



Research article

Health care provider perceptions of a query-based health information exchange: barriers and benefits

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ABSTRACT

Background Health information exchange (HIE) systems are implemented nationwide to integrate health information and facilitate communication among providers. The Nebraska Health Information Initiative is a state-wide HIE launched in 2009.

Objective The purpose of this study was to conduct a comprehensive assessment of health care providers' perspectives on a query-based HIE, including barriers to adoption and important functionality for continued utilization.

Methods We surveyed 5618 Nebraska health care providers in 2013. Reminder letters were sent 30 days after the initial mailing.

Results A total of 615 questionnaires (11%) were completed. Of the 100 current users, 63 (63%) indicated satisfaction with HIE. The most common reasons for adoption among current or previous users of an HIE ($N = 198$) were improvement in patient care ($N = 111$, 56%) as well as receiving ($N = 95$, 48%) and sending information ($N = 80$, 40%) in the referral network. Cost ($N = 233$, 38%) and loss of productivity ($N = 220$, 36%) were indicated as the 'major barriers' to adoption by all respondents. Accessing a comprehensive patient medication list was identified as the most important feature of the HIE ($N = 422$, 69%).

Conclusions The cost of HIE access and workflow integration are significant concerns of health care providers. Additional resources to assist practices plan the integration of the HIE into a sustainable workflow may be required before widespread adoption occurs. The clinical information sought by providers must

also be readily available for continued utilization. Query-based HIEs must ensure that medication history, laboratory results and other desired clinical information be present, or long-term utilization of the HIE is unlikely.

Keywords: evaluation, health information exchange, Nebraska, provider

BACKGROUND

As the potential financial and medical benefits of health information exchange (HIE) continue to be explored nationally, the roll-out of such systems has been met with both optimistic expectation and resistance.^{1,2} Widespread use of HIE systems around the country is a key aspect of the American Recovery and Reinvestment Act with the goals of more efficient information sharing and ultimately the formation of a national health information network.³ Since 2009, Nebraska's HIE has been maintained through the Nebraska Health Information Initiative (NeHII).⁴

NeHII is a query-based HIE sponsored by Nebraska health care providers and health insurers who share and use information for treatment, payment and public health reporting purposes. NeHII is a web-based system accessed by each authorized provider using a unique identification number and password. The statewide network allows participating providers to query and securely view patient information. NeHII connects pharmacy, laboratory and insurer data allowing prescribers to view patient medication histories, laboratory results and formulary information from multiple sources.

Barriers to both initial adoption and long-term utilization of HIEs exist. Others have reported that while many physicians see HIE as likely to have positive impact on patient care, payment for access to the system is a common barrier to adoption. In Massachusetts, for example, only 37% of physicians agreed to pay a monthly access fee of US\$150.⁵ Efficient workflow integration is another recognized barrier for the initial adoption and continues to be a primary concern among current HIE users.⁶ As such, delays in patient visit interaction brought about by entering or locating patient data in the electronic systems have been associated with a decrease in HIE use.⁶⁻⁸

Regular HIE utilization is associated with the willingness of patients and physicians to contribute information into the data sharing systems. Practitioners' rating of an HIE's helpfulness is associated with the completeness of the available data.⁹ If a physician is unable to find the desired information for a significant number of the patients queried, continued use of the HIE is unlikely. In addition, completeness of data is contingent on the belief that system security is maintained adequately. Data sharing is linked intrinsically with patient privacy. Mental health practitioners may be especially concerned with security of patient data in electronic systems.¹⁰

The purpose of this study was to conduct a comprehensive assessment of Nebraska health care providers' perspectives on a query-based HIE, including barriers to adoption and important functionality for continued utilization. This survey was a component of a comprehensive evaluation of HIE in Nebraska.

Identification of implementation barriers and assessment of desired clinical information can be used to improve provider training and inform future system functionality.

METHODS

We mailed 5618 surveys to health care providers in Nebraska including physicians (doctors of medicine – MD/doctors of osteopathic medicine – DO), physician assistants (PAs) and advanced practice registered nurses (APRNs). A comprehensive mailing list of health care providers in Nebraska was obtained from the Health Professionals Tracking Service at the University of Nebraska Medical Centre.¹¹ The initial mailing was conducted in May 2013, and a reminder letter was sent in June 2013.

The survey was modelled after other provider satisfaction surveys and included 17 questions assessing previous use of HIE, reasons for adoption, utilized functionality, identification of desired functionality and barriers to adoption/utilization.¹² In addition, open-ended questions focused on HIE system improvements, concerns and other comments. Three physicians reviewed the final draft to establish face validity and avoid ambiguity of questions. Basic descriptive analyses were performed using SPSS.¹³ The study was approved by the Institutional Review Board of the University of Nebraska Medical Centre.

