Barriers and Facilitators of Health Information Exchange (HIE) Adoption in the United States

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Abstract

HIE is growing in the United States because HIE is an important priority under the Meaningful Use stage II requirements. However, only a small percent of U.S. hospitals engaged in HIE with unaffiliated providers and large variation existed among states. In order to understand potential HIE Adoption Recommendations, we reviewed the literature on barriers and facilitators of HIE adoption in the United States. Our search yielded 669 articles, 48 meeting our inclusion criteria. In general, we found several organizational and end user HIE adoption barriers as well as facilitators. Therefore, policymakers, healthcare organizations, vendors, and clinic staffs need to work closely and innovatively in order to overcome all of these barriers and utilize facilitators to expedite nationwide HIE adoption, minimize data breach, and eventually, achieve continuity of care.

1. Background

The American government planned to adopt health information technology (IT) under the 2009 Health Information Technology for Economic and Clinical Health Act (HITECH Act) in order to build a nationwide information infrastructure. [1] It initiated Meaningful Use in 2009 and offered incentives to encourage healthcare organizations and providers to install Electronic Health records (EHR). HIE is an important priority under the Meaningful Use stage II requirements. [2] Thus, HIE is occurring in nearly every state within the continental United States. As proof, in 2010 the U.S. Department of Health and Human Services awarded more than $548 million through the State HIE Cooperative Agreement Program [3]. During that time there were more than 234 active HIEs identified by the eHealth Initiative report. [4] In 2011, a mail survey with telephone follow-up of 4,326 national respondents found that a majority of office-based physicians could exchange lab and medication data, and about one third could exchange clinical summaries with patients or other providers. [5] The strongest predictor of exchange capability is EHR adoption. [6] However, organizational and physicians’ capabilities to exchange data varies by EHR vendor and the technical infrastructure in each state. [6], [7] This article explores the potential barriers and facilitators to HIE adoption in the U.S. as presented in the available literature.

The uncoordinated nature of healthcare delivery in the United States leads to fragmented health information and impedes patient care continuity and safety. [8] Health information exchange (HIE), the process of electronically exchanging patient information among different hospitals, physicians, and other healthcare providers in a community at the point of care, is considered a solution to the fragmentation of data in healthcare. [9] There are two types of HIE in the United States: public HIE and private HIE. [10] The public HIEs are broader in region than private ones and encompass a specific region involving multiple hospital-based organizations. The public HIEs usually cost more than or equal to $10 million and are operated by public or government entities. [11] On the other hand, private HIEs are typically based on two integrated delivery networks or large hospital organizations that are funded and governed by private sponsoring entities, mostly by the integrated delivery network itself. [12] The majority of private HIEs have a 501(c) (3) status. [10] 501(c) is a unit of the U.S. tax code (Internal Revenue Code) which offers 29 types of nonprofit organization exemptions from some federal income taxes. 501(c) (3) status organizations are the most common type of tax-exempt nonprofit organizations in the U.S., which are eligible to receive tax deduction. [13] Therefore, most private HIEs have an apparent advantage of mitigating funding challenges. [12] Usually, small
regional HIEs can cost less than $5 million and operate on $200,000 per year. [10]

HIE technology becomes a promising method to lower the cost and improve quality of healthcare because it allows healthcare providers to efficiently access health information, avoid unnecessary testing and treatment, reduce time to obtain health information, and increase healthcare provider awareness of patient interactions with the healthcare system (see Table 1 for HIE benefits). [8], [14] Also, HIE increases patient satisfaction by decreasing waiting time. [10] Additionally, technologies to support inter-organizational HIE make electronic information sharing more attainable in the current information age. More importantly, both the physician and nurses have generally positive views of HIEs. [15], [16]

