The District of Columbia Regional Health Information Organization (DC RHIO) Current Progress and the Road Ahead

An Assessment Report based on the CHIDS HIE Evaluation Framework

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Executive Summary

Background

In 2007, the District of Columbia Regional Health Information Organization (DC RHIO) initiative was launched to create a regional health information exchange (HIE) framework, infrastructure, and system. The core objective of the initiative was to enable multiple hospitals, clinics, and other health care institutions to rapidly and securely access medical history information about patients, so as to yield improvements in the health of the population, enhance the patient experience of care (including quality, access, and reliability); and reduce, or at least control, the per capita cost of care. As such, the initiative sought to deliver tangible clinical and financial value for all RHIO stakeholders. The DC RHIO was funded via a 3-year grant award from the District of Columbia and managed by the District of Columbia Primary Care Association (DCPCA). Programs funded by the DC government, including the DC RHIO, must have performance metrics and meaningful outcomes that demonstrate a return on the taxpayer’s investments. Many of the traditional performance criteria and outcome measures cannot fully quantify the results of creative programs—which may be unprecedented in scope, timelines and deliverables—and new methods to capture information and measure progress are needed.

The Center for Health Information and Decision Systems (CHIDS) at the Robert H. Smith School of Business, University of Maryland College Park has developed a multi-dimensional assessment model for the DC RHIO, evaluated its performance along multiple areas and offered a set of recommendations to guide DC RHIOs future evolution. The research and associated recommendations are based on the information and documents provided by key stakeholders of the DC RHIO, an environmental scan of HIE efforts across the nation, best practices published in the literature, and benchmarking with three leading HIE efforts.

Assessment Model

A variety of HIE experiments have been launched across the nation. The learning from these experiments coupled with the fundamental objectives and goals of an HIE suggest five key performance dimensions or components:

1) VALUE CREATION & SUSTAINABILITY: At the core of the assessment model is the value creation and sustainability dimension that isolates the sources and magnitude of value being generated by the HIE for society and other relevant stakeholders, quantified in both measurable outcomes and intangible value. Closely tied to value creation is sustainability, or the degree to

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1 Institute for Healthcare Improvement Triple Aim-based objectives.
which the HIE has been able to construct a business model and a revenue stream that adequately offsets its operational costs.

2) GOVERNANCE: The governance assessment dimension evaluates the policies, structural mechanisms, and decision making processes that guide the strategic, tactical, and operational activities of the enterprise.

3) TECHNOLOGY represents the quality of the infrastructural foundation upon which the RHIO or HIE is constructed. This dimension speaks to the robustness of the foundation, measured along multiple dimensions such as cost-effectiveness, adherence to standards, and usability. This dimension also includes change management and other related activities that are necessary in order to successfully implement the technical solution and ensure adoption and use by targeted stakeholders.

4) COMMUNITY ENGAGEMENT asks the question: has the RHIO been successful in engaging and bringing to the table all concerned parties that are essential for its continued success?

5) PUBLIC TRUST evaluates the types of privacy practices and policies that have been crafted, and the degree to which public trust in the enterprise exists.

Findings

Our evaluation reveals that the DC RHIO has made progress in most of the dimensions of the HIE Assessment Model and has reached operational status (transmitting data that is being used by healthcare stakeholders), but a significant amount of work remains to be done in order to reach sustainability. The conclusions drawn in this assessment must be interpreted in light of the DC RHIO’s maturity stage and where it currently stands in its evolution. Going forward, there are many opportunities and challenges that lie ahead as the DC RHIO strives towards its mission of improving the health of District residents. The three most significant next steps relate to the development of a sustainable business model, the crafting of appropriate governance structures, and increasing the adoption and use of the DC RHIO system. Additional challenges around scaling technology, engaging the broader community, and continuing to build public trust and confidence in the exchange will need to be carefully planned for.
Recommendations

These recommendations pertain not only to specific actions that the DC RHIO should take going forward, but also reference some broader issues that must be addressed within the context of the District of Columbia.

- Develop a Plan for Sustainability;
  - We recommend that the DC RHIO construct a hybrid revenue model that is based on revenues from subscriptions (that include a set of pre-determined services) as well as traditional fees paid for additional services;
- Expand the potential pool of participants across the healthcare value chain, most notably private physician practices, laboratories, and other clinical data users or sources;
- Improve the usability of the technologies and expand the services mix through innovation and user-centered design, paying special attention to the technologies highlighted in Sections 5.3 & 6.1;
- Ensure data integrity and availability;
- Develop organizational capacity to achieve revenue and cost targets;
- Develop governance mechanisms to ensure accountability and performance tracking following the principles of good governance outlined in Section 4 of this report;
- Institute a systematic and sustained monitoring and evaluation program;
  - Such a program must include a hierarchy of metrics beginning with improvements in care quality and patient safety, public health benefits, and cost savings, and cascading down to intermediate metrics such as those described in Section 4 of this report;
- Plan for provider and patient education to develop public trust and confidence;
- Coordinate across District efforts in health information exchange;
- Design a communication plan and communication mechanisms for partner organizations;
- Publicize the DC RHIO experience.

This report provides comprehensive coverage of our assessment model, evaluation findings, and supporting research.
1. Introduction

The District of Columbia Regional Health Information Organization (DC RHIO) is the primary health information exchange in our nation’s Capital. The DC RHIO project is being led by the District of Columbia Primary Care Association (DCPCA) and funded by the District of Columbia Government via an initial 3-year grant which runs through September 2010.

The DC RHIO health information exchange went “live” in March 2010 connecting two anchor acute care hospitals and a network of six safety net clinics; it has signed data sharing agreements with 4 other acute care hospitals that are expected to go live by the end of 2010, as well as letters of intent with 2 additional safety net clinics. The process leading to go-live involved a wide range of activities and work by multiple stakeholders to lay the foundation for the exchange of health information across the District. While it has accomplished some major achievements, the DC RHIO, like most RHIOs, is still searching for a sustainable operating and governance model to enable its long-term viability and growth beyond grant funding. This planning activity is given added impetus with the completion of the initial 3-year grant period in September 2010.

Further, as the DC RHIO evolves, there is a need to document and assess the progress made to date in comparison with other similar on-going efforts around the nation to both measure performance and plan for a successful future. This requires a comprehensive, multi-dimensional assessment of the DC RHIO. In 2009, the DCPCA contracted with the Center for Health Information and Decision Systems (CHIDS) at the Robert H. Smith School of Business, University of Maryland, to conduct an independent evaluation of the DC RHIO.

In performing its evaluation, CHIDS collected data from a variety of sources, including primary data in the form of stakeholder interviews and a user survey post go-live, benchmarking data from three “successful” health information exchanges (HIEs) across the nation, and an environmental scan based on secondary data from the research literature and industry reports. This report details CHIDS findings and the evaluation framework, and provides context for HIE strategic decision-making tailored to the unique case of HIE in the District.
2. The DC RHIO: From Inception to Go-Live

The genesis of DC RHIO can be traced to April 2004, when the U.S. Department of Health and Human Services, through the Council of Governments, assembled healthcare leaders from across the Washington DC Metropolitan Region to consider a regional health information exchange infrastructure. Initial efforts involving a diverse group of participants with competing interests did not succeed at reaching a consensus.

Subsequently, in fall 2005, DCPCA, in collaboration with partners, convened the Health Information Systems (HIS) Vision Group, which included representatives from DC Government, Montgomery Country Primary Care Coalition, and the RAND Corporation. This group focused on initial projects including the implementation of electronic health records (EHRs) in community health centers and developing a proof of concept demonstrating health data sharing between a hospital and a community health center.

In the fall of 2006, the DC Government provided a grant to facilitate the implementation of EHRs in six safety net clinics. The participating clinics included: Bread for the City (BFTC); Family and Medical Counseling Service (FMCS); La Clínica del Pueblo (LCDP); Mary’s Center for Maternal and Child Care (MC); So Others Might Eat (SOME); and, Whitman-Walker Clinic (WWC). DCPCA managed the selection and implementation of an eClinical Works EMR in all six clinics that was completed in October 2008. This effort created an opportunity to link this network of deployed EMRs to hospitals to create the core of the DC regional health information exchange.

In parallel with the installation of EHRs at the clinics, an initial proof of concept project demonstrating data sharing between a community health center and local hospitals was also accomplished. Using the Microsoft Amalga technology, then known as Azyxxi, in use at the regional MedStar facilities, clinicians at Bread for the City health clinic were able to access hospital clinical information in real-time. According to the DC RHIO business plan document, clinicians at BFTC noted improvement in their ability to provide follow-up care to patients that were seen previously in the emergency department or previously received inpatient care at the participating MedStar hospitals. This proof of concept provided an early pathway and foundation for development of a regional health information exchange to improve the value of health care in the region.

As a result, the DC Department of Health (DOH) awarded a contract to DCPCA to create DC RHIO, which was part of the District’s Omnibus Community Access to Health Care legislation that was signed into law in December 2006. This legislation awarded $6 million of the District’s Tobacco Settlement Trust Fund bond proceeds in the form of a grant to DCPCA over the time period from October 1, 2007 to September 30, 2010. According to the 2009 business plan, the
legislation called for the implementation of Microsoft Amalga software to accomplish regional data exchange between at least six community health centers and two hospitals, creation of a governance structure and development of a long term business plan.

In March of 2010, the DC RHIO “went live” at six community health clinics and in the Washington Hospital Center and Georgetown Hospital Emergency Departments. Section 5 provides results of a survey of HIE users conducted in April – May 2010. Plans are in place for connecting the HIE to two additional hospitals (George Washington University Hospital and Howard University Hospital) and two additional community health organizations (Unity Health Care and Community of Hope, both Federally-Qualified Health Centers) by September 2010. System go-live timeframe for United Medical Center, Providence Hospital, Sibley Memorial Hospital and Children’s National Medical Center, respectively, are contingent upon finalizing data sharing agreements and resolving issues in other domains needing stakeholder consensus.

The DC RHIO is at a nascent stage of activity, but has reached an important milestone with an operational infrastructure and providers and administrators expressing hope to use the system in the provision and management of care. The work done till date can serve in the further development of an integrated District health system that can potentially improve quality, reduce costs, and enhance access to care.

2.1 Financial Model of DC RHIO

The DC RHIO was initially funded with $6,000,000 in funds from the District Tobacco Funds Proceeds made in the form of a 3-year grant agreement with the Department of Health as the funding authority. The DC RHIO has been wholly financed from this grant award to date and it is yet to generate revenues from its operations. In September 2010, the initial grant period ends and the DC RHIO will need to secure additional funding to continue operations.

The DC RHIO Business Planning Workgroup is evaluating alternate business and governance models over the June – September 2010 period and expects to make a recommendation to the District “State-Designated Entity (SDE)” for a business plan that will likely take into account an interim and long-term strategy for sustainability. The current structure of costs and expenses will affect the appropriate business model. Primary costs are technology, staff and to a lesser extent, support services. Exhibit 1 shows the current and projected cost structure provided by the DC RHIO in their 2009 business plan documentation.
Exhibit 1. DC RHIO Pro-forma Estimates

<table>
<thead>
<tr>
<th>($000's)</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Proceeds</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extraordinary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grant</td>
<td>3,500</td>
<td>4,000</td>
<td>4,000</td>
<td>2,000</td>
<td></td>
</tr>
<tr>
<td>eHealth Trust</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2,245</td>
<td>3,741</td>
</tr>
<tr>
<td>Operating</td>
<td>0</td>
<td>0</td>
<td>148</td>
<td>493</td>
<td>985</td>
</tr>
<tr>
<td><strong>Total Proceeds</strong></td>
<td>3,500</td>
<td>4,000</td>
<td>4,148</td>
<td>4,738</td>
<td>4,726</td>
</tr>
<tr>
<td><strong>Expenses</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staffing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal</td>
<td>307</td>
<td>424</td>
<td>642</td>
<td>750</td>
<td>780</td>
</tr>
<tr>
<td>Outsourced</td>
<td>200</td>
<td>206</td>
<td>212</td>
<td>219</td>
<td>225</td>
</tr>
<tr>
<td>Technology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implementation</td>
<td>900</td>
<td>1,200</td>
<td>1,000</td>
<td>700</td>
<td>400</td>
</tr>
<tr>
<td>Hosting/Maintenance</td>
<td>900</td>
<td>1,200</td>
<td>1,400</td>
<td>1,700</td>
<td>2,100</td>
</tr>
<tr>
<td>Maintenance</td>
<td>150</td>
<td>200</td>
<td>250</td>
<td>300</td>
<td>400</td>
</tr>
<tr>
<td>Professional Services</td>
<td>755</td>
<td>504</td>
<td>480</td>
<td>804</td>
<td>548</td>
</tr>
<tr>
<td>Facilities</td>
<td>48</td>
<td>51</td>
<td>54</td>
<td>57</td>
<td>61</td>
</tr>
<tr>
<td>Other Expenses</td>
<td>160</td>
<td>160</td>
<td>160</td>
<td>160</td>
<td>160</td>
</tr>
<tr>
<td><strong>Total Expenses</strong></td>
<td>3,420</td>
<td>3,945</td>
<td>4,198</td>
<td>4,690</td>
<td>4,674</td>
</tr>
<tr>
<td><strong>Margin</strong></td>
<td>80</td>
<td>55</td>
<td>-50</td>
<td>48</td>
<td>52</td>
</tr>
</tbody>
</table>

There are 5 estimated FTEs for 2010 and 6 FTEs for 2011 totaling $307,000 and $424,000, respectively. FTEs account for executive, managerial, technical, and financial staff.

Technology Pricing - The technology costs for DC RHIO are in the form of a fixed fee per quarter payable to Microsoft for hosting, licensing, maintenance, and support of the Microsoft Amalga software. Additional technology costs include time and materials for implementation of new participants and a fixed fee of $25,000 per feed per organization when a new data interface type is developed.

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2 DC RHIO draft business plan (2009) (pro-forma estimates are under review and revision summer 2010).
Exhibit 2. Microsoft Amalga Quarterly Costs

<table>
<thead>
<tr>
<th>Year</th>
<th>Oct 2010-Sep 2011</th>
<th>2011-2012</th>
<th>2012-2013</th>
<th>2013-2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price per quarter</td>
<td>$350,000</td>
<td>$500,000</td>
<td>$675,000</td>
<td>$750,000</td>
</tr>
</tbody>
</table>

Based on the current cost structure, the DC RHIO projects that it will require $3.4M, $3.9M, $4.2M, $4.7M, and $4.7M in annual proceeds, which totals $20.9M total during the period.

2.2 Governance Approach to Date of DC RHIO

The DC RHIO is currently structured as a non-profit public private collaborative operating as a project within the DCPCa. The DCPCa is managing all project management and development activities for the DC RHIO. The DCPCa contracts for technical services, negotiates and maintains data sharing and data use agreements with all participants, and is charged with ensuring that operations are consistent with the DC RHIO mission, principles and policies.

DC RHIO Advisory Board, which is made up of a wide range of stakeholders including representatives of DC government, private payers, hospitals, and clinics, is expected to provide oversight. The Advisory Board is formally convened each quarter to review progress and provide input. Over the course of the past three years, several smaller groups within the wider advisory board have been convened around specific topical needs, such as the Governance Workgroup, Metrics Workgroup and Privacy Workgroup, respectively.

The DC Department of Health is the funding authority and participates in oversight, but does not participate in the day-to-day management. The draft business plan document produced in February 2009 advocated maintaining the DC RHIO as an entity managed by the DCPCa with a Board of Directors providing oversight and funded via an eHealth Trust Fund capitalized by payer assessments. This proposal was modeled after Vermont’s, which established in the state treasury a special fund to be a source of funding for medical health care information technology programs and initiatives, with health insurers paying a .0199% fee per claim transaction. This financing scheme is one potential model under advisement. A diagram of the proposed structure is provided in Appendix A.

Programs funded by the DC government, including the DC RHIO, must have performance metrics and meaningful outcomes that demonstrate a return on the taxpayer’s investments. The aforementioned DC RHIO Business Planning Workgroup will be considering governance mechanisms during June-September 2010 and will then make a recommendation to the State...
Designated Entity (SDE) for the federally-funded State HIE Cooperative Agreement Program Award

2.3 The Underlying Technology

The DC RHIO uses Microsoft Amalga to support health information exchange. The Amalga HIE platform was a system that was initially developed at Washington Hospital Center under the name “Azyxxi” which Microsoft acquired in 2006 to be part of its health IT portfolio. The Amalga HIE solution is termed the “Microsoft Amalga Unified Intelligence System (UIS)” which promises to connect data from disparate systems and make that usable in real time. The data feeds use HL7 messaging standards and the system is built on the Microsoft .NET Framework. The system supporting DC RHIO aggregates data feeds from the respective hospital and clinic electronic health records into a shared repository.

Currently, the DC RHIO reports that the following patient data can be accessed via a secure portal by authorized participant users:

1. View Patient Information (demographics)
2. View Clinic Observations
3. View Clinic Allergies
4. View Clinic Diagnoses & Procedures
5. View Clinic Medications
6. View Lab Results (provided by clinics and hospitals)
7. View Hospital Discharge Summaries
8. View Hospital Radiology Reports

Future services are planned to potentially include surveillance use cases, increased EHR integration, referral support and others consistent with the DC RHIO mission. Additional services will be under advisement in conjunction with the DC RHIO Business Planning Workgroup deliberations during the period June – September 2010.