RESULTS

A total of 5618 surveys were mailed, and 615 were returned (11%). The majority of surveys were completed by physicians ($N = 315$, 51%), followed by APRNs ($N = 122$, 20%) and PAs ($N = 97$, 16%) (Table 1). The most common specialties were family medicine ($N = 149$, 24%) and internal medicine ($N = 94$, 15%). The majority of the reported practices had 175 beds or more ($N = 200$, 33%) and were urban, non-teaching ($N = 186$, 30.2%). HIE usage was reported by 100 participants (16%), and 19 (3%) intended to implement HIE within next year.

Among 615 respondents, 198 were current or previous users of the HIE (32%). These providers were asked to rate their influences to adopt HIE. Desire to improve patient care was indicated by the majority of practitioners as a major influence to adopt HIE ($N = 111$, 56%) (Table 2). The capabilities of receiving ($N = 95$, 48%) and sending information ($N = 80$, 40%) among a physician's referral network were also indicated as major influences to adopt, along with the desire to meet meaningful use

Table 1 Respondent characteristics

Characteristic	N (%) ^a
<i>Occupation</i>	
MD/DO	315 (51.2%)
APRN	122 (19.8%)
PA	97 (15.8%)
Other	14 (2.3%)
<i>HIE adoption status</i>	
Implemented and using NeHII	100 (16.3%)
Intend to use NeHII within next 12 months	19 (3.1%)
Deciding whether or not to use NeHII in next 12 months	33 (5.4%)
Not intending to use NeHII within next 12 months	25 (4.1%)
<i>Specialty</i>	
Family medicine	149 (24.2%)
Internal medicine	94 (15.3%)
Paediatrics	54 (8.8%)
Surgery	37 (6.0%)
Anaesthesiology	33 (5.4%)
Emergency medicine	30 (4.9%)
Orthopaedic surgery and rehabilitation	26 (4.2%)
Obstetrics and gynaecology	22 (3.6%)
Psychiatry	20 (3.3%)
Otolaryngology	11 (1.8%)
Other ^b	47 (7.6%)
<i>Practice location</i>	
Rural	169 (27.5%)
Urban non-teaching	186 (30.2%)
Urban teaching	174 (28.3%)
<i>Practice bed size</i>	
Small (1–74)	187 (30.4%)
Medium (75–174)	91 (14.8%)
Large (175+)	200 (32.5%)
TOTAL	615 (100%)

^aPercentages were calculated out of 615 total responses and do not add up to 100 due to missing data

^bSpecialties with fewer than 10 providers

Table 2 Reasons for HIE adoption

	Major influence N (%) ^a	Minor influence N (%)	Not an influence N (%)
Desire to improve patient care	111 (56.1%)	24 (12.1%)	37 (18.7%)
Capability of receiving information electronically within my referral network	95 (48.0%)	42 (21.2%)	34 (17.2%)
Desire to meet meaningful use criteria	89 (44.9%)	35 (17.7%)	48 (24.2%)
Capability of sending information electronically within my referral network	80 (40.4%)	47 (23.7%)	46 (23.2%)
Interest/expectation from my patients	29 (14.6%)	51 (25.8%)	90 (45.5%)
Financial benefit to my practice	41 (20.7%)	46 (23.2%)	84 (42.4%)
HIE being used by trusted colleagues	52 (26.3%)	51 (25.8%)	69 (34.8%)
Technical assistance with HIE implementation in my practice	57 (28.8%)	54 (27.3%)	61 (30.8%)

The most common responses are indicated in bold

^aPercentages were calculated out of 198 participants who reported previous HIE use. The percentages do not add up to 100 due to missing data

criteria ($N = 89$, 45%). Patients' expectations, financial benefits to practice and HIE use among colleagues were not influences to adopt HIE for the majority of providers. Of the 100 providers who currently use NeHII, 50 (50%) reported enhanced patient care as a result of using the HIE and 63 providers (63%) were somewhat or very satisfied with the current system.

Regardless of their previous HIE usage or implementation plans, all providers were asked to rank barriers to using NeHII. The cost of use and lost productivity during implementation were cited as major barriers by 38% and 36% of respondents, respectively (Table 3). Minor barriers included resistance of employees to change in work habits ($N = 244$, 40%), adequacy of HIE training ($N = 235$, 38%), concern with sharing patient information in the network ($N = 231$, 38%), system reliability ($N = 222$, 33%) and technical support ($N = 204$, 33%). In addition, access to high-speed Internet was a barrier for 184 providers (30%) and reaching a consensus to use an HIE was a barrier for 290 providers (47%).