According to a report by KLAS Research, private HIE growth is exceeding public HIE growth. The report stated three possible reasons. First, governance typically was the reason for the restricted growth of public networks. Second, public HIEs usually depend on public or government surveillance due to tighter rules and complex regulations. Finally, the financial models for public HIEs are more complicated. [17] A Black Book Ranking Report in 2014 found that 33% of multi-provider networks and hospital systems are investigating private HIEs for more standardized sharing of patient data. Also, 82% of all payers and providers believe operational national public HIEs are at least 10 years behind private HIEs. Meanwhile, 98% of healthcare organizations believe that private, community, or regional HIEs are more effective in achieving accountable care delivery organizations. [18] Although HIEs have potential benefits of improving continuity of patient care, HIE adoption is still limited. [8] There are urgent needs from both HIE vendors and health care organizations to recognize the barriers and facilitators to HIE in order to facilitate the HIE adoption in the U.S. Therefore, this article is going to analyze potential barriers and facilitators to HIE adoption.

2. Methods

Any peer-reviewed or non-peer-reviewed literature that focuses on barriers or facilitators of HIE adoption in the United States were considered for review. The author used the keywords health information exchange, barriers, and/or facilitators to search in PubMed. However, it was difficult to retrieve related articles in PubMed. The same keywords were used to search in all resources of Ovid (54 retrieved), InSpec (329 retrieved), Business Source Complete (7 retrieved), and Scopus (287 retrieved) databases between January 2007 and April 2014. After removing duplicates, and screening the search results for only HIE in the U.S. a total of 42 articles were retrieved and reviewed.

3. Results

3.1. HIE adoption barriers

3.1.1. Organizational barriers.

The many anticipated benefits of HIE on healthcare have promoted its implementation and adoption in the United States. The first adopters discovered many barriers to using HIE and it is necessary to overcome these barriers in order to meet the growing need for HIE. Organizational barriers include privacy and security [1], [10], [14], [19]-[21], sustainability, proprietary issues [10], funding, governance [20], legal barriers and regulation [19], [20], lack of data standards that permit exchange of clinical data, and complex systems. [14], [19], [22] Legal barriers to IT adoption (including HIE systems) existing in the U.S. involve numerous laws related to fraud, abuse, antitrust, liability, malpractice, etc. [19] Additionally, there are other non-technical factors, such as loss of competitive advantage, uncompensated care burden, issues of patient consent, limited understanding, and differences of business models. [20], [23]-[25] Moreover, lack of publications showing that HIE is effective [26] might be another issue which could hinder HIE implementation and information sharing among hospitals.

A study [27] published in 2011 showed that only 10.7% of U.S. hospitals (N=344) used HIEs with unaffiliated healthcare providers. It also found that for-profit hospitals and smaller hospitals (6-99 beds) were much less likely to use HIEs than those nonprofit hospitals or larger ones (≥ 400 beds). Hospitals in markets with higher Medicare spending were less likely to exchange data whereas hospitals with more concentrated markets were more likely to exchange data. The researchers believed that competition might be the reason holding some healthcare providers back. [22], [27] When the researchers tried to do a similar study by using the annual American Hospital Association (AHA) Information Technology supplement survey data in 2012, they found the same characteristics of HIE-adopted hospitals as their former study finding except more U.S. hospitals (30%, N=689) were using HIE with unaffiliated providers by the end of 2012. However, HIE adoption rates vary dramatically among different states. For example, three states (Rhode Island, Delaware, and Vermont)
had more than 70% participation while other states only had minimal participation. [7]

