

# **The Impact of Electronic Health Information Exchange (HIE) Services in Maine: Avoidable Service and Productivity Savings Estimates Related to HealthInfoNet Services**

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# Table of Contents

Executive Summary .....	ii
About the Authors .....	iv
Introduction .....	1
Background .....	3
Prior HIE Benefit Analyses in Maine .....	5
Methods for 2008 HealthInfoNet Savings Analysis .....	8
Summary of Data Used to Calculate Potential HIE Savings .....	9
Summary of Savings Studies Applied in this Analysis .....	11
Range of Modeling Estimates .....	16
Findings .....	16
HealthInfoNet Demonstration Phase Savings .....	16
Savings by Payer Category .....	18
Statewide Savings .....	20
Bibliography .....	26
General Sources .....	26
Data Sources for Population, Insurance Coverage, and Payment Rates .....	28
Appendices .....	31

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# Executive Summary

## Project Overview

To support the HealthInfoNet stakeholder group, the University of Massachusetts Medical School Center for Health Policy and Research (CHPR), in collaboration with Witter & Associates, conducted an analysis of the potential annual savings associated with the services currently being implemented by HealthInfoNet during its demonstration project. This study:

- Assessed the potential return on investment (ROI) associated with electronic health information exchange (HIE) in Maine in follow up to the study conducted by Baker Newman & Noyes in 2004;
  - Considered the best available approach at the time to estimate potential HIT savings for Maine.
- Reviewed and modeled recent national estimates of the impact of HIE;
- Obtained Maine specific population, payment, and utilization statistics; and
- Quantitatively applied the national savings models to Maine statistics based on their applicability to the services delivered and anticipated provider participation in the HealthInfoNet demonstration project. Several assumptions were used to generate potential savings estimates:
  - Estimation of savings using multiple approaches applied with a standardized method and updated to 2008 dollars; and
  - Conservative recognition of savings already being achieved by existing levels of HIT/HIE adoption (30%) and maximum achievable benefits (80%).

## HealthInfoNet Electronic HIE Savings Estimates

It is estimated that the services being provided by HealthInfoNet during the demonstration project will generate broad annual healthcare savings. The savings estimates are based on avoided laboratory testing, avoided imaging studies, and provider productivity improvements.

- Demonstration project savings are estimated to range from \$10.6 - \$12.5 million annually in the first phase of implementation during 2009, up to \$20 million annually by phase 3 of implementation in 2011.
- The eventual rollout of these specific services statewide to all providers may generate between \$40 and \$52 million in annual healthcare savings.

The HealthInfoNet demonstration project savings will accrue across all healthcare stakeholders.

- Participating providers are estimated to realize between 37% and 44% of the total savings from improved productivity and avoided services provided to the uninsured. These annual savings range from \$4.6 million in phase 1, up to \$7.6 million by phase 3.

- Maine commercial payers may realize 30% - 33% of total annual savings from avoided services. The value of these annual savings range from \$3.5 million in phase 1, up to \$6.2 million by phase 3 from avoided services.
- MaineCare (Maine's Medicaid program) will accrue approximately 10% of the annual avoided service savings, from a low of \$900,000 in phase 1 up to \$1.8 million by phase 3.
- Medicare avoided service savings represent 15% - 22% of the total savings estimated, between \$1.6 million and \$4.4 million through phase 3.
- Although not assessed in this analysis, some savings will also accrue to patients for reduced co-pays and deductibles for unnecessary services as well as downstream benefits of reduced costs for plan coverage.

This analysis only estimated the avoided service and productivity savings associated with the HealthInfoNet demonstration project rollout. This analysis did not estimate other potential savings areas that may substantially increase the impact of electronic HIE in Maine. Some notable areas in which savings related to electronic HIE use have been described in the literature that may be applicable to HealthInfoNet activities include the impact of medication list and history availability on generic substitution, overall prescription drug use, and reductions in adverse drug events (ADEs); as well as reductions in overall medical errors and improvements in broad public health monitoring and prevention efforts from general health information sharing.

The savings estimates presented here cannot fully dictate the investment distribution and commitments of healthcare stakeholders. As with any new venture, there are up-front costs that will need to be borne by some stakeholders unequally. The current investments and the broad stakeholder involvement in HealthInfoNet activities to date demonstrate strong commitment that, if sustained throughout the demonstration pilot will likely materialize significant statewide healthcare savings. The estimated annual savings associated with the HealthInfoNet demonstration project make a compelling argument for ongoing investment in electronic HIE by the healthcare stakeholder community of Maine.

## About the Authors

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Mr. Alfreds has lead HIT and HIE policy analysis and evaluation projects supported by the Office of the National Coordinator for HIT, the Agency for Healthcare Research and Quality, State Medicaid Agencies, and public/private health information exchange organizations. Mr. Alfreds is currently leading an examination of public oversight, accountability, and financing models for sustainable health information exchange for the National Governors Association State Alliance for e-Health, sponsored by the National Coordinator for HIT (ONC). In addition, Mr. Alfreds serves as an advisor to a number of other ONC value and sustainability projects currently underway.

Mr. Alfreds has broad experience in applied health services research, policy analysis, and technical assistance focusing on the needs of State and Federal public sector agencies and clients. Mr. Alfreds has provided applied policy research support to state Medicaid agencies in Massachusetts, New Hampshire, and Maine through his affiliations with the University of Massachusetts Medical School and the University of Southern Maine Muskie School of Public Service.

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Recent projects include

- Oregon Health Record Bank (Medicaid Transformation Grant): project evaluation and program planning support.
- Oregon statewide benefits analysis of the widespread adoption of advanced health technologies; extensive analysis and report on Oregon 2006 EHR survey.
- Oregon and Metro Portland health information exchange planning including business plan development, cost-benefit and financing assessments, operational and governance plans.

Mr. Witter has over thirty years experience in the leadership, operations and finances of healthcare organizations. Mr. Witter spent six years at the Association of American Medical Colleges (Washington, DC) serving as Vice President of Enterprise (business) Development, Vice President of Information Resources (CIO) and Director of the Clinical - Administrative Data Service. Mr. Witter spent six years as president and CEO of the Academic Medical Center Consortium (Rochester, NY), an organization created by twelve major teaching hospital CEOs to conduct major health services research-based initiatives to improve quality and operations. Mr. Witter spent seventeen years at the Oregon Health Sciences University serving as, Interim University President, Vice President for Administration, Director of the Biomedical Information and Communication Center, University Hospital CEO, COO and CFO. Mr. Witter holds bachelor and master degrees in economics.

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## Introduction

HealthInfoNet is an independent, nonprofit organization whose mission is to create an integrated statewide clinical sharing infrastructure that will provide a secure data sharing network for both public and private healthcare stakeholders across the state of Maine. The concept of HealthInfoNet began in 2004 when the Maine Health Access Foundation (MeHAF), the Maine CDC, the Maine Quality Forum (MQF), and the Maine Health Information Center (MHIC) coordinated the Maine Health Information Network Technology (MHINT) project to study the feasibility of a statewide electronic health information exchange (HIE) network. The study found that strong support existed among multiple public and private healthcare stakeholders for such a system.

By 2005, the MHINT project organized a process for bringing together a larger group of stakeholders to explore what it would take to create an electronic HIE network in Maine. An extensive planning and development process ensued. This process resulted in the establishment of HealthInfoNet as an independent non-profit organization whose mission is to develop a statewide HIE network that will allow healthcare providers rapid access to patient-specific healthcare data at the point of care. Maximizing the effectiveness of available electronic HIE technologies from such vendors as 3M and Orion Networks, HealthInfoNet will provide the necessary tools to ensure that accurate, secure, and current clinical and administrative healthcare data is available to providers across the state. In 2009 HealthInfoNet will begin rolling out a 24-month electronic HIE demonstration project. This demonstration includes the following participating organizations:

- Central Maine HealthCare;
- Eastern Maine Healthcare Systems;
- Franklin Memorial Hospital;
- Maine Centers for Disease Control and Prevention (CDC);
- Maine General Health;
- MaineHealth; and
- Martin's Point Healthcare.

The demonstration project will include a broad data set including a subset of the Continuity of Care Record (CCR). The CCR is a patient health summary standard developed jointly by ASTM International, the Massachusetts Medical Society, the Health Information Management Systems Society (HIMSS), the American Academy of Family Physicians (AAFP), the American Academy of Pediatrics (AAP), and other health informatics vendors. The CCR standard is an electronic representation of the most relevant and timely components of a patient's medical records that need to be shared between providers to promote quality of care across settings. It contains various standardized data sets including patient demographics, insurance information, diagnosis and problem lists, medications, laboratory results, radiology reports, allergies, and care plans. These represent a "snapshot" of a patient's health data that can be useful or possibly lifesaving, if available at the time of clinical encounter.

HealthInfoNet's demonstration project will incorporate multiple data sets to provide a broad clinical information set to providers. The information that will be included in the demonstration project includes:

- Registration and encounter data:
  - Necessary information for accurate patient identification; and
  - Encounter history;
- Conditions, diagnoses, and problem lists;
- Allergies and adverse reactions;
- Prescription medications;
- Laboratory and microbiology results;
- Radiology reports; and
- Text based, dictated, and transcribed documents.

In April of 2008, the Maine State Legislature established a resolve (Chapter 198) to "Advance Maine's HealthInfoNet Program." This resolve required the Maine Quality Forum and HealthInfoNet to convene a broadly representative stakeholder group to study and make recommendations for establishing and financing a quality improvement and technology fund that would contribute to HealthInfoNet's sustainability, both in the current demonstration phase and in scaling the electronic HIE services for statewide deployment.

To support the stakeholder group, the University of Massachusetts Medical School Center for Health Policy and Research (CHPR), in collaboration with Witter & Associates, conducted an analysis of the potential state wide annual savings associated with the services currently being implemented in the HealthInfoNet demonstration project. This analysis is designed to assist the HealthInfoNet Stakeholder Study Group in developing and valuing initial and ongoing funding strategies for electronic HIE activities in the state of Maine by estimating the potential, achievable savings associated with HealthInfoNet demonstration project services. The goals of the study are to:

- Revisit potential return on investment (ROI) associated with HIE in Maine following up from the study conducted by Baker Newman & Noyes in 2004;
- Break down more recent national estimates of the impact of HIE;
- Match relevant savings estimates based on Maine data by what is:
  - Reasonable based on HIE successes to date;
  - Applicable to HealthInfoNet demonstration phase service delivery; and
  - Achievable to the stakeholders participating currently and in the future;
- Assist the HealthInfoNet Stakeholder group in understanding the potential range of financial impact of HIE; and
- Inform the business planning processes of HealthInfoNet to assure that the development work currently being conducted will lead to a sustainable business plan.

