

Adoption of Health Information Exchange by Emergency Physicians at Three Urban Academic Medical Centers

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Keywords

Health communication, information services, emergency medicine, workflow, interviews

Summary

Objectives: Emergency physicians are trained to make decisions quickly and with limited patient information. Health Information Exchange (HIE) has the potential to improve emergency care by bringing relevant patient data from non-affiliated organizations to the bedside. NYCLIX (New York CLinical Information eXchange) offers HIE functionality among multiple New York metropolitan area provider organizations and has pilot users in several member emergency departments (EDs).

Methods: We conducted semi-structured interviews at three participating EDs with emergency physicians trained to use NYCLIX. Among "users" with > 1 login, responses to questions regarding typical usage scenarios, successful retrieval of data, and areas for improving the interface were recorded. Among "non-users" with ≤1 login, questions about NYCLIX accessibility and utility were asked. Both groups were asked to recall items from prior training regarding data sources and availability.

Results: Eighteen NYCLIX pilot users, all board certified emergency physicians, were interviewed. Of the 14 physicians with more than one login, half estimated successful retrieval of HIE data affecting patient care. Four non-users (one login or less) cited forgotten login information as a major reason for non-use. Though both groups made errors, users were more likely to recall true NYCLIX member sites and data elements than non-users. Improvements suggested as likely to facilitate usage included a single automated login to both the ED information system (EDIS) and HIE, and automatic notification of HIE data availability in the EDIS. All respondents reported satisfaction with their training.

Conclusions: Integrating HIE into existing ED workflows remains a challenge, though a substantial fraction of users report changes in management based on HIE data. Though interviewees believed their training was adequate, significant errors in their understanding of available NYCLIX data elements and participating sites persist.

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1. Background

1.1 Health Information Exchange and Emergency Medicine Physician Adoption

Health Information Exchange (HIE) has the potential to improve patient care by bringing relevant patient data to the point of care. HIE seems particularly promising in emergency departments (EDs), where patients frequently present outside their usual medical home and outside the normal hours during which primary care doctors, pharmacies or insurers can typically be reached. Furthermore, emergency presentations often have an acuity that demands rapid decision-making, at a time when patients may be unable to provide useful historical information. These were among the reasons the Institute of Medicine recommended robust information systems to improve emergency health services [1, 2].

Though emergency medicine (EM) physicians have trained to care for patients with limited information, prior work suggests they should benefit from HIE. Studies have shown a significant fraction of patients in health information exchanges, ranging from 7.6% to 8.5%, have “crossover” care from other institutions [3, 4]. One study showed about a third of patients seen in EDs had missing information deemed important to care; among the sickest patients, that fraction rose to nearly half [5]. An earlier survey in New York City noted that 85% of EM physicians experienced difficulty obtaining relevant patient information from outside providers, resulting in frequent failed or aborted retrieval attempts [6].

When health information exchange was studied in emergency departments, cost savings were observed [7, 8] and further trials have been proposed for the evaluation of patient outcomes and resource utilization [9].

However, initiatives aimed at improving ED workflows are often stymied by the nature of shift work, high patient acuity and unpredictable patient flow [10].

Barriers to adopting electronic medical records [EMR] have been well-described [11, 12], and since HIE applications mirror many of the data review capabilities of EMR systems, they experience similar obstacles. The installation expense and disruptive nature of new systems, forgotten passwords, user interface frustrations, and mistrust of external data have all been cited as barriers to adoption [7, 13, 14]. Moreover, unlike a new EMR system, HIE implementations are not currently considered mission-critical or mandatory in most ED settings, creating further barriers to adoption. Studies have found the rate of HIE usage to be variable (depending on site-specific factors) but generally low, ranging from approximately 0.5–20% [15–17].

1.2 NYCLIX implementation

NYCLIX (New York CLinical Information eXchange) is a regional health information exchange in the New York metropolitan area. NYCLIX’s members include 10 academic medical centers, the Visiting Nurse Service of New York, and two ambulatory groups. The NYCLIX technical infrastructure includes a federated database with a central master patient index. Registration, laboratory, and radiology data are available from all NYCLIX hospital participants; other data types (e.g., allergies, medication lists, cardiology reports, etc.) are available from some but not all members. NYCLIX is a 501(c) 3 non-profit corporation, with infrastructure that was funded by Federal and State grants and by contributions from the members. NYCLIX has developed a privacy and security framework that is aligned with the New York State Department of Health’s recommendations [18]. Access to NYCLIX data by providers requires affirmative written patient consent.