In 2012, a study showed that 18 out of 18 representatives from nine organizations believed in some potential benefits from HIEs, while some expected overall benefits and none of them expected net financial benefits. Surprisingly, more benefits were expected for the poorest and sickest patients. Few concerns with losing patients to other organizations or publishing unfavorable quality data were noticed. However, many concerns were present about HIEs increasing the risk of data hacking, especially among larger (≥ 400 beds) organizations. [28] In 2013, interviews of 17 state and national health informatics policy experts concluded that HIE was difficult to implement because of political and economic reasons and that organizational issues and geographic challenges existed with the regional health information organization (RHIO) model of data exchange. [29] Interoperable RHIOs were identified as the ‘basic building blocks’ of the national health information infrastructure. [30] Security, data storage, database administration, technical support, and $2,000,000 to $3,000,000 in annual operating costs were some of these challenges. [31] Exchanging patient information is agreed to be a good idea but might cause some institutes to lose $11 million revenue per year. Also, it is very complicated to govern how organizations access, control, and use data within the RHIO model, especially if they are competitors in those same areas. Thus, running RHIOs is a trust issue rather than a technical issue. Additionally, several policy questions cannot be solved by geography, such as: how many RHIOs should a state have? What factors can guarantee that all regions progress appropriately and cooperate efficiently? [29] Although other alternative exchange models, such as direct project, enterprise HIE, and vendor-mediated HIE, exist, similar dilemmas need to be solved. Finally, interoperability is always an issue no matter what model or HIE system is adopted.

### 3.1.2 End user barriers.

Clinical staff acceptance is always a challenge to any new technology adoption. Several barriers from end users of HIE usages are: lack of access to incentives/capital by healthcare providers [10], [19], start-up costs [5], time burdens/constraints [32], [33], resources to select and implement a system (38%) [6], multiple logins [10], vulnerable information accessibility and misuse [23], [32], and trust in HIE partners. [34]

There were 105,705 unique user sessions that were analyzed from the Integrated Care Collaboration (ICC) of Central Texas. Distinct types of user behaviors were found to exist and vary among jobs, organizations, and time within a single HIE system. [2] Moreover, usages differ from the patient encounter times. For example, repetitive searching was the most common in hospital settings and uncommon in Emergency Departments (EDs). Surprisingly, physicians used HIE least and nurses used HIE most. Overall, most users used HIE very little. [2] However, this finding may not represent all HIE usage pattern in any health care settings. A few physicians who were interviewed by the author stated their concerns of distrust of unknown resources. Plus, redundant and inaccurate categorized information presented in some HIE systems discourage the physicians to use it due to time constraints. This is consistent with the finding of Vest and Jasperson [2] who stated that physicians seldom repeat HIE data searching. Another study found different HIE-related workflows among 14 clinical sites. Two general role-based HIE usage models include nurse-based and physician-based. The information retrieved is related to roles. In general, nurses would like to retrieve recent hospitalization data while nurse practitioners and physicians would like more open-ended usage. [35] However, user-unfriendliness, disrupted workflow, and low desirability are factors affecting HIE usage reported by 15 emergency department physicians. [36] Last, but not least, it is difficult for the physician owners of practices to invest when it is hard to yield a positive return on investment. [14]

### 3.2. HIE adoption facilitators

#### 3.2.1. Organizational facilitators.

Several studies tried to investigate effective methods to improve HIE adoption. Researchers found that non-profit public hospitals with more live and operational applications, more ED visits, network membership, and physician portals would increase HIE adoption. [24] Removal of legal barriers [19] is always a must to facilitate HIE adoption. Moreover, rich professional and social networks are proved to be favorable settings for HIE adoption. [34] It is very valuable for small-to-medium sized primary care practices to receive financial incentives. [34] Obviously, subsidies and performance incentives by payers and government are welcome. [19] On the other hand, it is crucial to have certification and standardization of vendor applications that can permit clinical data exchange. [19] Technical assistance and support during and after implementation [34] are other facilitators for HIE adoption. Finally, better data security and privacy protection are important factors for long term HIE adoption consideration (see...
Table 2 for organizational HIE adoption barriers and facilitators). [19],[21],[22] Potential methods include but are not limited to: toughen consent, add prohibitions, limit data recipients, and develop privacy rules. [21]