Exhibit 3 depicts the high-level exchange capabilities.

Appendix B provides coverage of current services in the context of Meaningful Use Stage 1 criteria.
Exhibit 3. Exchange Capabilities

- Shared Medical Record

**Patient Information**
- Name: Mary A Smith
- Address: 1651 A ST, Washington, DC
- Guarantor: Self
- Insurance: Medicare Part B
- DOB: 05/01/1958
- Next of Kin: John M Smith

**Patient Medical Record**
- Attending MD: Brian Lee
- Institution: Whitman Walker
- Visit Date: 05/31/2008
- Reason/Complaint: Follow up
- Observations: 165/Le, B.B., 132/85
- Lab Results: L-HIV viral load
- Problem List: HIV, HTN, Acute Sinusitis
- Diagnoses: Diabetes Mellitus, AIDS
- Discharge Summary: None
- Radiology Rpts: None
- Medications: Truvada, Agenetric, Norvir, Cireen, Lusinapril, Sactria
- Allergies: Pradugol, Immunizations: Polio, Diphtheria, Hep B, Influenza

**HL7 Message Types**
- ADT A04: Admission Information
- ADT A44: New Patient Information
- ADT A88: Update Information
- MDM T04: Discharge Summary
- ORM T09: Patient Medication
- OLR 001: Lab Orders
- OBS 001: Lab Results
- OBS 003: Labs Results
- ORU R00: Radiology Results
- PRF FC01: Problem List
- V3U V04: Patient Immunization

**Participating Community Health Centers**
- Brazil for the City
- Whitman-Walker Clinic
- La Clinica Del Pueblo
- Mary’s Center for Maternal and Child Care
- Family and Medical Counseling Services
- So Others Might Eat (SOMFa)

**Participating Hospitals**
- Georgetown University Hospital
- Washington Hospital Center

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3 DCPCA documentation.
3. HIE Environmental Scan and Benchmarking

The Office of National Coordinator for Health Information Technology (ONC) distinguishes between a RHIO and an HIE: the former is defined as “an organization that brings together health care stakeholders within a defined geographic area and governs the electronic exchange of health-related information among them for the purpose of improving health and care,” while the latter simply refers to “the electronic movement of health-related data and information among organizations according to agreed standards, protocols, and other criteria”. Although the ONC definition does not refer to any organizational form or entity that constitutes the collective and/or has oversight responsibility for it, today, the acronym HIE is commonly used to denote the group of organizations that collaborate based on defined policies and shared governance.

The HIE landscape is rapidly evolving. The 2010 eHealth Initiative Survey of HIEs reports some positive results in HIE activity with progress being made across the country to improve care and reduce costs. Indeed, the number of organizations that reported being operational has sharply increased. Seventy-three health information exchange initiatives reported being operational in 2010, up from 57 initiatives in 2009, a nearly 30% increase from last year and an almost 75% increase from 2008. There are at a minimum 234 active HIE initiatives ongoing across the US. Notably, the number of sustainable (as self-reported by eHI respondents) initiatives has reached 18 initiatives that have broken even through operational revenue.

The top priority of HIE’s as has been the case for survey respondents for 6 of the last 7 “developing a sustainable business model” (137 respondents). Other top concerns include “addressing new government and policy mandates” (131), followed by “defining the value that accrues to the users of the health information” (129).

The organizational growth of HIEs continues to show promise with a 28% growth (57 in 2009 to 73 in 2010) in operational HIEs, which are defined as HIEs reaching Stage 5-7 of the eHI HIE Maturity Model (Exhibit 4).
Exhibit 4. eHI Stages of HIE Development

<table>
<thead>
<tr>
<th>Stage</th>
<th>Characteristics of HIE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td>Recognition of the need for health information exchange among multiple stakeholders in your state, region or community. (Public declaration by a coalition or political leader)</td>
</tr>
<tr>
<td>Stage 2</td>
<td>Getting organized; defining shared vision, goals, and objectives; identifying funding sources, setting up legal and governance structures. (Multiple, inclusive meetings to address needs and frameworks)</td>
</tr>
<tr>
<td>Stage 3</td>
<td>Transferring vision, goals and objectives to tactics and business plan; defining your needs and requirements; securing funding. (Funded organizational efforts under sponsorship)</td>
</tr>
<tr>
<td>Stage 4</td>
<td>Well under way with implementation –technical, financial and legal. (Pilot project or implementation with multiyear budget identified and tagged for a specific need)</td>
</tr>
<tr>
<td>Stage 5</td>
<td>Fully operational health information organization; transmitting data that is being used by healthcare stakeholders.</td>
</tr>
<tr>
<td>Stage 6</td>
<td>Fully operational health information organization; transmitting data that is being used by healthcare stakeholders and have a sustainable business model.</td>
</tr>
<tr>
<td>Stage 7</td>
<td>Demonstration of expansion of organization to encompass a broader coalition of stakeholders than present in the initial operational model.</td>
</tr>
</tbody>
</table>

The development of HIE technology is also improving driven in part by increased understanding and diffusion of standards. Exhibit 5 details the CITL Technology Maturity Model which shows four levels of systems for communicating health information spanning from a non-IT based method such as phone or mail to level 4 which represents fully interoperable HIE. There are claims that the value of systems increases exponentially as the market nears level 4 and one study estimates the value of HIE at a level 4 at $77 billion.5

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4 eHealth Initiative (eHI) HIE Maturity Model.
**Exhibit 5. CITL HIE Technology Maturity Model**

<table>
<thead>
<tr>
<th>Level</th>
<th>Defining Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Non-electronic data—no use of IT to share information (examples: mail, telephone).</td>
</tr>
<tr>
<td>2</td>
<td>Machine transportable data—transmission of non-standardized information via basic IT; information within the document cannot be electronically manipulated (examples: fax or PC-based exchange of scanned documents, pictures, or PDF files).</td>
</tr>
<tr>
<td>3</td>
<td>Machine-organizable data—transmission of structured messages containing non-standardized data; requires interfaces that can translate incoming data from the sending organization’s vocabulary to the receiving organization’s vocabulary; usually results in imperfect translations because of vocabularies’ incompatible levels of detail (examples: e-mail of free text, or PC-based exchange of files in incompatible/proprietary file formats, HL-7 messages).</td>
</tr>
<tr>
<td>4</td>
<td>Machine-interpretable data—transmission of structured messages containing standardized and coded data; idealized state in which all systems exchange information using the same formats and vocabularies (examples: automated exchange of coded results from an external lab into a provider’s EMR, automated exchange of a patient’s “problem list”).</td>
</tr>
</tbody>
</table>

The maturity in technology is reflected in the increasing variety in the services mix provided by HIE (Exhibit 6). Representative of level 4 is the increase in direct connectivity to EHRs. The most common service is results delivery also known as clinical messaging, which may be delivered by portal, inbox, fax, or in advanced systems directly into the EHR.

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6 HIE Maturity Model developed by the Center for Information Technology Leadership (CITL).
### Exhibit 6. HIE Services Mix

<table>
<thead>
<tr>
<th>Current Functionalities for HIE Initiatives</th>
<th>2009</th>
<th>2010</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectivity to electronic health records</td>
<td>38</td>
<td>67</td>
<td>76.3%</td>
</tr>
<tr>
<td>Results delivery (e.g. laboratory or diagnostic study results)</td>
<td>44</td>
<td>50</td>
<td>13.6%</td>
</tr>
<tr>
<td>Health summaries for continuity of care</td>
<td>n/a</td>
<td>49</td>
<td>n/a</td>
</tr>
<tr>
<td>Clinical documentation</td>
<td>34</td>
<td>40</td>
<td>17.6%</td>
</tr>
<tr>
<td>Alerts to providers</td>
<td>31</td>
<td>39</td>
<td>25.8%</td>
</tr>
<tr>
<td>Consultation/referral</td>
<td>20</td>
<td>38</td>
<td>90.0%</td>
</tr>
<tr>
<td>Electronic prescribing</td>
<td>26</td>
<td>37</td>
<td>42.3%</td>
</tr>
<tr>
<td>Electronic referral processing</td>
<td>21</td>
<td>34</td>
<td>61.9%</td>
</tr>
<tr>
<td>Disease or chronic care management</td>
<td>19</td>
<td>27</td>
<td>42.1%</td>
</tr>
<tr>
<td>Clinical decision support</td>
<td>19</td>
<td>26</td>
<td>36.8%</td>
</tr>
<tr>
<td>Enrollment or eligibility checking</td>
<td>n/a</td>
<td>25</td>
<td>n/a</td>
</tr>
<tr>
<td>Quality improvement reporting for clinicians</td>
<td>10</td>
<td>24</td>
<td>140.0%</td>
</tr>
<tr>
<td>Ambulatory order entry</td>
<td>16</td>
<td>22</td>
<td>37.5%</td>
</tr>
<tr>
<td>Disease registries</td>
<td>16</td>
<td>13</td>
<td>-18.8%</td>
</tr>
<tr>
<td>Public health alerts</td>
<td>n/a</td>
<td>13</td>
<td>n/a</td>
</tr>
<tr>
<td>Public health: electronic lab reporting</td>
<td>n/a</td>
<td>13</td>
<td>n/a</td>
</tr>
<tr>
<td>Connectivity to personal health records</td>
<td>10</td>
<td>13</td>
<td>30.0%</td>
</tr>
<tr>
<td>Quality performance reporting for purchasers or payers</td>
<td>12</td>
<td>11</td>
<td>-8.3%</td>
</tr>
<tr>
<td>Public health: surveillance</td>
<td>13</td>
<td>8</td>
<td>-38.5%</td>
</tr>
<tr>
<td>Public health: case management</td>
<td>13</td>
<td>6</td>
<td>-53.8%</td>
</tr>
<tr>
<td>Reminders</td>
<td>16</td>
<td>24</td>
<td>50.0%</td>
</tr>
</tbody>
</table>

---

3.1 HIE Funding and Business Models

Funding Mechanisms

The majority of HIEs have used extraordinary funds at start-up. Federal and state government grants comprise the bulk of the initial funding. AHRQ has been an active funding source. The HITECH legislation is providing states (State-designated entities) with additional HIE capital with the $300 million State Cooperative Agreement program. State Medicaid agencies have taken an active funding role in some markets such as South Carolina and Arizona, respectively. Some states are considering allocation of municipal bond proceeds such as Maine. Other states are funding through payer assessments, including Vermont which is levying a 0.199 percent fee and for which New Jersey is seeking to enact as well.

However, there are also examples where private organizations have invested in the form of loans or grants. For example, in the case of HealthBridge, six key stakeholders each contributed $250,000 in the form of a loan. Blue Cross Blue Shield in Massachusetts donated $50 million dollars for HIE and Health IT expansion. Laboratories, employers, and others have also been involved in funding HIE. Exhibit 3 details the funding of several Stage 4-7 HIEs.

Exhibit 7. Funding of Select Stage 4-7 RHIO’s

<table>
<thead>
<tr>
<th>Organization</th>
<th>Stage</th>
<th>Geographical Area</th>
<th>Date Founded</th>
<th>Total Funds to Date</th>
<th>Primary Source of Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater Rochester RHIO</td>
<td>5</td>
<td>Rochester, NY</td>
<td>2005</td>
<td>$20,700,000</td>
<td>Government grants</td>
</tr>
<tr>
<td>Bronx RHIO</td>
<td>5</td>
<td>Bronx, NY</td>
<td>2007</td>
<td>$13,100,000</td>
<td>Government grants</td>
</tr>
<tr>
<td>MidSouth eHealth Alliance</td>
<td>5</td>
<td>Memphis, TN</td>
<td>2005</td>
<td>$12,500,000</td>
<td>Government grants</td>
</tr>
<tr>
<td>Big Bend RHIO</td>
<td>6</td>
<td>Tallahassee Region, FL</td>
<td>2005</td>
<td>$10,400,000</td>
<td>Government grants</td>
</tr>
<tr>
<td>NYCLIX</td>
<td>5</td>
<td>New York, NY</td>
<td>2006</td>
<td>$8,300,000</td>
<td>Federal + community org grants</td>
</tr>
<tr>
<td>DC RHIO</td>
<td>5</td>
<td>Washington, DC</td>
<td>2006</td>
<td>$6,000,000</td>
<td>State grants</td>
</tr>
<tr>
<td>CalRHIO</td>
<td>4</td>
<td>CA</td>
<td>2004</td>
<td>$4,610,000</td>
<td>Hospitals, Foundations, Health Plans</td>
</tr>
<tr>
<td>VT ITL</td>
<td>6</td>
<td>VT</td>
<td>2005</td>
<td>$4,200,000</td>
<td>State grants</td>
</tr>
</tbody>
</table>

8 CHIDS estimates based on multiple sources (2009)
### Business Models

A sustainable HIE reflects a situation where **all the costs of the HIE operations are funded based on the value generated from HIE** (e.g. transaction fees, subscriptions, 3rd party reimbursements) instead of other sources external to the direct value chain (e.g. government grants and subsidies). The HIE attempts to monetize that value typically via one of five primary business models, summarized in **Exhibit 8**. Further, a sustainable HIE is also one in which it is possible for any health care provider, health care consumer or payer to electronically share individually identifiable information to support efficiency and quality of care in a standards-based format using non-proprietary mechanisms in a manner compliant with all state and federal security and privacy laws, regulations, and policies. 

The most common model is the hybrid model, which has been operationalized by many HIEs across the nation. The value exchange model is an interesting new concept being used on a limited basis, initially planned for by CalRHIO and United Health Insurance. CareSpark in TN is using a variation of the value exchange model in which participants pay up-front fees and all cost savings are returned to participants; these cost savings are forecast in excess of $20 million over the coming years.

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### Exhibit 8. HIE Business Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membership/Subscription</td>
<td>Members pay a set subscription fee for participation, typically based on size (e.g. bed size, revenues). Subscription fee benefit is that for one price, participants can utilize without counting costs of transactions. RHIOs should pay close attention in developing pricing scheme to ensure costs and margins are covered.</td>
</tr>
<tr>
<td>Transaction Fees</td>
<td>Participants pay a fee per transaction (e.g. for every result delivered). Transaction fees are best when tied to direct sources of value, e.g. the receipt of electronic test results that otherwise would have quantifiable handling costs. Transaction fees should be avoided in instances where the fee disincentivizes data contributions to RHIO.</td>
</tr>
<tr>
<td>Hybrid Model</td>
<td>A common approach, in a hybrid model, certain services are included in a subscription mechanism with other services or transactions fee-based. Those data transactions which directly contribute to the value of the RHIO, such as data feeds from labs, such as clinical results, are usually in the form of subscription</td>
</tr>
<tr>
<td>Sales of goods or services</td>
<td>Revenue from selling goods, information, or services, e.g. implementation services, selling cleansed data. This source of revenue is typically ancillary to core services.</td>
</tr>
<tr>
<td>Value Exchange</td>
<td>Agreement between stakeholders (typically payers) to pay HIE for value generated based on an agreed upon economic model. Based on premise of “shared savings”. In April 2009, United Healthcare became the first U.S. commercial health plan to agree to pay for HIE services for their members in California. The administration costs of value exchange can be high and it has an additional level of complexity.</td>
</tr>
</tbody>
</table>

### 3.2. Governance of HIE

The role of governance in an HIE oversight varies. There are three general models of governance for state health information exchange shown in Exhibit 9. The most common and preferred method in most mature markets is a private sector-led enterprise with government collaboration. Some states in accord with the recently awarded HITECH Cooperative Planning

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Grants are taking a leadership role as convener and coordinator in HIE. For several years, States have played a role in the development of health IT legislation to ease transition to a digitally enabled healthcare environment. Although States have a role in HIE governance as large purchasers and key stewards of public health, responsible use of taxpayer dollars dictates that HIEs contribute to reducing costs and improving access and quality of care in a visible and accountable manner.

**Exhibit 9. Models of HIE Governance**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Legal Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government-led electronic health exchange</td>
<td>State maintains control of operations and oversight; Direct control over performance, privacy and security; May offer tight integration with state health reform; Financing typically complex; Political, economic, and budgetary issues; Will need to est. sustainable revenue.</td>
<td>Public authority, Government controlled corporation. Existing state agency (state agency perceived lack neutrality can be challenge).</td>
</tr>
<tr>
<td>Electronic HIE as a public utility with state oversight</td>
<td>Provides oversight and regulatory authority w/o responsibility for delivering services; Convening and coordinating are primary roles; May be responsible for developing fair economic models and rates for industry participants; No examples to date of state pure rate setting for HIE.</td>
<td>Public authority, Existing state agency.</td>
</tr>
<tr>
<td>Private sector-led HIE with government collaboration</td>
<td>Most preferred in mature markets; Private sector provides services and has governing responsibility; States may support and collaborate, provide regulation or threat of regulation; When existing consensus and commitment, state direct oversight may be suboptimal; Must be vigilant in addressing potential market failures.</td>
<td>Typically a non-profit 501(c)(3) corporation.</td>
</tr>
</tbody>
</table>
HIEs should consider when designing governance mechanisms. **Exhibit 10** shows the board composition of 6 established HIEs. The most common participants include payers who fill 2.5 seats on average, followed by hospitals and providers who occupy 2.3 and 1.7 seats on average, respectively. Average board size totals about 16 members.