In the spring of 2009 the NYCLIX data feeds were enabled and pilot users in several participating EDs began using the HIE capability. Though workflow varies by site, EM physicians typically access NYCLIX by clicking a static link within an ED information system (not within the patient’s chart), then enter login credentials and search the system for their patient and the presence of HIE data.

2. Objectives

As part of the effort to evaluate the impact of HIE on resource utilization, patient care and physician practice, we sought to examine the perceptions, workflow and adoption of NYCLIX among EM physician pilot users.

3. Methods

Based on prior published works investigating barriers to EMR and HIE adoption [6] and feedback received and discussed among the NYCLIX Clinical Advisory Group, a branched semi-structured survey instrument was developed for pilot users, for use within several months following their NYCLIX training. Of the list of EM physicians who had completed prior training at three academic urban hospitals participating in the NYCLIX pilot program, twenty-two were randomly selected for recorded interviews. Eighteen physicians agreed to participate, a number within the range necessary for maximal variation of interview responses in order to achieve theoretical saturation [19].

The interviews were conducted in person or by phone, with interviewers posing open-ended questions with prompts for user discussion for ten to twenty minutes. Phone conversations were digitally recorded and log sheet with physician responses were filled out.

Physicians who reported having logged in to NYCLIX more than once were defined as “users” and were asked questions regarding typical usage scenarios, their impressions of successful retrieval of data (i.e., HIE data affecting ED patient care), and ideas about improving the NYCLIX interface.

Users with one login or fewer were defined as “non-users” and were asked about NYCLIX accessibility and perceived utility.

Both groups of users were asked to recall elements of their NYCLIX training session, which lasted approximately one hour and was conducted on a rolling basis, approximately two to eight months prior to these interviews. Demographic information and recall scores were determined with Microsoft Excel 2007. Individual identifiers were removed from responses, and opinions were summarized and grouped according to the evolving narratives [20] by two of the authors (NG, SV). Succinct excerpts were isolated for the purpose of clarity.

4. Results

Twenty-two NYCLIX pilot users were selected for interview; eighteen agreed to participate. Four were classified as *non-users*. Those classified as NYCLIX *users* on average were younger (39 vs. 46) worked more clinical hours per week (21 vs. 15.6) and had fewer years since graduating residency (9.1 vs. 14).

Of *users*, half (7/14) estimated successful retrieval of HIE data that affected patient care on one or more occasions. Triggers for targeted searches (looking for specific data on a specific patient, as opposed to browsing the list of all consented patients under a clinician’s care with HIE data) included patients reporting visits at other New York City (NYC) hospitals with pertinent cardiac (9/14, 64%) or laboratory (5/14, 36%) data, and suspected drug seekers (4/14, 29%).

Among the four *non-users*, forgotten login credentials were frequently cited for non-use (75%). *Non-users* suggested better workflow integration via flags in their ED information system (EDIS) to alert them to the presence of NYCLIX data. Another suggestion was a link from the EDIS that passes users’ credentials and patient information to NYCLIX, launching with a single click directly into the relevant patient’s NYCLIX record. These modifications to the existing workflow were seen as a means to increase their likelihood of adoption and usage, and were echoed by *users* as well.

All interviewees reported satisfaction with their training. As a way to test retention of important information from training, interviewees were asked to recall three hospitals participating in NYCLIX from a list of 16 that included nine non-participating hospitals in the area. They were also asked to select two out of three data elements available from every hospital provider out of a list of ten items. *Users* recalled more true NYCLIX member sites than *non-users* (averaging 2.4 correct responses per user vs. 1.75 per non-user). *Nonusers* tended to mention sites that were geographically close to their

ED rather than sites actually participating in NYCLIX, and recalled fewer data elements available from all NYCLIX hospitals (an average of 1.0 elements vs. 1.2 for users). Excerpts of user and non-user responses appear in ► Table 1.