The findings of this analysis review potential annual healthcare savings opportunities resulting from the implementation of the scope of electronic HIE services proposed by HealthInfoNet during its demonstration project. Specific savings presented relate to potential avoidable services in emergency room (ER) and ambulatory care

settings, as well as productivity gains by providers who have access to the electronic HIE network. These savings were reviewed through the following parameters:

- Statewide aggregate savings associated with current HealthInfoNet rollout of services statewide;
- Savings by specific phases of the HealthInfoNet demonstration as identified by HealthInfoNet leadership; and
- Savings by healthcare payer category.

## Background

The substantial challenges and opportunities to improve the quality of healthcare in the U.S. made national headlines in 1999 and 2001 with the release of the milestone reports from the Institute of Medicine (IOM): *To Err is Human*<sup>1</sup> and *Crossing the Quality Chasm*.<sup>2</sup> These reports highlighted medical errors as a major cause of death in the United States and revealed that healthcare quality in the nation “falls short of established benchmarks based on the best available evidence.”<sup>3</sup> They concluded that a fundamental redesign of the healthcare delivery system is necessary to improve quality. One of the primary recommendations from the IOM was the creation of an information infrastructure to support evidence-based decision-making by providers, patients, and members of the healthcare delivery team.

In 2003, the Center for Studying Health System Change (CSHSC), conducted a study that assessed the extent to which a representative sample of the U.S. population received evidence-based care for a broad spectrum of conditions.<sup>4</sup> It was noted that, on average, patients received evidence based care only 50% of the time with little difference in performance between areas of acute care, preventive care, and care for chronic conditions. With only half of the American population receiving recommended medical care, and healthcare expenditures consistently rising year after year, the need for innovations in the U.S. healthcare system is clear. Health information technology (HIT) and electronic HIE have been identified as critical tools to assist in addressing these issues. Although not the panacea, there is growing evidence that these tools have the potential to greatly improve care delivery and reduce costs.

Administrative electronic healthcare systems that share claims and billing information are in use in most healthcare settings today.<sup>5</sup> The investment in administrative systems in healthcare has been directly related to their financial return. A recent study from the New England Electronic Data Interchange Network found that the

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<sup>1</sup> Institute of Medicine, (1999): *To Err is Human: Building a Safer Health System*. Washington, DC: The National Academies Press.

<sup>2</sup> Institute of Medicine, (2001): *Crossing the Quality Chasm: A New Health System for the 21st Century*. Washington, DC: The National Academies Press.

<sup>3</sup> Institute of Medicine (1999).

<sup>4</sup> Elizabeth McGlynn et al., “The Quality of Health Care Delivered to Adults in the United States,” *The New England Journal of Medicine*, 348, no. 26 (June 26, 2003): 2635-2645.

<sup>5</sup> Stires, D.: *Technology Has Transformed the VA*. May 15, 2006. Internet address: [http://money.cnn.com/magazines/fortune/fortune\\_archive/2006/05/15/8376846/](http://money.cnn.com/magazines/fortune/fortune_archive/2006/05/15/8376846/) (Accessed February 2008).

average labor and material cost of a single claim transaction submitted via paper or fax was \$5, whereas the same transaction exchanged electronically was \$0.25, representing a 95% savings from moving to electronic transactions.<sup>6</sup>

Recent studies have demonstrated that clinical HIT and electronic HIE can enhance the effectiveness of healthcare delivery by helping providers make informed decisions via access to patient specific evidenced-based guidelines for preventive and other types of care, decision support tools for chronic care, and real-time access to laboratory results, imaging studies, and other clinical information. A recent meta analysis of HIT literature revealed that increased access to information through the use of clinical HIT contributed to a statistically significant enhancement of primary and secondary preventive care measures, chronic care treatment, appropriate laboratory testing, and the use of advance directives. There was also evidence that electronic health records (EHRs) or electronic medical records (EMRs) and computerized provider order entry (CPOE), and the electronic exchange of the information contained within them, can better inform providers and reduce medical errors.<sup>7</sup> Nearly half of serious medication errors in the country have been associated with providers' lack of information on medications and patients' medical histories at the point of care.<sup>8</sup>

Despite the potential for benefit, recent surveys estimate that the current adoption and use of these technologies is low, with only 17-25% of physicians in ambulatory settings using EMRs and only 4-21% of hospitals using CPOE.<sup>9</sup> The costs of clinical HIT systems are high and are generally borne by healthcare providers. However, the return on investment for these clinical systems is gradual and does not fully accrue to providers. Since the current healthcare payment system primarily pays providers on a fee-for-service basis, providers have limited financial incentive to invest in technologies that reduce the number of services they are paid for. The gradual returns for these technologies benefit the healthcare system as a whole, but do not necessarily benefit any one party enough to offset the significant up-front investments. The underinvestment in electronic HIE throughout the healthcare system is a result of these factors as well as the fragmentation and competition in the healthcare marketplace between both providers and payers that has prevented the collaboration necessary to promote standardized health information sharing.

The increased focus on healthcare safety and quality as evidenced in recent IOM reports, combined with the need to control rising healthcare costs, and the

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<sup>6</sup> Halamka, J., Aranow, M., Ascenzo, C., Bates, D., Debor, G., Glaser, J., Goroll, A., Stowe, J., Tripathi, M., and Vineyard, G.: Health Care IT Collaboration in Massachusetts: The Experience of Creating Regional Connectivity. *Journal of American Medical Informatics Association* 12(6):596–601, Nov/Dec 2005.

<sup>7</sup> Chaudhry, B., Wang, J., Wu, S., Maglione, M., Mojica, W., Roth, E., Morton, S.C., and Shekelle, P.G.: Systematic Review: Impact of Health Information Technology on Quality, Efficiency, and Costs of Medical Care. *Annals of Internal Medicine* 144(10):742-752, May 16, 2006.

<sup>8</sup> Bates, D.W. and Gawande, A.A.: Improving Safety with Information Technology. *The New England Journal of Medicine* 348(25):2526-2534, June 19, 2003.

<sup>9</sup> Jha, A.K., Ferris, T.G., Donelan, K., DesRoches, C., Shields, A., Rosenbaum, S. Blumenthal, D. How Common are Electronic Health Records in the United States? A Summary of the Evidence. *Health Affairs*, Web Exclusives, 25, no. 6 (October 2006): pp. w496-w507.

challenges related to HIT and electronic HIE adoption, have elicited a national drive toward supporting the adoption and appropriate use of administrative and clinical HIT and electronic HIE across the healthcare continuum. There are multiple efforts at the national level to assist in and organize these efforts. The Office of the National Coordinator for HIT, since its creation in 2004, has provided significant guidance and funding to support these initiatives.<sup>10</sup> The Agency for Healthcare Research and Quality (AHRQ) has provided seed funding through multiple HIT and electronic HIE initiatives such as its Patient Safety and Health IT program. The Health Resources and Services Administration, through its Office of Health IT, has been providing technical support and seed grants for HIT and electronic HIE implementation by safety net providers and clinics. CMS has also allocated resources for HIT and electronic HIE in the Medicaid program by promoting the Medicaid Information Technology Architecture (MITA)<sup>11</sup> and in the Medicare program by providing grants for eRx, quality measurement and improvement initiatives, and physician adoption of EMRs. In addition, many healthcare entities have developed public and private collaborations to individually facilitate electronic HIE within communities and regional areas.<sup>12</sup> Electronic HIE, however, is still at a nascent stage and the return on investment for broad scale HIE projects has not been fully demonstrated, as many initiatives are still early in their implementation phases.

### **PRIOR HIE BENEFIT ANALYSES IN MAINE**

Early Maine efforts in considering electronic HIE opportunities included an analysis conducted for the Maine Health Information Center (MHIC) in 2004 by Baker, Newman, and Noyes (BNN).<sup>13</sup> This report assessed the state of health information technology (HIT) developments in Maine, the readiness and opportunity of clinical information sharing, potential savings to be realized, and made recommendations for health information technology deployment in Maine. This analysis estimated HIT savings using a model described in the Patient Safety Institute's (PSI) March 2004 White Paper: "Economic Value of a Community Clinical Information Sharing Network Part I – Value to Payers" prepared by First Consulting Group (FCG).

In 2004, very few comprehensive analyses had been published regarding the impact of and potential savings and costs associated with widespread HIT implementation. The PSI-FCG analysis estimated potential national annual savings of \$46.4 billion from advanced clinical information sharing networks. The 2004 BNN analysis

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<sup>10</sup> For more information on ONC activities see: <http://www.hhs.gov/healthit/>

<sup>11</sup> MITA is a CMS led Medicaid Management Information System (MMIS) modernization initiative. The goal of MITA is to promote an integrated Medicaid IT infrastructure that supports data exchange between state agencies, public and private payers and providers, and other stakeholders by minimizing the technical barriers to data exchange between systems and organizations. MITA provides a mechanism whereby state Medicaid agencies can use their federal matching funds for IT development and maintenance to incorporate infrastructure within the MMIS system that supports interoperability with the wider healthcare community. For more information on MITA see: [www.cms.hhs.gov/MedicaidInfoTechArch/](http://www.cms.hhs.gov/MedicaidInfoTechArch/)

<sup>12</sup> See the State-Level HIE Consensus project at [www.staterhio.org/](http://www.staterhio.org/)

<sup>13</sup> Maine Health Information Network Technology (MHINT). A Statewide Clinical Information Sharing Network Feasibility Study. Phase I Report, December 15, 2004

estimated that total annual potential savings for the statewide adoption of advanced HIT ranged from \$179 - \$248 million. Table 1 shows the breakdown of savings reported in the BNN study.