**Exhibit 10. HIE Sample Board Composition**

<table>
<thead>
<tr>
<th>Fixed categories for participants?</th>
<th>AZHeC</th>
<th>CALRHIO</th>
<th>CORHIO</th>
<th>DHIN (DE)</th>
<th>NYeC</th>
<th>TN eHealth</th>
<th>ALL</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Board Membership</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospitals</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>14</td>
<td>2.3</td>
</tr>
<tr>
<td>Providers</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>10</td>
<td>1.7</td>
</tr>
<tr>
<td>Clinics</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0.3</td>
</tr>
<tr>
<td>Local HIEs</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>1.0</td>
</tr>
<tr>
<td>Payers (public and private)</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>15</td>
<td>2.5</td>
</tr>
<tr>
<td>Purchasers</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>8</td>
<td>1.3</td>
</tr>
<tr>
<td>Public Health-State</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0.3</td>
</tr>
<tr>
<td>Public Health-County/Local</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0.3</td>
</tr>
<tr>
<td>Researchers</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>0.8</td>
</tr>
<tr>
<td>Consumer Organizations</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>0.7</td>
</tr>
<tr>
<td>State Gov’t Rep</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>10</td>
<td>1.7</td>
</tr>
<tr>
<td>State Legislature</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Quality-focused Organizations</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0.7</td>
</tr>
<tr>
<td>Laboratory</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>Others</td>
<td>0</td>
<td>1</td>
<td>7</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>13</td>
<td>2.2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>22</td>
<td>22</td>
<td>16</td>
<td>9</td>
<td>13</td>
<td>17</td>
<td>99</td>
<td>16.5</td>
</tr>
</tbody>
</table>

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11 Mannatt Health Solutions
3.3 HIE Landscape Summary

Our HIE environmental scan indicates that HIE initiatives exhibit significant variation in their stages of maturity, business models, and participants. Although evidence about the value being created by HIEs is in a nascent stage, most of the observed anecdotal benefits are related to operational efficiencies. Rigorous evidence demonstrating the effects of HIE on health outcomes is yet to be quantified. Nevertheless, there is significant momentum behind these efforts and optimism that HIEs can help to achieve the goals of patient safety, efficiency, and access to care. As experience with and understanding of these new organizational forms and their economic and social value continues to grow, best practices and lessons learned will hopefully emerge. Our findings and recommendations in this report are based on what we know about progress of HIEs and what we know from similar experiments and phenomena in the private sector.

3.4 HIE Activities in the DC Region

Federal Programs

State Health Information Exchange (State HIE) Cooperative Agreement Program

In March 2010, ONC announced the State Health Information (State HIE) Exchange Cooperative Agreement Program awardees. Awardees are responsible for increasing connectivity and enabling patient-centric information flow to improve the quality and efficiency of care. Grant activities include the coverage of the necessary governance, policies, technical services, business operations, and financing mechanisms for HIE over a four-year performance period. This program intends to build on existing efforts to promote regional and state-level health information exchange while advancing toward nationwide interoperability.

The qualified SDE grantee for the District of Columbia is the “Government of the District of Columbia” which was awarded $5,189,709. State planning activities under this Agreement are being led by James Focht, the D.C. Department of Healthcare Finance CIO, who is serving on the DC RHIO Governance and Sustainability Planning Workgroup. The DC RHIO Business Planning Workgroup will be providing a recommendation to the SDE, which will decide the strategic plan for future District-wide HIE.

As detailed in the District of Columbia State HIE Cooperative Agreement Program Grant Application, “the project strategy for the District’s Cooperative Agreement is to coordinate and leverage the local existing public and private sector HIE efforts that have developed in the District over the past two years to create a seamless District-wide integrated, scalable, and
interoperable HIE. This District-wide HIE will initially interface public sector systems such as the Public Health Laboratory, public health data surveillance systems, the Immunization Registry, the Early and Periodic Screening, Diagnosis and Treatment database (also known as EPSDT or Health Check), and the Medicaid Management Information System (MMIS) together with private sector initiatives such as the DC RHIO, the Children’s IQ Network, and the FQHCs’ health information organization... it is more cost-effective to link and build on these existing efforts that it would be to design and build a separate new District-wide HIE system.”

Health Information Technology Extension Program (Regional Extension Centers)

The HITECH Act authorizes a Health Information Technology Extension Program which consists of Regional Extension Centers and a national Health Information Technology Research Center (HITRC). The regional centers will offer technical assistance, guidance, and information on best practices to support and accelerate health care providers’ efforts to become meaningful users of Electronic Health Records (EHRs).

The DCPCA was awarded $5,488,437 to serve as the District’s REC.\(^\text{12}\) It is expected that the REC will integrate closely with HIE adoption activities as part of its charge to promote EHR adoption. The REC’s goal is to assist a minimum of 1,000 primary care providers in achieving meaningful use of EHRs.

Regional HIE Activity

**Chesapeake Regional Information System for our Patients (CRISP):** CRISP is the designated HIE statewide entity for Maryland. CRISP expanded from its start as a regional HIE collaborative in the Baltimore area. In 2009, the Maryland Health Services Cost Review Commission proposed a small surcharge on some hospital bills to raise $10 million in start-up funding to develop a statewide health information exchange. Five hospitals rates will be raised “extra pennies on each of their claims,” resulting in higher insurer payments, therefore payers are essentially funding the start-up of a statewide HIE.

In 2010, The Maryland Department of Health and Mental Hygiene was awarded $9,313,924 under the State HIE Cooperative Agreement Program, which will help facilitate the further development of CRISP. CRISP is also the Regional Extension Center for the state of Maryland and is being funded with a grant of $5.5 million over four years, after which it is scheduled to be independent.

\(^\text{12}\) Health Information Technology Extension Program
Medicaid Patient Data Hub: The D.C. Department of Health Care Finance (DHCF) is deploying a system called the Medicaid Patient Data Hub (PDH) to provide data analytics, clinical information sharing and other information management services targeted at the Medicaid patient population. This effort is funded through a Medicaid Transformation Grant. The core product developed by MedPlus (a subsidiary of Quest Diagnostics) is in place and has undergone acceptance testing. Claims and clinical data are expected to be included in the system. One primary use case of the system involves utilization to enhance the Early Periodic Screening, Diagnosis, and Treatment (EPSDT) Program, which is the child health component of Medicaid and required in every state. Disease management and advanced predictive modeling capabilities are additional features expected to be provided by the system.¹³

The DC RHIO and Patient Data Hub are planning to coordinate so the PDH may receive clinical data for Medicaid patients to facilitate DHCF’s responsibilities in accord with HIPAA guidelines. The management of the respective systems have expressed interest in ensuring that these resources create synergy and not duplicate services. DHCF is defining the data sharing use cases that establish HIPAA pathways for data exchange and the DC RHIO technical team is working with MedPlus to define use case-specific integration approaches. Development of the DC RHIO – PDH interface is planned to begin in 2010.

Children’s IQ Network

The Children’s IQ Network is a pediatric-specific HIE being led by Children’s National Medical Center (CNMC) with a primary emphasis on covering children in the region spanning DC, VA and MD. Using a recruitment and subsidy model with practices resulting from the Stark Exception legislation, CNMC is subsidizing the acquisition and implementation of EHRs for pediatric physicians. As of Q4 2009, IQ Network is live in over two dozen locations on two different EHR systems (about 170 physicians) with additional interfaces in the testing phase and planned activation of additional interoperability features in summer 2010.

The method for sharing data between the Children’s IQ Network and DC RHIO is undetermined at present with discussions ongoing.

Northern Virginia RHIO (Nova RHIO)

A broad group of stakeholders representing the interests of healthcare in northern Virginia Planning District 8 began meeting in 2006 to take steps towards regional information exchange and there have been planning activities ongoing since then. Hospitals that were part of the

initial planning effort include Reston Hospital Center (HCA), Inova Health Systems, Virginia Hospital Center (Arlington), and Potomac Hospital. The Nova RHIO website states they are engaged in a medication history pilot with the Inova Alexandria ED and a project called “File for Life” to capture community members’ health information digitally, as well as a CMS-funded initiative to implement EHRs in local physician practices. The progress of the Nova RHIO in achieving its aims for HIE is undetermined at present.

3.5 Benchmark Findings

In addition to a broad environmental scan, the assessment reported here was informed by a benchmarking exercise that examined three HIEs credited with being “successful,” and sought to understand their context and lessons via conversations with their leadership. The three selected HIEs were HealthBridge (Greater Cincinnati), Delaware Health Information Network (DHIN - Delaware State), and Michiana Health Information Network (MHIN – Southeast Michigan to Northern Indiana). The conversations covered themes around sustainability, technology, governance, and success drivers. Each of these HIEs was originally founded in the late 1990’s.

Early on in the formation of the respective HIEs, the decision was made to match the business case to the needs of the stakeholders and price accordingly – i.e., participants are only charged for services where there is clear and quantifiable value. In the case of HealthBridge it was decided that providers are the key constituents and primary funders so their needs were paramount. Similarly, MHIN is provider-centric and funded through provider organizations principally. DHIN, as a division within the Delaware Healthcare Commission, is focused on patient health and quality, but also has public health as an area of emphasis.

Service offerings typically begin with “quick wins” and develop in incremental steps. A recommended first step is replacing manual paper-based processes with digitally enabled transactions that maintain alignment to workflows while minimizing the administrative burden of paper management. When providers and administrators start to see what they would be faxing, scanning or making a phone call without the HIE system, the value becomes more clear. These benefits should be communicated appropriately.

For hospitals, providing data through the HIE is a win compared to providing results and other data in paper form to practices and others in a community who need access to that information. Equally for the providers, having a single interface to the multiple systems is more efficient than trying to independently interface with the several hospitals typically serving an area. For the HIE, it is important to continually add new additional data sources to build the network effect.
The dynamic between the push and pull model was emphasized with the former being preferred. In a push model such as email the information is delivered via a clinical inbox or even better directly into an interfaced EHR, whereas in a pull system which operates like a search engine the provider is searching for data across an enterprise. The pull system may also entail an additional step in the workflow which is not preferred.

Both HealthBridge and MHIN use primarily a subscription-based service for most services which is a capped tiered structure based on institution type, size, and services provided. The fee structure runs a wide gamut with annual fees for major hospital systems that are estimated to run from $200,000-$500,000 to smaller ancillary facilities such as nursing homes, critical access hospitals in the range from under $10,000 annually to around $50,000. One driver for subscription pricing is to incentivize sending as many transactions as possible across the network, whereas per transaction pricing may create disincentives. Certain transactions have fees associated with them, such as in HealthBridge’s case the ambulatory order entry system where each transactions cost basis is less than the cost of the paper-based process. The cost for physician practices in all cases is marginal or free. DHIN is also funded primarily by health systems, although funding is “extraordinary” with legislation providing for private participants to match state funding dollar-for-dollar.

Other “keys to success” themes were illuminated in the discussions with the benchmarks. The need for strong community engagement with dedicated effective leadership was often cited. HIE is a community effort and to the extent that all the major players are at the table and collaborating it facilitates development and growth. The major players in each of the benchmarks are the health systems as well as the laboratories in the respective regions. These successful HIEs serve a limited geography, and in that geography they command a majority presence of providers and hospitals. Another lesson is the risk of the “go-it-alone” strategy. Competing efforts from local hospitals or other health information exchange players can dilute the impact of a truly interconnected system. This dynamic is interwoven with the need to have all the key stakeholders at the table.

The issue of payer involvement is important to note. While payers had a role in planning or even some limited funding as in the case of DHIN, they are not paying participants nor funding agents in any of the benchmark HIEs. Albeit, payers are involved in the governance structure of the HIEs, and in the case of DHIN, the Chairman of the Board is the head of the local AETNA Medicaid Plan. The point is that payers should and need to be involved, but should not be relied upon to contribute. Rather, the business case of HIEs should focus on where value transactions can be made, most likely with the provider community.
Exhibit 11. Benchmark HIEs Snapshot

<table>
<thead>
<tr>
<th></th>
<th>MHIN</th>
<th>HealthBridge</th>
<th>DHIN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Business Model</strong></td>
<td>Est. ~$10K–&gt;$400K annual subscriptions, ancillary services (interface deployment, quality, EHRs)*</td>
<td>Tiered Subscription for unlimited data most services. Transaction fees for select services.</td>
<td>DE statute requires private sector matching funds from stakeholders. Working on a “sustainable model”.</td>
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<tr>
<td><strong>Founded</strong></td>
<td>1998</td>
<td>1997</td>
<td>1997</td>
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<tr>
<td><strong>Funding Origination</strong></td>
<td>$200K from 6 hospitals and a laboratory</td>
<td>$1.75M loan</td>
<td>$12M</td>
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<tr>
<td><strong>Services</strong></td>
<td>Results reporting, “print efficiency”, community repository data sourcing.</td>
<td>Clinical messaging and portal. Sends information including lab data, radiology/ADT information, demographics, admissions notices, discharge summaries, transfer notices.</td>
<td>Results delivery (ehr direct, clinical inbox, direct to fax), Patient search function.</td>
</tr>
<tr>
<td><strong>Funding, Current</strong></td>
<td>Commercial Services (100%)</td>
<td>Commercial Services (100%)</td>
<td>Federal (1/3), State (1/3), Customers (1/3)</td>
</tr>
<tr>
<td><strong>Physicians</strong></td>
<td>1,000</td>
<td>4,400</td>
<td>60% of providers currently practicing in DE (800+ est.)</td>
</tr>
<tr>
<td><strong>Hospitals</strong></td>
<td>~ 7 hospitals, 80+ total organizations</td>
<td>29 hospitals, 5500 physician users, 17 local health departments, 700 physician offices and clinics</td>
<td>3 health systems, adding 4th, ~800,000 patient records</td>
</tr>
<tr>
<td><strong>Keys to success</strong></td>
<td>Accelerating pace of benefit, broad and supportive constituency, adding data sources</td>
<td>Push system value, Stakeholder Support</td>
<td>All the players at the table, Strong government support, limited geography</td>
</tr>
</tbody>
</table>

*MHIN charges are estimated range as actual charge structure is not publicly available information.
4. An Assessment Model for a RHIO

A RHIO or a health information exchange represents a unique and increasingly important organizational form, typically a collaborative partnership between entities drawn from the public, not-for-profit sector, governmental agencies, and the for-profit private sector. Such public-private partnerships are becoming common in the domain of public health, where any one sector may not possess the knowledge, expertise, and resources to address problems that are substantial in magnitude. However, the PPP organizational model also poses challenges with respect to a variety of issues including the availability of resources, governance arrangements, and the often conflicting objectives of the plurality of stakeholders. PPPs have been variously structured as for-profit or not-for-profit entities and can have varying missions. Regardless of its structure, the assessment of the performance of such an enterprise must be broad-based, focusing on the generation of value along multiple dimensions.

As discussed in earlier sections of this report, a variety of HIE experiments have been launched across the nation. The learning from these experiments coupled with the fundamental objectives and goals of an HIE suggest five key performance dimensions or components: value creation and sustainability, governance, technological infrastructure, community engagement, and public trust (Exhibit 12).

At the core of the assessment model is the value creation and sustainability dimension that isolates the sources and magnitude of value being generated by the HIE for society and other relevant stakeholders, quantified in both measurable outcomes and intangible value. Closely tied to value creation is sustainability, or the degree to which the HIE has been able to construct a business model and a revenue stream that adequately offsets its operational costs.

The governance dimension evaluates the policies, structural mechanisms, and

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decision making processes that guide the strategic, tactical, and operational activities of the enterprise. Technology represents the quality of the infrastructural foundation upon which the RHIO or HIE is constructed. This dimension speaks to the robustness of the foundation, measured along multiple dimensions such as cost-effectiveness, adherence to standards, and other desirable features. This dimension also includes change management and other related activities that are necessary in order to successfully implement the technical solution and ensure adoption and use by targeted stakeholders. Community engagement asks the question: has the RHIO been successful in engaging and bringing to the table all concerned parties that are essential for its continued success?

Finally, to the extent that a RHIO operates in the highly sensitive public health domain where the digitization of information raises critical concerns related to privacy and security, the public trust assessment dimension evaluates the types of privacy practices and policies that have been crafted, and the degree to which public trust in the enterprise exists.

Two observations about the dimensions of the assessment model are in order. First, the dimensions are inter-related and mutually reinforcing. For example, community engagement is a driver of value creation and sustainability, since more participants in the exchange expands the space of revenue opportunities. Likewise, to the degree that new participants will enter the exchange only if they believe that it is managed effectively, governance is likely to be a driver of community engagement. High levels of public trust will reinforce and accelerate community engagement. Second, adequate performance in each dimension is necessary for the overall success and continued viability of a RHIO. For instance, a RHIO that exhibits outstanding performance in one domain such as community engagement, but is unable to construct a sustainable business model is unlikely to remain a going concern.

We discuss each performance dimension in detail below.