5. Discussion

5.1. ED pilot users adoption of NYCLIX

Our results revealed some responses consistent with findings from prior HIE studies, but also some surprises.

The lack of benefit of HIE reported by some *non-users* in this study has been noted elsewhere. In a recent survey, outpatient specialists were found to be less enthusiastic about the benefits of HIE compared to primary care providers [12]. Individual reports of benefit or enthusiasm, however, lack the persuasive power of organizational assessments. In a recent systematic review, Vest et al. (2010) noted that few studies exist assessing HIE effect at an organization level [15]. One earlier estimate of cost savings from HIE in a network of city EDs was substantial, with potential savings from avoided duplicate testing and hospital admissions, and reduced ED communications and operating costs [23].

The patient scenarios that users disclosed as most frequently prompting HIE queries – patients with outstanding cardiac catheterization reports, laboratory data, and those suspected of seeking pain medication prescriptions – fit somewhat with prior research into what EM physicians are seeking in past histories [17, 24]. Shablinsky et al. had reported that EM physicians requested past history details when confronted with diagnoses of chest pain, asthma, alcoholism, diabetic ketoacidosis, stroke, and sickle cell anemia, in order of descending priority. Johnson noted that recent testing at affiliated facilities led to the most HIE access – indeed, at several sites in the MidSouth eHealth Alliance, registrars or triage nurses are tasked with querying the HIE for patients who reveal recent RHIO ED visits so that the clinicians are aware of the existence of this data at the time of the initial interview [17]. This stands in contrast to the typical process at NYCLIX emergency departments, where it is incumbent upon physicians to investigate prior RHIO visits by asking the patient and querying NYCLIX, and may explain why even the most frequent NYCLIX users search for a small fraction of their total patient volume [unpublished data].

Though NYCLIX pilot users believed their mandatory training session was adequate, errors were uncovered in their understanding of available data elements and participating sites. Believing that geographically close hospitals are NYCLIX members when in fact they are not, or believing that more patient data elements are present, is likely to lead to fruitless queries and ultimately to dissatisfaction with HIE. Prior analyses of EMR implementations have led to the recommendation that realistic expectations for effort and performance are crucial for establishing short- and long-term user satisfaction [22, 25]. The same management of expectations is likely necessary for HIE adoption, and so, constant reminders of the participating sites and available data should reinforce appropriate use of HIE data and improve adoption, though these reminders are not currently features of NYCLIX.

5.2 Future Directions

Fostering behavioral change in any clinician is an endeavor, and asking EM physicians to search a new database separate from their existing information systems and outside established workflows is particularly challenging.

Still, to realize the promise of HIE to tailor appropriate care to patients, decrease duplicate testing and potentially avoidable admissions, and improve patient safety, EM physician adoption is crucial.

Our interviews of ED pilot *users* and *non-users* of NYCLIX produced important suggestions for enhancing adoption. Already, at one NYCLIX institution, flags are being developed for the EDIS and clinical patient data repository which will transport users directly to the NYCLIX portal once clicked. Furthermore, a new column was added to the NYCLIX portal to indicate whether patients currently in a given ED have data available from other NYCLIX sites, obviating the need to drill into each chart to see if outside data is there.

Finally, a computer-based training module was implemented, so that potential users who have not undergone training can click on a link in their site's EDIS or results review application and be brought directly to the training module. After completing the module, login credentials are sent, enabling access.

These planned improvements will address several of the EM physicians' perceived obstacles to access. It is worth noting, however, that these interviews showed a substantial fraction of users reporting changes in patient management based on HIE data. Even in this early phase of use, it seems health information exchange may already be fulfilling some of its promise of improving patient care.

Statement of Clinical Relevance

Integrating HIE into existing ED workflows remains a challenge, though a substantial fraction of users interviewed for this research cite changes in management based on HIE data. A single automated login to both the EDIS and HIE may facilitate usage, as would automatic notification of HIE data availability in the EDIS. Though users believed their training was adequate, significant errors in their understanding of available NYCLIX data elements and participating sites persist.

Conflicts of Interest

The authors have no relationships to disclose as potential conflicts of interest in this research.