3.2.2. End user facilitators.

Based on a survey taken by 144 physicians, technical assistance (70%) was ranked the first facilitator followed by financial incentives to use (65%) or purchase health IT systems (54%). [5] Also, findings from this literature review stated that end users prefer that HIEs be useful, useable [36] and user friendly. [5] A single automated login [37] is highly desired. Plus, ideal HIEs should contain all proper data and have seamless access. [10] Role-specific customization for display to accommodate different healthcare providers’ workflow and information needs [35] is highly recommended. Automatic notification of HIE data availability [37] would be an excellent feature. For the long-term HIEs success, researchers believed that understanding end users’ HIE perspectives is crucial. [35] Finally, a study showed that physicians who prefer viewing patient health information electronically are at least 3 times more likely to adopt and use HIE (see Table 3 for end user HIE adoption barriers and facilitators). [5]

4. Discussions

There are several recommendations for HIE adoption. First is at the organizational level. The potential benefits of HIEs, such as more efficient workflow, improved quality of care, cost reduction, and increased revenue, in ambulatory primary care practices and emergency medicine are well recognized in twenty peer-reviewed articles with original findings.[38],[39] However, there are so many different settings other than PCP and ED in any healthcare organization. Limited research data showed convincing and promising results of HIE adoption within the organizational administration. Therefore, further study addressing the impact of HIEs on patient safety and quality of care is needed. HIE outcomes evaluation is required to give healthcare providers and policymakers evidence and confidence to adopt HIE because there are limited HIE benefits for healthcare outcomes at different levels [26] This is also an evidence-based practice requirement for future policy and investment. [25], [39] Furthermore, specific research about the best HIE practice and adoption are important. [39] Thus, we need some longitudinal studies and retrospective quality reviews for patient outcomes after HIE implementation.

Yet some states (Rhode Island, Delaware and Vermont) have 70% participation in HIE, they are not representative because these three states are some of the smallest in population and number of healthcare facilities. Some organizations refuse to adopt HIE due to political and economic reasons, although the U.S. government offers incentives (offers a great amount of money to those healthcare organizations or providers that achieve different criteria of Meaningful Use Act at different stages and financial punishment (gives fines to those healthcare organizations or providers that won’t adopt certain health IT systems after certain dates) to facilitate HIE adoption. Using states as middlemen and mandating exchange under public health law may avoid the data exchange challenges [29], such as data standard and interoperability, which is impossible to be provided by any single healthcare organization. Policymakers need to develop new policies which can counteract the weaknesses of each HIE model, ensure data is shared among healthcare providers effectively, and offer incentives for organizations to help clinicians use HIEs, as well as for clinicians to add data to HIEs. [7],[14], [29],[40] Furthermore, organizations must shift from an ownership view of health data to a continuity of care perspective. Healthcare providers must understand potential benefits of external health information in order to build a successful HIE network and effectively integrate external health data into clinical practices. [8]

Second, better designed HIEs that are useful, usable, and user-friendly will have a better market. A study suggested better data delivery through simpler methods, such as creating default views based on different healthcare providers or working locations, which provides an easy approach to match different users’ information needs. [2] Clinicians, EHR/HIE vendors, and trainers should work together and integrate HIE into current clinical workflows [40] in order to meet healthcare providers’ needs and promote adoption and usage. [36]

Third, targeting different healthcare providers’ data needs will increase the adoption of HIEs because adoptions in different settings are affected differently by different influences. [41] A recent study used adoption data on 1,060 different primary and secondary care physicians over 32 consecutive months and tested HIE adoption. Its results showed that physicians’ geographical locations are determining factors in their HIE adoption. They are more affected by other similar specialty physicians due to sharing more common patients. Moreover, rural-areas-practiced physicians are highly affected by those urban-areas-practiced physicians in HIE.
adoption. [41] Specifically, primary care providers (PCPs) were more enthusiastic than specialists about the benefits (reducing costs, improving quality, and saving time) of HIE. [15] However, infection perfectionists’ (IPs) awareness and engagement in EHR/HIE was not great from an online survey. [42] Improving healthcare providers’ HIE knowledge should be the first step to promote adoption.