4.1 Value Creation and Sustainability

What is the core value proposition of a RHIO? At the highest level of abstraction, a RHIO exists to improve the health and well-being of the community it serves. Indeed, the notion of a RHIO was born from the assumption that there are public health benefits to be gained from the electronic storage and exchange of health data across the health care ecosystem. RHIOs have the potential to alleviate issues associated with a disconnected healthcare system in a region. Sharing clinical data in real-time can improve the quality of care and reduce costs associated with redundancies, administrative inefficiencies and suboptimal care coordination. Combining clinical data with claims data offers the promise of improved visibility into the effectiveness of alternative therapies and interventions. Large collections of clinical data can drive research that
illuminates our understanding of disease progression. Such benefits can accrue at macro-level public health outcomes and at the individual hospital, practice, practitioner and patient level.

Sample benefits include:15

- Improve best practice clinical decision making by sharing comprehensive patient records with clinicians, laboratories, referring physicians and agencies;
- Improve operating efficiency, from labor cost reductions and administrative burden of paper-based information sharing, follow-up and management;
- Improve clinical efficiency reducing ER visits, fewer medical errors, avoiding duplicative tests and procedures.

As with any PPP, value creation and appropriation is heterogeneously distributed across stakeholders. Each stakeholder within a RHIO has their specific value areas and challenges to monetizing their perceived value. It is incumbent upon the RHIO to identify, monitor and measure those value areas and provide a level of service commensurate with delivering that value.

Value creation and sustainability are tightly linked, with the latter being predicated on the former. Sustainability implies that the RHIO has constructed a business model that is financially viable. In the 2009 eHealth Initiative survey of HIEs, the development of a sustainable business model was cited as a “very difficult challenge” and “moderately difficult challenge” by 56% and 35% of respondents, respectively.16 Most RHIOs have been launched with a mix of grant and investment funding to seed development with the intent to create a critical mass of participants and data flow that would yield a sustainable operating model based on cash flow from operations. The HIE is a classic instance of network effects, where the value of participation is an increasing function of the number of players who participate in the exchange. To date, only a handful of RHIOs have successfully made the transition to a sustainable model with the eHI 2010

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survey reporting 18 sustainable HIEs\textsuperscript{17}. Those RHIOs that have been successful have discovered or were originally constructed on the basis of compelling value propositions for the different community users, with hospitals and physicians being the key constituents. And that is the key to RHIO sustainability, to identify sources of value for each stakeholder group, create services to deliver the value, and monetize that value, typically in the form of subscription and/or transaction fees. The value must be identified and articulated in the form of cost savings or revenue opportunities, and priced in a manner consistent with each stakeholder’s willingness to pay. The types of benefits that a RHIO can yield for each participant type and stakeholder are described next. These are synthesized from the primary data gathered through stakeholder interviews and benchmarking research, as well as secondary data from published literature. Stakeholders are instantiated to the specific context of the DC RHIO. We note that each benefit represents a potential source of revenue and must be appropriately accounted for in the construction of a sustainable business model.

4.1.1 Potential Value Sources for Different Stakeholders

Hospitals

Hospitals are the “anchor tenants” of the regional health ecosystem and key participants in all sustainable RHIOs. Not only are they important providers and consumers of data, given their referral relationships with many physician practices they can be a significant driver of community HIE adoption. Hospital participation in sustainable RHIO is typically based on a subscription fee.

Challenges related to hospital participation include the perception by many hospitals and provider practices that they are adding value by contributing resources and data to the RHIO and therefore should not be required to pay for basic services. Hospitals expect to derive a variety of benefits from HIE participation, including improved quality of care, improved competitive market position, improved customer service and resultant patient loyalty, and access to large data repositories for

\begin{footnote}
\textsuperscript{17} eHealth Initiative (2010). “The State of Health Information Exchange in 2010: Connecting the Nation to Achieve Meaningful Use (A Report Based on the Results of the eHealth Initiative’s 2010 Seventh Annual Survey of Health Information Exchange.”
\end{footnote}
clinical research. Hospitals typically have their own robust health IT systems that share internal test and order data, so some of the compelling efficiency value at the physician level may not be mirrored in the inpatient environment.

Sample benefits for hospitals include reductions in clinician time spent searching for records, less time providing data to outside entities, reduced ER crowding, RN efficiency gains, enhanced ability to conduct clinical research, and higher reimbursements as a result of “meaningful use” compliance with electronic data sharing incentives.

**Physician Practices**

Private physician practices along with hospitals both are primary providers of the data and serve as the primary consumers of data for a HIE. A sustainable HIE must engage a critical mass of physicians for success. There is anecdotal evidence that a critical mass of physicians yields competitive pressures reinforcing the value of participation.

Many physicians understand the benefits of a connected health system, even if they can’t experience it to date. When asked about HIE, we often hear physicians comment that the potential is immense. When physicians can access and use patient information in a timely way, Barron reports “[We] are able to be better physicians. We communicate more quickly and clearly with patients on the telephone and by letter, transmit important clinical information more efficiently to specialists, and spend less time paging through charts to find out what the previous cholesterol values (for example) had been.” Quick wins for HIE in physician practices include replacing those things that require the scanning and faxing, making a phone call.

Benefits that physicians may derive from a RHIO span a gamut from patient safety to administrative and practice efficiency. They may include, for example, lower costs of communication, time savings associated with chart requests, reduced staff time spent on clerical administration and filing, reduced delays associated with paper-based ordering, improved access to test results and resultant efficiencies on practice, improved quality of practice life (i.e.,

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fewer hassles looking for information, getting home sooner at the end of the day, etc), reduced staff time spent on handling lab and radiology results, and enhanced reimbursements as a result of result of “meaningful use” compliance with electronic data sharing incentives.

Health Clinics

The health clinic physician practices are set to realize the same benefits as private practices, but are the most challenged in terms of financial resources to support RHIO activity. Publicly funded health clinics have various reporting requirements and the data captured in the RHIO may facilitate compliance reporting.

Even in resource-constrained environments, when manual, resource-intensive processes can be replaced by value-added services there is net gain. Health clinics also serve an important public health need for access to quality care. To the extent that the HIE facilitates improved access to quality care, the traditional funders of safety net clinics receive value relevant to their mission of providing care for indigent and resource constrained populations and should, therefore, be considered as a potential source of financial resource contributions to fund RHIO activity.

Payers

It is often noted that the benefits of health IT and HIE accrue to payers in the form of healthier patients from better managed and coordinated care as well as decreased utilization of services. While the logic of this is understandable, it is difficult to quantify the magnitude of this benefit and therefore to directly monetize the benefit for payers to fund HIE activity.

There have been cases of RHIOs where payers are instrumental in both funding and data integration, such as HEALTHelINK in western New York State. In Massachusetts, Blue Cross Blue Shield has been a leading advocate and funder of HIT and HIE. The Delaware Health Information Network (DHIN) took a payer-provider business problem, and developed value-added services focused on replacing paper-based transactions with electronic transactions, including query eligibility of covered benefits (i.e. co-pays and deductibles), send and receive referral authorizations for approval and routing to specialty providers, submit electronic claims, etc.20 In California, a novel value exchange approach received agreement whereby payers pay the HIE based on a shared savings model to their members.21 This innovative approach is complex and includes reporting burdens, but may hold promise going forward. In other markets, the State Government has taken the approach that payers are the beneficiaries and thereby regulated

21 CalRHIO and United Healthcare had agreed on this method, but this project has stalled. (2010).
fees to payers are equitable approach to support HIE funding, with at least one state using 0.199 cent fee on administrative claims transactions. Payers also have participated in ancillary funding of activities through pay-for-performance schemes enabled via HIE.

It is important to recognize the tension inherent in payer participation and consumer participation due to the mistrust between these stakeholders. Some suggest that access controls mirroring those that exist in the paper world help to allay consumer concerns and increase trust in the RHIO. However, a result of payer clinical data exclusion is that many payers do not see clear direct value in their participation. The prevailing mindset is that if they do not receive clinical data then they should not have to pay for it.

Nevertheless, payers are very interested in the information, and as one payer describes, “we are consumers of information. That’s what managed care is all about, is taking the claims experience and trying to rationalize it, understand what’s happening, and be able to improve the services to and outcomes for our members and district’s beneficiaries. Thus is congruent with the concept of the RHIO being a data repository and platform that can create insight to improve outcomes.” Other value areas identified include “there are treatment protocols, there are outcome studies that when we get into looking at comparative effectiveness of treatments, those kinds of things I think will be supported by an HIE”.

Potential benefits for payers can include fewer inpatient hospitalizations, reduction in unnecessary tests, fewer medical errors and enhanced patient safety, and better management of chronic conditions.

**Department of Health Care Finance (DHCF)**

One of the largest health care payers in the District, DHCF is engaged with the promise of HIE to improve outcomes and lower costs. The availability of clinical data to integrate with claims data will facilitate improved understanding of the benefits and improved management of costs. DHCF is the lead coordinating agency for the District’s federally funded HIE planning activities, and is a critical stakeholder. Medicaid spending can be positively affected by HIE, and the quantification of HIE value through disease management protocols and other evaluations should be included in HIE sustainability planning.

**Department of Health**

As the lead agency “to promote and protect the health, safety and quality of life of residents, visitors and those doing business in the District of Columbia” the Department of Health (DOH) is a key government agency involved in the DC RHIO. DOH has bearing on distribution of grant...
funds for HIE, so their involvement is key. In addition to public health improvements that are consistent with agency’s core mission, additional benefits involve improved reporting and compliance with mandates.

Best practices for State-Level HIE indicate that public health enterprises should play a leadership role in state [District]-wide HIE initiatives with the private health care sector. Departments of Health may also serve as a neutral party in the oversight and governance of a state’s emerging HIT implementation. In DC the designated entity by public health (DOH) to provide the leadership and day— to-day management of the DC RHIO is the District of Columbia Primary Care Association.

As noted, the value for DOH arises from the potential of the RHIO to improve the health of the District. For example, from a public health perspective, the RHIO can be viewed as an enabler of population health with benefits accruing to the community’s health. The data captured in the RHIO can yield improved identification of disease outbreaks, earlier interventions to control and manage such outbreaks, and better utilization of scarce emergency department resources.

Other Players

- Testing organizations such as laboratories and imaging centers are important participants in HIEs around the country. Indeed, laboratory results are one of the most frequent data types exchanged by HIEs (68 initiatives).\(^{22}\) Leveraging an HIE infrastructure may yield significant efficiencies in communicating data to testing organization customers, yielding value for both the testing center and the users of results.
- Consumers are an important piece of the value equation and while they are beneficiaries of care coordination, models supporting direct consumer financial support of HIE are yet to be constructed and operationalized. It is important to note, however, that some consumer advocacy organizations have participated in initial funding and are often included in governance activities.
- Clinical research organizations (CROs) find value in the data and they and their Pharma partners can serve as a source of revenue. The use of data for these purposes has to be approved by stakeholders and concerns exist around this type of participation. Although the clinical research aspect can serve as ancillary funding, it is not sufficient independently for sustainability.

\(^{22}\) eHealth Initiative (2010) “The State of Health Information Exchange in 2010: Connecting the Nation to Achieve Meaningful Use (A Report Based on the Results of the eHealth Initiative’s 2010 Seventh Annual Survey of Health Information Exchange.)”
• Employers participate in the HIE by virtue as their role of healthcare purchasers. Employer based participation has traditionally been in the form of seed funding support although this activity is undetermined market-wide and not a primary driver usually. Employer involvement can engender some of the same concerns among consumers that payers do in mistrust of data use.

**Exhibit 13** provides a list of potential benefits from a RHIO that may accrue to different stakeholders. We note that these are potential and not necessarily realizable benefits. The magnitude of benefit appropriation is dependent on a variety of factors such as the ability to quantify value, the quality of the technology implementation, the quality of internal processes in the participating organizations, etc.
### Exhibit 13: Health Information Exchange Stakeholders and Benefits (Source: CHIDS research)

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Sample Benefits</th>
<th>Cost Savings</th>
<th>Efficiency</th>
<th>Health Outcomes/Clinical</th>
<th>Compliance</th>
<th>Discovery</th>
<th>Tracking &amp; Reporting</th>
<th>Coordination</th>
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<tbody>
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<td><strong>Providers</strong></td>
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<td>• Integrated delivery networks</td>
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<td><strong>Stakeholders most Commonly Exchanging Data with Providers</strong></td>
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<td>• States (funder, data resource partner, project facilitator, and neutral convener)</td>
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<td>• Technology partners</td>
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4.1.2 RHIO Sustainability

Recognizing that sustainability is dependent not only on a financially viable business model but also on other organizational and environmental considerations such as technology, governance, etc., we include such non-financial aspects as distinct components in the assessment model. Prior studies on HIE have largely focused on financial viability as one of the major barriers towards sustainability. Studies suggest that at the initiation and planning stages, HIEs have been optimistic in their efforts. However, at later stages, their progress and growth has been slow. An early study has found that exchanging a narrow set of data and involving a broad group of stakeholders were independently associated with HIE sustainability\(^{23}\). While securing early funding from participants was associated with a higher likelihood of financial viability, early grant funding was not very helpful for sustainability. Difficulty in securing funding is an important challenge and very few HIEs earned sufficient revenue to be sustainable in their early days of operation.\(^{24} \,^{25}\)

Driving an HIE towards sustainability is an immensely complex task. Along with financial issues, prior research also argues that other factors affect sustainability including inappropriate business models, difficulties in aligning the goal of social welfare with individual stakeholders’ objectives, and poor technology choices.\(^{26} \,^{27} \,^{28}\) Engaging patients, providers, and other stakeholders, and earning their trust is one of the other factors that drive HIE success.\(^{29}\) Examples of HIEs that have been able to earn the trust of their stakeholders and achieve some success are the Massachusetts eHealth Collaborative (MAeHC) effort and the HIEs supported by the HEAL NY of New York State.\(^{30} \,^{31}\)

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Transaction efficiency is important for the performance of HIEs. As HIEs start fulfilling the expected business needs of the hospitals or physicians, such as exchanging test and diagnosis results at the time of need, their benefits becomes apparent. In comparison to the proprietary data exchange systems developed by hospitals, where competition to attract physicians is the main driver, the community driven HIEs are driven by transaction efficiency. This can, in turn, result in greater participation, more frequent data exchange, higher volume of transactions, and provides scale effect for the HIEs; which can result in sustainability. However, transaction efficiency is dependent on the technology and systems used for the exchange of health information; HIEs operating in rural areas that lack in technology infrastructure confront challenges in realizing transaction efficiencies.

Researchers have also suggested that comprehensive understanding of the needs of phases and processes of implementation, evaluation criteria, and related environmental factors, such as strong state or regional leadership and political support are determinants of the success and sustainability of HIEs.

The penetration of EMR/EHR in the RHIO or HIEs geographical region is also correlated with sustainability. The electronic medical record is the core technology that must be in place to facilitate health information exchange. Regions that have high adoption rates of EMRs are more readily able to plug in an HIE. Recognizing this, many RHIOs have coupled EMR integration assistance and an EMR into their service offerings. Also critical to sustainability is the support of

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key stakeholders within the region. In some regions, it may be a single dominant health system, whereas in other areas, there may be a consortium of major employers that realize the benefits of health information exchange, as was the case in the genesis of HealthBridge.

To the degree that every RHIO requires a critical mass of participation before it can reach a tipping point and begin to realize revenues, adequate seed funding is critical. Indeed, the long-term financial viability of a RHIO is predicated on adequate funding for initial planning, infrastructure development, and supporting operations. Without adequate funding to meet the ramp up period, a RHIO can be forced to neglect important considerations and indeed, as in the case of the Santa Barbara RHIO, cease operations. At the same time, seed funding should come with clear milestones and targets for sustainability within reasonable time to ensure proper allocation of resources.

4.1.3 RHIO Business Model

A business model fundamentally specifies the cost and revenue streams for an enterprise. Often, business models also include other aspects of organizational design and operating activities. Prior literature has identified three critical success factors in the broader framework of business models that are drivers of a successful HIE. First, studies argue that careful crafting and consideration of the operational, financial and societal returns in the business model will ensure smooth and streamlined processes of the HIE organizational structure.41 42 Second, specifically incorporating a plan for comprehensive evaluation of the return on investments will ensure that the HIE is progressing as per original plan to achieve its objectives.43 Third, the regulatory and financial structure in the healthcare sector has implications for the feasibility of any given business model and also shapes the success or failure of the HIE.44

A robust business model ensures that the HIE incorporates and appropriately addresses the requirements, preferences and demands of the participating organizations, other stakeholders and the broader healthcare ecosystem, including optimizing available resources and planning for the foreseen changes.45 For example, planning the business model solely based on physician

subscriptions may not be feasible because physicians are not always willing to pay to participate in HIE due to a perceived asymmetry of benefits--while payers realize the gains, physicians have to incur the costs. Aligning the HIE’s objectives with the participants’ goals, and collaboratively planning for the structure, governance, pricing and incentive structures will help ensure the support of stakeholders in the future. HIEs can follow models such as centralized, federated or hybrid, depending on the preferences and requirements of the participating stakeholders.

The initial and ongoing support from the stakeholders based on a robust and agreed upon business plan will help provide assurance that all the participating organizations follow the required standards for data exchange, maintain confidentiality, and adhere to the prescribed guidelines. Prior research has estimated that adhering to a standardized HIE model could yield a net value of $77.8 billion per year, although some question these optimistic estimates.

