typically to support administrative tasks; the medical record was seen as a separate document altogether.

2. Organizational Impetus to Adopt HIT

As previously described, when selecting the sites, the "hub" delivery system had sophisticated HIT in place, and in some cases, showcased later in the report, some of the PAC/LTC settings did as well. That said, a great deal of variation in HIT adoption by the visited PAC/LTC settings was observed. The majority of NHs/HHAs visited collected information on paper and entered clinical and administrative data (i.e., MDS/OASIS and claims data) into a software specifically designed for those purposes. If additional HIT applications were available, they were add-on modules provided by niche software. Thus, HIE was generally observed to be a traditional process not facilitated through the use of HIT even when the providers had an electronic health information system in place.

When asked what the criteria were for selecting a software vendor and/or software application, costs and ongoing maintenance fees were the most commonly cited. Related training costs also were usually mentioned as a concern. With some notable exceptions (the VNS of New York and Erickson Retirement Communities), interoperability with other settings was not mentioned as a vendor or product selection criterion, and was not necessarily perceived as a necessary or even a desired attribute to an EHR system.

There are multiple reasons that may explain why NHs and HHAs have not made significant investments in and use of more robust EHR systems. In general, both setting types operate with very small margins, and are financially constrained even more now that the Prospective Payment System is in place (CMS, 2007a; National Bureau of Economic Research, 2007).

On more than one occasion the site visitors heard, "if the Federal Government would build and mandate 'it,' then the PAC and LTC market would find a way to make it work." Informants cited the fact that once OASIS/MDS reporting was required to be submitted electronically, NHs and HHAs acquired the necessary equipment to meet that requirement.

HHAs and NHs have a very high rate of staff turnover, averaging close to 50% per year (AHCA, 2003; Seavey, 2004). The costs of implementing an EHR system are high, but the ongoing maintenance and training costs are additional substantial costs that may represent an ongoing additional barrier to adoption. Concerns about the affordability of EHR systems continue to be expressed by NHs despite some anecdotal evidence that some NHs have been able to recover their HIT investment cost through more accurate Medicare SNF claims.

Part of the presumed "cost" is the risk associated with EHR deployments in that they may "fail." This concern was expressed by many of the smaller NHs/HHAs visited. The JHHA (New York SNF) lived this reality--they implemented an EHR system in their SNF only to have to abandon it several years later because it did not meet their needs. The Administrator of the JHHA commented that they are committed to implementing

HIT and are currently vetting new software options. This is described in more detail in Appendix C. The decision by the CCHIT to specify certification criteria for NH EHRs could help to minimize NH provider risk in making HIT investment decisions.

At several sites (Briarwood in Indianapolis, St. Joseph's Villa and CareSource in Utah), leaders in the PAC/LTC settings were unfamiliar with the private and public initiatives related to EHR adoption and work being done by RHIOs in their own communities. It was observed that although innovators in these communities are involved in implementing and expanding data exchange efforts, the PAC/LTC settings have either not been invited to participate in the planning or are choosing not to become involved.

As is true with all care settings attempting to implement an EHR system, the disruption of current processes and workflow are great, and the long-term benefits and rewards associated with the adoption of an interoperable EHR system are not always tangible or even imaginable, especially to those expected to use the system. As is the case for other health care settings, NH and HHA providers need "champions," persons who can lead the HIT implementation within their organizations. This person needs to be able to lead by implementing and embracing the changes, understand HIT, and take into account workflow issues inherent in the organization. The champion needs to be able to understand and articulate to others how HIT implementation can alter workflow to increase efficiency and improve care quality.

In some cases, making an EHR investment was not even being considered by key decision-makers' of the organizations that we visited. What is most important to PAC/LTC administrators and staff is the ability to receive legible, timely, complete, and accurate data from the referring health setting. The particular medium used for this information transmission (e.g., phone, fax, hard copy, electronic) was of secondary concern, as was any concern about the cost, time, effort, and opportunity for error involved in re-entering available information stored electronically "somewhere else." Furthermore, several administrators indicated that hospitals (including EDs) and physician offices often are not interested in much of the data collected at SNFs and HHAs. What information is shared often is not trusted, valued, or read by the receiving entity. As previously described, sometimes the information that is being exchanged is not what the receiving organization describes as needed. In addition, liability and fear of litigation were mentioned as reasons why physicians at the receiving hospital or ambulatory setting are skeptical of the information received from PAC/LTC settings, thereby resulting in duplicate testing and procedures to ensure the data they are acting upon are reliable.

The authors note that the literature concerning the organizational benefits of adopting an EHR system, such as worker productivity gains, optimization of billing processes, and other efficiencies is limited and those few studies that report the impact of HIT implementation in hospitals or physician offices have mixed (i.e., positive and negative) results (Booz Allen Hamilton, 2006; Poissant, Pereira, Tamblyn, & Kawasumi, 2005; Sidorov, 2006). Poissant and colleagues conducted a systematic review of the

literature on the impact of physician and nurse documentation time in hospital and ambulatory care settings that recently implemented an EHR system. They reviewed findings from studies that used methodologies such as randomized control trials, self-report/survey, as well as time and motion studies. Poissant et al. concluded that increased or decreased documentation times for both nurses and physicians were dependent upon many variables, including the type of computerized system used (i.e., bedside terminals, desktops, PDAs), the length of time since EHR implementation, and the information being documented (e.g., admissions, CPOE functions, etc.). In general, nurses were more likely than physicians to gain time efficiencies by using a computer system to document patient information. However, for separate select tasks, nurse documentation time increased, while physician documentation time decreased.

G. SPECIFICS REGARDING TECHNOLOGY OBSERVED DURING SITE VISITS

As described in previous sections, the site visit team observed that while in some instances computers enabled remote access to health information there was no "clinical data interoperability," that is, we did not observe any instance of semantic interoperability that would enable computer-to-computer data exchange and re-use of clinical content between non-affiliated sites. No site reached Level 4 in Table 2 for HIE for any of the four clinical areas that were examined during the course of this study. As previously mentioned, there also were no instances where information was exchanged using both agreed upon messaging and content HIT standards.

To frame our specific observations regarding interoperability (or lack thereof), firm definitions of the relevant concepts in this report are outlined below, because use of these concepts in current health care discussions is so highly variable.