ED physicians’ adoption of HIE is always crucial due to possible significant HIE benefits of improving patient safety, decreasing duplicate testing, avoiding unnecessary admissions, and tailoring proper care to patients. Researchers suggested to enhance ED adoption because their study showed that it was still a challenge for some ED physicians to integrate their HIE into their current workflows. Plus, ED physicians in their study didn’t understand all the data elements and sites information accurately even though they were very satisfied with their HIE training. [37] Therefore, follow-up HIE training might be a good strategy to prevent similar events from happening. Electrocardiograms (ECGs) and discharge summaries are on ED physicians’ rank-order list. Specifically, images reports for ECGs and X-rays as well as written reports for advanced imaging and cardiac studies are preferred. [43]

Fourth, offering nurses their preferred HIE data is significant to enhance nursing HIE adoption. A web-based survey to home health workers in New York with 566 participants found that almost all Registered Nurses (RNs) (96.7%) agreed that rapid access to outside information without effort would benefit their care delivery. Those RNs’ top five most desired data in their patients’ HIE profiles are as follows: inpatient discharge summaries (81.5%), medication lists (80%), PCP contact information (67.7%), laboratory data (58.8%), and ED clinical notes (56.8%). [16] However, different RNs might have different preferences of their patients’ HIE data. More research is needed to study nurses’ workflow and data preference in order to improve nursing HIE adoption.

The author conducted semi-structured interviews with nine health care providers, including registered nurses, physicians, physician assistants, nurse practitioner, and an informatics nurse in two Magnet-designated hospitals in April 2014. Specifically, the author visited a cancer center in a 249-bed acute care and teaching hospital as well as an Ambulatory Surgery Center and Day of Admission Surgery unit in a 490-bed tertiary care hospital that offers a broad range of specialties. Both of these hospitals are using the same HIE vendor, which was ranked by Black Book Ranking Report in 2014 as one of the best five vendors in the United States. Unsurprisingly, all the end users complained about all of the HIE adoption barriers discussed above. Plus, certain oncologists really wanted certain historical lab data over 7 years, and staff in the Day of Admission Surgery unit wanted a scanned documentation feature (such as PCP’s EKGs, OR consents, medication orders and other scanned documents from surgeons’ offices).

It is helpful to facilitate HIE adoption in U.S.by understanding another country’s perspective on HIE. A pilot program in South Korea revealed that South Korean physicians have an overall positive perceptions of HIE and its benefits. [44] South Korean physicians believed that the most potential quality benefits through HIE adoption include such factors, such as eliminating duplicated medication, lab, imaging tests, preventing drug-drug interaction, expediting diagnosis, and making better care plan decisions. However, they seem least worried about revenue reduction, time saving, and cost savings because of HIE. Physician practice settings significantly influenced their perceptions of HIE in South Korean. Physicians’ concerns regarding HIE include information safety and security, system costs, and malpractice. South Korean physicians and American physicians might have different opinions on HIE adoption benefits, however, their concerns about HIE are similar. Their most valued information included: pathology, lab results, diagnostic imaging, medication, and working diagnosis.

The Swiss researcher [45] reported that it took more than ten years to implement e-toile (the Geneva health information exchange) in Switzerland. They believed the reason was that the highly fragmented Swiss health system is based on a complicated interaction of private and public stakeholders. There are also many non-technical obstacles, such as eHealth laws, eHealth strategies, and increased financial pressure on all healthcare stakeholders. The researchers don’t believe that it is as constructive to deploy eHealth systems in Switzerland as in most other developed countries due to these obstacles. [45] These experiences and lessons are valuable to their American peers.