The exact nature of the business model for a RHIO is a function of many factors, and the composition and needs of the players in a market will define the business model. Research suggests that business development should be focused on incremental steps. There are quick wins that can be had. For example, the Michiana Health Information Network, the development of an electronic results delivery service which replaced printing, faxing, and scanning for physicians was able to demonstrate immediate savings for provider practices. The business model must achieve buy-in from the key customers, generate value, and collect monies in the form of subscriptions or transaction fees, although, as described in the environmental scan, other ancillary revenue opportunities usually exist.

In addition to providing services that RHIO participants pay for, there are other mechanisms for RHIOs to optimize their financial performance through innovative offerings and business relationships that are cost-effective. For example, a RHIO should consider a scalable technology solution that leverages ASP or pay per use model for paying for services providing by vendors. To the extent possible, fixed costs such as IT employees or investments in IT infrastructure should be avoided without firm commitments from customers about usage, pricing and revenues. Innovative offerings that are potentially monetizable include clinical drug trials and protocols directly with Pharma, quality and transparency pilots, pay-for-performance initiatives with payers, and payer-coordinated claims processing efficiency pilots.

4.2 Governance

The second dimension of the performance assessment model addresses the issue of governance. Appropriate governance is a critical factor for the HIE as it defines the roles and functions for the top management, determines organizational structure and operational strategy to achieve the objectives. The governance structure influences the recruitment of suitable board members who have interest in achieving the HIE’s goals within its structural constraints. For example, HIEs with a public governance structure model may get the grant and regulatory support from the oversight and commitment of state and regional governments. Although prior studies do not provide any clear typology of governance, there are several plausible conceptual models of public governance that can inform the legal structure, financing and accountability of HIEs. Public health plays a leadership role in some existing HIE initiatives. Further, public health can serve as a neutral party in the oversight and governance of a state’s emerging HIT implementation (e.g. North Carolina’s electronic health data systems).

For community driven or collaborative HIE initiatives, establishing the shared “norms” through appropriate governance structure is a requirement to garner adequate community or collaborators’ support. Specifically, the prior literature has emphasized that the governance structure needs to be inclusive in case of the community driven or collaborative HIE initiatives. Similarly, for other types of HIEs, the governance structure influences leadership.

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50 UMSC-CHPR (2009). Public Governance Models for a Sustainable Health Information Exchange Industry: Report to the State Alliance for E-health, Report by University of Massachusetts Medical School Center for Health Policy and Research (CHPR) in collaboration with the National Opinion Research Center (NORC) and the National Governors Association Center for Best Practices.


stakeholder engagement\textsuperscript{55}, and earning their commitment for evolution of standards, policies, education, infrastructure, connectivity and implementation that are necessary for the HIE’s success\textsuperscript{56} \textsuperscript{57} \textsuperscript{58} \textsuperscript{59}. Some success along these lines has been seen in the case of the Jackson Community Health Information Exchange in Michigan where a 160-member physician contracting group joined together to champion a community electronic health record storage and exchange platform \textsuperscript{60}.

4.2.1 Core Principles of Good Governance

Governance sets the broad framework for running an enterprise and specifies details related to the structures, roles, and processes that enable any complex organization to operate efficiently and effectively to accomplish its mission and satisfy the requirements of all stakeholders. Any organization that requires multiple, perhaps competing stakeholders to work in cooperation, and that serves an important social purpose, such as a public private partnership (PPP), must not only design its governance diligently, but also continually monitor, evaluate, and refine its processes to ensure mission alignment.

Organizational structures responsible for governance should conform to the following general principles and best practices:

1) **Shared Governance with Appropriate Representation:** The structure responsible for setting the strategic direction of the entity and making all critical resource allocation decisions, such as the Board of Directors, should have representation from all the major stakeholders comprising the consortium. There is an important trade-off between every organization having a “voice” at the table and the efficiency of governance processes. In instances where the consortium consists of tens or hundreds of organizations, alternative formulae for representation are needed. To illustrate, in an HIE, if physician practices were to participate as members of the consortium, physicians may elect one


representative to serve on the Board. Similarly, if all clinics within a state were members of the HIE, a single representative from all clinics would serve on the Board. Furthermore, to the extent possible, the Board must be constructed to be representative of the diversity of stakeholders along multiple dimensions, including size, relative power, and products. For example, should technology companies choose to participate in an HIE as members, it is as important to ensure the representation of the small entrepreneurial companies with perhaps a single HIT product, as it is for a large organization such as GE Healthcare or Microsoft.

2) **Extensive and Continuous Board Engagement:** Unlike an organization in a start-up phase, a going concern requires sustained and continued engagement of its highest-level decision making body. This requires that the Board has a well-defined schedule of meetings, that all Board members are required to participate in these meetings, and that there is a formalized process for communicating decisions made by the Board throughout the rest of the organization and to the public.

3) **Trust among Top Management Team Members:** Research has shown that in the absence of high levels of trust among the top management team members, the organization can very quickly become dysfunctional. It is therefore important to socialize Board members into their responsibilities, provide them with opportunities for building relationships with each other, and to expend time and effort developing mutual trust and respect at the very beginning of Board construction.

4) **Transparency in Decision Making:** Any organization with a mission that is as consequential as the advancement of public health is heavily reliant on public trust and confidence in order to survive and thrive. Decision making processes within the Board and other key committees within the HIE must be transparent to the public, available for scrutiny, and decisions must be justifiable on the basis of compelling arguments and strong evidence.

5) **Vertical Structures for Key Processes and Activities:** In addition to the highest-level decision making body, much of the administration of the organization will be conducted along more “functional” or “vertical” lines. For example, an HIE may have a technology infrastructure committee tasked with developing and maintaining the technological base for the exchange. The leader of this committee will have a line relationship to the Board, serving a liaison and providing input as needed for strategic decisions. Similarly, a “clinical committee” may be charged with the responsibility of determining secondary uses of EHR data; the head of this committee would report to the Board.

6) **Lateral Coordination Mechanisms:** When organizations become large and are comprised of stakeholders, coordination across the disparate functional areas and businesses is frequently challenging. Lateral coordination mechanisms are committees that meet periodically to share experiences and information about the different pieces of the organization so that there is a shared and collective understanding of the overall
status of organizational health. An HIE should consider appointing a committee with members representing the leaders of all “functional” or “vertical” structures to enable lateral information sharing.

4.2.2 Evaluating the Governance of a RHIO

As discussed above, governance is a complex and multi-faceted concept and, to a large extent, governance can be deemed to be effective if the organization is able to meet its objectives while complying with all regulatory and legal requirements that affect it. Governance can also be assessed as effective if the general public and concerned stakeholders are satisfied with the design and operation of the enterprise. Several intermediate indicators can be used as direct predictors of effective governance. These are summarized in exhibit 14.

Exhibit 14. Metrics for Evaluating RHIO Governance

<table>
<thead>
<tr>
<th>Structure: Size and Composition (Board, Committees)</th>
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</thead>
<tbody>
<tr>
<td>• Coordination Mechanisms: Roles, Task Forces, designed to facilitate mission accomplishment and efficient operations</td>
</tr>
<tr>
<td>• Representation coverage (All relevant stakeholders represented subject to size)</td>
</tr>
<tr>
<td>• Leadership roles for key HIE value chain activities such as technology</td>
</tr>
<tr>
<td>• Vertical structures</td>
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<tr>
<td>• Lateral coordination mechanisms</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Board “Governance IQ” 61</th>
</tr>
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<tbody>
<tr>
<td>• Board Management Skills and Know How = Board Competency</td>
</tr>
<tr>
<td>• Behavioral and Social Skills = Emotional Intelligence</td>
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<tr>
<td>• Competency + Emotional Intelligence = High Governance IQ</td>
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<table>
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<tr>
<th>Other Governance Attributes</th>
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<tbody>
<tr>
<td>• Transparency in decision making processes</td>
</tr>
<tr>
<td>• Degree of board engagement (continuous and extensive)</td>
</tr>
<tr>
<td>• Trust among top management team members</td>
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</tbody>
</table>

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• Formalization of decision making policies (extent to which key decision processes are documented)

4.3 Technology

Technology in the context of HIE evaluation refers to the collection of tools, systems and techniques used to facilitate the operations of the HIE. To the degree that the core value proposition of a RHIO or HIE is to facilitate the electronic capture, storage, and dissemination of information and provide connectivity among the various disparate elements of the healthcare ecosystem, technology plays a critical role in the success and long-term sustainability of the enterprise. HIEs may use one or more technological approaches to HIE. These include but are not limited to edge servers, shared EHR, clinical data repository (CDR), master patient index (MPI), record locator service (RLS), telemedicine technology, eRx, technologies to support medication management, and disease or immunization registries. There are tradeoffs in management of information efficiency and security risks versus a federated architecture versus centralized system – the resources to pull real-time querying across multiple systems is computationally intensive and in a centralized system greater risk of data theft exists. Although, most leading vendors have applied additional protocols to manage the security risk and often across a RHIO one will find a hybrid of centralized and federated systems. There is no “silver bullet” technology and the appropriate technology is based on the specific needs of the individual HIE.

In evaluating the technological foundation upon which a RHIO is constructed, there are two broad sets of considerations. One set of considerations relates to the quality of the artifacts in the solution, and encompasses dimensions such as scalability, adherence to standards, system reliability, cost-effectiveness, and range of services that are supportable. Among these is NHIN Alignment: The NHIN is a set of standards, services and policies that enable secure health information exchange over the Internet. The ability to connect with the NHIN is an important factor for data exchange with other HIEs and federal agencies [via the CONNECT gateway].

The degree to which the technical foundation is flexible and able to connect with disparate systems is also critical. Within a typical community, there exists a range of healthcare organizations each with their own health information management systems. A large health system may have multiple health information management systems across different units which add to the complexity. The extent to which these systems, primarily the EHR, can communicate

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with the HIE, helps drive utility. When there are a wide range of proprietary systems in use in a given community, it is more difficult to create all the interfaces to the HIE. Typically, once an EHR vendor has created the interface, it can be re-used across their customer base.

Equally important to assessing technology is the design of the “customer-facing” elements, and the degree to which these exhibit high levels of usability for their intended audiences. For example, a system that provides information in an interruption-driven, stress-laden setting such as an Emergency Department must be extremely intuitive to use and well-integrated into the clinical workflow. The design of the user interface and how it integrates with existing systems will affect the utilization and hence, value of the RHIO system. Further, the system should fit into real-world workflows within its respective use environments. The extent to which HIE data can be accessed within a provider’s native system positively affects usability and ergo adoption.

Prior research has underscored the importance of effective change management during the implementation and roll-out of technology interventions. Thus, a second major set of considerations for assessing the technology component of a RHIO relates to the management of the change process. Here, activities such as user-centered design during initial system construction, user training, and technical support play a major role in driving adoption and uptake, particularly in settings where system use is volitional and not mandated.
Exhibit 15 summarizes the attributes of technology that need to be evaluated in the performance assessment of an HIE.

**Exhibit 15. Technology Attributes for RHIO Assessment**

<table>
<thead>
<tr>
<th>Technical Features</th>
<th>Sample Metrics</th>
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</thead>
</table>
| • Scalability      | ➢ How easily can the volume of transactions, data, and connection partners be increased?  
                      ➢ How long does it take for a new participant to be connected to the RHIO?  
                      ➢ How long does it take to add a new user? |
| • Standards Alignment | ➢ Is the RHIO compliant with NHIN standards?  
                        ➢ Can the RHIO connect to multiple proprietary systems? |
| • Range of Services | ➢ Can new services be added with ease?  
                      ➢ Is the data architecture flexible enough to support multiple views of the data? |
| • System Reliability | ➢ What is the uptime of the system?  
                         ➢ Are adequate back up processes in place? |
| • Usability         | ➢ Are the applications consistent with the workflows they support?  
                         ➢ How usable is the system in its real-world setting? How compatible is it with existing workflow?  
                         ➢ Is adequate data available and in the appropriate format for use? |

<table>
<thead>
<tr>
<th>User Acceptance and Change Management</th>
<th>Sample Metrics</th>
</tr>
</thead>
</table>
| • Training                           | ➢ How effective were the training processes?  
                         ➢ Are users able to utilize the tools with ease? |
| • Adoption                           | ➢ What proportion of intended users is actually using the system?  
                         ➢ What is the depth and breadth of system use (i.e., for how many transactions and across how many features)?  
                         ➢ To what degree do users intend to experiment with the system? |
| • Technical Support                  | ➢ Have adequate support structures been instituted?  
                         ➢ How long does it take to respond to a user assistance request? |
4.4 Community Engagement

Dimension 4 of the assessment framework evaluates if the RHIO has been successful in engaging a sufficient number of participants to ensure a viable financial model. In an ideal scenario, all the providers within the RHIO’s domain of operation would participate, as would the payers who are dominant in the region. Most regions have competing HIE efforts underway that tends to fragment the available market. However, participants would gravitate towards the solution that offers the most value for them and therefore, to the degree that the focal RHIO can demonstrate this value, it should be successful in attracting participants. The degree of market penetration is one broad measure of participation. Michiana is estimated to have over 77% of the physicians included in their market; DHIN by securing the 3 main health systems in DE has over 800,000 patient records in a state of 850,000 persons (although some of the patient records are from those in neighboring states). HealthBridge is the most prolific of benchmarks with 29 hospitals, 5,500 physician users, 17 local health departments, and 700 physician offices and clinics.

Beyond simple participation in the RHIO as a user of its services, community engagement also measures a more intangible aspect related to the level of involvement that participants have in the RHIO and the degree of ownership they feel for its success. Thus, for example, providers may actively offer input into how systems may be improved. They may envision additional uses of data and request new services to be provided. Other indicators reflecting this type of broad community buy-in includes willingness to participate in improvement efforts, willingness to serve on various committees, etc. CareSpark annually polls all its volunteers and committee members to gauge how well it is performing in community engagement and asks questions such as: “Please rank CareSpark's effectiveness in maximizing the utilization of your: Knowledge & Expertise; Skills; Contacts; Other Resources; and, Time” respectively.

Exhibit 16 lists various measures that can be used to evaluate the community engagement dimension.

Exhibit 16. Community Engagement Metrics

<table>
<thead>
<tr>
<th>Engagement Component</th>
<th>Sample Metrics</th>
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<tbody>
<tr>
<td>Market Penetration</td>
<td>Number of participating hospitals (proportionate to total number in region)</td>
</tr>
<tr>
<td></td>
<td>Number of participating physician practices and clinics (proportionate to total number in region)</td>
</tr>
<tr>
<td></td>
<td>Number of connected patient records (proportionate to</td>
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</tbody>
</table>
4.5 Public Trust

The privacy and security of health information is a matter of significant concern to the public. The HITECH legislation has spurred the digitization of health information, while simultaneously acknowledging that new policies and safeguards are needed to offer citizens the assurances they need to trust systems such as electronic medical records and health information exchanges. Recently a study\(^{63}\) has argued for more stringent privacy laws beyond HIPAA as RHIOs and HIEs across the nation begin to get connected to each other and start combining their data. Other studies\(^ {64}\) reveal that patients are deeply concerned about potential compromise and misuse of sensitive health information, and that these concerns vary with the type of stakeholder requesting the information, the type of information being requested (e.g., general health, mental health, genetic), and the purpose for which it will be used.

Against this backdrop, it is imperative that a RHIO build sufficient public trust so that patients are willing to allow their information to be digitized and stored. Fair information practices, as prescribed by the FTC, clearly articulated and widely disseminated privacy policies, the nature and frequency of consent procedures, and the nature of security precautions in place to protect against data compromise are critical factors in generating trust.


The Nationwide Privacy and Security Framework for Electronic Exchange of Individually Identifiable Health Information published by the ONC (2008) forms the basis for privacy and security evaluation which advocates eight principles:

**Individual Access:** Individuals should be provided with a simple and timely means to access and obtain their individually identifiable health information in a readable form and format.

**Correction:** Individuals should be provided with a timely means to dispute the accuracy or integrity of their individually identifiable health information, and to have erroneous information corrected or to have a dispute documented if their requests are denied.

**Openness and Transparency:** There should be openness and transparency about policies, procedures, and technologies that directly affect individuals and/or their individually identifiable health information.

**Individual Choice:** Individuals should be provided a reasonable opportunity and capability to make informed decisions about the collection, use, and disclosure of their individually identifiable health information.

**Collection, Use and Disclosure Limitation:** Individually identifiable health information should be collected, used, and/or disclosed only to the extent necessary to accomplish a specified purpose(s) and never to discriminate inappropriately.

**Data Quality and Integrity:** Persons and entities should take reasonable steps to ensure that individually identifiable health information is complete, accurate, and up-to-date to the extent necessary for the person’s or entity’s intended purposes and has not been altered or destroyed in an unauthorized manner.

**Safeguards:** Individually identifiable health information should be protected with reasonable administrative, technical, and physical safeguards to ensure its confidentiality, integrity, and availability and to prevent unauthorized or inappropriate access, use, or disclosure.

**Accountability:** These principles should be implemented, and adherence assured, through appropriate monitoring and other means.