1. Health Information Exchange (HIE)

As described throughout this report, HIE applies to any mode of transmission of HIE--voice, paper, fax, or digital--about a given patient. The broader definition of HIE (rather than considering only electronic (i.e., digital) exchange) for several reasons is used. Not only were instances observed where patients' health information was exchanged using more traditional (voice, paper and fax) methods and in some case standardized (but not semantically interoperable) e-HIE, but it also was observed that HIE was often a hybrid of the more traditional and digital methods. There were instances when the information exchanged resided in a computer on one or both ends of the exchange, but the actual exchange of data was done via phone or fax. For example, site visitors heard a description of a discharge planner viewing her computer screen while talking on the phone to an admitting planner typing things into her computer during an initial conversation regarding placement of a patient. More frequently, it was explained, the person receiving the voice (usually telephonic) information will be taking handwritten notes, and later these notes are transcribed into the local computing system.

Representatives from the selected sites provided the following reasons for not more fully utilizing their HIE capacity.

2. Interoperation and Interoperability

Over the last few years, several efforts have been aimed at developing a universal (beyond health care) definition of interoperation and interoperability. (In this report, the terms will be considered synonymous.) The Presidential Executive Order of August 2006 (E.O. 13410) defines interoperability as "the ability to communicate and exchange data accurately, effectively, securely, and consistently with different information technology systems, software applications, and networks in various settings, and exchange data such that clinical or operational purpose and meaning of the data are preserved and unaltered."¹⁹ The ability to exchange data and retain the meaning of such data across different HIT systems and software applications requires the use of agreed up HIT messaging and content standards.

As noted, a variety of methods of HIE were observed during our site visits and in the rare case that HIE was automated such exchange was not standardized. HIE that is automated, but not standards-based, is by definition ad hoc though from a local point of view it is no less useful. For example, the occasional pre-population of records in one system from information in another system, as was observed at Montefiore Medical Center (New York), was always seen as desirable in the few places it was observed, and it was desired in many contexts where it did not yet exist (e.g., as was reported by Erickson). Only rarely did automated (i.e., electronic) data exchange make use of HL7 Version 2 (HL7v2) messaging standards, although intra-enterprise use of such messaging was observed (e.g., at LDS Hospital in Utah where HL7v2 is used extensively). Some sites planned to make use of HL7v2 messages as the basis for inter-enterprise interoperation. No where was it observed that the use of "semantic" standards, wherein information in one computer was transmitted to a computer in a different care enterprise in a way that the meaning, for the sending computer, was retained in the receiving computer. For example, one can imagine an electronic representation of a discharge medication list from a hospital being "understood" by a computer at a PAC site (in the same way that a local medication list would be understood, and, say, checked for drug interactions), but we did not observe such "exchange by meaning." Instead, universally, we saw manual (i.e., human) "medication reconciliation" at receiving sites.

While the site visit team believes that the observed lack of deployment of data, terminology, and messaging standards may result for deep reasons not yet fully understood, the following hypotheses based on the sites visited are offered. First, knowledge of such standards is limited at the sites visited; there is little awareness of messaging standards and no unilateral mention of terminology standards. Further, there seems to be little motivation to acquire this knowledge. The simplest explanation for this first hypothesis is that "anywhere, anytime" access of patient information that

¹⁹ <http://www.whitehouse.gov/news/releases/2006/08/20060822-2.html>.

follows the patient is a multi-enterprise, multi-disciplinary objective that all stakeholders can understand, and therefore imagine. The idea that computer-empowerment of one computer by another should be part of such access is just not something that the visited sites tended to think of first, and this is in spite of the burden manual re-entry imposes. Second, at sites where inter-enterprise interoperability based on standard messaging is contemplated, the information technology staff are focused on acquiring the resources required for the translation of the patient information, which might be only a summary, into HL7v2 and the translation of the resulting HL7v2 message back into something the receiving computer can (at least) display. Often the business case for paying for the resources necessary to translate patient information in a standardized way is not yet well articulated and the required resources are not always easy to procure. Third, the notion that terms (e.g., the names of diagnoses, laboratory tests, medications, procedures and the like and their meanings) are to be shared across enterprise boundaries seems to cause concerns and sometimes anxiety among some providers. Often these concerns focus on the fact that terms are used differently at different but neighboring enterprises (i.e., the same term may mean something different or different terms are used to name the same meanings). Shared, local use of language may support local care and providers cannot imagine using standardized terms while retaining the way they are used to doing things. A more sophisticated view of the potential use of standard language is that the latter will (locally) reduce the quality of care.

The only way to overcome the challenges implicit in these hypotheses may be to gain experience with terminology standards while simultaneously reducing the technical and financial barriers impeding their deployment and use. It may be for instance that actual use is not nearly as difficult as it is imagined to be.

The lack of agreed upon HIT standards needed by PAC and LTC providers was observed to be a particular challenge. At the time of the site visits, while the NCVHS had endorsed the CHI Patient Assessment and Disability standards,²⁰ the Secretary of HHS had not yet endorsed the use of these standards. PAC/LTC providers are understandably reluctant to demand/request standards-based EHR systems of the PAC/LTC vendors when such standards are not recognized. However, the endorsement by the Secretary in August 2007 of these standards and his approval that these standards be used by federal agencies in implementing new and to the extent possible in modifying existing health information systems should help address providers' uncertainty about which standards should be included in their EHR applications. The commitment by CMS to include CHI standards in the development of the new patient assessment CARE instrument also could help mitigate provider concerns.

Similarly, the recently balloted and approved HL7 CCD standard (i.e., that supports the standardized exchange of human-readable and/or coded documents, such as transfer/discharge documents) and endorsement by the HIT Standards Panel (HITSP) of the CCD as an exchange standard should help reduce provider's uncertainties about the exchange standard that software should support. Further, the expected

²⁰ <http://ncvhs.hhs.gov/061128lt.pdf>.

endorsement of this standard by the American Health Information Community (AHIC) should work to further reduce providers' risks in this area. The CCD could be something that any vendor can understand and any of the vendor's customers can imagine using. This standard specifies a way of exchanging information about a patient so that the receiver can use standard software to display, process, and store that information.

Further, the decision by the CCHIT to specify the certification criteria for NH EHRs by 2009 and develop a roadmap by which future certification criteria will be adopted should assist both NH providers and HIT vendors in anticipating and planning for needed EHR functionality. The CCHIT NH EHR certification criteria likely will include use of the "Patient Assessment and Disability Standards" endorsed through CHI and the HL7 CCD information exchange standard endorsed by HITSP.

While it is unrealistic to assume that the adoption of the CHI Patient Assessment and Disability standards and the HL7 CCD HIE standard will change anything quickly, formalization and use of these standards could promote realistic planning and resource allocation on the part of vendors and providers alike. Providers in communities that were visited could plan to implement these standards in some incremental way as soon as resources could be allocated. For example, Erickson and St. Agnes Hospital (Maryland) could ask their vendors to implement the CCD standard so as to support HIE for patients treated at these two health settings. The fact that implementation of the standard may be a resource-intensive and burdensome undertaking for the vendors could potentially be ameliorated in proportion to the vendor's market share.