Human Subjects Protections

This research plan was submitted and deemed exempt from review by the Mount Sinai Program for the Protection of Human Subjects/Institutional Review Board.

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Table 1 Excerpts from interviews with users and non-users.

1A. Users recall their NYCLIX queries and respond to whether it has affected patient management

- "I've checked recent beta hCG levels, hemoglobin... It was useful."
- "It doesn't work too often for me... I remember a patient insisted there was a visit I couldn't find. Another time, I could confirm the visit but not the test results."
- "I'd say [in 15–20%] it did [affect my management of the patient] ... there was this one patient, an elderly man who presented to ED with chest pain. Family was not at bedside... so we planned a standard cardiac workup. We had no previous info on the patient. ...[upon accessing NYCLIX we learned] serial cardiac enzymes had already been done [elsewhere] and those were negative. Instead of admitting the patient, he was discharged home... [NYCLIX] prevented an unnecessary admission."
- "It hasn't happened yet...maybe some of that is that I'm not using it enough"

1B. Users describe usage scenarios

- "When I have a known recent visit in a patient who can't provide detail, I'll make the effort to log in."
- "I've looked for recent stress tests when patients tell me they've had one."
- "I open NYCLIX when I'm desperate or something's not adding up. I've checked NYCLIX for patients I think are drug seeking, to see if they've been elsewhere recently."
- "I use NYCLIX when the patient tells me he's been at another hospital recently, and has important tests done which he or she is not too clear about.... A patient with a recent cath, for instance."
- "I use NYCLIX when I want to have more past medical history, and I suspect it's on NYCLIX."

1C. Quotes from non-users

- "Every click is a barrier... a single sign-on and even a flag in [my ED information system – EDIS] would save me time and make me more likely to use NYCLIX. And we need EKG data!"
- "I can't use NYCLIX – it's been so long since I was trained, I forgot my login."
- "I don't even remember my login. And it's rare when I find myself wishing for info that's not already in our system, or a quick phone call away."

1D. Quotes from users about improving access

- "I would love to be prompted more externally, you know like monthly emails: see who accessed it this month... very simple very short, little prompts for me to think about accessing it"
- "The biggest thing is to get more people to participate and get more institutions to provide more data ... I think it's extremely valuable and a very good clinical tool. [But it will be necessary to get more] participation from the clerical staff to get people enrolled so that people would participate."
- "I hate having to remember a second password. I wish NYCLIX had more data [elements] and more member hospitals."
- "I'd really like a flag in [my EDIS] telling me if there's data in NYCLIX... I also have a hard time remembering the member hospitals, would like some kind of pop-up reminder."

1E. Users consider browsing the list of consented ED patients with available data in NYCLIX, instead of targeted searches prompted by individual patients

- "I only use it when I have a focused clinical question. I'm not just browsing."
- "I use the 'patients in ED' start screen but never considered just browsing. Since we have a lot of crossover, I may start doing that..."
- "Because [NYCLIX] requires logging on and specific purposeful activities to get on to it ... I tend to do a target search for a particular patient."