**Table 1: Potential Annual Savings for Maine from BNN 2004 Analysis**

<b>Maine Savings as Derived from National Studies</b>	<b>Low (a)<sup>14</sup></b>	<b>High (b)<sup>15</sup></b>
Avoid unnecessary inpatient hospitalizations due to missing information	\$ 130.0 M	\$ 176.8 M
Decrease preventable inpatient adverse drug reactions	\$2.0 M	\$10.3 M
Decrease outpatient visits related to preventable outpatient ADEs	\$0.1 M	\$0.1 M
Decrease outpatient visits related to missing information	\$5.75 M	\$6.5 M
Decrease unnecessary duplicative laboratory tests	\$10.1 M	\$14.1 M
Decrease unnecessary duplicative x-ray tests	\$15.4 M	\$21.4 M
Decrease redundant medications and overuse of medication	\$10.8 M	\$11.2 M
Decrease emergency department expenses	\$6.7 M	\$6.7 M
<b>Total Potential Savings</b>	<b>\$ 179.5 M</b>	<b>\$ 248.4 M</b>

BNN adjusted the gross potential Maine savings for several factors that would otherwise overestimate the savings, including alternative outpatient services that would be used if an inpatient admission were avoided, conversion of estimates based on billed patient charges to payments made by health plans or patients, and the assessment of the incremental cost impact of savings. The total amounts of these adjustments are shown in Table 2.

**Table 2: Net Maine Savings from 2004 BNN Analysis**

<b>Net Maine Savings as Derived from National Studies</b>	<b>Low (a)</b>	<b>High (b)</b>
Total Potential Savings	\$ 179.5 M	\$ 248.4 M
Less: Alternative Services – outpatient services provided in lieu of unnecessary inpatient hospitalizations (33% adjustment)	(\$42.9M)	(\$58.3M)
Subtotal	\$ 136.6 M	\$ 190.1 M
Less: Net revenue – adjustment of charges to payments (40% adjustment)	(\$52.0M)	(\$73.3M)
Subtotal	\$ 84.6 M	\$ 116.8 M
Less: Incremental Cost – adjustment for incremental cost reduction impact to providers (50% adjustment)	(\$42.3M)	(\$58.4M)
<b>Net Potential Savings</b>	<b>\$ 42.3 M</b>	<b>\$ 58.4 M</b>

After these adjustments, the net Maine savings by component are shown in Table 3.

<sup>14</sup> The low figures represent values with patient-specific clinical data available.

<sup>15</sup> The high figures include the addition of clinical decision support (CDS).

**Table 3: Net Maine Savings by Component from 2004 BNN Analysis**

<b>Net Maine Savings by Component</b>	<b>Low (a)</b>	<b>High (b)</b>
Avoid unnecessary inpatient hospitalizations due to missing information	\$ 17.6 M	\$ 22.60 M
Decrease preventable inpatient adverse drug reactions	\$1.0 M	\$5.2 M
Decrease outpatient visits related to preventable outpatient ADEs	\$0.03 M	\$0.1 M
Decrease outpatient visits related to missing information	\$2.9 M	\$3.3 M
Decrease unnecessary duplicative laboratory tests	\$5.1 M	\$7.7 M
Decrease unnecessary duplicative x-ray tests	\$7.0 M	\$10.7 M
Decrease redundant medications and overuse of medication	\$5.4 M	\$5.6 M
Decrease emergency department expenses	\$3.4 M	\$3.4 M
<b>Total Potential Savings</b>	<b>\$ 42.3 M</b>	<b>\$ 58.4 M</b>

BNN in their analysis used the PSI-FCG valuation model, which was considered the best available approach at the time to estimate potential HIT savings for Maine. The PSI-FCG model itself relied on a limited number of studies and parameters. The PSI-FCG and BNN methodology have subsequently been used by Colorado in estimating potential HIT savings. Oregon and others have used the PSI-FCG analyses in developing their saving estimates.<sup>16</sup> However, the individual savings component estimates include a mix of HIT functionalities including EMR adoption, CPOE, clinical decision support, and information exchange, but did not estimate the components of savings specifically related to HIE functions or consider the differential impacts of primary payer categories.

Since 2004, a number of additional studies have been completed that assess the potential savings and benefits of various HIT systems. In May 2004, the Center for Information Technology Leadership (CITL) released an analysis on “The Value of Healthcare Information Exchange and Interoperability” that estimates potential national annual savings of \$90 billion with the adoption of the most advanced levels of electronic HIE and interoperability (HIE&I) functionality. In 2005, RAND completed a series of studies on HIT adoption, potential annual savings, and adoption phasing, with a national estimate of HIT enabled annual efficiency savings of \$77 billion. Summaries of the CITL HIE&I and the RAND studies were published in the journal Health Affairs in 2005. These two efforts added substantially to the methodologies, scope of literature, and data documented on the financial impact of electronic HIE.

A number of communities and states have also developed estimates of potential savings and costs for electronic HIE functions based on related methodologies and approaches. In Oregon, estimates of the statewide impact on health expenditures from the widespread adoption of HIT and specific savings estimates for electronic HIE have been used to prioritize options for statewide HIT and electronic HIE development and inform business planning processes. The Oregon studies

<sup>16</sup> Metropolitan Portland Health Information Exchange Business Plan 2.0 (May 2007) prepared for the Oregon Business Council by the Oregon Healthcare Quality Corporation, available at <http://www.q-corp.org/q-corp/images/public/pdfs/MPHIE%20BizPlan2%20053007.pdf>.

developed a standardized approach that could be applied for multiple purposes and HIT/HIE functionalities.<sup>17,18</sup>

The goal of this study is to use the standardized approach developed in Oregon to specifically assess potential annual healthcare expenditure savings related to the electronic HIE services proposed by HealthInfoNet during their demonstration project and its phased implementation.

## Methods for 2008 HealthInfoNet Savings Analysis

This analysis, conducted in the fall of 2008, targets savings from avoided services and physician productivity directly related to the specific electronic HIE functions planned for HealthInfoNet during its demonstration project. In addition, it estimates the impacts of those savings by phase (1, 2, & 3) of implementation across healthcare payer categories. This analysis estimates savings for the following components:

- Outpatient – Ambulatory Care Settings:
  - Avoidable laboratory testing caused by missing information;
  - Avoidable imaging studies caused by missing information;
  - Avoidable visits caused by missing information;
  - Physician/staff productivity loss looking for missing information; and
  - Physician productivity impact for repeated work for history taking and medication reconciliation.
- Emergency Room Settings:
  - Avoidable emergency room costs for outpatient ER visits;
  - Avoidable emergency room costs related to inpatient admissions;
  - Avoidable admissions through the emergency room caused by missing information;
  - Avoidable ER laboratory testing caused by missing information;
  - Avoidable ER imaging studies caused by missing information;
  - Physician/staff productivity loss looking for missing information; and
  - Physician productivity impact for repeated work for history taking and medication reconciliation.

While this analysis uses many of the same functional areas as the original BNN study conducted in 2004, the current analysis incorporates a number of refinements including:

- The latest modeling methods based on recent national and regional studies (discussed below);
- The latest available data:
  - Maine population coverage by payer category;
  - Healthcare claim payment and service utilization rates from most recent available studies and local data sources; and

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<sup>17</sup>. Ibid..

<sup>18</sup> Witter DM, Ricciardi T. Potential Impact of Widespread Adoption of Advanced Health Information Technologies on Oregon Health Expenditures. Prepared for the Oregon Health Care Quality Corporation and the Office of Oregon Health Policy and Research. September 2007.

- Hospital discharges, visits, and ER rates.
- Estimation of savings using multiple approaches applied with a standardized method and updated to 2008 dollars;
- Estimation of savings by primary payer/sponsor categories;
- Recognition of savings already being achieved by existing levels of HIT adoption and maximum achievable benefits:
  - Assuming that 30% of potential savings proposed by the national estimates are already being accrued as a result of current information sharing practices in participating Maine healthcare organizations (floor);
  - Assuming that only up to 80% of the savings could be captured due to the inability to involve all providers in the HIE efforts and health system issues preventing the realization of additional savings (ceiling).
- Estimation of savings associated with the specific services that will be provided by HealthInfoNet during its demonstration project including:
  - Savings developed by demonstration project estimated provider participation and ER visit capture rate in three phases:
    - Phase 1 (2009): Estimate of 15% of Maine ambulatory providers and 50% of Maine ER visits.
    - Phase 2 (2010): Estimate of 20% of Maine ambulatory providers and 60% of Maine ER visits; and
    - Phase 3 (2011): Estimate of 30% of Maine ambulatory providers and 70% of Maine ER visits.
  - Savings developed for state wide-rollout of demonstration services (to all ambulatory providers and encompassing all ER visits)

**SUMMARY OF DATA USED TO CALCULATE POTENTIAL HIE SAVINGS**

In order to accurately reflect aggregate savings associated with avoidable services and productivity increases resulting from electronic HIE in Maine, it was critical to have an accurate population estimate for the state. Table 4 presents the estimated 2008 Maine population by age and primary healthcare payer source.

**Table 4: Maine 2008 Population Estimate by Age and Primary Payer Source**

<b>Maine 2008 Population Estimate by Age and Primary Payer Source</b>					
<b>Age</b>	<b>Commercial</b>	<b>Medicare</b>	<b>Medicaid</b>	<b>Uninsured</b>	<b>Total</b>
<b>0-17</b>	159,827	-	87,905	18,647	266,379
<b>18-64</b>	604,455	43,801	113,883	113,883	876,022
<b>65+</b>	4,283	196,826	1,836	1,020	203,965
<b>Total</b>	768,565	240,627	203,624	133,550	1,346,366
<b>(%)</b>	(57%)	(18%)	(15%)	(10%)	(100%)

Note: Commercial payers include Anthem BCBS, Aetna, Harvard Pilgrim, CHAMPUS/TriCare and other categories.

This estimate is based on a number of sources including the U.S. Census Current Population Survey for 2007, Urban Institute data on 2004-5 Maine insurance coverage, Kaiser Family Foundation data for 2005-6, MaineCare eligibility data from 2004 – 2007, MHIC commercial eligibility data for 2006-7, and MHIC Medicare data

for 2003-4.<sup>19</sup> Each of these sources uses different time frames, eligibility/inclusion criteria, and counting methodologies. The population figures presented here therefore, represent the ‘best’ synthesized estimate based on the information available in the fall of 2008. Criteria used to estimate the current Maine population include:

- Population estimates are point in time estimates to reduce the potential for overestimation for the primary type of health plan coverage;
- Under 18: Medicare is assumed to be zero. Some data source report a few cases but this is deemed to be insignificant;
- 65 & Over, Medicaid: Medicare-Medicaid dual eligible individuals were treated as Medicare for services related to the modeling. Medicaid individuals reported as 65 & over include persons waiting for Medicare eligibility due to enrollment lag, varying eligibility requirements, and persons without citizenship; and
- 65 & Over, Other: Many analyses assume all 65 & over individuals are covered by Medicare. There is a small portion of 65 & over individuals that are not eligible for Medicare and are uninsured or have employer-based or individual coverage.