3. World Wide Web

The most powerful example of information technology use today is the World Wide Web. Its use is pervasive and so successful in many arenas such as retail commerce and banking that health care providers (and to a lesser extent patients) are beginning to have expectations for their health care experience that rival these other interactions.²¹ When care providers are asked what they want from HIT, they often express their wishes in web-based analogies; which for the purposes of this paper has been reduced to personalized "anytime/anywhere" access. However, health care providers (and patients) also want other attributes that come to mind when they think of this immediate access, namely autonomous, maintenance-free, low-cost, system and vendor-independent communication. However, while the web often is used as the model against which other frameworks are compared, the site visitors observed only one new and one planned use of web-based technology. Significantly, they both involved new technology investments. As part of the IHIE, Docs4Docs is deploying remote web-based physician access to local patient encounter information. At Hillside Rehabilitation Center (Utah NH), their ongoing deployment of the BlueStep EHR will take advantage of web-accessible backup for the patient information they accumulate. One important use of this backup will be for "disaster-recovery" (i.e., by having the patients' data off-site, in the event of a disaster, care providers will have intact medical records from which to

²¹ As the then Secretary of HHS, Tommy Thompson, often observed, "If Lands End can remember my shirt size, why can't my doctor's office remember my phone number and other demographic information?"

provide care). Another explanation why only two sites showcased their use of the web may be that the web is pervasive enough to be an assumed tool. Therefore, some sites may be planning use of the web for data exchange but did not make mention of it, and in other circumstances those interviewed may not have been aware that their system makes use of the web.

4. Communication Gaps Across Organizations

One of the biggest challenges observed during this study was the lack of awareness of HIE-related opportunities going on outside the doors of each enterprise. These challenges presented themselves as both technological and organizational issues. As HHS Secretary Leavitt observes, "All health care is local."²² As most organizational energy in most provider enterprises is allocated to *existing* problems within their own organization, the idea that answers, or, more likely, partial solutions may exist "out there" is only rarely considered. For example, the site visit team observed many instances where organizations unilaterally decided on what information a receiving care provider needed in the event of a patient transfer, without any discussion between the two organizations about the type of information that both organizations actually needed to provide care for transferred patients. Similarly local, unilateral attempts at local HIT solutions often are pursued without any awareness/ understanding of the efforts of others in the health care community to address the same or similar problems. Instead, providers tend to look outside their organization for solutions (if they are considered at all) when the solution become overwhelming in size and complexity and only then do enterprises look to partner with nearby providers or otherwise enlarge their search for solutions. Because of this, substantive progress, however partial, in one place is often completely unknown even to nearby providers. Conversely, because trust among the parties exchanging data about a given patient is a major requirement for collective action, and it generally was observed that e-HIE only occurred among regional providers who know one another well or have an agreement with one another to be able to cooperate and share solutions. This happens in spite of the fact that some providers (e.g., Erickson) are committed as a matter of organizational objective to sharing their experiences with other providers. The simple exercise of the site visit team asking the various settings how data are (or are not) transferred illuminated the wide communication gap. Presumably, communication about the fact that HIE is possible needs to precede planning for HIE, as it is hard to implement HIE solutions without thinking what problems one would like to solve.

5. Health Information Exchange Network (HIEN) Involvement

Three of the four site visits were in communities with some type of RHIO/HIEN. One was a fairly established regional network (IHIE), one was established within a state (UHIN), and one was a newly-formed RHIO (Bronx RHIO). The ability for these networks to exchange information was idiosyncratic to the location visited. The UHIN largely exists because of state-regulated requirements regarding claims submission and credentialing of physicians. The IHIE was established over time and spearheaded by a

²² <http://www.hhs.gov/news/press/2007pres/20070103.html>.

few forward-thinking physicians and informaticists. It was through Drs. McDonald and Overhage's good will and perseverance that the IHIE was able to get initial buy-in with the participating hospitals and physicians. The Bronx RHIO is just getting started, and has been heavily funded by both the state (NY HEAL money) and the Federal Government.

6. Site-Specific Technology

In the remainder of this section, each site will be reviewed against a number of emerging criteria for interoperation readiness, or lack thereof. For more details, see appendices corresponding to each site visit.

a. Erickson Retirement Communities: Hardware and Software. Erickson's main HIT priority has been the Erickson-wide (one or more facilities in each of ten states)²³ rollout of GE Centricity functionality for "100% of Erickson physicians."²⁴ While this functionality does not yet include CPOE, it does include web-based "anytime/anywhere" access for physicians. Currently, this deployment does not make use of CHI standards except as are required for reimbursement. However, internal standards are sufficient to create comparable data within the Erickson enterprise and these are being used to predict the incidence of falls, and they will be used to track the efficacy of interventions that attempt to prevent falls. Interestingly, given Erickson's commitment to an internal ethic of "enter once, read many times" (aimed at avoiding the re-entry of internal data already in an Erickson computer), it was surprising that no plans were described to exchange data between Centricity and CareMEDX, the primary record for patients in home health care, Part A SNF, and LTC.²⁵ More predictably, as with most providers, neither system interoperates with external laboratories or pharmacies, although health care providers often are content to have the information they need available even if it is on two computer screens. Still, the fact that Centricity is deployed nationally by Erickson is a singular accomplishment, one from which significant benefits are already accruing. For instance, Erickson's information technology philosophy and systems seemed to contribute significantly to employee satisfaction and a trend toward staff retention.

At the time of the site visit, Erickson discussed its readiness to adopt HL7 messaging standards. They have initiated discussions with St. Agnes hospital (their primary, unaffiliated acute care hospital in Maryland) to deploy a custom data exchange solution with their two EHR systems. The site visit occurred before the CCD standard was an approved and widely available standard.

Summary: Erickson uses a national EHR that supports web-based access. This EHR does not interoperate with non-affiliated sites, although Erickson would like it to interoperate with their preferred local hospital as soon as possible, nor does it

²³ <http://www.ericksoncommunities.com>.

²⁴ <http://www.ericksoncommunities.com/wellness/centricity.asp>.