All providers were asked to assess the desired HIE features regardless of their HIE implementation status. Providers ranked a variety of HIE features by their importance from 'very important' to 'not important' (Table 4). Features ranked as 'very important'

were accessing comprehensive medications ($N = 422$, 69%), patient allergies ($N = 396$, 64%), viewing lab results ($N = 381$, 62%), clinical notes ($N = 378$, 62%), patient problem lists ($N = 358$, 58%) and radiology images ($N = 325$, 53%). Exchanging clinical summaries ($N = 343$, 56%) was also reported as 'very important'. Features ranked 'somewhat important' by the majority of participants included public health reporting ($N = 257$, 42%), additional free access for staff ($N = 217$, 35%) and electronic insurance information ($N = 205$, 33%).

HIE was believed to have significant impact on practice regardless of previous experience and usage (Table 5). HIE was reported to 'very likely' help identify critical lab values ($N = 264$, 43%), duplicate prescriptions ($N = 263$, 43%), medication errors ($N = 221$, 36%) and needed lab tests ($N = 211$, 34%). In addition, providers identified that HIE would 'very likely' help order fewer tests ($N = 256$, 41.6%), monitor prescription drugs ($N = 240$, 39%) and enhance patient care ($N = 243$, 39.5%). Most responders indicated that HIE was 'somewhat likely' to help order more on-formulary drugs ($N = 194$, 32%) and provide preventative care ($N = 180$, 29%). The ability of NeHII to enhance patient care was reported as 'very likely' by 243 providers (40%) and 'somewhat likely' by 160 providers (26%).

Table 3 Perceived barriers to adoption and utilisation

	Major barrier <i>N</i> (%)^a	Minor barrier <i>N</i> (%)	Not a barrier <i>N</i> (%)
Costs associated with using NeHII	233 (37.9%)	160 (26.0%)	95 (15.4%)
Loss of productivity during the transition to using NeHII	220 (35.8%)	192 (31.2%)	85 (13.8%)
Resistance to change in work habits	122 (19.8%)	244 (39.7%)	131 (21.3%)
Adequacy of training for you and your staff	185 (30.1%)	235 (38.2%)	75 (12.2%)
Concern with providing patient information over the NeHII network	97 (15.8%)	231 (37.6%)	172 (28.0%)
Reliability of the system	187 (30.4%)	222 (36.1%)	75 (12.2%)
Adequacy of NeHII technical support	198 (32.2%)	204 (33.2%)	82 (13.3%)
Access to high-speed Internet	43 (7.0%)	141 (22.9%)	314 (51.1%)
Reaching consensus within my practice to use NeHII	106 (17.2%)	184 (29.9%)	203 (33.0%)

The most common responses are indicated in bold

^aPercentages were calculated out of 615 participants and do not add up to 100 due to missing data

Table 4 Important functionality for inclusion in HIE

Functions	Very important N (%) ^a	Somewhat important N (%)	Not important N (%)
Accessing a comprehensive list of the patient's medications	422 (68.6%)	40 (6.5%)	10 (1.6%)
Accessing a comprehensive list of the patient's allergies	396 (64.4%)	66 (10.7%)	15 (2.4%)
Viewing lab results from other providers	381 (62.0%)	91 (14.8%)	16 (2.6%)
Accessing clinical notes	378 (61.5%)	88 (14.3%)	14 (2.3%)
Accessing a patient problem list	358 (58.2%)	107 (17.4%)	20 (3.3%)
Exchanging patient clinical summaries with other physicians	343 (55.8%)	121 (19.7%)	25 (4.1%)
Viewing images from radiology procedures	325 (52.8%)	130 (21.1%)	35 (5.7%)
Indicator of availability of the patient's NeHII record	251 (40.8%)	180 (29.3%)	44 (7.2%)
Single sign-on	232 (37.7%)	189 (30.7%)	61 (9.9%)
Public health reporting	138 (22.4%)	257 (41.8%)	102 (16.6%)
Additional free access for staff	150 (24.4%)	217 (35.3%)	124 (20.2%)
Accessing electronic insurance information	178 (28.9%)	205 (33.3%)	113 (18.4%)

The most common responses are indicated in bold

^aPercentages were calculated out of 615 participants and do not add up to 100 due to missing data