**Exhibit 17** summarizes the attributes of privacy and security that need to be present in order for a RHIO to be successful in building public trust.

**Exhibit 17. Public Trust Metrics**

<table>
<thead>
<tr>
<th>Sample Metrics</th>
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<tbody>
<tr>
<td>➢ Existence of privacy policy</td>
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<tr>
<td>➢ Communication of privacy policy</td>
</tr>
<tr>
<td>➢ Nature of consent (opt-in/opt-out)</td>
</tr>
<tr>
<td>➢ Frequency of consent</td>
</tr>
</tbody>
</table>
4.6 Summary

The assessment of a RHIO must pay attention to all five components of the assessment model: value creation and sustainability, governance, technology, community engagement, and public trust. Adequate performance in all five dimensions is necessary for the long-term success of an HIE. A program of continual measurement and evaluation, and sharing of results with concerned stakeholders will ensure appropriate accountability and support continuous improvement.
5. A Multi-Dimensional Assessment of DC RHIO

We apply the HIE assessment framework described in Section 4 to the DC RHIO. The assessment covers primarily the period from initial grant funding in 2007 until the go-live phase initiated in March 2010, but additional primary data gathering in 2007 until the go-live phase initiated in March 2010, but additional primary data gathering was conducted through August 2010 which is included. Thus, it focuses principally on the ramp-up stage that has laid the foundation and groundwork for a District-wide health information exchange.

As of March 2010, DC RHIO reported completing many activities, some noted here:

- **Interactions with Key stakeholders** – DC RHIO participants include representatives of hospitals, community clinics, payer organizations, public health, DC government, local business and other interested parties.
- **Data sharing agreements (DSAs) signed** – Data sharing agreements are finalized and signed with six of eight hospitals.
- **Contracted with technical provider** – DCPCA has entered into an agreement with Microsoft to provide technical services.
- **Technical work ongoing** – The core Amalga system with attention to HITSP standards has been developed and deployed. System is live in 2 hospitals and six clinics with additional 2-3 hospitals and 2 health clinic organizations representing over two-dozen clinics, respectively, slated for go live during 4th quarter 2010. A version update adding additional features is ongoing summer 2010.
- **Collaboration with Preparedness group** – Extended the DC RHIO technology platform to support the ED-IT Connectivity initiative completed August 2009; “live” at 8 hospitals & DC DOH.
- **Draft deployment and operational plans** – Versions have been developed.
- **Business plan** – A governance task force met regularly through 2008 and provided recommendations as part of the business plan document delivered February 2009.
- **Developed privacy policies and patient materials** – A privacy workgroup in collaboration with legal counsel developed a set of privacy policies including an “opt-out” model for patients. Privacy materials were developed, and distributed to the participating healthcare provider participants.
- **Developed metrics** – the Metrics Workgroup has developed metrics to evaluate the impact of the DC RHIO on quality, satisfaction and efficiency.
- **Trained participants** – Training material developed and training has been provided to participants (clinical and administrative).
We first position DC RHIO’s stage of development in the context of the stages of development described in the eHI report\textsuperscript{65}. Based on its progress and accomplishments, at the point of this evaluation the DC RHIO is between stages 4 and 5 of the eHI maturity model (\textbf{Exhibit 18}). The proof-of-concept has been realized, a number of stakeholders are connected, the exchange is live and collecting and sharing data, and some activities necessary for future growth have been put in place. We note that to the degree that the system has been live only for a short period of time, the full-extent of value creation is yet to be quantified. In the analysis presented below, we use data from the interviews as well as that collected through a user survey shortly after the go-live date.

\textbf{Exhibit 18. DC RHIO Stage of Maturity}

<table>
<thead>
<tr>
<th>Stage 4</th>
<th>Well under way with implementation –technical, financial and legal. (Pilot project or implementation with multiyear budget identified and tagged for a specific need)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 5</td>
<td>Fully operational health information organization; transmitting data that is being used by healthcare stakeholders.</td>
</tr>
</tbody>
</table>

\textsuperscript{65} eHealth Initiative (2009). "Migrating Toward Meaningful Use: The State of Health Information Exchange - A Report Based on the Results of the eHealth Initiative’s 2009 Sixth Annual Survey of Health Information Exchange."
5.1 Value Creation and Sustainability

Comments on DC RHIO Value

“...being able to look at care provided to patients, being able to track usages, health care services, getting data back up the chain for public health reporting and surveillance...”

“The ability to look at both the clinical data and the claims data is absolutely transformational.”

[Patients] “who have multiple chronic illnesses will definitely benefit from the RHIO.”

“...we can take care of our patients better because we have more information about what they are doing and how they are seeking care...”

Interview respondents were asked about the nature of value they expected from the DC RHIO for their specific organization in particular and the region in general. Stakeholders engaged in the DC RHIO project comment extensively on their value creation expectations that range from improvements in patient safety, reduced costs as a result of electronic information exchange, compliance with meaningful use mandates, and enhanced care coordination across medical encounters with different providers. While value creation is expected from most groups interviewed, interviewees indicated that the value was not yet being realized because of difficulties including but not limited to insufficient/ missing patient data, and usability issues from non-integrated dual systems, i.e. separate EHR system and DC RHIO system.

Data collected through the user survey reaffirm the comments made in the interviews. Respondents were asked about value in the domains of quality of care (patient safety, medication errors, and care coordination), efficiency (duplicate tests, efficiency in information exchange), and stakeholder satisfaction (patient satisfaction, provider satisfaction, and patient access to care). The typical benefits expected from the electronic exchange and availability of health information at the point of care were identified, with improvements in quality of care being a recurrent theme. We note that in light of the fact that the system went live only recently, evidence in the form of improvements in health outcomes is not available. Survey responses in the three domains are summarized below66 (see Appendix E for survey methodology and respondent characteristics).

66 All responses are on a 1-7 Likert Scale, anchored by “Strongly Disagree (1)” and “Strongly Agree (7).
The use of DC RHIO will improve patient safety.

DC RHIO will be helpful in reducing medication errors.

It is likely that DC RHIO will improve care coordination across the different care delivery organizations.

Expectations of Efficiency Gains

DC RHIO will lead to efficiencies in information exchange.

I expect DC RHIO to reduce the number of duplicate tests.
As noted in Section 4, a core aspect of value creation for any HIT system such as a RHIO is that it should improve the quality of work-life for healthcare providers and help them accomplish their task of healthcare provision more effectively and efficiently. The survey included a series of questions asking respondents specifically how DC RHIO would be useful in the work that they do. As the charts below indicate, perceptions of usefulness are generally high. The lowest scored item is “DC RHIO will improve my productivity” reflecting, as might be expected, concerns about the learning curve associated with the new system.

In summary, our analysis reveals significant optimism among DC RHIO participants and stakeholders about its value creation potential. Evidence to support this optimism will need to be gathered through a systematic evaluation program that would collect data on health outcomes and efficiency gains over a longitudinal time frame so that positive trends can be validly quantified and confirmed. Another important indicator of value creation is an increasing level of participation in the enterprise, signaling that potential benefits are becoming more
widely expected in the community. A final piece of evidence supporting value creation is participants’ willingness to pay for services offered by DC RHIO. Because DC RHIO currently does not levy any charges on participating organizations, the market valuation of its products and services cannot be evaluated.

The sustainability of DC RHIO and its business model from this point forward are yet to be established. At the current time, we see that the leaders of DC RHIO have taken steps to garner support from key stakeholders. Future prospects are critically dependent on the identification of service offerings and a structured plan to monetize them. We view these as the critical next steps in the evolution of the DC RHIO, and offer recommendations related to sustainability in Section 6 of this report.

5.2 DC RHIO Governance

The evaluation of DC RHIO governance is based on an assessment of the structures and processes developed during its incubation period up to the time the system went live. We note that a robust set of governance principles and structures for the DC RHIO of the future are yet to be constructed.

The DC RHIO seeks to be a “broad-based collaborative organization.” Much of the operational work is managed by the DCPCA, and the team has sought to utilize its Advisory Board as a source of expertise, counsel, and reality-checks on the decisions made through the conceptualization and design process. The Advisory Board has served as a horizontal coordination mechanism to bringing together participants from multiple functional backgrounds including strategy, technology, law, and economics. It has provided oversight over the course of the project. The project team has utilized external resources and intellectual capital, such as bringing in a legal team when developing data use and data sharing agreements. The governance processes have managed to navigate and execute agreements related to the highly sensitive and potentially contentious issue of data sharing. Workgroups and task forces have been convened to take responsibility for specific vertical

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68 DC RHIO draft business plan (2009).
activities of the DC RHIO, such as technology, and the recently convened business planning workgroups around sustainability and governance. Although there were periodic activities in convening members and soliciting input, multiple interviewees expressed stakeholder communications as an area that could be improved. The recommendations section will address specific communications strategies.

5.3 Technology

The technology component of the Assessment Model focuses on two distinct targets of evaluation: the technical features of the solution, and user acceptance & change management.

Technical Feature Assessment

The DC RHIO has been constructed on the Microsoft Amalga Platform. The Amalga platform is designed to connect with information from disparate systems and make it usable in different contexts, whether for clinical, administrative, research or other applications. The DC RHIO conducted an assessment of standards alignment in 2008 and the core infrastructure of Amalga was verified to be in adherence with prevailing national standards. The Amalga platform based on the .NET Framework and Microsoft reports that it is readily scalable, and accessible via standard Internet messaging protocols using a VPN (virtual private network) approach.

At the current time, although technically complete, the DC RHIO provides a limited range of functional capabilities, restricted to views of specific clinical and demographic information. **Section 2.3** details the eight core functions and data types included in the current system release. Plans have been constructed to expand this set of services in an incremental fashion once the system has been widely adopted and is in daily use. Additional capabilities to be rolled out in the near future include an enhanced user interface and enhanced service codes.

With respect to system reliability, given the short period of time that has elapsed since system roll-out, there is no evidence available at the time of this evaluation.

It is widely acknowledged and extensively documented that even technically outstanding and feature-rich systems can be abysmal failures because system designers failed to pay adequate attention to usability considerations. Survey data from users of the DC RHIO were utilized to assess the usability of the DC RHIO, and triangulated with observations made during the interviews. The majority of interviews was conducted prior to system roll-out and as such, represents expectations that the stakeholders held. User interviews four months post go-live are also summarized in the analysis. Post go-live survey data reflects reactions of users after they have had an opportunity to observe and use the system for approximately 5 weeks.
Approximately 4 months after system implementation, discussions with providers and other system users indicate areas of potential value and opportunities for DC RHIO system enhancement. A quality professional at a clinic identified service code designation enhancements necessary to provide added value to epidemiological analysis needs. The high-level codes in current use lack some details that would be helpful in conducting quality-related activities to support patient and population health. (It is noted that service codes are planned to be updated for the next release DC RHIO system.)

Clinic feature enhancements identified as valuable for future releases include the primary diagnosis code, immunizations with dates and verified medication lists. Of note is that the wish list items are available based on the current architecture of DC RHIO, but issues with data availability are preventing common use. In workgroup deliberations and discussions with doctors, new features to aid in the referral process were noted as an area of high potential benefit. The integration of lab data is another key area that DC RHIO should continue working towards to increase the utility of the system for its users. Viewing of hospital lab data is expected to be live in the near term with the functionality already included in the current system design. A clinic medical director indicated that the ability to view the notes from specialists and the ED would be a most valuable improvement to the DC RHIO system. Further, the ability to send a fax or email directly from the system was highlighted as a way the DC RHIO could aid administrative efficiencies at the practice. When data is available time savings can be significant; clinic medical assistants indicated they spend over 30 minutes a day on average with hospital staff trying to gather necessary patient discharge and other information for patient care which is planned to be available via the DC RHIO system. At a practice management level, the ability to verify hospital admissions and identify high-risk patients for intervention in batches was also cited as desirable, whereas the system places some limitations for certain data lookups that require individual search at present.

Commentary on the DC RHIO system from the hospital indicates “tremendous potential” to improve patient care, with several challenges to value-realization at present related to the current technology state. A limiting factor affecting adoption is the requirement for doctors to leave their native system and click through multiple screens to access RHIO patient information. A potential improvement may be flagging data with an alert for the provider rather than requiring a provider to search for potentially relevant data. Key alerts for doctors identified for exploration include allergies, medication lists, problem lists and lab data. Of positive note is that these data types are currently included in the existing architecture of DC RHIO. Other hospital technology wish list items include removing separate user name and password requirements for the DC RHIO system.
Usability

The survey asked questions related to two aspects of usability: ease of use and compatibility\(^{69}\), measuring the impacts of the technology on workflow. User perceptions of the ease of use of DC RHIO are generally positive, and significantly above a “neutral” response. Interviews also revealed that the interface was generally gauged to be easy to navigate.

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Workflow Impacts

Recent research underscores the importance of paying attention to clinical workflow in the design of HIT systems\(^70\) \(^71\), and notes that failure to do so will result in ultimate failure of the system and can lead to abandonment of the technology. The items for the compatibility measure attempt to gauge users’ perceptions of the “fit” between the technical artifact and their work patterns. As one interviewee observed “Any new technology brings a level of disruption. Processes have to be changed and redone.” The scores provided for the compatibility questions suggest that workflow impacts have been addressed during design and roll-out: while respondents acknowledge that the system will change some of their work routines, the sample (n=45) of respondents do not believe that the change will be disruptive.

In the hospital environment, especially in the Emergency Department, when a doctor must shift between his/her native system and another system then adoption will be hampered. In developing a more usable HIE system, techniques that integrate HIE data directly with the EHR and can be accessed via the native system provide a goal to explore further. Approximately 40% of sustainable HIE’s report direct connectivity to physician’s EHR.\(^72\)


User Acceptance and Change Management

Training is a critical element of successful system implementation, as in on-going technical support that helps users overcome any frustrations they may experience as they traverse the learning curve. The DC RHIO project team held extensive training sessions pre go-live. Four survey questions probed users about their understanding of the DC RHIO system, their reactions to the training, and their expectations about technical support. Respondents generally believe that they have had adequate opportunities to ask questions about DC RHIO and to have the questions addressed. Reactions to the training received are largely positive, and users expect adequate technical support to be forthcoming.

A second key aspect of change management is the inculcation of positive attitudes towards increasing system usage and exploration in the future. Such “value-adding” use is crucial to discovering new ways in which the information provided by the system can be more effectively exploited. Research suggests that when users experiment with system functionality, they find innovative functionalities that may not have been envisioned by the designers of the system and begin to take greater ownership of the system. Three questions asked users about their future use and exploration intentions. Responses to these questions indicate enthusiasm among users for greater and more creative use of the system in the future.

One of the foremost issues with user acceptance of the current system is the lack of data availability. As one physician reported, “I went to the [DC RHIO] system several times to get data for patients who had been at a participating hospital, but the data was not there most of the time so I stopped trying...” The same physician reports a strong belief in the potential value, but he/she will not be using the system until the data availability issues are resolved.
Training and Technical Support

**I have had sufficient opportunity to ask questions about DC RHIO.**
- Strongly Agree
- Somewhat Agree
- Somewhat... (not labeled)
- Strongly Disagree

**My questions about DC RHIO have been addressed.**
- Strongly Agree
- Somewhat Agree
- Somewhat... (not labeled)
- Strongly Disagree

**The training I received (seminars, training materials, etc.) was adequate.**
- Strongly Agree
- Somewhat Agree
- Somewhat... (not labeled)
- Strongly Disagree

**Technical support for DC RHIO will be adequate.**
- Strongly Agree
- Somewhat Agree
- Somewhat... (not labeled)
- Strongly Disagree
In regard to depth and breadth of use, given the pilot stage of DC RHIO functionality and the short elapsed time since go-live, the usage of the system is still at an early stage. Appendix F summarizes self-reported usage data from the survey for each of the currently available features, which shows about an equal dispersion from never use to always use. We note that a substantial volume of patient data has been digitized and is able to be shared. As of July 31, the total number of unduplicated patients is 278,038, of which 129,273 are residents of the District of Columbia. Of these patients, approximately 87% and 13% are found in the hospitals and clinics, respectively.
5.4 Community Engagement

At its core, a RHIO is an inter-organizational system who ultimate success is dependent upon ubiquitous and widespread access across all relevant players. This requires buy-in and engagement from the entire ecosystem of healthcare stakeholders, ranging from governmental agencies, not-for-profit organizations, providers, payers, and ultimately, the patients themselves. Such community engagement is critical to realize the network benefits that accrue from RHIOs and HIEs and to fully realize the vision of a nationwide health information network.

The evaluation dimension of community engagement includes market penetration and community involvement. Whereas the former assesses the proportion of eligible partners who are currently participating in the enterprise, the latter measures the degree to which partners are active participants in moving the effort forward and take ownership of it.

At the point of this evaluation, DC RHIO has tried to engage representatives from all stakeholder groups in its planning and implementation activities. The system has been implemented in 2 hospitals and 6 clinics and 3 hospitals and an additional two dozen clinics are scheduled to be connected by late 2010. The clinics include Unity Health Care network, the District’s largest private Medicaid Payer, which will represent another major step forward in the community clinic participation. The American Hospital Association lists 8 primary non-federal, short-term, acute care hospitals in the District of Columbia. Exhibit 19 details the volume of these hospitals and demonstrates that DC RHIO is live in 2 hospitals which collectively represent 39% of District’s bed count and has plans to be live in 3 additional hospitals by year-end 2010 to early 2011 totaling 66% of beds. However, at participating live hospitals, the DC RHIO is currently only available in the ED which represents approximately 56 providers. Planned deployment in on-boarding hospitals is ED-limited at outset as well.