Data for Maine-based healthcare payment and utilization rates were used in this analysis in order to specifically assess the impact of electronic HIE on Maine healthcare expenditures. Commercial payment rate and utilization data were obtained from the Maine Health Information Center (MHIC) commercial and Medicare claims data. Payment rates were adjusted for inflation to 2008 dollars. Medicare and Medicaid standard payment rates were also obtained from public data sources. Some notable assumptions used in the inclusion of specific payment and utilization rate estimates for this analysis include:

- Medicare payment rates were assumed to be approximately equal to cost;
- Average payment rates for laboratory tests and imaging studies are derived from MHIC commercial claims data;
- Uninsured payment rates were assumed to be the equivalent to cost and provider organizations are the primary financing source;
- Uninsured use rates were derived as a percentage of commercial use rates based on a published estimates from the Urban Institute<sup>20</sup>; and
- Commercial payment rates from 2006-7 MHIC claims data were adjusted to 2008 dollars by an annualized rate of 3.33%. Medicare payment rates from 2003-4 MHIC claims data were adjusted to 2008 by an annualized rate of 2.22%. Each of these adjustments was considered to be conservative to prevent over-estimation of savings and was in line with national estimates.

Table 5 shows the 2008 payment rates used in this analysis.

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<sup>19</sup> References to these sources can be found in the Bibliography section of this report.

<sup>20</sup> Hadley, J, Holahan J, Coughlin T, Miller D, Covering the uninsured in 2008: Current Costs, Sources of Payment, and Incremental Costs. Health Affairs, June 2008. 25:5w399.

**Table 5: Maine 2008 Healthcare Service Payment Rate Estimates**

<b>Maine 2008 Payment Rate Estimates (Based on 2008 Dollars)</b>				
	<b>Commercial</b>	<b>Medicaid</b>	<b>Medicare</b>	<b>Uninsured</b>
<b>PCP visits</b>	\$100	\$42	\$78	\$78
<b>Specialty visits</b>	\$115	\$45	\$82	\$82
<b>ER visits</b>	\$400	\$40	\$180	\$180
<b>Laboratory tests</b>	\$70	\$13	\$25	\$25
<b>Standard imaging</b>	\$190	\$58	\$110	\$110
<b>Advanced imaging</b>	\$1000	\$240	\$460	\$460
<b>Combined standard &amp; advance imaging</b>	\$375	\$100	\$184	\$184

Maine hospital inpatient discharges, outpatient visits, and emergency room encounters were obtained from the Maine Health Data Organization (MHDO) for CY 2006. These data can be found in Table 6.

**Table 6: Maine Hospital Inpatient Discharges, Outpatient Visits and ER Encounters: CY2006**

<b>Maine Hospital Inpatient Discharges, Outpatient Visits and ER Encounters: CY2006</b>					
	<b>Total</b>	<b>Commercial</b>	<b>Medicare</b>	<b>Medicaid</b>	<b>Uninsured</b>
<b>Inpatient Discharges</b>	163,705	52,279	73,004	31,398	7,024
<b>Discharges with an ER service</b>	67,443	17,209	38,189	8,949	3,096
<b>Outpatient ER Visits</b>	666,745	242,074	137,358	206,063	81,250
<b>Total ER Encounters</b>	734,188	259,283	175,547	215,012	84,346
<b>Outpatient Visits</b>	4,731,136	1,965,052	1,567,774	922,751	275,559

Source: Inpatient-MHDO Maine Hospital IP records, Outpatient-MHDO Maine Hospital OP records, CY 2006.

**SUMMARY OF SAVINGS STUDIES APPLIED IN THIS ANALYSIS**

The projected annual savings developed in this analysis represent a synthesis of selected savings estimates from various national and regional studies. This section describes the savings estimates from the studies reviewed, and identifies the components used to develop the 2008 Maine electronic HIE annual savings estimates.

A number of models have been published for estimating the benefits of various health information technologies and electronic HIE services. For the most part, these studies have focused on estimating aggregate benefits and savings for the U.S. as a whole or in specific provider settings. Four major studies were used to estimate savings related to the services being implemented by HealthInfoNet during its demonstration project. These studies include analysis and research conducted by the Center for Information Technology Leadership (CITL), the RAND Corporation, Mark Overhage et.al. from two hospital emergency rooms in Indiana (Community Hospital East, and Wishard Memorial Health Services), and Peter Smith et.al. from 32 primary

care clinics in the state of Colorado. Each of these studies is described in detail below.

Savings estimates from the use of electronic HIE components vary among these studies for several reasons including:

- Scope of technologies projected for adoption;
- The relationship between HIT tools and HIE efforts;
- Types of savings estimated; and
- Availability of data to make savings estimates.

To address these issues, the studies modeled for this analysis, were included based on their delineation of savings from the specific HIE services being implemented by HealthInfoNet. Project principles estimated the potential savings associated with the specific electronic HIE services when quantitative information for the model was not available from the published study source. These estimates were developed through interviews with study principles, healthcare providers in Oregon, and HealthInfoNet staff. The final savings estimates presented in the findings section of this paper were selected with an effort to avoid double counting of any functional type of savings. Where a particular type of saving was estimated in multiple studies, a range of potential savings is presented.

### **Center for Information Technology Leadership<sup>21</sup>**

The Center for Information Technology Leadership (CITL) was formed in 2002 by Boston-based Partners HealthCare System as a research organization to help guide the healthcare community in making more informed strategic IT investment decisions. Ambulatory Computerized Provider Order Entry (ACPOE) was the first research topic undertaken by CITL. The goal was to determine the value of ACPOE systems in improving quality and reducing costs.

In 2004, CITL examined the potential value of health information exchange and interoperability (HIE&I) in follow up to its 2003 ACPOE valuation study. The HIE&I study examined the financial benefits and costs of HIE&I of health information. Data was gathered through literature review, expert interviews, and software modeling. CITL created four categories for staging the level of electronic information exchange and information interoperability. The four levels specified are:

- Level 1 – Today’s prevailing phone and mail communications;
- Level 2 – Machine-transportable data (standard fax);
- Level 3 – Machine-organizable data (e-mail and electronic messaging);
- Level 4 – Machine-interpretable data (interoperable data exchange with standardized message formats and content).

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<sup>21</sup> The CITL published reports that formed the basis of this analysis include: Walker J, Pan E, Johnson D, Adler-Milstein J, Bates DW, Middleton B. The Value of Health Care Information Exchange and Interoperability. Health Affairs. January 2005: W5:10-18.  
Pan E, Johnston D, Walker J, Adler-Milstein J, Bates DW, Middleton B, The value of healthcare information exchange and interoperability. Center for Information Technology Leadership (HIMSS) report 2004.

The study considered the benefits of information flow and interoperability between particular providers and other stakeholders including:

- Outpatient providers and independent laboratories;
- Outpatient providers and radiology centers;
- Outpatient providers and pharmacies;
- Providers and public health departments; and
- Providers and payers.

The 2008 Maine savings analysis uses the Level 4 capabilities in assessing the potential savings that could ultimately be achieved with statewide electronic HIE in the state. Due to the scope of the HealthInfoNet demonstration phase, only savings associated with avoidable laboratory testing and imaging services are included in this analysis.

Avoidable laboratory testing and imaging services under the HEI&I analyses not only include results from the benefits of ACPOE but also enhanced access to prior test results through health information exchange services. For this analysis we estimated 40% of the potential annual savings to be associated with electronic HIE, 20% of the savings associate with Electronic Medical Record (EMR) use, 20% of the savings associated with ACPOE, and 20% of the savings associated with the Clinical Decision Support System (CDSS). See Table A1 in the appendix for the calculated total savings and per member per year (pmpy) savings by Maine payer category based on the CITL methodology.

### **RAND HIT Project<sup>22</sup>**

In 2003 and 2004, the RAND Health Information Technology (HIT) Project team conducted a study to better understand the role and importance of HIT in improving healthcare and inform government actions that could maximize the benefits of HIT use. RAND's analyses and publications use the terms "Health Information Technology" (HIT) and "Electronic Medical Record Systems" (EMR-S) interchangeably. RAND uses EMR to describe a comprehensive cluster of functionalities including:

- The Electronic Medical Record (EMR) containing current and historical patient information;
- Clinical Decision Support (CDS) functions providing reminders and best-practice guidance for treatment;
- A Clinical Data Repository (CDR) which stores EMR information; and
- Computerized Physician Order Entry (CPOE) functionality facilitating orders tied to patient-information and -treatment pathways.

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<sup>22</sup> The findings of RAND HIT Project are reported in a series of publications. This analysis is primarily based on: Richard Hillestad, James Bigelow, Anthony Bower, Federico Girosi, Robin Meili, Richard Scoville, and Roger Taylor, "Can Electronic Medical Record Systems Transform Healthcare? Potential Health Benefits, Savings, and Costs," *Health Affairs*, Vol. 24, No. 5, September 14, 2005. Federico Girosi, Robin Meili, and Richard Scoville, *Extrapolating Evidence of Health Information Technology Savings and Costs*, Santa Monica, Calif.: RAND Corporation, MG-410-HLTH, 2005.

RAND conducted an extensive literature review, expert panel interviews, and computer modeling to develop their savings estimates. The estimates developed by RAND look broadly at a number of services. For the Maine analysis, only the savings associated with avoidable outpatient laboratory testing and imaging studies were included. RAND describes laboratory savings from EMR-S equipped with CPOE functions, clinical decision support (CDS), and interoperability with other providers. These technologies together can avoid unnecessary tests by improving physician access to test results ordered by other providers and alerting physicians to new test orders that may be superfluous. Avoidable radiology and imaging services are described as occurring with increased access to prior study results and improved communication between ordering physicians and radiologists, minimizing repeat or inappropriate studies.

As with the CITL study, it was estimated that 40% of the potential annual savings are associated with electronic HIE, 20% of the savings are associated with EMR use, 20% of the savings are associated with CPOE, and 20% of the savings are associated with the CDS. See Table A2 in the appendix for the calculated total savings and pmpy savings by Maine payer category based on the RAND methodology.