²⁵ Dan Cobb, CareMEDX Chief Technology Officer, and prominent contributor to professional and standards organizations, accompanied us on relevant portions of the Erickson site visit.

interoperate with the Erickson EHR product used by the Erickson PAC and LTC providers. They do not use HIT standards except as are required for reimbursement. Centricity makes use of Oracle to store patient information. Because of organizational priorities and experience and the relatively contemporary, highly scalable implementation of Centricity, Erickson is positioned to productively leverage any relevant national standard (e.g., a standard for patient data exchange). Erickson will probably be able to send and receive data using any emerging national exchange standard before many of the unaffiliated providers in the 16 communities in which Erickson is located are ready to receive or send health data.

b. Montefiore Medical Center: Hardware and Software. Montefiore uses LastWord as the hospital EHR, the exports from which periodically refresh a Sybase data repository. The Sybase supports general querying and aggregation of patient data, functions not available in the LastWord system. Montefiore is the anchor provider in the recently-funded Bronx RHIO. The RHIO will include other hospitals (e.g., the Bronx VA), some ambulatory care sites, and one PAC/rehabilitation/LTC nursing facility (JHHA). Other PAC/LTC sites may join soon, as will local laboratories and pharmacies. Data exchange in the RHIO will depend on a common computer-represented patient summary (which, at the time of the site visit was called a virtual patient object [VPO]). The latter will make use of dbMotion technology to manage secure access, among other things.²⁶ A basic premise of the RHIO is that patient data remain stored at its source and only the patient summaries, in the form of a VPO, are transmitted to requesting providers. Although the Bronx RHIO is committed to the use of relevant standards, the developers have not yet finalized the list of standards they will incorporate. For example, they are not yet considering the use of the CCD. However, the VPO, dbMotion technology, and the Montefiore patient data repository, should allow for incorporation of any emerging national patient data exchange standard.

The VNS of New York exchanges patient data with Montefiore and other Bronx providers using traditional fax and phone methods. However, the VNS of New York has projects underway in which they are exchanging information--computer-to-computer--with physician office EHRs and with Cornell Weil Medical Center (discussed in Appendix C). The VNS of New York's long-standing innovative use of information technology enables it to leverage that technology as part of attempts to exchange data with other providers. The VNS of New York has achieved sufficient intra-enterprise interoperation so that it is now focusing its development efforts on data exchange with non-affiliated providers.

Summary: No non-affiliated interoperability was observed and no use of HIT standards was observed except those used for reimbursement. Montefiore Medical Center, the VNS of New York, and some Bronx RHIO sites are self-reportedly "poised for interoperability." The now-funded Bronx RHIO is well positioned to leverage any emerging national patient data exchange standards. Not coincidentally, the VNS of New York has several HIE pilots underway with non-Bronx providers. (see Appendix C for a discussion of the VNS pilot projects).

²⁶ <http://www.dbmotion.com/>.

c. LDS Hospital: Hardware and Software. LDS Hospital continues to evolve its EHR, which today consists of a heterogeneous mix of internally-developed and commercial-off-the-shelf (COTS) components. The distinguishing features of the IHC system (including LDS Hospital) include a longitudinal data repository that is accumulating both inpatient and outpatient information on the IHC population, and an ongoing effort to make all the components interoperate internally using HL7v2 messaging. An IHC goal is to use its recent partnership with GE Healthcare to move all components, including the data repository, to COTS status. IHC has pioneered the use of HL7 messaging and the use of LOINC, a CHI standard, for use within its own enterprise in these intra-enterprise messages. Other uses of CHI standards are those required for reimbursement. LDS Hospital and almost all other providers in Utah make use of the UHIN for accelerated in-state billing and reimbursement. LDS Hospital will be participating in a pilot project aimed at use of the UHIN to communicate limited clinical information to and from other Utah health settings. No further details, such as whether there will be a UHIN Master Patient Index were provided to the site visit team.

All PAC/LTC sites visited in Utah had some HIT in place. One site, Hillside Rehabilitation Center, is installing a relatively advanced EHR system developed by BlueStep, which is entirely web-based and hosted remotely. Features include a focus on workflow management and web-accessible disaster-recovery backup. For further background information, see Appendix D.

Summary: Interoperability with unaffiliated sites was not observed, however all sites made use of the UHIN for claims submission, which is significant in and of itself. No use of CHI standards was observed, except for LDS Hospital's extensive use of HL7 messaging and LOINC for laboratory test result reporting. However, all sites could be poised to exchange clinical information with one another by building on their current use of the UHIN for financial transactions. Predictably, the first types of electronic clinical data exchange through UHIN will likely be laboratory results and medication ordering, which have standardized codes already used for payment.

d. Indiana Health Information Exchange/Indiana University: Hardware and Software. The Indiana University's EHR (Indiana Network for Patient Care) is a locally developed, deployed, and maintained system that is a pioneer system in the development and evaluation of physician order entry and decision support and the creation and use of longitudinal patient records (Overhage, Suico, & McDonald, 2001). Today, it makes use of commodity hardware to run legacy (MUMPS and Windows) software. More significantly, this system was one factor that enables the retrieval of previous encounter information from different hospitals by local EDs. This retrieval does not pre-populate the local system today, but pre-population is one planned feature of the Indianapolis-wide Docs4Docs system. This feature supports web-based physician access to available patient encounter information stored in the EHRs of Indianapolis hospitals by collecting this information in a regional data repository. An example provided during the site visit described a patient seen in one ED for chest pain who proved to have had a recent negative cardio-vascular work-up at another hospital. The

patient was later discovered to have a pulmonary embolism and a second, costly cardio-vascular work-up was avoided because the ED physicians could see the (negative) results of the cardio-vascular work-up. Currently, this repository does not feature a uniform patient summary. The IHIE is an expanding umbrella that leverages these and other planned data exchange projects including the data to be collected from state-mandated e-prescribing. Thus, the goal of being able to retrieve all available information about a patient is being approached incrementally. The IHIE is open to all settings that would like to participate, and generally project leaders assist with the inclusion of each site. At the time of this report, the only members of the IHIE are local hospitals and physicians.

Summary: Non-affiliated, human-readable HIE exists on a systematic basis between Indianapolis EDs and selected local hospitals, including Wishard Hospital, which was visited by the site visitors. Indianapolis-wide physician access to available (i.e., data that are collected and stored for other reasons) patient encounter information is supported by the web-based Docs4Docs system, and plans are in place for historical information on the patient to also be entered into the participating providers' EHRs. CHI standards were not being used (other than those required for reimbursement) with the notable exception of the widespread use of LOINC to normalize laboratory report data and for widespread use of HL7v2 messages. The Beverly Healthcare Nursing Home at Brookview made use of relatively advanced national (Beverly) proprietary HIT that does not use HIT (e.g., CHI) standards. At present there are no plans for Beverly to join the emerging IHIE. The VNS of Indiana supports its home care nurses and other clinicians with a laptop-accessible EHR, which also does not use HIT (e.g., CHI) standards. The full site visit report can be found in Appendix E.