Table 5 Perceived benefits of HIE use

HIE Benefit	Very likely N (%) ^a	Somewhat likely N (%)	Not at all likely N (%)
Identify critical lab values	264 (42.9%)	136 (22.1%)	20 (3.3%)
Identify duplicate prescriptions	263 (42.8%)	121 (19.7%)	30 (4.9%)
Order fewer tests due to better availability of lab results	256 (41.6%)	129 (21.0%)	26 (4.2%)
Overall, would NeHII enhance patient care?	243 (39.5%)	160 (26.0%)	24 (3.9%)
Prescription drug monitoring	240 (39.0%)	144 (23.4%)	24 (3.9%)
Identify potential medication errors	221 (35.9%)	180 (29.3%)	22 (3.6%)
Identify needed lab tests	211 (34.3%)	154 (25.0%)	42 (6.8%)
Order more on-formulary drugs (as opposed to off-formulary drugs)	130 (21.1%)	194 (31.5%)	79 (12.8%)
Provide preventative care	170 (27.6%)	180 (29.3%)	50 (8.1%)

The most common responses are indicated in bold

^aPercentages were calculated out of 615 participants and do not add up to 100 due to missing data

DISCUSSION

Improvement in patient care was the most commonly reported reason for the adoption of HIE in Nebraska. Improvement in patient care was also regarded by a large majority of providers in Massachusetts to result from HIE use.⁵ Accessing laboratory values and prescriptions were considered important features of HIE by responders in our survey. Accessing laboratory and prescription information was also found by Patel *et al.*¹ to be 'very useful', indicating the importance of these features to health care providers. In addition, most responders to this survey believed that HIE use would aid in preventing repeat testing. Studies on HIE usage patterns have shown that 20% of users report preventing repeat testing as a direct consequence of HIE usage.⁸

Consistent with other studies, our respondents indicated that they have high expectations for features of HIE and its ability to enhance care.¹⁴ For every potential enhancement to their practice, providers frequently chose HIE as 'very likely' or 'somewhat likely' to help. In order for a clinician to successfully identify data in a query-based HIE, another provider or health system must have previously decided to share data. Users of a new or developing query-based HIE must understand that information for some patients will not always be available. Education on the degree to which a 'young' HIE can deliver desired information will continue to be critical to ensure provider satisfaction through realistic expectations. From a system's perspective, the presence of an electronic flag in an electronic medical record (EMR) indicating that information for a patient is available in the HIE could prevent unnecessary queries – presumably decreasing provider frustration.

To support continued utilization, HIE developers must ensure that the information most desired by users are maintained or enhanced. The most important information areas were patient medications and laboratory values. The availability of the laboratory data has the opportunity for improvement. Viewing of radiology images is currently absent from NeHII's functionality, but was indicated as being 'very important' by over half of responders. The medication history feature was absent while the survey was conducted, yet it was the feature selected most frequently of all as 'very important', demonstrating its value for providers.

Consistent with other studies, Nebraska providers reported the cost of HIE as a major barrier.⁵ The finding that the loss of productivity was considered a major barrier was also similar to that of other studies that reported a decline in HIE use when it served as an additional step in the patient-provider interactive process.^{8–10} Although the adequacy of training and technical support were classified as 'minor barriers', these items were frequently reported. Provider training that focuses on system access and functionality is currently available from the HIE. However, additional resources for system integration into a practice's workflow may be required for successful HIE adoption. Whether health care systems, providers or payers will be willing to pay for this initial planning is unclear.

The survey primarily consisted of closed-ended questions in an effort to reduce respondent burden. However, this strategy prevented us from further characterizing provider responses. For example, 50% of the current NeHII users reported 'enhanced patient care' as a result of using the HIE. The closed-ended question prevented the identification of specific improvements to patient care that might have been identified with open-ended questions. However, knowledge that half of the current HIE users observed improvements to patient care is important information to share with providers considering adoption of the technology and the HIE stakeholders evaluating the cost effectiveness of the system.

The low response rate requires that our findings be interpreted cautiously. Since respondents to surveys are more likely to have strong opinions regarding the subject matter than non-respondents, it is possible that a response bias exists, limiting the generalisability of our findings. We believe, however, that the low response rate was partially driven by a poor understanding of HIE and no intent to use the technology in next 12 months rather than strong opinions of the technology. Author experience with other HIE-related projects conducted during the same time frame found that the term 'Health Information Exchange', and the potential benefits of the technology were not well understood by many providers. It is possible that providers unfamiliar with the subject matter and having no intent to use the technology were less likely to respond.

The 615 respondents did vary considerably in their practice size, location (rural/urban) and clinical specialty, supporting wider generalisability. It is significant that our study includes responses from APRNs and PAs in addition to MD/DO providers. In addition, our results are consistent with other provider responses to questions about HIE barriers and benefits.

CONCLUSIONS

The costs of HIE adoption and workflow integration are significant concerns of health care providers. Additional resources to assist practices plan the integration of the HIE into a sustainable workflow may be required before widespread adoption occurs. The information desired by clinicians must also be readily available for continued utilization. Query-based HIEs must ensure that medication history, laboratory results and other desired clinical information be present, or long-term utilization of the HIE is unlikely.

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Competing Interests: None

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