### **Overhage ER Savings Analysis<sup>23</sup>**

In 2002, researchers from the Indiana University School of Medicine and the Regenstrief Institute for Health Care published a randomized controlled study of information sharing between a large urban hospital and two hospital emergency departments. This study specifically looked at the impact of information sharing from one large urban hospital computer-based patient record (via printed abstract and online access) to two hospital-based emergency departments (ED) located in the same urban area with a demonstrated history of crossover in patient care. At each of the ED locations, physicians rarely used limited online access to institutional data prior to this study.

By providing ED clinicians access to patient information from the electronic medical record, the study found that patient charges for ED care were decreased by an average of \$26 per encounter, \$13 per encounter for discharged patients and \$123 per encounter for admitted patients. These reductions were based on mean charges.

To apply these savings to the state of Maine and the HealthInfoNet demonstration project, the charges were inflated to 2008 dollars based on an average inflation rate of 5%. In addition, charges were adjusted to commercial payment rates and Medicare costs. See Table A3 in the appendix for the calculated total savings and pmpy savings by Maine payer category based on the Overhage methodology.

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<sup>23</sup> Overhage JM, Dexter PR, Perkins SM, Cordell WH, McGoff J, McGraff R, McDonald CJ. A randomized controlled trial of clinical information shared from another institution. *Ann Emerg Med*. January 2002; 39:14-23.

## Missing Information Savings Analysis (Smith et.al.)<sup>24</sup>

Quantitative data regarding the impact of missing information on the practice of medicine was obtained from a study conducted by Peter Smith et.al., based on a Colorado practice-based research network, including 32 primary care clinics and 253 clinicians participating in the Applied Strategies for Improving Patient Safety medical error reporting study.

Smith reported that 13.6% of primary care visits had missing information. The consequences of missing clinical information included:

- Delays in care: 25.5% of missing information visits;
- Additional laboratory tests: 22.3% of missing information visits;
- Additional visits: 20.9% of missing information visits;
- Additional imaging studies: 10.9% of missing information visits.

Beyond delays in care and additional services that resulted in missing information at the point of care, clinicians documented productivity losses from not having necessary information at the point of care. These productivity losses included additional time spent by physicians and support staff looking for the missing information, communicating it on the telephone with hospitals, specialists, pharmacies, and each other, as well as additional time spent reconciling divergent information.

This information was sufficient for the development of estimates of avoidable ambulatory visits, laboratory tests, imaging studies, inpatient admissions, and productivity loss in Maine ambulatory care practices and emergency rooms (ERs). Inefficiencies in ambulatory practices from missing information were developed based on time spent unsuccessfully looking for missing information and the additional time physicians spent repeating the collection of the patient's history and medications lists that should have been available. Parameters used to assess the potential savings associated with missing information related to electronic HIE in Maine include:

- Maine specific payment rates inflation adjusted to 2008;
- Adjusted missing information rates for specialty and emergency room services based on interviews and research staff input:
  - Specialty visits were assumed to have 60% of the missing information rates as compared to primary care; and
  - 70% of patients receiving services in the ER have prior medical history data somewhere and 90% of this information is not immediately available in the ER.
- Productivity savings based on \$150/hr for physician and \$40/hr for office staff.

See Tables A4 and A5 in the appendix for the calculated total savings and per pmpy savings by Maine payer category based on the Smith methodology.

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<sup>24</sup> Smith PC, Araya-Guerra R, Bublitz C, Parnes B, Dickinson LM, Van Vorst R, Westfall JM, Pace WD, Missing clinical information during primary care visits. JAMA 293(5): 565-571, February 2, 2005.

## **RANGE OF MODELING ESTIMATES**

Due to the differences in the methods and the organization of specific savings across the studies reviewed and modeled in this analysis, there are multiple overlapping categories of services that are included in the final savings estimates. To avoid double counting of savings associated with electronic HIE services in Maine, the savings figures in the findings section are presented in a range with the specific savings categories identified by study to help reviewers and healthcare stakeholders understand the source of the savings identified.

Categories of savings were chosen for inclusion in the final Maine estimates based on the specificity of the underlying supporting data and their applicability to the HealthInfoNet demonstration services. The savings estimates presented also assume that 30% of the estimated savings are already being accrued to providers, payers, and purchasers due to existing information sharing capacities (floor). In addition, it was assumed that only 80% of the potential savings could be achieved, in order to address the fact that some healthcare stakeholders will not adopt electronic HIE technologies due to environmental (economic and non-economic) conditions (ceiling).

The savings estimates presented below are grouped by avoided services and productivity savings. The avoided services savings most immediately benefit the payers of those services. Payers include patients, health plans (commercial plans, self-insured employer plans, Medicare, and Medicaid) as well as providers who function as the payers for uncompensated care rendered to the uninsured and under-insured. The productivity savings most immediately benefit the providers and practice sites. Eventually all these savings should translate into lower healthcare expenditures for the community as a whole. Over time, efficiency and productivity savings dampen and/or delay the need for price increases in the fees charged to patients.

## **Findings**

### **HEALTHINFONET DEMONSTRATION PHASE SAVINGS**

In 2008 and 2009, HealthInfoNet will be implementing the first phase of their demonstration project. This initial rollout of the core set of services is targeted for four Maine-based integrated delivery networks (IDNs): MaineHealth, Eastern Maine Healthcare, Central Maine HealthCare, and Maine General. The participating hospitals within these IDNs will encompass approximately 15% of the ambulatory care provision and 50% of ER visits across the state. Future phases of HealthInfoNet rollout will be targeted at increasing provider participation in the demonstration.

- Phase 2 (2010): Estimate of 20% of Maine ambulatory providers and 60% of Maine ER visits.
- Phase 3 (2011): Estimate of 30% of Maine ambulatory providers and 70% of Maine ER visits.

Savings estimates for the three phases of the demonstration project were developed to assist HealthInfoNet and the Stakeholder group in assessing the potential impact of the demonstration services and to develop a business planning process for

sustaining the operations and maintenance of the HealthInfoNet electronic HIE efforts in the future. Table 7 presents the aggregate savings associated with each phase of the HealthInfoNet demonstration project.<sup>25</sup>

**Table 7: Low and High Estimates of Total Annual Savings Associated with HealthInfoNet Phases 1-3**

Estimated Total Annual Savings for HIN Phases	HIN Demonstration Phase 1 (2009) Savings		HIN Demonstration Phase 2 (2010) Savings		HIN Demonstration Phase 3 (2011) Savings	
	Low	High	Low	High	Low	High
<b>Avoided Services</b>						
Avoided Services in Ambulatory Care	\$2.6 M	\$2.6 M	\$3.5 M	\$3.5 M	\$5.2 M	\$5.2 M
Avoided Services in Emergency Room	\$3.7 M	\$0.3 M (admits)	\$4.5 M	\$0.4 M (Admits)	\$5.2 M	\$0.5 M (Admits)
Reduced ER Costs – Inpatient		\$2.5 M		\$3.0 M		\$3.5 M
Reduced ER Costs – Outpatient		\$2.8 M		\$3.4 M		\$3.9 M
<b>Annual Avoided Service Savings</b>	<b>\$6.3 M</b>	<b>\$8.3 M</b>	<b>\$8.0 M</b>	<b>\$10.3 M</b>	<b>\$10.5 M</b>	<b>\$13.2 M</b>
<b>PRODUCTIVITY</b>						
Ambulatory Care Productivity Savings	\$1.5 M	\$1.5 M	\$2.0 M	\$2.0 M	\$3.1 M	\$3.1 M
ER Productivity Savings	\$2.7 M	\$2.7 M	\$3.2 M	\$3.2 M	\$3.8 M	\$3.8 M
<b>Annual Productivity Savings</b>	<b>\$4.2 M</b>	<b>\$4.2 M</b>	<b>\$5.2 M</b>	<b>\$5.2 M</b>	<b>\$6.8 M</b>	<b>\$6.8 M</b>
<b>Total Estimated Annual Savings</b>	<b>\$10.6 M</b>	<b>\$12.5 M</b>	<b>\$13.2 M</b>	<b>\$15.6 M</b>	<b>\$17.2 M</b>	<b>\$20.0 M</b>

It is estimated that the HealthInfoNet demonstration project will save between \$10.6 and \$12.5 million during the first phase of the project rollout in 2009, with these savings projected to increase to between \$17 and \$20 million by 2011. As discussed above, the savings presented here were reduced by the floor and ceiling assumptions relating to the current level of HIE occurring and a conservative estimate of the maximum level of HIE diffusion.

To date, few empirical studies have attempted to articulate the distribution of HIE benefits among provider, payers, and purchasers of healthcare. The reasons include the nascent stage of electronic HIE implementations, limited availability of necessary data, and variations in the size, services, and technological operations of electronic HIE organizations. In addition, many HIE organizations have limited capacity for formal evaluations and have been challenged to identify evaluation measures that

<sup>25</sup> CITL and RAND, in their valuation models, did not delineate between outpatient laboratory and imaging services occurring in the ER or ambulatory settings. As a result CITL and RAND estimates were not used in the calculation of estimated savings for the HealthInfoNet demonstration project phases. The CITL and RAND estimates models were used to assess the aggregate savings state wide, resulting in higher relative savings than the Overhage and Smith models. Therefore the estimates presented in Tables 8 and 9 do not take into account the full range of possible savings and may under represent the breadth of potential savings documented by CITL and RAND.

can be consistently applied across the varied HIE implementations and stakeholders.<sup>26</sup> Due to the focus on the impact of missing information in the healthcare practice site, the Smith study allowed for the estimation of savings that impact providers and the organizations that employ them, while each of the CITL, RAND, and Overhage studies allowed for the estimation of avoidable services whose savings primarily accrue to healthcare payers.

Based on the data available at the time of this analysis, it is estimated that between 33% and 40% of the demonstration project savings, ranging from \$4.2 million in phase 1 to \$6.8 million by phase 3 will accrue to providers and provider organizations. These productivity savings include the time not spent collecting information from other sources, reconciling divergent information, and recreating existing patient history and medication lists. Providers, safety net clinics, and hospitals may also realize an additional 4% of avoided services savings associated with uncompensated care delivered to uninsured and underinsured patients. Due to data limitations for this study, these productivity savings could not be broken down into detailed savings for specific provider organizations.

**SAVINGS BY PAYER CATEGORY**

The healthcare payment, utilization, and population data available for this analysis allowed for the estimation of HealthInfoNet demonstration project savings by payer category. In 2008, 57% of the population was covered by some form of commercial insurance, 15% of the population was covered by Medicaid, 18% of the population was covered by Medicare, and approximately 10% of the population was uninsured. Savings from avoided services resulting from electronic HIE accrue to these populations based on their relative rates of service utilization and payment rates.