IV. SUMMARY AND SUGGESTED NEXT STEPS

As described throughout this report, HIE across care settings has been observed to be costly, complicated, and challenging, as it, involves:

- exchange of the full spectrum of health information (e.g., summaries to transfer care from one setting to another, exchange of medication and other orders, reporting of results, etc.);
- exchange of health information between multiple parties, including across a number of unaffiliated clinicians, providers, and organizations;
- use of a variety of information exchange mechanisms (e.g., face-to-face, telephone, fax, or the use of computers) within and across organizations, often employing more than one modality for a given "exchange;" and
- varied e-HIE capacities within and across organizations (e.g., the ability to generate and/or receive any type of electronic health information [including standardized health information]).

During the site visits, in some instances HIE challenges stemmed from the technological inability to efficiently exchange electronic information (e.g., lack of software, including the lack of software that uses HIT standards). However, much of the complexity and variability in HIE appeared to be rooted in the different priorities various health care organizations placed on the exchange (by any method) of certain types of health information.

This section of the report summarizes findings identified through the site visits, literature review (see interim report entitled "Report on Health Information Exchange in Post-Acute and Long-Term Care"²⁷), and other more recently available information related to HIE on behalf of persons receiving PAC and LTC, focusing particularly on the use of e-HIE. The report concludes with a discussion of activities that are or could be considered to accelerate the implementation of e-HIE on behalf of persons receiving PAC and LTC.

A. HEALTH INFORMATION EXCHANGE BY ANY MEANS

Several factors were identified as facilitating or creating barriers to the timely exchange of health information by any means, including non-e-HIE, needed to care for persons receiving care from PAC and LTC providers. As observed during the site visits, many stakeholders indicated that, at present, the key for securing timely information exchange were strong, cross-organizational interpersonal relationships. Such relationships were identified as essential for supporting timely and needed HIE regardless of the method(s) by which health information is exchanged (e.g., manually, by fax, or using HIT). At all sites it was observed that the relationships built between

²⁷ <http://aspe.hhs.gov/daltcp/reports/2007/HIErpt.htm>.

staff at institutions (e.g., hospital discharge planner and admission coordinator at a NH, liaisons from HHA/NH working in hospitals prior to discharge) were of paramount importance. Not only did these relationships tend to ensure that referrals were made more efficiently and the information shared was more complete (i.e., these relationships seemed to help reinforce accountability for information transfer), but also it seemed to increase job satisfaction. The site visitors observed that even to the extent e-HIE was used, personal relationships were not completely supplanted by technology, and it is likely that as HIT implementation becomes more widespread, this observation will persist.

Other factors that were identified through the site visits and a review of the literature as facilitating HIE included:

- Medicare payment policies that some believe have created indirect incentives for HIE (e.g., capitated, episode-based prospective payment methods) and other policies that include direct incentives for the timely exchange of health information across organizations (e.g., pay-for-performance incentives).
- Medicare requirements to use e-prescribing standards to support electronic medication ordering.
- State requirements for the exchange of health information as patients transition across settings of care (e.g., requirements in the state of New York to use the PRI).
- Cross-organizational use of software products that enable the standardized electronic exchange across settings of patient discharge information (e.g., use of ECIN to exchange the PRI in New York).
- Anticipated revisions to the Joint Commission (previously known as JCAHO) hospital requirements that will focus, in part, on ensuring safe and effective hand-offs as patients transition out of hospitals to other settings of care.

Several factors that were identified as creating barriers to HIE included:

- The perception (whether well-informed or not) that implementation of and concerns about being out of compliance with HIPAA creates barriers to HIE across health care settings.
- The belief held by many PAC/LTC providers that they are effectively unable to request more complete/accurate health information from referring hospitals given the dependence of PAC/LTC providers on hospitals as a primary source of referrals.
- Lack of awareness of the availability of HIT standards that, if implemented, could support e-HIE and health information re-use.

- Failure to use HIT products that support standardized exchange of health information and information re-use.

B. IMPLEMENTATION OF HIT INCLUDING E-HIE

This report described several factors that contributed to the limited use of e-HIE to support the exchange of information needed for PAC and LTC patients including:

- The limited use of electronic health information exchange (e-HIE) products. The limited use of such products was attributed to the: (a) cost of products; (b) lack of requirements to use such products; (c) questions about the relative costs and benefits of HIT and HIE applications; (d) lack of provider awareness of the need for and availability of HIT standards; and (e) a failure to consider how HIT and HIE applications could be used to enhance workflow in PAC and LTC settings (e.g., how service delivery could be made more efficient through the re-use of electronic health information received through e-HIE).
- Hospitals and HIE organizations sometimes had not given clinicians in PAC and LTC settings access (such as view-only access) to patient data in hospital EHRs for those patients who were to be discharged from hospitals and admitted by the PAC/LTC providers.
- HIE organizations often did not involve PAC and LTC providers in the formation of these exchange partnerships.
- PAC and LTC providers sometimes choose not to participate in discussions with HIE organizations.

C. INTEROPERABLE HIT

As mentioned above and described throughout this report and the literature review, the lack of HIT standards particularly for: (i) PAC and LTC providers; and (ii) e-HIE often have been identified as barriers to more timely exchange of needed, interoperable health information. However, over the last few years, there have been several significant advances related to the identification, endorsement, and/or use of HIT standards that will, if implemented, support interoperable HIE, including HIE on behalf of PAC and LTC patients, including the:

- The endorsement by the Secretary of HHS in August 2007 of the CHI Disability and Patient Assessment standards and commitment that these standards will be used by federal agencies in implementing new and to the extent feasible in modifying existing health information systems. These standards:
 - Have been and will continue to be applied to the NH MDS;

- Will be applied to the home health OASIS instrument; and
 - Will be applied to the CARE assessment instrument (previously known as the "PAC-PAI") and will be used by CMS in the Medicare Post-Acute Care Payment Reform demonstration required in Section 5008 of the Deficit Reduction Act.
- Approval by HL7 of the CCD implementation guide for the standardized exchange of clinical documents (e.g., discharge and transfer documents).
 - Approval by the HITSP of the CCD as the standard for certain types of HIE.
 - Projected use of the CCD standard by the CCHIT as the standard to support the exchange of documents by certified physician office and hospital EHRs.
 - Announcement by CCHIT of its intent to specify certification criteria for NH EHRs. Such criteria are expected to include specifications concerning the functionality of certified EHRs and the interoperability standards that certified EHRs must support. For example, certification criteria are expected to include the need for EHRs to support standardized assessments and standardized exchange of patient summaries.
 - Use of the CCD standard and/or CHI Patient Assessment standards in upcoming private sector HIE demonstrations that will include PAC and LTC providers.
 - Findings from the AHRQ/CMS e-prescribing pilots that found that standardized e-prescribing (including in NHs) created efficiencies gains and quality improvements.
 - CMS regulations requiring the use of certain standards to support e-prescribing under Medicare Part D (however, it is important to note that at present NHs are excluded from the requirement to use these standards).
 - Approval in September 2007 by ANSI of the e-prescribing standard needed to support e-prescribing in NHs (i.e., NCPDP SCRIPT v10.1).
 - Approval by the AHIC of the need for a use case that will focus on HIE at the time of referrals and transfers in care. This use case should be developed in 2007 and submitted to the HITSP in early 2008 for the identification of the specific standards needed to support the exchange.