In a survey [46] regarding HIE adoption in a PCP setting of seven countries (Australia, Canada, Germany, New Zealand, the Netherlands, the United Kingdom, and the United States), it revealed that PCPs in Australia, the Netherlands, New Zealand, and the United Kingdom used the most HIE systems, followed by Germany and Canada. The United States lagged well behind. Several nations realized the potential benefits of HIE and initiated national and international efforts. Globally, fully functioning HIE is uncommon. Challenges of HIE adoption included incentives, interoperability, record linking, insufficient infrastructures, governance, and interorganizational relationships. Solving HIE’s cost
and quality issues will facilitate HIE adoption in many countries. However, HIE adoption raised policy concerns of central planning, national identifiers, standards, and exchanged data types.

In general, there are so many similar barriers affecting HIE adoption in the United States compared to other countries. Incentives might be important, but are not the only key factor that can attract more organizations to adopt HIE. Governmental infrastructure, stronger policies, and standardized data at a national or state level will dramatically facilitate HIE adoption. User-friendly HIE tailoring to different healthcare providers’ workflows and consistent technical assistance will help clinicians to accept and contribute structured data. Because the HITECH Act does not specify how HIE should be accomplished, there are many gaps for policymakers, healthcare organizations, vendors, and clinic staff to fill. The lack of specification can bring in creativity. Therefore, all stakeholders need to work closely and creatively in order to overcome all of these barriers and utilize facilitators to expedite nationwide HIE adoption, minimize data breach, and, eventually, achieve continuity of care.

References:


Table 1. HIE benefits [8]

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<th>Number</th>
<th>Benefit</th>
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<tbody>
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<td>1.</td>
<td>Allows healthcare providers to directly access patient health data</td>
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<td>2.</td>
<td>Reduces time to obtain patient data</td>
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<td>3.</td>
<td>Provides healthcare provider a historical view of patients usage of healthcare system</td>
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<td>4.</td>
<td>Method to lower cost and improve healthcare quality</td>
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Table 2. Organizational HIE adoption barriers and facilitators

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<tr>
<th>Organizational HIE Adoption Barriers [10], [19], [20], [22]-[24], [26]</th>
<th>Organizational HIE Adoption Facilitators [19], [24], [34]</th>
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<td>1. Privacy and security</td>
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<td>2. Interoperability and sustainability</td>
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<td>3. Proprietary issues Funding</td>
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<td>4. Governance</td>
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<td>5. Legal barriers and regulation</td>
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<td>1. Non-profit status, public hospitals, more live and operation applications</td>
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<td>2. More emergency room visits, network membership, and physician portals</td>
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<td>3. Removal of legal barriers</td>
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<td>4. Rich professional and social networks are favorable settings for HIE adoption</td>
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<td>5. Subsidies and performance incentives by</td>
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<tr>
<th>End user HIE adoption barriers [5], [10], [19], [23], [32]-[34]</th>
<th>End user HIE adoption facilitators [5], [10], [35]-[37]</th>
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<tr>
<td>1. Incentives</td>
<td>1. Technical assistance (70%)</td>
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<td>2. Lack of access to capital by healthcare providers</td>
<td>2. Financial incentives to use (65%) or purchase (54%) health IT systems</td>
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<td>3. Start-up costs (57%)</td>
<td>3. Useful, useable and user friendly</td>
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<td>4. Time burdens</td>
<td>4. A single automated login</td>
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<td>5. Time constraints</td>
<td>5. Contains all proper data in one database with seamless accessibility</td>
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<td>6. Resources to select and implement a system (38%)</td>
<td>6. Role-specific customization to accommodate different workflow and information</td>
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<td>7. Multiple logins</td>
<td>7. Automatic notification of HIE data availability</td>
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<td>8. Vulnerable information accessibility and misuse</td>
<td>8. Understanding end users' HIE perspectives is crucial to the long-term success</td>
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<td>9. Trust in HIE partners</td>
<td>9. Preferring viewing patient health information electronically at least 3 times more likely to adopt and use HIE</td>
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