Appendix A includes detailed tables showing savings by each of the studies modeled, the aggregate savings for the state, and the specific savings associated with HealthInfoNet demonstration phases by payer category. Table 8 shows the estimated savings by payer category (Commercial, Medicaid, Medicare, and Uninsured) and phase (year) of the demonstration project.

**Table 8: Maine Estimated Annual Avoided Service Savings for the Three Phases of the HealthInfoNet Pilot Project by Payer Category**

Maine Estimated Annual Avoided Service Savings for HIN Phases by Payer Category	HIN Demonstration Phase 1 (2009) Savings by Payer		HIN Demonstration Phase 2 (2010) Savings by Payer		HIN Demonstration Phase 3 (2011) Savings by Payer	
	Low	High	Low	High	Low	High
Ambulatory Care	\$1.6 M	\$1.6 M	\$2.1 M	\$2.1 M	\$3.1 M	\$3.1 M
ER Savings	\$1.9 M	\$2.2 M	\$2.3 M	\$2.7 M	\$2.7 M	\$3.1 M
<b>Commercial Sub-Total</b>	<b>\$3.5 M</b>	<b>\$3.8 M</b>	<b>\$4.4 M</b>	<b>\$4.7 M</b>	<b>\$5.8 M</b>	<b>\$6.2 M</b>

<sup>26</sup> American Health Information Management Association (AHIMA). State-Level HIE Value and Sustainability Workbook: Approaches for Financing and Bringing Interoperable HIE to Scale. November, 2008. (to be released 11/18/2008)

<b>Medicaid</b>						
Ambulatory Care	\$0.2 M	\$0.2 M	\$0.2 M	\$0.2 M	\$0.3 M	\$0.3 M
ER Savings	\$0.7 M	\$1.1 M	\$0.9 M	\$1.3 M	\$1.0 M	\$1.5 M
<b>Medicaid Sub-Total</b>	<b>\$0.9 M</b>	<b>\$1.3 M</b>	<b>\$1.1 M</b>	<b>\$1.5 M</b>	<b>\$1.4 M</b>	<b>\$1.8 M</b>
<b>Medicare</b>						
Ambulatory Care	\$0.8 M	\$0.8 M	\$1.1 M	\$1.1 M	\$1.6 M	\$1.6 M
ER Savings	\$0.8 M	\$2.0 M	\$0.9 M	\$2.3 M	\$1.1 M	\$2.7 M
<b>Medicare Sub-Total</b>	<b>\$1.6 M</b>	<b>\$2.8 M</b>	<b>\$2.0 M</b>	<b>\$3.4 M</b>	<b>\$2.7 M</b>	<b>\$4.4 M</b>
<b>Uninsured</b>						
Ambulatory Care	\$0.1 M	\$0.1 M	\$0.1 M	\$0.1 M	\$0.2 M	\$0.2 M
ER Savings	\$0.3 M	\$0.4 M	\$0.3 M	\$0.5 M	\$0.4 M	\$0.6 M
<b>Uninsured Sub-Total</b>	<b>\$0.4 M</b>	<b>\$0.5 M</b>	<b>\$0.4 M</b>	<b>\$0.6 M</b>	<b>\$0.6 M</b>	<b>\$0.8 M</b>
<b>Total Estimated Annual Savings</b>	<b>\$6.3 M</b>	<b>\$8.3 M</b>	<b>\$8.0 M</b>	<b>\$10.3 M</b>	<b>\$10.5 M</b>	<b>\$13.2 M</b>

Maine commercial payers will likely realize the highest annual savings associated with avoidable services, ranging from \$3.5 million in phase 1, up to \$6.2 million annually by phase 3. Medicare savings will range from \$1.6 - \$4.4 million between phases 1 and 3. MaineCare (Maine's Medicaid program) will accrue approximately 10% of the annual savings from avoided services, from a low of \$900,000 in phase 1, up to \$1.8 million by phase 3.

Savings for avoided services in ambulatory care and the ER settings in Maine broadly accrue based on the population distribution among payer categories and result in reduced payments for these services by the respective health plans. As a result, the percentage of savings that accrues to each payer category remains relatively unchanged as the demonstration project increases its reach to additional providers. The distribution of avoided service and the total savings estimates, including the productivity estimates by payer category, is presented in Table 9. Since healthcare providers absorb the costs of uncompensated care rendered to the uninsured, providers are included as a payer category in Table 9.

**Table 9: Estimated Percentage Distribution of Savings for the HealthInfoNet Demonstration Project by Category**

<b>Payer Category</b>	<b>Percentage of Avoidable Service Savings by Category</b>	<b>Percentage of Total Savings (includes productivity savings)</b>
<b>Commercial Payers</b>	<b>45% - 55%</b>	<b>30% - 33%</b>
<b>Medicaid</b>	<b>14% - 16%</b>	<b>9% - 10%</b>
<b>Medicare</b>	<b>25% - 34%</b>	<b>15% - 22%</b>
<b>Providers</b>	<b>6% (Uncompensated care)</b>	<b>37% - 44% (Uncompensated + productivity)</b>

It should be noted that the savings accrued by the healthcare system as a result of electronic HIE will impact the aggregate costs of healthcare services. As providers are more productive and can see more patients in any given time, the fee for service and capitation rates for these services will eventually be reduced accordingly. Both

the payers and the purchasers of healthcare in the state will then realize this reduction. The time frame for the realization of benefit across healthcare stakeholders as a result of electronic HIE is not possible to estimate at this time due to the limited examples of electronic HIE evaluations available at this time.

**STATEWIDE SAVINGS**

The statewide rollout of the services planned for implementation in the HealthInfoNet demonstration project range between \$40.5 million and \$52.8 million.<sup>27</sup> These savings include the costs related to avoided laboratory and imaging services in the ambulatory and emergency room settings, ambulatory visits, and hospital admissions from the emergency room. \$15.5 million (>33%) of the total statewide savings are associated with productivity benefits for clinical staff. Table 10 shows the break down of the total savings by category.

**Table 10: Range of Potential Annual Savings Associated with HealthInfoNet Demonstration Services Rolled out to All Providers State Wide**

<b>Estimated Statewide HIE Savings for Maine: HealthInfoNet Demonstration Project Service Mix</b>		<b>Maine Total</b>		
<b>SMITH: Avoided Services Ambulatory Care Settings</b>	<b>Low</b>	<b>Med</b>	<b>High</b>	
Avoidable Visits Caused by Missing Information	\$4.0 M	\$4.0 M	\$4.0 M	
Avoidable Laboratory Tests due to Missing Information	\$3.4 M	\$3.4 M		
Avoidable Imaging Studies due to Missing Information	\$10.0 M	\$10.0 M		
<b>SMITH: Avoided Emergency Room Related Services</b>				
Avoidable Admissions Caused by Missing Information	\$0.7 M	\$0.7 M	\$0.7 M	
Avoidable Laboratory Tests due to Missing Information	\$1.7 M			
Avoidable Imaging Studies due to Missing Information	\$5.1 M			
<b>CITL</b>				
Savings from Avoidable Outpatient Imaging Studies			\$18.1 M	
<b>RAND</b>				
Savings from Avoidable Outpatient Laboratory Tests			\$14.3 M	
<b>OVERHAGE</b>				
Reduced Emergency Room Costs - Visits Leading to Inpatient Admissions		\$5.1 M		
Reduced Emergency Room Costs - Outpatient Visits		\$5.6 M		
<b>Total Estimated Avoided Services Savings</b>	<b>\$24.9 M</b>	<b>\$28.9 M</b>	<b>\$37.2 M</b>	
<b>PRODUCTIVITY SAVINGS (SMITH)</b>				
<b>Productivity Improvements in Ambulatory Care</b>				
Physician/Staff Productivity Loss Looking for Information	\$2.9 M	\$2.9 M	\$2.9 M	
Physician Productivity Impact - Repeated Work	\$7.3 M	\$7.3 M	\$7.3 M	
<b>Productivity Improvements in Emergency Room</b>				
Physician/Staff Productivity Loss Looking for Information	\$1.5 M	\$1.5 M	\$1.5 M	
Physician Productivity Impact - Repeated Work	\$3.9 M	\$3.9 M	\$3.9 M	
<b>Total Estimated Productivity Savings</b>	<b>\$15.6 M</b>	<b>\$15.6 M</b>	<b>\$15.6 M</b>	
<b>Total Estimated Savings</b>	<b>\$40.5 M</b>	<b>\$44.4 M</b>	<b>\$52.8 M</b>	

<sup>27</sup> All savings presented here are gross savings. The costs associated with the HealthInfoNet demonstration project are not included. It is estimated that HealthInfoNet costs for the demonstration project will be \$4 - \$6 Million.

## Conclusions

Although using a standardized methodology to conservatively estimate the impact of electronic HIE services being implemented by HealthInfoNet, the potential savings to the Maine healthcare system are significant. It is estimated that the HealthInfoNet demonstration project will generate broad annual healthcare expenditure savings ranging from \$10.6 - \$12.5 million in the first phase of implementation during 2009, that will increase up to \$20 million annually by phase 3 of implementation in 2011. The eventual rollout of these specific services statewide to all providers may generate between \$40 and \$52 million in total healthcare savings.

Participating providers are likely to realize between 37% and 44% of the total savings as a result of improved productivity and avoided services provided to the uninsured and underinsured. Provider and provider organization savings estimates range from \$4.6 million annually in phase 1, up to \$7.6 million annually by phase 3. Maine commercial payers will likely realize 30% to 33% of total savings, ranging from a low of \$3.5 million annually in phase 1, up to \$6.2 million annually by phase 3 from avoided services. MaineCare will accrue approximately 10% of the annual savings from avoided services, from a low of \$900,000 in phase 1, up to \$1.8 million by phase 3. The avoided services savings to Medicare represent 15% to 22% of the total savings estimated (\$1.6- \$4.4 million). Although not separately assessed in this analysis, some savings accrue to patients for reduced co-pays and deductibles for unnecessary services as well as downstream benefits of reduced costs for plan coverage.