The endorsement of CHI standards for patient assessments, the application of these standards to the NH MDS and expected application to the home health OASIS; approval by HL7 of the CCD implementation guide and the use of this standard by CCHIT; specification by CMS of e-prescribing standards and the approval by ANSI of the e-prescribing standards needed to support e-prescribing in NHs will enable providers to request and HIT vendors to develop products that support: (i) standardized

assessments; and (ii) the exchange of certain types of information needed on behalf of patients treated by PAC and LTC providers.

The specification of NH EHR certification criteria by CCHIT is expected to level the playing field between HIT vendors and providers, enabling providers to have greater confidence in the functionality and standards included in the HIT products they purchase, and creating a roadmap that vendors can use for the development of increasingly standardized EHR products.

The application of the CHI Patient Assessment standards to the NH MDS and planned application to the home health OASIS; use of these standards by CMS in the demonstration of the CARE instrument; expected use of the patient assessment and information exchange standards in private sector demonstrations to be conducted by CAST and Integrating the Healthcare Enterprise, and the anticipated specification of HITSP standards for an AHIC use case on referrals and transfers of care will provide guidance to the vendor and provider communities about how these standards can be applied to support standardized HIT products and interoperable HIE to support the care needed by PAC and LTC patients.

D. ACCELERATING THE IMPLEMENTATION OF E-HIE

Despite the identification and endorsement of several important HIT standards, including standards to support HIE, and the expected use of these standards in public and private sector demonstrations, e-HIE by health care providers, including PAC and LTC providers, is quite limited, and the use of interoperable HIT and e-HIE is even less common. The following describes several activities that could be considered to accelerate implementation of standardized e-HIE on behalf of patients treated by PAC and LTC providers.

The identification and specification of additional HIT standards is needed in certain areas including:

- Specification by the AHIC of a transfer of care use case that involves the exchange of information on behalf of patients being treated in PAC and LTC settings would enable this type of exchange to be included in and focused on as part of the national HIT agenda, and would likely result in a nationally-recognized endorsement (i.e., by the HITSP and AHIC) of the HIT standards needed to support this type of exchange. Members of the PAC and LTC communities are working on developing a use case focusing on admission and/or discharge from PAC/LTC that could be considered by AHIC and if approved, the HITSP would identify the standards needed to support this type of HIE.
- Specification of an implementation guide that would provide guidance to the PAC and LTC vendor communities as to how to integrate the CHI-endorsed patient assessment and HL7 CCD HIE standards into their software products.

- Implementation of the NCPDP SCRIPT v10.1 standard in CMS e-prescribing regulations will enable NH providers and vendors to knowledgeably invest in standardized e-prescribing products.

However, as observed during the site visits, implementation of HIT in general, much less the implementation of interoperable HIT and e-HIE remains a huge gap. Unaffiliated PAC and LTC providers were less likely to have implemented HIT than their counterparts that are part of chain organizations and/or are affiliated with integrated delivery systems. The anticipated public and private sector demonstrations of the use of the CHI-Patient Assessment standards and the HL7 CCD standard to exchange needed patient summary/discharge information as patients transition across settings of care are expected to demonstrate the use of and increase awareness of how standardized applications can support HIE. These demonstration efforts may wish to consider the feasibility of including unaffiliated PAC and LTC providers in the demonstration efforts.

Identification by the HITSP and endorsement by AHIC of HIE standards needed to support referrals and transfers in care, and the likely identification by CCHIT of the CHI-Patient Assessment and HL7 CCD standards as criteria for certified NH EHRs also will support implementation standardized e-HIE.

A dominant theme to emerge from the third annual LTC-HIT Summit in June 2007 was the need to accelerate and support the implementation of standardized HIT in PAC and LTC. Recommendations that were discussed during the 2007 LTC Summit included:

- Request the Secretary of HHS to provide assistance to PAC and LTC providers in implementing HIT (including, for example, using standards for e-prescribing in LTC and federally-required patient assessments).
- Engage state agencies (including Medicaid programs and the National Governors' Association) to support the implementation of interoperable HIT in LTC.
- Educate providers regarding interoperable HIT (e.g., its uses, known and expected benefits, costs, etc.).
- Further analyze and disseminate information on the costs and benefits of HIT implementation on behalf of PAC and LTC patients, including information on who incurs these costs and who reaps the benefits.
- Reduce the risks PAC and LTC providers encounter in the acquisition of HIT products.

- Identify and share information among PAC and LTC providers on how the use of HIT can change and enhance workflow.

Several actions are being undertaken to address many of these recommendations including:

- The recent endorsement by the Secretary of HHS of the use of the CHI-Patient Assessment standards in federal health care programs.
- Research being sponsored by ASPE to:
 - examine the costs and benefits of HIT implementation, including e-HIE, on behalf of patients receiving PAC and LTC;
 - support an infrastructure building effort that will:
 - a. further apply CHI-endorsed standards to the MDS and OASIS;
 - b. specify the HIE infrastructure for standardized patient assessments and patient summaries (respectively using the CDA and CCD standards); and
 - c. examine intellectual property issues associated with federally-required assessments (i.e., the MDS, OASIS, and Inpatient Rehabilitation Facility PAI); and
 - design a survey of NH EHR adoption and use.
- The work being led by the private sector LTC community, and supported by ASPE, to specify the functions and standards needed in NH EHR products. The product of this work will be considered by CCHIT in specifying the certification criteria for EHRs used in NHs.
- The anticipated private sector demonstrations of interoperable HIE involving PAC and LTC providers.

Additional consideration is needed to develop and implement a widespread education and outreach strategy to educate PAC and LTC providers and other stakeholders on a variety of HIT issues to increase awareness and use of interoperable HIT. Such an educational campaign could also share information about how workflow can be made more efficient through the implementation of various HIT applications. Educational and outreach efforts also should include discussions with other health care provider types (e.g., hospitals, physicians, HDSs), HIE organizations, and other stakeholders about the need to include PAC and LTC providers in HIE efforts.