References

1. Clancy CM. Keynote address: Closing the research-to-practice gap in emergency medicine. *Acad Emerg Med* 2007; 14(11): 932–935.
2. Kohn LT, Corrigan JM, Donaldson MS, Committee on Quality of Health Care in America, Institute of Medicine editors. *To err is human: building a safer health system*. Washington, DC, USA: National Academies Press; 1999.
3. Vaidya S, Shapiro JS, Kuperman G. Unique patients and crossover rates in a health information exchange in New York City. *AMIA Annu Symp Proc* 2010.
4. Finnell JT, Overhage JM, Dexter PR, Perkins SM, Lane KA, McDonald CJ. Community clinical data exchange for emergency medicine patients. *AMIA Annu Symp Proc* 2003: 235–238.
5. Stiell A, Forster AJ, Stiell IG, van Walraven C. Prevalence of information gaps in the emergency department and the effect on patient outcomes. *CMAJ* 2003; 169(10): 1023–1028.
6. Shapiro JS, Kannry J, Kushniruk AW, Kuperman G, New York Clinical Information Exchange (NYCLIX) Clinical Advisory Subcommittee. Emergency physicians' perceptions of health information exchange. *J Am Med Inform Assoc* 2007; 14(6): 700–705.
7. Overhage JM, Dexter PR, Perkins SM, Cordell WH, McGoff J, McGrath R, et al. A randomized, controlled trial of clinical information shared from another institution. *Ann Emerg Med* 2002; 39(1): 14–23.
8. Frisse ME, King JK, Rice WB, Tang L, Porter JP, Coffman TA, et al. A regional health information exchange: architecture and implementation. *AMIA Annu Symp Proc* 2008; 212–216.
9. Shapiro JS, Vaidya SR, Kuperman G. Preparing for the evaluation of health information exchange. *AMIA Annu Symp Proc* 2008: 1128.
10. Curran-Smith J, Best S. An experience with an online learning environment to support a change in practice in an emergency department. *Comput Inform Nurs* 2004; 22(2): 107–110.
11. Friedmann BE, Shapiro JS, Kannry J, Kuperman G. Analyzing workflow in emergency departments to prepare for health information exchange. *AMIA Annu Symp Proc* 2006: 926.
12. Wright A, Soran C, Jenter CA, Volk LA, Bates DW, Simon SR. Physician attitudes toward health information exchange: results of a statewide survey. *J Am Med Inform Assoc* 2010; 17(1): 66–70.
13. Gottlieb LK, Stone EM, Stone D, Dunbrack LA, Calladine J. Regulatory and policy barriers to effective clinical data exchange: lessons learned from MedsInfo-ED. *Health Aff (Millwood)* 2005; 24(5): 1197–1204.
14. Patel V, Abramson EL, Edwards A, Malhotra S, Kaushal R. Physicians' potential use and preferences related to health information exchange. *Int J Med Inform* 2011; 80(3): 171–180.
15. Vest JR, Gamm LD. Health information exchange: persistent challenges and new strategies. *J Am Med Inform Assoc* 2010; 17(3): 288–294.
16. Davison C, Johnson K, Estrin V, King J, Yang K, Tang L, Frisse M. Assessing Information Access in a Health Information Exchange. *AMIA Annu Symp Proc*; 2009.
17. Johnson KB, Gadd CS, Aronsky D, Yang K, Tang L, Estrin V, et al. The MidSouth eHealth Alliance: use and impact in the first year. *AMIA Annu Symp Proc* 2008: 333–337.
18. The New York e-Health Collaborative: The Statewide Collaboration Process. Privacy and security policies and procedures for RHIOs and their participants in New York State: Version 2.0. Nov 13, 2009. http://www.nyehealth.org/images/files/File_Repository16/heal5/PrivSec_PPs_V2.pdf
19. Kuzel AJ. Sampling in qualitative inquiry. *Doing qualitative research*. 2nd ed. Thousand Oaks, CA: Sage Publications Inc; 1999. p. 33.
20. Sittig DF, Ash JS, Guappone KP, Campbell EM, Dykstra RH. Assessing the anticipated consequences of computer-based provider order entry at three community hospitals using an open-ended, semi-structured survey instrument. *Int J Med Inform* 2008; 77(7): 440–447.
21. Menachemi N, Powers T, Au DW, Brooks RG. Predictors of physician satisfaction among electronic health record system users. *J Healthc Qual* 2010; 32(1): 35–41.
22. Chisolm DJ, Purnell TS, Cohen DM, McAlearney AS. Clinician perceptions of an electronic medical record during the first year of implementation in emergency services. *Pediatr Emerg Care* 2010; 26(2): 107–110.
23. Frisse ME, Holmes RL. Estimated financial savings associated with health information exchange and ambulatory care referral. *J Biomed Inform* 2007; 40(6 Suppl.): S27–32.
24. Shablinsky I, Starren J, Friedman C. What do ER physicians really want? A method for elucidating ER information needs. *Proc AMIA Symp* 1999: 390–394.
25. Simon SR, Kaushal R, Jenter CA, Volk LA, Burdick E, Poon EG, et al. Readiness for electronic health records: comparison of characteristics of practices in a collaborative with the remainder of Massachusetts. *Inform Prim Care* 2008; 16(2): 129–137.