## Discussion

The savings estimates presented in this analysis likely under-report the total realizable annual savings associated with the electronic HIE in Maine for the following reasons:

- For the state wide aggregate electronic HIE savings, the high range of ER estimates include avoidable outpatient laboratory results and imaging studies from CITL and RAND and admission and visit avoidance from Smith et.al. These estimates likely underestimate the true cost of avoidable admissions and outpatient visits due to the conservative assumptions used to estimate that only 70% of patients visiting the ER have prior medical information that may be useful in that encounter.
- The CITL and RAND ER estimates do not clearly separate avoidable outpatient laboratory results and imaging service savings in the ER and ambulatory settings. To avoid double counting, these figures were not used to calculate the HealthInfoNet demonstration project savings. As a result, the demonstration project savings may underestimate the potential range of savings available to payers and providers for these avoided services.
- A number of potential savings areas are not included in this analysis due to limitations in the reliability of national studies and the availability of data at the time of this analysis. Some notable areas in which savings related to electronic

HIE use have been described in the literature that may be applicable to HealthInfoNet include the impact of medication lists on generic substitution and overall prescription drug use, reductions in adverse drug events (ADEs), reductions in overall medical errors, and improvements in broad public health monitoring and prevention efforts that may increase potential savings associated with HIE.<sup>28,29,30</sup>

There are a number of technical limitations to this analysis. As is the case with any modeling project it is subject to numerous assumptions and judgments. This project relies on published savings estimates from other projects since those are the only sources of data readily available. Cost information from these studies, in some cases, is several years old, and therefore inflation estimates needed to be included.

In addition to the technical limitations of modeling, some experts have expressed skepticism about HIT and electronic HIE savings and cost modeling due to the nascence of these technologies, the limited empirical evidence of value published to date, the lack of focus on quality care impacts, and the perception that, if improved quality of care is the goal, savings may be elusive.<sup>31,32,33</sup>

In spite of this skepticism, this analysis makes a major assumption that the providers and IDNs participating in the HealthInfoNet demonstration continue their participation throughout the project. The savings associated with the demonstration project and the statewide rollout, however, may be impacted by other HIE implementation issues. Some of these issues include:

- **HIT Adoption:** The savings presented in this analysis do not take into account the significant investments needed on the part of providers to make clinical information electronic through the adoption and use of electronic medical records (EMR), computerized provider order entry systems (CPOE), electronic prescribing (eRx), clinical decision support, and other HIT tools. The quality and patient safety benefits of these technologies do not necessarily accrue to the providers due to the current healthcare payment system attributes. This mismatch of incentives creates significant barriers to the rapid adoption of advanced HIT systems.
- **Avoided Services are Lost Revenues:** Savings generated when services can be avoided represent a loss of revenue to the providers of those services and

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<sup>28</sup> Wang SJ, Middleton B, et.al. "A Cost Benefit Analysis of Electronic Medical Records in Primary Care," *American Journal of Medicine* 2003;114:397-403

<sup>29</sup> Chaudhry, B., Wang, J., Wu, S., Maglione, M., Mojica, W., Roth, E., Morton, S.C., and Shekelle, P.G.: Systematic Review: Impact of Health Information Technology on Quality, Efficiency, and Costs of Medical Care. *Annals of Internal Medicine* 144(10):742-752, May 16, 2006.

<sup>30</sup> Alfreds, ST. et.al. Facilitating Electronic Health Information Exchange in State Publicly Funded Health Programs: Challenges and Opportunities. Final Report to the State Alliance for eHealth. National Governors Association. April 2008.

<sup>31</sup> Walker JM. Electronic medical records and health care transformation, *Health Affairs*, 24:5 September/October 2005, 1118-1120.

<sup>32</sup> Himmelstein DU, Woolhandler S. Hope and hype: predicting the impact of electronic medical records, *Health Affairs*, 24:5 September/October 2005, 1121-1123.

<sup>33</sup> Goodman C, Savings in electronic medical record systems? Do it for the quality, *Health Affairs*, 24:5 September/October 2005 1124-1126.

to the organizations such as reference laboratories and imaging centers with whom the providers contract. While most providers would avoid delivering unnecessary services, revenue losses may create a real financial impact on some categories of providers. If providers were to increase rates to offset revenue losses, some of the projected saving may erode. If providers are functioning at or near capacity, revenues from services provided to new or existing patients may replace revenue lost from avoided services. For contracted organizations, there is little incentive to invest in electronic HIE systems that may reduce order volume and ultimately revenue. However, the administrative benefits of a secure network and connecting them to providers may outweigh lost revenue.

- **Adoption Timelines:** This study does not consider the timelines for the implementation and adoption of electronic HIE services beyond the demonstration phase, and HIT systems in provider settings. Many health systems and physician practices are making substantial investments in advanced HIT systems. The widespread adoption of advanced HIT systems may generate a broader set savings than projected in this report.
- **Workflow Integration and Training:** This report assumes that provider organizations using HealthInfoNet will make the necessary changes to integrate the services and information into their internal workflows and train their staff to take advantage of HealthInfoNet services. The study does not consider the impact of possible lags in workflow integration or staff training.
- **HIE Costs and Financing:** This report does not address the costs or financing of HealthInfoNet activities by provider organizations. The nature of the current payment system along with the challenges facing many primary care providers in the state of Maine (individual, small group, and safety net clinics) may impact the capacity of some provider organizations to make HIE investments.<sup>34</sup> In addition, budget shortfalls due to the economic downturn may negatively impact other stakeholder investments in electronic HIE (public and private).

Regardless of the limitations discussed above, the estimated annual savings associated with the specific services being implemented in the HealthInfoNet demonstration project, between \$10 million in phase 1 and \$20 million in phase 3, make a compelling argument for ongoing investment in developmental activities to complete this project by the healthcare stakeholder community of Maine. Future studies may be able to determine additional potential savings and benefits associated with electronic HIE including reduced pharmaceutical utilization and medication management, improved patient safety, and advancements in public health monitoring.

The savings estimates presented here provide an initial look at the “who benefits” question, which is of critical importance to all healthcare stakeholders, especially in

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<sup>34</sup> Lenardson, J, McGuire, C, Alfreds, S, & Keith, R. Understanding Changes to Physician Practice Arrangements in Maine and New Hampshire. University of Southern Maine, Muskie School of Public Service. January 2008.

an economy that is showing significant downward recessionary trends. However, these estimates cannot fully dictate the investment commitments of healthcare stakeholders.<sup>35</sup> Although, according to this analysis, Medicare stands to reap 15% - 22% of savings benefit, direct federal investments in electronic HIE in the near future are unlikely. In addition, to date, national payers for healthcare have been reticent to provide significant support to electronic HIE. Beyond the issues discussed above, due to their presence in multiple states, national payers are conscious of political drivers that may force investments in one state to be replicated in all other states in which they conduct business. This cautionary approach, along with the perceived threat of “free-riding” has limited national payer investments in electronic HIE.<sup>36</sup>

Finally, the public benefits of electronic HIE have led some stakeholders to ask whether electronic HIE should be considered, to some degree, a public good like air, water, or national defense, or at the least a public utility, like electricity or telecommunications. The various healthcare roles of government (state and federal), as purchasers of healthcare for Medicaid and Medicare-covered individuals and employees, regulators of healthcare through policy setting, licensure and enforcement of regulations, and advocates of general public health make them a critical stakeholders in electronic HIE and benefactors to its potential positive impacts. In addition, the critical importance of timely and accurate health related information for complex care coordination, surveillance, and disaster management during emergencies, posits electronic HIE as a necessary public resource. Whether a natural disaster, as exemplified by the tragedies of hurricanes Katrina and Rita or the emergence of a pandemic infectious disease, rapid, accurate, and redundant networks that share health information are needed. The value of such networks cannot easily be delineated among healthcare stakeholders, but there is little question that the societal benefit is high.

The federal government, through ONC and other federal agencies, is supporting the development of a Nationwide Health Information Network. The appropriate roles of state governments, however, are yet to be determined. Initiatives such as the NGA State Alliance for eHealth are working with states to inform policy development on electronic HIE.<sup>37,38</sup> To date, state governments’ have shown significant variation in their support of electronic HIE due to many factors. These factors include the current state of electronic HIE and collaboration between healthcare stakeholders within the states, the financial and political capacity of the state to invest in such initiatives, the

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<sup>35</sup> Recent work by the American Health Information Association (AHIMA) State Level HIE Consensus project has been an important resource for the development many electronic HIE efforts to date. A new report, “*State-level HIE Value and Sustainability Workbook: Approaches for Financing and Bringing Interoperable HIE to Scale*,” reviews specific financing and investment methodologies (public and private) for multi-stakeholder HIE efforts.

<sup>36</sup> Due to its network effect and broad multi-stakeholder benefits, free-riding by payers is a perceived competitive disadvantage preventing many national payers from investing in state and regional electronic HIE efforts.

<sup>37</sup> *Accelerating Progress: Using Health Information Technology and Electronic Health Information Exchange to Improve Care. First Annual Report and Recommendations from the State Alliance for eHealth*. National Governors Association Center for Best Practices. September 2008. Internet Address: [www.nga.org/Files/pdf/0809EHEALTHREPORT.PDF](http://www.nga.org/Files/pdf/0809EHEALTHREPORT.PDF). (Accessed November 2008).

<sup>38</sup> For more information of the State Alliance for eHealth see: [www.nga.org/center/ehealth](http://www.nga.org/center/ehealth)

availability of federal funding, and the leadership demonstrated by state officials in championing electronic HIE initiatives.<sup>39</sup>

As a result, the Maine state government must consider multiple areas in which to support electronic HIE. These areas may include the alignment of regulatory policies to both promote electronic HIE and protect consumers and industry participants, use of state purchasing power to incent the adoption of technologies that facilitate HIT adoption and electronic HIE, licensing and other regulatory requirements to drive participation by national stakeholders, promotion of electronic HIE in public sector healthcare delivery, and working with HealthInfoNet to assure that a sustainable operational model of electronic HIE develops in Maine that is equitable, effective, and can benefit broader population health and safety.

Taking these issues into account and supporting HealthInfoNet electronic HIE efforts requires commitment on the part of both public and private stakeholders. The potential benefits associated with this commitment and financial investments are likely to return to those stakeholders in a relatively short time frame as a result of avoided services and productivity increases, in addition to other savings not quantified in this analysis. As the HealthInfoNet Stakeholder group continues its process for developing a fund to support electronic HIE services and HIT adoption across the state of Maine, it should consider the significant potential savings from the HealthInfoNet demonstration project as a baseline for the potential for widespread healthcare savings associated with broader electronic HIE and HIT efforts in Maine.

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<sup>39</sup> Alfreds, ST et.al. (April, 2008).