REFERENCES

- American Health Care Association (2003). Results of the 2002 AHCA Survey of Nursing Staff Vacancy and Turnover in Nursing Homes.
http://www.ahca.org/research/rpt_vts2002_final.pdf [On-line].
- American Health Care Association (2006). A Snap-Shot of the Use of Health Information Technology in Long Term Care.
http://www.amda.com/news/othernews/2007/ahca_hit_longtermcarewhitepage1206.pdf [On-line].
- Booz Allen Hamilton (2006). *Evaluation Design of the Business Case of Health Technology in Long-Term Care: Final Report*. Washington, DC: Office of Disability, Aging and Long-Term Care Policy, ASPE, HHS.
<http://aspe.hhs.gov/daltcp/reports/2006/BCfinal.htm> [On-line].
- Brody, J. (2007). Personal Health; To Protect Against Drug Errors, Ask Questions.
<http://www.nytimes.com/2007/01/02/health/02brody.html?ei=5088&en=e96599a5fa428c85&ex=1325394000&partner=rssnyt&emc=rss&pagewanted=print> [On-line].
- Centers for Medicare & Medicaid Services (2001). Conditions of participation: Discharge planning. *Federal Register*, Section 482.43, 503-504.
- Centers for Medicare & Medicaid Services (2006). Uniform Patient Assessment for Post-Acute Care -- Final Report.
<http://www.cms.hhs.gov/QualityInitiativesGenInfo/Downloads/QualityPACFullReport.pdf> [On-line].
- Centers for Medicare & Medicaid Services (2007a). Press Release: Details for Long-Term Care Hospital Prospective Payment System Proposed Rule for Rate Year 2007. <http://www.cms.hhs.gov/apps/media/press/release.asp?Counter=1757> [On-line].
- Centers for Medicare & Medicaid Services (2007b). Revised Long-Term Care Facility Resident Assessment Instrument User's Manual, Version 2.0.
<http://www.cms.hhs.gov/NursingHomeQualityInits/downloads/MDS20Update200703.pdf> [On-line].
- Coleman, E.A. (2002). Aspen Transitional Care Conference Proceedings.
<http://www.uchsc.edu/hcpr/documents/AspenTransitionProceedings.pdf>, Accessed November 17, 2003.
- Coleman, E.A. (2003). Falling through the cracks: Challenges and opportunities for improving transitional care for persons with continuous complex care needs. *J Am Geriatr Soc*, 51, 549-555.

- Coleman, E.A. & Berenson, R.A. (2004). Lost in transition: Challenges and opportunities for improving the quality of transitional care. *Annals of Internal Medicine*, 141, 533-536.
- Coleman, E.A., May, K., Bennett, R.E., Dorr, D., & Harvell, J. (2007). Report on Health Information Exchange in Post-Acute and Long-Term Care. <http://aspe.hhs.gov/daltcp/reports/2007/HIErpt.htm> [On-line].
- Computer Sciences Corporation (2007). CSC and "Connecting for Health" Team Successfully Demonstrate Nationwide Health Information Network Prototype. <http://www.csc.com/newsandevents/news/8468.shtm> [On-line].
- Consolidated Health Informatics (2006). Standards Adoption Recommendation -- Functioning and Disability. <http://www.ncvhs.hhs.gov/061011p2b.pdf> [On-line].
- Continuing Care Leadership Coalition (2006). *Health Information Technology in Long Term Care Survey Findings 2006*. New York, NY.
- Department of Veterans Affairs (2006). VA Geriatrics and Extended Care (GEC) Referral. <http://www1.va.gov/geriatricsshg/docs/vha-10-0415-fill.pdf> [On-line].
- Federal Register (2006). Executive Order 13410: Promoting Quality and Efficient Health Care in Federal Government Administered or Sponsored Health Care Programs -- August 28, 2006. Volume 71, Number 166, 51087-51091.
- Forster, A., Murff, H., Peterson, J., Gandhi, T., & Bates, D. (2003). The incidence and severity of adverse events affecting patients after discharge from the hospital. *Annals of Internal Medicine*, 138, 161-167.
- Health Level Seven & ASTM (2006). HL7 Implementation Guide: CDA Release 2-Continuity of Care Document (CCD). http://www.hl7.org/documentcenter/ballots/2007JAN/downloads/CDAR2_IMPL_CCD_I2_2007JAN.zip [On-line].
- Healthcare Informatics in collaboration with AHIMA & AMDIS (2005). Mapping a changing healthcare landscape: Results of a Regional Health Information Organization Survey. http://www.ahima.org/hitweek/Mapping_Survey.pdf [On-line].
- Healthcare Information & Management Systems Society & the Center for Health Information & Decision Systems (2006). HIT Dashboard. <http://www.hitdashboard.com> [On-line].
- HMO Workgroup on Care Management (2004). *One patient, many places: Managing health care transitions*. Washington, DC: AAHP-HIAA Foundation.

- Hudak, S. & Sharkey, S. (2007). *Health Information Technology: Are Long Term Care Providers Ready?* Oakland, CA: California HealthCare Foundation.
- Hughes, G. (2003). Transfer of Patient Health Information Across the Continuum (Updated). *AHIMA Practice Brief, Practice Guidelines for Managing Health Information*, 64S-64Z.
- Kaushal, R., Bates, D.W., Poon, E.G., Jha, A.K., Blumenthal, D., & the Harvard Interfaculty Program for Health Systems Improvement NHIN Working Group (2005a). Functional Gaps In Attaining A National Health Information Network. *Health Affairs*, 24, 1281-1289.
- Kaushal, R., Blumenthal, D., Poon, E.G., Jha, A.K., Franz, C., Middleton, B., et al. (2005b). The Costs of a National Health Information Network. *Annals of Internal Medicine*, 143, 165-173.
- Moore, C., McGinn, T., & Halm, E. (2007). Tying Up Loose Ends: Discharging Patients With Unresolved Medical Issues. *Archives of Internal Medicine*, 167, 1305-1311.
- Morrison, R.S., Olson, E., Mertz, K.R., & Meier, D.E. (1995). The inaccessibility of advance directives on transfer from ambulatory to acute care settings [see comment]. *JAMA* 274(6):478-82.
- National Bureau of Economic Research (2007). Prospective Payment System (PPS) Data. <http://www.nber.org/data/pps.html> [On-line].
- National Committee on Vital and Health Statistics (2006). Letter to the Honorable Michael O Leavitt, Secretary, HHS. <http://www.ncvhs.hhs.gov/061128lt.pdf> [On-line].
- Office for the National Coordinator for Health Information Technology (2004). *The decade of health information technology: Delivering consumer-centric and information-rich health care*. Washington DC.
- Overhage, J.M., Suico, J., & McDonald, C.J. (2001). Electronic Laboratory Reporting: Barriers, Solutions and Findings. *Journal of Public Health Management & Practice*, 7, 60.
- Poissant, L., Pereira, J., Tamblyn, R., & Kawasumi, Y. (2005). The Impact of Electronic Health Records on Time Efficiency of Physicians and Nurses: A Systematic Review. *Journal of the American Medical Informatics Association*, 12, 505-516.
- Poon, E., Jha, A., Christino, M., Honour, M., Fernandopulle, R., Middleton, B., et al. (2006). Assessing the level of healthcare information technology adoption in the United States: a snapshot. *BMC Medical Informatics and Decision Making*, 6, 1.