Exhibit 19. Hospital Participation Metrics

<table>
<thead>
<tr>
<th>District Hospitals 73</th>
<th>Beds</th>
<th>Total discharges (000's)</th>
<th>Gross patient Revenue ($000)</th>
<th>DC RHIO Status</th>
<th>% of District Beds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washington Hospital Center</td>
<td>803</td>
<td>41,200</td>
<td>2,787,172</td>
<td>Live in ED</td>
<td>26.1%</td>
</tr>
<tr>
<td>Georgetown University Hospital</td>
<td>406</td>
<td>15,900</td>
<td>1,415,840</td>
<td>Live in ED</td>
<td>13.2%</td>
</tr>
<tr>
<td>Howard University Hospital</td>
<td>266</td>
<td>13,100</td>
<td>520,106</td>
<td>Scheduled 2010</td>
<td>8.6%</td>
</tr>
</tbody>
</table>

The Kaiser Foundation lists 1,608 Nonfederal Primary Care Physicians in the District for 2008. The DC RHIO has not made inroads into the physician private practice space. While this was not a goal of the initial grant period, participation by private physicians will be a key driver of future value and their involvement must be addressed.

Another stakeholder absent from the DC RHIO at present is the large clinical laboratories including Quest Diagnostics and LabCorp and others in the region. These institutions represent a vital data link in the healthcare ecosystem and further analysis should be done regarding their participation. Indeed, in several leading RHIO including the benchmark HIE’s of Michiana and DHIN, reference laboratories are key players. Similarly, additional radiology partners should be explored, although lab data exchange is generally a quicker win than exchanging images.

In regard to community involvement, we observed some level of engagement on the part of the stakeholders. Engagement levels of participants in a typical public-private partnership are directly related to the extent they believe that the partnership is aligned with the mission and objectives of the organization they represent. Their comments suggested a sense of ownership and stake in the success of DC RHIO (doubtless as a result of their expectation of value creation for public health in general and for their specific organization in particular), and recognition that this was an important community effort worthy of their involvement. Interviewees commented on their level of commitment and their actions: “...we've actively supported DCPA’s efforts, whether it’s eCW or the RHIO, and quite frankly looked to try..."
to tap into that technology in a different way to serve our patients better.” In discussing efforts in the District in general, an interviewee noted “But I am pretty optimistic about the RHIO.” Another piece of evidence suggestive of community involvement are the data sharing agreements discussed earlier; such agreements are politically and organizationally sensitive, and success in their execution is indicative of general community trust in the DC RHIO. Our assessment of community engagement also revealed one area of opportunity for DC RHIO where further effort is required: the involvement of executives who are leading the participating institutions. Without the direct and sustained engagement of C-level executives, DC RHIO will find it difficult to sustain and grow the momentum among stakeholder organizations.

It is also noteworthy that the DC RHIO project has had involvement from representatives of complementary efforts such as the Children’s IQ Network. The involvement of these members of the community can help with mutual learning, sharing of best practices, and a shared understanding that the goals of the two efforts are synergistic. The payer community has been represented on the Advisory Board, but does not seem to be actively participating in business planning discussions.

5.5 Public Trust

High levels of public trust are the foundation for a sustainable and successful RHIO. Trust is essential not only for participating organizations who agree to engage in electronic data sharing that can create potential vulnerabilities, it is of utmost significance for healthcare consumers. Studies consistently show that privacy of their health information continues to be a major impediment in consumer acceptance of health information technology.

Comments on Privacy Issues

“...Clients definitely should understand what their privacy rights are under the law, but they should also understand what the limitations to those privacy rights are...”

“...For instance, sharing of mental health information and substance abuse information is very tightly governed as opposed to information about high blood pressure or kidney disease or fractured legs because there is some additional measure of sensitivity associated with mental health and substance abuse records, even HIV records. And I think when these laws were made years ago they were made obviously with all good intentions to protect people who suffered from these conditions but then times change, the technology changes, and people’s thinking changes, and the laws stay the same, so I think some modification in the legal system...”

Our interviewees corroborated these general concerns and we heard comments that are consistent with nation-wide polls. Interviewees underscored the importance of privacy: “…there are technology concerns about hacking and how safe the data in out there on an internet-based system...,” “…So there’s a little bit of what I’d call shock the first time the patient finds out we have access to all their information...”
In the case of DC RHIO, we note that data sharing agreements have been crafted and finalized with a number of participating organizations. While these agreements are legal partnerships, their successful execution is a signal of trust between the parties in the exchange transaction. DC RHIO has developed a full set of privacy policies for its own operation, following the principles outlined in the Markle Foundation’s Common Framework. Each participating organization has its own privacy policy, and some are using proactive methods such as posters to share these with patients using their facilities. As illustrated in the quote in the previous sidebar, participating organizations are reflecting on the legal and policy implications of electronic health information and looking to actively participate in the national debate. This suggests high levels of awareness of the importance of patient privacy within the participating organizations.

DC RHIO in its work on privacy implications of health information exchange has sought input from privacy experts and legal counsel, as appropriate. The DC RHIO uses an “opt-out” policy in that the default is digitization and sharing of patient information unless the patient chooses to opt-out. Patient materials that describe the privacy principles and the patient’s rights were developed and distributed to system user partners. The policies and patient materials were developed in consultation with a Privacy Workgroup and legal counsel. The privacy practices should be reviewed periodically including how they are operationalized in the multiple care settings to insure DC RHIO is adequately informing patients. The policy implications of the varying consent mechanisms74 do not have sufficient evidence to be measured at present.

DC RHIO has taken steps to provide additional safeguards for behavioral health and substance abuse data, which is currently blocked by the DC RHIO for access. The sharing of these data types via electronic exchange is difficult due to additional regulatory and privacy concerns relative to other clinical data. A tradeoff exists between privacy and sharing this data, which will need to continue to be examined as this protected data is valuable in coordinating care for certain provider types, especially social workers and certain clinical specialties.

Closely tied to privacy is the issue of security and the degree to which adequate security precautions have been built into the technical infrastructure. The DC RHIO platform uses a secure Virtual Private Network (VPN) for the exchange of data. Further, robust authentication

74 Consent Types: No consent. Health information of patients is automatically included—patients cannot opt out; Opt-out. Default is for health information of patients to be included automatically, but the patient can opt out completely; Opt-out with exceptions. Default is for health information of patients to be included, but the patient can opt out completely or allow only select data to be included; Opt-in. Default is that no patient health information is included; patients must actively express consent to be included, but if they do so then their information must be all in or all out; and Opt-in with restrictions. Default is that no patient health information is made available, but the patient may allow a subset of select data to be included. Goldstein & Rein, Consumer Consent Options for Electronic Health Information Exchange: Policy Considerations and Analysis, Developed for ONC, March 12, 2010.
procedures are in place to ensure that only authorized users are able to view patient data. Subtle issues related to privacy and security, such as the need to suppress information about “Do-Not-Publish Patients” and the business rules for identifying such patients have been built into the technology. The platform also provides for routine auditing of access logs.

5.6 Summary

In conclusion, our evaluation reveals that the DC DHIO has made progress in most of the dimensions of the HIE Assessment Model. The conclusions drawn in this assessment must be interpreted in light of the DC RHIO’s maturity stage and where it currently stands in its evolution. Going forward, there are many opportunities and challenges that lie ahead as the DC RHIO strives towards its mission of improving the health of District residents. The three most significant next steps relate the development of a sustainable business model, the crafting of appropriate governance structures, and increasing the adoption & use of the DC RHIO system. Additional challenges around scaling technology, engaging the broader community, and continuing to build public trust and confidence in the exchange will need to be carefully planned for. Our interviews also surfaced a number of useful suggestions from stakeholders and some concerns that warrant attention. In the concluding section of this report we offer a set of recommendations for consideration and future implementation.
6. Recommendations

Based on our evaluation of the DC RHIO at its current stage of development, the input provided by key stakeholders of the DC RHIO, an environmental scan of HIE efforts across the nation, best practices published in the literature, and benchmarking with three leading HIE efforts, we offer a set of recommendations to guide DC RHIOs future evolution. These recommendations pertain not only to specific actions that the DC RHIO should take going forward, but also reference some broader issues that must be addressed with the context of the District of Columbia.

6. 1 Develop a Plan for Sustainability

The future success of DC RHIO is critically dependent on its ability to develop a sustainable business model going forward. The business model will have two essential components: a realistic and achievable revenue model based on the value created by the RHIO, and a scalable and predictable cost model to ensure financial viability.

While the initial funding for DC RHIO came from public dollars, such funding is not likely to be available for extended periods of time. Thus, it is imperative to generate revenue from products and services and plan that clearly articulates and quantifies the sources and magnitude of expected revenue. In other words, we recommend that the DC RHIO plan to evolve toward a largely private-sector funded and led enterprise, with involvement and oversight by funding and governmental agencies. The independent public-private partnerships that operate using market principles are more likely to innovate and discover products and services that satisfy market needs, and exercise cost control.

We recognize that given DC RHIOs stage of maturity, it is unlikely to become self-sustaining in the immediate near-term (Exhibit 20). Although it is tempting to consider payer assessments, grant funds, and other government sources, we recommend generating revenues from operations of the RHIO and consider raising equity and loans from participating providers and stakeholders to align incentives and ensure commitment. While other HIEs are considering options such as VT (enacted) and NJ (proposed) who are levying a fee on insurance claims, ME considering a $10m bond issue, and MD levying a surcharge on certain hospital bills for which insurers pay, we do not consider them as contributing to true long-term sustainability. Michiana and HealthBridge show that it is possible for an HIE to be viable without substantially depleting government resources and they ensured their viability based largely on their value proposition to the participating stakeholders.

75 State HIE Toolkit, an Office of the National Coordinator for Health Information Technology funded State-level HIE Consensus Project (SLHIE Project), Accessed June 2010.
The determination of the revenue model requires DC RHIO leaders to identify a set of services that are monetizable and the determination of appropriate prices for these services that the market will be willing to pay for. Earlier sections of this report have identified a range of services that can be selected from, given an understanding of the specific nature of participants in the District’s context. We recommend that DC RHIO leadership determine which services are most viable, what the appropriate price point is for each service, and the cost of service provisioning based on current experience as well as costs reported by other HIE efforts. These numbers can they be used to project a set of cash flows (see Appendix C, Table to aid in estimating potential revenue, and Appendix D, Table to aid in estimating pricing of services, respectively, as a sample format to aid in projections) that will determine when the breakeven shown in Exhibit 20 will occur and what future revenue streams can be expected.

The experience of other RHIOs and our benchmark data suggest that an initial focus on clinical messaging services (paper replacement) and community data sourcing would be appropriate, with additional value-add activities such as EHR interoperability for results delivery directly into an EHR and more advanced features being included in the offerings over time. The management of referrals is an area of value that has been cited by several local users. A caveat, special attention must be paid to the developing NHIN Direct initiative which will likely fulfill some of the results delivery and other exchange needs such as referrals for many smaller practices most notably but potentially also for a wider stakeholder group. Given the importance of public health and their expressed desire for population health and surveillance tools, this should be explored further in near term. We recommend that system users are engaged in the design and refinement process of the technology. Also, there should be focus on making the DC RHIO more proactive in providing health information, such as alerting providers of their relevant DC RHIO patient information rather than a generalized search method. The issue of behavioral health and substance abuse data access via the DC RHIO system will need to be addressed.

We recommend that the DC RHIO construct a hybrid revenue model that is based on revenues from subscriptions (that include a set of pre-determined services) as well as traditional fees paid for additional services.
In addition to identifying and selecting a portfolio of services, the DC RHIO should develop a cost model that is scalable and cost-effective. To the degree that the major cost incurred by the enterprise is related to the technological infrastructure, appropriate control of these costs and risk mitigation is essential. Potential cost models that could be pursued include open source solutions and contracts with vendors, including Microsoft, that are based on an ASP, pay-per-use model.

Additional Activities in the Evolution towards Sustainability

There are many other domains of activity where proactive efforts today by the DC RHIO are likely to yield significant results in the future in terms of becoming a financially sustainable operation that it is able to deliver on its mission of improvements in public health. We discuss two such opportunities and encourage the leadership of DC RHIO to actively explore them.

The first broad endeavor is related to expanding the potential pool of participants across the healthcare value chain. To the degree that complete connectivity in health information exchange requires ambulatory practices to be part of the HIE, DC RHIO must actively engage physician practices. Early implementation of connectivity with a handful of carefully selected private practices to demonstrate value and communication of these efforts to the larger physician community will help create the “demand-pull” from the ambulatory end. Here the activities of the Regional Extension Center can be leveraged – the DC RHIO could consider piloting this program in cooperation with the DC REC. The REC will also be crucial in driving EMR adoption among physicians, which is a prerequisite to the practice being able to connect to the health information exchange. Connectivity to laboratories such as Quest and LabCorp should also be part of the next set of extended partnerships.

A closely related activity is reaching out to a handful of carefully selected consumers as early users in a pilot program that demonstrates the power of connectivity between a PHR and the DC RHIO. Since Microsoft is already a technology partner, a possible extension of this relationship to include the HealthVault PHR should be explored. It is noted that DC RHIO is pursuing provider-patient-RHIO connectivity via the Prosocial Applications Inc. SmartPHR application. SmartPHR reports the ability to exchange Continuity of Care Records through Microsoft HealthVault.

The second opportunity lies in creativity and innovation around service offerings. While efforts in other states provide initial insight into potential services, there are vast unexplored areas for creative offerings that are potentially value-creating. These include services options such as EMR push, secondary data use services for clinical research, comparative effectiveness, and pilot programs for quality and disease management.
6. 2 Develop Organizational Capacity to Achieve Revenue and Cost Targets

The design of the DC RHIO organization and staffing levels will need to be revisited in light of the proposed sustainability model. Clearly the achievement of revenue targets will require sales and marketing investments to understand market needs and generate appropriate products and services. As the DC RHIO grows in size with respect to number of participating organizations, so will the administrative burden associated with managing these partnerships.

Our current assessment is that in the next two years DC RHIO will require the equivalent of at least five FTEs: one devoted to general leadership and oversight, two for managing the technology aspects and project management, a fourth as external relations facilitating additional partners joining the exchange and communications and a fifth for administrative activities. We expect some part of the leadership role to include marketing activities that, as business volume grows, could be separated into a new FTE position.

6. 3 Develop Governance Mechanisms to Ensure Accountability and Performance Tracking

As described in Section 4, the governance of public-private partnerships is complex. The exact governance structures to be instituted are dependent on the final legal form of the organization and any statutory requirements imposed by that legal form. We underscore the importance of subscribing to carefully following the principles of good governance outlined earlier in constructing the decision making board and designing various horizontal and vertical coordination mechanisms. We also note that a PPP such as DC RHIO involves a healthy level of competition among the participating organizations and a spirit of cooperation (referred to as co-competition76 in inter-organizational networks) must be actively nurtured and encouraged.

6. 4 Institute a Systematic and Sustained Monitoring and Evaluation Program

The value proposition of the DC RHIO must be quantified in order to encourage buy-in and participation in the enterprise. Value quantification is also essential to assure the public that their resources are being used wisely and optimally, and to increase their confidence in the ability of the enterprise to achieve its mission. Value quantification is also key to DC RHIO’s ability to charge for services as participants will seek evidence of claimed benefits.

We recommend that DC RHIO develop a systematic and rigorous monitoring and evaluation program. Such a program must include a hierarchy of metrics beginning with improvements in

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care quality and patient safety, public health benefits, and cost savings, and cascading down to intermediate metrics such as those described in Section 4 of this report. Data on these metrics must be collected according to a pre-specified protocol and research plan and over a longitudinal time frame. The metrics identified by the DC RHIO Metrics Workgroup provide a starting point to build a monitoring program (See Appendix H Scorecard Summary). Additional metrics described in this assessment can be monitored and tracked on a regular basis. These programs should extend not only to administrative efficiencies and anecdotal care quality but into rigorous clinical outcomes and health economics research.

6. 5 Plan for Provider and Patient Education to Develop Public Trust and Confidence

The importance of public trust for the long-term success of the NHIN was highlighted earlier and is supported by significant evidence from public opinion polls and early experiences of HIE efforts across the country. An important aspect of building public trust is social marketing to create awareness and understanding of the notion of health information privacy and its legal and personal ramifications. Often patients have a visceral reaction to privacy issues simply because they are unaware of their rights and of safeguards and other mechanisms that are in place to protect them. Similarly, providers are often uninformed about what they need to pay attention to in regard to being compliant with extant regulation. This gap in understanding is further exacerbated by the fact that the health information privacy domain is rapidly evolving and new legislation and frameworks are being introduced on a continual basis.