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# Appendices

The following tables A1- A5 provide the detailed savings estimates and per member per year savings by payer category for each of the national studies that were modeled and included in the Maine savings analysis. Table A6 provides the productivity savings estimates and PMPY savings estimates in ambulatory care settings and ER settings for the state.

**Table A1: Maine Estimated Annual Avoidable Service Savings with CITL – HIE&I Methodology by Payer Category**

<b>Maine Estimated Avoidable Laboratory and Imaging Service Savings HIE&amp;I Methodology</b>					
	<b>Commercial</b>	<b>Medicare</b>	<b>Medicaid</b>	<b>Uninsured</b>	<b>Total</b>
<b>Savings from Avoidable Outpatient Laboratory Tests</b>	\$5.9 M	\$2.4 M	\$0.6 M	\$0.2 M	<b>\$9.1 M</b>
<b>Savings from Avoidable Outpatient Imaging Studies</b>	\$10.6 M	\$5.6 M	\$1.4 M	\$0.5 M	<b>\$18.1 M</b>
<b>Combined Avoidable Service Savings</b>	<b>\$16.6 M</b>	<b>\$8.0 M</b>	<b>\$2.0 M</b>	<b>\$0.7 M</b>	<b>\$27.2 M</b>
<b>Maine Estimated Annual Avoidable Laboratory and Imaging Service Savings HIE&amp;I Methodology PMPY</b>					
	<b>Commercial</b>	<b>Medicare</b>	<b>Medicaid</b>	<b>Uninsured</b>	<b>Total</b>
<b>Savings from Avoidable Outpatient Laboratory Tests</b>	\$7.69	\$10.15	\$2.75	\$1.64	<b>\$6.78</b>
<b>Savings from Avoidable Outpatient Imaging Studies</b>	\$13.84	\$23.26	\$6.79	\$4.05	<b>\$13.48</b>
<b>Combined Avoidable Service Savings</b>	<b>\$21.52</b>	<b>\$33.41</b>	<b>\$9.53</b>	<b>\$5.70</b>	<b>\$20.26</b>

**Table A2: Maine Estimated Annual Avoidable Service Savings with RAND Methodology by Payer Category**

<b>Maine Estimated Annual Avoidable Service Savings with RAND Methodology</b>					
	<b>Commercial</b>	<b>Medicare</b>	<b>Medicaid</b>	<b>Uninsured</b>	<b>Total</b>
<b>Savings from Avoidable Outpatient Laboratory Tests</b>	\$9.5 M	\$3.8 M	\$0.7 M	\$0.4 M	<b>\$14.4 M</b>
<b>Savings from Avoidable Outpatient Imaging Studies</b>	\$10.6 M	\$5.5 M	\$1.2 M	\$0.5 M	<b>\$17.8 M</b>
<b>Combined Avoidable Service Savings</b>	<b>\$20.0 M</b>	<b>\$9.3 M</b>	<b>\$1.9 M</b>	<b>\$0.9 M</b>	<b>\$32.1 M</b>
<b>Maine Estimated Annual Avoidable Laboratory and Imaging Service Savings RAND Methodology PMPY</b>					
	<b>Commercial</b>	<b>Medicare</b>	<b>Medicaid</b>	<b>Uninsured</b>	<b>Total</b>
<b>Savings from Avoidable Outpatient Laboratory Tests</b>	\$12.29	\$15.90	\$3.65	\$2.69	<b>\$10.68</b>
<b>Savings from Avoidable Outpatient Imaging Studies</b>	\$13.75	\$22.77	\$5.71	\$4.12	<b>\$13.19</b>
<b>Combined Avoidable Service Savings</b>	<b>\$26.04</b>	<b>\$38.67</b>	<b>\$9.36</b>	<b>\$6.81</b>	<b>\$23.87</b>

**Table A3: Maine Estimated Annual Emergency Room Savings Related to HIE: Overhage et.al. Methodology by Payer Category**

<b>Maine Estimated Annual Emergency Room Savings Related to HIE: Overhage et.al. Methodology</b>					
<b>Reduced Emergency Room (ER) Costs</b>	<b>Commercial</b>	<b>Medicare</b>	<b>Medicaid</b>	<b>Uninsured</b>	<b>Total</b>
<b>Inpatient Admissions</b>	\$1.7 M	\$2.5 M	\$0.6 M	\$0.2 M	<b>\$5.1 M</b>
<b>Outpatient ER Visits</b>	\$2.6 M	\$1.0 M	\$1.5 M	\$0.6 M	<b>\$5.6 M</b>
<b>Combined In &amp; Out-Patient Savings</b>	<b>\$4.3 M</b>	<b>\$3.5 M</b>	<b>\$2.1 M</b>	<b>\$0.8 M</b>	<b>\$10.7 M</b>
<b>Maine Estimated PMPY Savings in the ER Related to HIE: Overhage et.al. Methodology</b>					
<b>Reduced Emergency Room (ER) Costs</b>	<b>Commercial</b>	<b>Medicare</b>	<b>Medicaid</b>	<b>Uninsured</b>	<b>Total</b>
<b>Inpatient Admissions</b>	\$2.24	\$10.57	\$2.93	\$1.54	<b>\$3.76</b>
<b>Outpatient ER Visits</b>	\$3.38	\$4.08	\$7.24	\$4.35	<b>\$4.19</b>
<b>Combined In &amp; Out-Patient Savings</b>	<b>\$5.62</b>	<b>\$14.66</b>	<b>\$10.17</b>	<b>\$5.90</b>	<b>\$7.95</b>

**Table A4: Estimated Annual Savings Impact of Missing Information on Avoidable Services in the Ambulatory and ER Settings: Smith et.al. Methodology**

<b>Estimated Annual Savings Impact of Missing Information on Avoidable Services in the Ambulatory and ER Settings: Smith Methodology</b>					
<b>Impact of Missing Information in Ambulatory Care Settings</b>	<b>Commercial</b>	<b>Medicare</b>	<b>Medicaid</b>	<b>Uninsured</b>	<b>Total</b>
Avoidable Visits Caused by Missing Information	\$2.1 M	\$1.3 M	\$0.4 M	\$0.2 M	<b>\$4.0 M</b>
Avoidable Laboratory Tests due to Missing Information	\$2.3 M	\$0.9 M	\$0.2 M	\$0.1 M	<b>\$3.4 M</b>
Avoidable Imaging Studies due to Missing Information	\$6.0 M	\$3.2 M	\$0.6 M	\$0.3 M	<b>\$10.0 M</b>
<b>Subtotal Impact of Missing Information in Ambulatory Care Settings</b>	<b>\$10.4 M</b>	<b>\$5.4 M</b>	<b>\$1.1 M</b>	<b>\$0.6 M</b>	<b>\$17.5 M</b>
<b>Impact of Missing Information in ER</b>					
Avoidable Admissions Caused by Missing Information	\$0.2 M	\$0.4 M	\$0.1 M	\$0.03 M	<b>\$0.7 M</b>
Avoidable Laboratory Tests due to Missing Information	\$1.0 M	\$0.2 M	\$0.3 M	\$0.1 M	<b>\$1.7 M</b>
Avoidable Imaging Studies due to Missing Information	\$2.7 M	\$0.9 M	\$1.1 M	\$0.4 M	<b>\$5.1 M</b>
<b>Subtotal Impact of Missing Information in the ER</b>	<b>\$3.9 M</b>	<b>\$1.5 M</b>	<b>\$1.5 M</b>	<b>\$0.6 M</b>	<b>\$7.4 M</b>
<b>Total Avoided Services Savings</b>	<b>\$14.2 M</b>	<b>\$6.9 M</b>	<b>\$2.6 M</b>	<b>\$1.2 M</b>	<b>\$24.9 M</b>

**Table A5: Estimated PMPY Savings Impact of Missing Information on Avoidable Services in the Ambulatory and ER Settings: Smith et.al. Methodology**

<b>Estimated PMPY Savings Impact of Missing Information on Avoidable Services in the Ambulatory and ER Settings: Smith Methodology</b>					
<b>Impact of Missing Information in Ambulatory Care Practices: Primary Care</b>	<b>Commercial</b>	<b>Medicare</b>	<b>Medicaid</b>	<b>Uninsured</b>	<b>Total</b>
Avoidable Visits Caused by Missing Information	\$2.76	\$5.51	\$2.03	\$1.26	<b>\$2.99</b>
Avoidable Laboratory Tests due to Missing Information	\$2.97	\$3.67	\$0.78	\$0.66	<b>\$2.53</b>
Avoidable Imaging Studies due to Missing Information	\$7.78	\$13.21	\$2.79	\$2.37	<b>\$7.46</b>
Subtotal PMPY Impact of Missing Information in Ambulatory Settings	\$13.51	\$22.39	\$5.59	\$4.30	<b>\$12.98</b>
<b>Impact of Missing Information in ER</b>					
Avoidable Admissions Caused by Missing Information	\$0.22	\$1.60	\$0.44	\$0.24	<b>\$0.51</b>
Avoidable Laboratory Tests due to Missing Information	\$1.33	\$1.02	\$1.48	\$0.89	<b>\$1.25</b>
Avoidable Imaging Studies due to Missing Information	\$3.47	\$3.69	\$5.34	\$3.19	<b>\$3.77</b>
Subtotal PMPY Impact of Missing Information in the ER	\$5.03	\$6.31	\$7.26	\$4.32	<b>\$5.52</b>
<b>Total Avoided Services Savings</b>	<b>\$18.53</b>	<b>\$28.70</b>	<b>\$12.85</b>	<b>\$8.62</b>	<b>\$18.51</b>

**Table A6: Estimated Annual Productivity Benefit Estimates for HIE in Maine: Smith Methodology**

<b>Estimated Annual Productivity Benefit Estimates for HIE in Maine: Smith Methodology</b>		
<b>Ambulatory Care Practices: Primary Care</b>	<b>Total Savings</b>	<b>PMPY</b>
Physician/Staff Productivity Loss Looking for Information	\$2.1 M	\$2.12
Physician Productivity Impact - Repeated Work H&PE/Med Lists	\$5.4 M	\$5.44
<b>Impact of Missing Information in Emergency Department</b>		
Physician/Staff Productivity Loss Looking for Information	\$1.5 M	\$1.12
Physician Productivity Impact - Repeated Work H&PE/Med Lists	\$3.9 M	\$2.89
<b>Total Productivity Benefits</b>	<b>\$15.6 M</b>	<b>\$30.07</b>