Seavey, D. (2004). *The cost of frontline turnover in long-term care*. Washington, DC: Better Jobs Better Care, Institute for the Future of Aging Services.

Sidorov, J. (2006). It Ain't Necessarily So: The Electronic Health Record And The Unlikely Prospect Of Reducing Health Care Costs. *Health Affairs*, 25, 1079-1085.

Utah Health Information Network (2007). <http://www.uhin.com/> [On-line].

Walker, J., Pan, E., Johnston, D., Adler-Milstein, J., Bates, D.W., & Middleton, B. (2005). The Value of Health Care Information Exchange and Interoperability. <http://content.healthaffairs.org/cgi/reprint/hlthaff.w5.10v1> [On-line].

ACRONYMS

AAHSA	American Association of Homes and Services for the Aging
ACE	Acute Care for Elders
AHCA	American Health Care Association
AHIC	American Health Information Community
AHRQ	HHS Agency for Healthcare Research and Quality
ALF	assisted living facility
ASP	application service provider
ASPE	HHS Office of the Assistant Secretary for Planning and Evaluation
BxRHIO	Bronx Regional Health Information Organization
CARE	Continuity Assessment Record and Evaluation [instrument]
CCD	continuity of care document
CCHIT	Certification Committee for Healthcare Information Technology
CCR	continuity of care record
CCRC	continuous care retirement community
CDR	Clinical Data Repository
CHI	consolidated health informatics
CICS	Customer Information Control System
CIS	clinical information system
CMS	HHS Centers for Medicare and Medicaid Services
CNS	Community Nursing Service
CoPs	Conditions of Participation
COTS	commercial-off-the-shelf
CPOE	computerized provider order entry
CSC	Computer Science Corporation
C-II	Schedule 2 Controlled Substances
DME	disposable medical equipment
ECIN	Extended Care Information Network
ED	emergency department
EHIT	Emerging Health Information Technologies
EHR	electronic health record
EMR	electronic medical record
e-HIE	electronic health information exchange
FFS	fee-for-service
FTE	full-time employee
GEC	VA Geriatrics and Extended Care
HCPR	University of Colorado Division of Health Care Policy and Research

HDS	health delivery system
HHA	home health agency
HHS	US Department of Health and Human Services
HIE	health information exchange
HIEN	Health Information Exchange Network
HIMSS	Healthcare Information and Management Systems Society
HIPAA	Health Insurance Portability and Accountability Act
HIT	health information technology
HITSP	Health Information Technology Standards Panel
HL7	Health Level Seven
H&P	history and physical
IHC	Intermountain Health Care
IHIE	Indiana Health Information Exchange
INPC	Indianapolis Network for Patient Care
IU	Indiana University
JHHA	Jewish Home and Hospital Agency
JHLS	Jewish Home and Hospital Lifecare System
LAN	local area network
LOS	length of stay
LTAC	long-term acute care
LTC	long-term care
MAR	medication administration record
MDS	minimum data set
MHHA	Montefiore Home Health Agency
MLTC	managed long-term care
NAHC	National Association for Home Care
NCHIT	National Coordinator for Health Information Technology
NCVHS	National Committee on Vital and Health Statistics
NH	nursing home
NHIN	National Health Information Network
NYDoH	New York Department of Health
OASIS	Outcome and Assessment Information Set
OT	occupational therapy
PAC	post-acute care
PAI	patient assessment instrument
PAL	PTXT application language
PASARR	Pre-Admission Screening and Annual Resident Review
PC	personal computer

PCP	primary care physician primary care provider
PCRS	Patient Care Record System
PDF	portable document file
POC	point-of-care
POLST	physician orders for life sustaining treatment
PRI	Patient Referral Instrument Patient Review Instrument
PT	physical therapist physical therapy
RHIO	regional health information organization
RN	registered nurse
RUG-III	resource utilization groups-Version III
SDO	standards development organization
SNCC	Schervier Nursing Care Center
SNF	skilled nursing facility
TAL	tandem application language
TOM	Task Order Monitor
UCDHSC	University of Colorado at Denver and Health Sciences Center
UHIN	Utah Health Information Network
UHINT	Utah Health Information Network tool
VNS	Visiting Nurse Service
VNSNY	Visiting Nurse Service of New York
VSP	vertical service provider

HEALTH INFORMATION EXCHANGE IN POST-ACUTE AND LONG-TERM CARE CASE STUDY FINDINGS

Files Available for This Report

Final Report

HTML: <http://aspe.hhs.gov/daltcp/reports/2007/HIEcase.htm>
PDF: <http://aspe.hhs.gov/daltcp/reports/2007/HIEcase.pdf>

Appendices

All Appendices

HTML: <http://aspe.hhs.gov/daltcp/reports/2007/HIEcase-A.htm>

Appendix A: Draft Case Study Plan

HTML: <http://aspe.hhs.gov/daltcp/reports/2007/HIEcase-A.htm#appendA>
PDF: <http://aspe.hhs.gov/daltcp/reports/2007/HIEcase-A.pdf>

Appendix B: Site Visit Report--Erickson Retirement Communities, Catonsville, Maryland

HTML: <http://aspe.hhs.gov/daltcp/reports/2007/HIEcase-A.htm#appendB>
PDF: <http://aspe.hhs.gov/daltcp/reports/2007/HIEcase-B.pdf>

Appendix C: Site Visit Report--Montefiore Medical Center, Bronx, New York

HTML: <http://aspe.hhs.gov/daltcp/reports/2007/HIEcase-A.htm#appendC>
PDF: <http://aspe.hhs.gov/daltcp/reports/2007/HIEcase-C.pdf>

Appendix D: Site Visit Report--Intermountain Health Care, Salt Lake City, Utah

HTML: <http://aspe.hhs.gov/daltcp/reports/2007/HIEcase-A.htm#appendD>
PDF: <http://aspe.hhs.gov/daltcp/reports/2007/HIEcase-D.pdf>

Appendix E: Site Visit Report--Indiana Health Information Exchange, Indianapolis, Indiana

HTML: <http://aspe.hhs.gov/daltcp/reports/2007/HIEcase-A.htm#appendE>
PDF: <http://aspe.hhs.gov/daltcp/reports/2007/HIEcase-E.pdf>