We recommend that DC RHIO develop plans for a systematic program for patient and provider education on privacy and security. Such a program can be initiated with cost-effective approaches such as the development of website content that is continually updated, and alerts informing users when content is updated. Resources permitting, DC RHIO could play a lead role in the community in initiating open dialog through town-hall and other information disseminations forums. Such forums can also be utilized as a way to proactively guide and inform the formulation of new legislation; as one of the interviewees observed: “Certainly there needs to be, I believe, more discussion about privacy in the community – among providers, among stakeholders, among consumers – about what these laws should be. I don’t think that the government should just make changes without consulting the community about what those changes are and who has access to information in the future as opposed to currently.”

77 An anecdotal story revealed that a certain patient class whose information was in the DC RHIO were showing better outcomes than similar patients whose information was not as complete in the DC RHIO system, ostensibly due to improved care coordination and treatment adherence which the DC RHIO helped facilitate.
6. 6 Coordinate across District Efforts in Health Information Exchange

At the time of this evaluation there are a number of health information exchange efforts with a potential overlap in mission and objectives with the DC RHIO, including the Children’s IQ Network (led by Children’s National Medical Center), the Medicaid Patient Data Hub (led by DCHCF), and the ED-IT effort (led by Medstar under a grant from Assistant Secretary for Public Health Preparedness and Response (ASPR). While each of these efforts is laudable in its own right and has a well-defined purpose, there is a compelling need to ensure that there is no duplication of effort and that learning is leveraged across the board.

Although it is difficult to predict how all these efforts will evolve and coalesce in the future, the rational outcome would be the existence of one single enterprise, constructed on common standards, that coordinates and manages the capture and exchange of health information across the entire region it serves. This will facilitate future connectivity with other exchanges across the nation (after all, citizens do not consume health care services in a single region alone) and ensure that DC is “ready” to plug into the NHIN. If the District is not vigilant about coordinating these efforts, there is a real danger of silo-based solutions that are difficult to integrate, not to mention the associated wastage of resources. As one interviewee noted “We need to figure out how to work collaboratively.” Another observed “I think there is a lot to learned from each other in terms of how to best construct the initiative, how to sustain it, how to do the politics, governance, all of that.”

An initiative of note is the Regional Extension Center Program in the District, which will help to drive EMR adoption and should be leveraged, i.e. to the extent the REC and DC RHIO can bundle HIE connectivity and EMR implementation, the promise of sustainable HIE is more likely to be realized. Given DCPCA’s role as REC grantee this alignment should be reasonable.

This recommendation is at the core of what the State Cooperative Grant will address over the coming 3 years, but it is worth special emphasis.

6. 7 Design a Communication Plan and Communication Mechanisms for Partner Organizations

During the start-up phase DC RHIO had many activities to perform and significant effort that needed to be expended in standing up the technology and completing all the foundational tasks for the exchange. Now that the system is live, we recommend that DC RHIO design a formal communications plan for keeping all participants (both current and future) informed about the state of the initiative.
Such a communications plan could include both “push” and “pull” mechanisms. We recommend that DC RHIO develop a database of potential partner organizations and key executives within these organizations, and periodically send electronic newsletters describing key accomplishments and activities of the RHIO. From a push perspective, the website content can be enhanced with a section on “The RHIO in Use” that provides vivid descriptions and anecdotes of how the information provided by the RHIO helped improve patient safety or reduced costs. Collecting and sharing such “success” stories is vital to developing the needed “buzz” around the effort.

6. 8 Publicize the DC RHIO Experience

As the nation continues on its march towards the Nationwide Health Information Network, many efforts are in process or being launched across the nation. There is much knowledge sharing and mutual discovery of best practices that is occurring in various forums such as CIO conferences, health IT conferences, physician summits, etc. We recommend that the DC RHIO become an active and visible participant in such forums. To the degree that some of these events are held locally within the District, they also present an outstanding opportunity to tell the DC RHIO story to potential new participants in the effort and attract them to join. A presence at and participation in physician gatherings will be key to the next stage of the evolution as the scope of participation is extended to the ambulatory setting. Inviting key executives from participating organizations to jointly work on conference presentations is also an effective way of increasing their engagement with DC RHIO activities and inculcating greater ownership of the efforts.
Appendix A. Governance Structure Proposed by DC RHIO\textsuperscript{78}
Appendix B. DC RHIO Meaningful Use Stage 1 Requirements Support Based on Current Capabilities

<table>
<thead>
<tr>
<th>Meaningful Use Service Requirements (Stage 1)</th>
<th>DC RHIO Supported</th>
<th>Key Beneficiary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of Patient Demographics Data</td>
<td>Yes</td>
<td>• Provider</td>
</tr>
<tr>
<td>Drug-Drug Interactions and Drug-Allergy Assessments</td>
<td>N/A</td>
<td>• Provider</td>
</tr>
<tr>
<td>Maintain Medication and Problem Lists</td>
<td>Yes</td>
<td>• Provider</td>
</tr>
<tr>
<td>Medication Reconciliation</td>
<td>Yes</td>
<td>• Provider</td>
</tr>
<tr>
<td>Discharge Summary</td>
<td>Yes</td>
<td>• Provider</td>
</tr>
<tr>
<td>Clinical Information Exchange</td>
<td>Yes</td>
<td>• Provider</td>
</tr>
<tr>
<td>Quality Recording</td>
<td>Yes</td>
<td>• Provider</td>
</tr>
<tr>
<td>CPOE (Computerized Provider Order Entry)</td>
<td>N/A</td>
<td>• Provider</td>
</tr>
<tr>
<td>Clinical Decision Support</td>
<td>Yes</td>
<td>• Provider</td>
</tr>
<tr>
<td>Syndromic Surveillance of Public Health</td>
<td>Yes</td>
<td>• Public Health</td>
</tr>
<tr>
<td>Patient Access to Data</td>
<td>Yes</td>
<td>• Patient</td>
</tr>
<tr>
<td>ePrescribing</td>
<td>N/A</td>
<td>• Provider</td>
</tr>
<tr>
<td>Generate Patient Lists by Condition</td>
<td>Yes</td>
<td>• Public Health</td>
</tr>
</tbody>
</table>

79 DCPCA presentation July 14, 2010.
## Appendix C. Table to Aid in Estimating Potential Revenue

<table>
<thead>
<tr>
<th>Org Type</th>
<th>#Orgs</th>
<th>Services Valued</th>
<th>Mean Subscription Fee</th>
<th>Total Subscription Fees</th>
<th>Mean Transaction Fees</th>
<th>Total Transaction Fees</th>
<th>Potential Revenue</th>
<th>Other Services</th>
<th>Total Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
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<td>Medical Clinics</td>
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<td>Physicians Offices</td>
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<td>Skilled Nursing Facilities</td>
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<td>Laboratories</td>
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<td>Health Plans</td>
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<td>Medicaid</td>
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<td>Public Health</td>
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<td>Others</td>
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</tbody>
</table>
### Appendix D. Table to Aid in Estimating Pricing of Services

<table>
<thead>
<tr>
<th>Activity performed by DC RHIO?</th>
<th>Quantity estimate</th>
<th>Is it already performed by some other entity?</th>
<th>WTP* by stakeholder</th>
<th>Cost</th>
<th>Pricing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current Services</strong></td>
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<tr>
<td>View patient information (demographics)</td>
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<tr>
<td>View clinic observations</td>
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<tr>
<td>View clinic allergies</td>
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<tr>
<td>View clinic diagnoses and procedures</td>
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<tr>
<td>View clinic medications</td>
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<tr>
<td>View lab results</td>
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<tr>
<td>View hospital discharge summaries</td>
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<tr>
<td>View hospital radiology reports</td>
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<tr>
<td><strong>Potential Services</strong></td>
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<td>Service 1</td>
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<td>Service 2</td>
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<td>Service N</td>
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<tr>
<td><strong>Sample Benefits</strong></td>
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<tr>
<td>Reduction in unnecessary tests and procedures</td>
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<tr>
<td>Save time associated with handling chart requests and referrals</td>
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<tr>
<td>Reduction in administrative portion of test costs</td>
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<tr>
<td>Better health outcomes from rapid identification of pre-existing conditions</td>
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<tr>
<td>Improve identification of billable patients</td>
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<tr>
<td>Reduce unnecessary ED admissions</td>
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<tr>
<td>Other benefits...</td>
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</tbody>
</table>

*WTP = willingness to pay*
Appendix E: Survey Details

Survey Methodology: We conducted an online survey between April 7, 2010 and May 1, 2010. The survey was developed based on extensive research conducted by CHIDS in the past on technology acceptance and included validated scales for measurement. An email with a survey link was sent to 240 participants. After 2 weeks, we sent an electronic reminder resulting in 45 total responses.

Respondent Characteristics

Total Number of responses: 45 / 240
Response Rate: 19%
Appendix F. Self-Reported System Use (April 2010)

**View Patient Information (demographics)**
- Always: 4
- Frequently: 2
- Occasionally: 6
- Never: 5

**View Clinical Observations**
- Always: 4
- Frequently: 3
- Occasionally: 5
- Never: 5

**View Allergies**
- Always: 3
- Frequently: 4
- Occasionally: 4
- Never: 6

**View Clinical Diagnoses & Procedures**
- Always: 4
- Frequently: 4
- Occasionally: 5
- Never: 4

**View Hospital Radiology Reports**
- Always: 5
- Frequently: 4
- Occasionally: 4
- Never: 2

**View Clinical Medications**
- Always: 4
- Frequently: 4
- Occasionally: 5
- Never: 4
(Appendix F continued)

<table>
<thead>
<tr>
<th>View Lab Results (provided by clinics and hospitals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always</td>
</tr>
<tr>
<td>Frequently</td>
</tr>
<tr>
<td>Occasionally</td>
</tr>
<tr>
<td>Never</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>View Hospital Discharge Summaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always</td>
</tr>
<tr>
<td>Frequently</td>
</tr>
<tr>
<td>Occasionally</td>
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<tr>
<td>Never</td>
</tr>
</tbody>
</table>
Appendix G. User Survey Format

The next four pages detail the user survey administered online.
1. Your opinions about the DC RHIO

Dear DC RHIO User,

The Center for Health Information and Decision Systems (CHIDS) at the University of Maryland is conducting an assessment of the DC RHIO system and appreciates your participation in a brief survey. Your organization is a key stakeholder in the DC RHIO and you will be a user of the DC RHIO health information exchange software built on the Microsoft Amalga platform (“DC RHIO”) to connect providers in the District.

Any personal information you choose to provide will be kept confidential. All analyses will be reported at the aggregate level, without identifying individual respondents.

The survey is in two parts. In the first part we will simply ask you for your opinions regarding various aspects of the system that you are about to use or are using. There are no right or wrong answers to these questions. We are only interested in understanding your perspective.

The second part of the survey asks for demographic information so we can better understand the needs of different stakeholder groups.

Please respond to all questions. The survey will take about 10 minutes. Thank you for your participation.

1. Please indicate your level of agreement with the following statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Neutral</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The use of DC RHIO will improve patient safety.</td>
<td></td>
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<tr>
<td>DC RHIO will be helpful in reducing medical errors.</td>
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<tr>
<td>Patients will be more satisfied as a result of the use of DC RHIO.</td>
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<tr>
<td>Healthcare provider satisfaction will improve as they use DC RHIO.</td>
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<tr>
<td>Once DC RHIO is implemented and used, patients will experience improved access to healthcare services.</td>
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<tr>
<td>DC RHIO will lead to efficiencies in information exchange.</td>
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<tr>
<td>I expect DC RHIO to reduce the number of duplicate tasks.</td>
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<tr>
<td>It is likely that DC RHIO will improve care coordination across the different care delivery organizations.</td>
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</tr>
</tbody>
</table>

2. Please think about your use of DC RHIO and indicate your level of agreement with the statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Neutral</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC RHIO will improve my performance in my job.</td>
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<tr>
<td>DC RHIO will allow me to accomplish tasks more quickly.</td>
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</tr>
<tr>
<td>DC RHIO will improve my productivity.</td>
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</tr>
<tr>
<td>Using DC RHIO will enable me to better serve patients.</td>
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<tr>
<td>DC RHIO will make it easier for me to do my job.</td>
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<tr>
<td>Overall, DC RHIO will be useful in the work I do.</td>
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</tr>
</tbody>
</table>

2. Your opinions about the DC RHIO
1. Please think about your use of DC RHIO and indicate your level of agreement with the statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Somewhat Disagree</th>
<th>Neutral</th>
<th>Somewhat Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning to use DC RHIO was easy for me.</td>
<td></td>
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<tr>
<td>It will be easy for me to become skilled at using DC RHIO.</td>
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<tr>
<td>I will find DC RHIO easy to use.</td>
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<tr>
<td>My interaction with DC RHIO will be clear and understandable.</td>
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</tr>
<tr>
<td>DC RHIO will fit well with my workflow.</td>
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<tr>
<td>I expect DC RHIO to change the way I currently do my job.</td>
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<tr>
<td>DC RHIO is likely to disrupt the way I like to work.</td>
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<tr>
<td>DC RHIO will be compatible with my preferred workflow.</td>
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</tbody>
</table>

2. Please think about your use of DC RHIO and indicate your level of agreement with the statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Somewhat Disagree</th>
<th>Neutral</th>
<th>Somewhat Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Going forward, I intend to explore new features in DC RHIO.</td>
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<td></td>
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<tr>
<td>I will try to find different ways in which I can use DC RHIO.</td>
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<tr>
<td>In the future I will increase my use of DC RHIO.</td>
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<tr>
<td>I have a clear understanding of the goals of this system.</td>
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<tr>
<td>My understanding of the capabilities of DC RHIO is adequate.</td>
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<tr>
<td>I comprehend the role my organization plays in the DC RHIO.</td>
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<tr>
<td>I am aware of the long-term objectives of this effort.</td>
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<tr>
<td>I have had sufficient opportunity to ask questions about DC RHIO.</td>
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<tr>
<td>My questions about DC RHIO have been addressed.</td>
<td></td>
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<tr>
<td>The training I received (seminars, training materials, etc) was adequate.</td>
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<tr>
<td>Technical support for DC RHIO will be adequate.</td>
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</tbody>
</table>

3. Any other feedback or suggestions for the DC RHIO System you may enter here. (Optional)

4. Are you currently using the DC RHIO system?
   - Yes
   - No

3. System Feature Use
1. If you are currently a user, please indicate which DC RHIO system features you are using and the frequency of use:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Never</th>
<th>Occasionally</th>
<th>Frequently</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>View Patient Information (demographics)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>View Clinic Observations</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>View Clinic Allergies</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>View Clinic Diagnoses &amp; Procedures</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>View Clinic Medications</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>View Lab Results (provided by clinics and hospitals)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>View Hospital Discharge Summaries</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>View Hospital Radiology Reports</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
</tbody>
</table>

2. What is/was the actual start date for use of the system? (MM/DD/YYYY)

3. Give example(s) of the new capabilities you found in the DC RHIO system, or creative ways of using the DC RHIO System. (Optional)

4. Demographics and Background

Please tell us a little bit about yourself.

1. Gender
   - Female
   - Male

2. Age
   - <20
   - 21-30
   - 31-40
   - 41-50
   - 51-60
   - 61-70
   - 71-80
   - 81+
3. Education (highest level attained)
   - High School
   - Associate Degree
   - Some College
   - Undergrad/Bachelor's Degree
   - Masters Degree
   - MD/PhD

4. Organization type you represent
   - Community Health Center
   - Hospital
   - Other
   - Other (please specify) 

5. Your Role
   - Doctor
   - Physician assistant
   - Nurse practitioner
   - Nurse
   - CMA
   - Social worker
   - Case worker
   - Management
   - Administrative Staff
   - Other (please specify) 

6. Number of years you have spent in this role
Appendix H: DC RHIO Metrics Workgroup, Summary Scorecard

<table>
<thead>
<tr>
<th>Category</th>
<th>Scorecard Metric Name</th>
<th>Metric Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality/Safety</td>
<td>Improve Patient Care</td>
<td>Patients who have received the appropriate care from the right care giver due to having the knowledge of medical history</td>
</tr>
<tr>
<td></td>
<td>Improve Patient Safety</td>
<td>Patients who do not receive unnecessary treatment or unnecessary medications/procedures based on health history knowledge</td>
</tr>
<tr>
<td></td>
<td>Drive Adoption / Improve Best Practices</td>
<td>Providers actively use the HIE as a routine part of the health care delivery process</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Increase Efficiency</td>
<td>Operational and administrative efficiencies resulting in reduced operational costs.</td>
</tr>
<tr>
<td></td>
<td>Reduce Service Costs</td>
<td>Less healthcare costs due to reduction of duplication of ED services, ancillary services and better case management and reduction in unnecessary comprehensive workflows</td>
</tr>
<tr>
<td></td>
<td>Improve Operations</td>
<td>Reduced operational costs of managing paper claims, patient records and EOB distribution</td>
</tr>
<tr>
<td>Stakeholder Satisfaction</td>
<td>Improve Measures of Stakeholder Satisfaction</td>
<td>Continuity of patient care/closer patient-physician relationship</td>
</tr>
<tr>
<td></td>
<td>Enable Management of Patient Health Information (PHI)</td>
<td>Patients who are active in the management of their care</td>
</tr>
<tr>
<td></td>
<td>Produce Administrative Savings</td>
<td>Administrative changes that improve health care operations</td>
</tr>
</tbody>
</table>

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