Build it and they will come? Assessment of use, usability and usefulness of the keystone health information exchange

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Abstract. Health Information Exchange (HIE) can have several benefits, in particular facilitating access to and sharing of patient-related information. Despite these potential benefits, implementation and maintenance of HIEs have been challenging and many attempts to develop HIEs have been abandoned. Most research on HIE focuses on the financial, organizational, and technical aspects of HIE and tends to ignore user acceptance and use of HIE. In this study we examined the Keystone HIE (KeyHIE) and surveyed clinicians to evaluate KeyHIE from their perspective. Results show that –from a user perspective- there are several barriers to the use of KeyHIE. Results of the study can help further development of KeyHIE and are useful for other HIEs.

Keywords. Health Information Exchange, Usability, Usefulness, Barriers

1. Introduction

The healthcare delivery system in the USA is very fragmented. Information about the care received by a patient during their hospital stay is often not shared with the patient's primary care provider. Hospitals have an electronic medical (or health) record system (EMR or EHR), that can be different from the EHR used by primary care clinics. Care coordination would improve significantly if the different health care delivery systems could easily share electronic information; this can be achieved with a Health Information Exchange (HIE). HIE has been defined as "the electronic sharing of health-related information according to nationally recognized standards for inter-operability, privacy, and data security" (NAHIT, 2008). The potential benefits of HIE are obvious: when medical records are available at the point of care, patients may receive more accurate and timely care. According to a systematic review by Fontaine et al. (2010) HIE includes the following benefits: (1) more efficient workflow, (2) improved quality of care, (3) cost savings, and (4) increased revenue. But the evidence for these benefits is limited.

Implementation and maintenance of HIEs have been difficult and many early attempts to develop HIEs have been abandoned. Most research on HIE focuses on the financial,

organizational, and technical aspects of HIE and tends to ignore user (i.e. clinicians) acceptance, use and usability of HIE. Only recently, physicians' attitudes towards HIE have begun to be explored (Fontaine et al., 2010; Patel, Abramson, Edwards, Malhotra, & Kaushal, 2011). Results of these studies show that physicians expect HIE to improve quality and efficiency of care, improve coordination and continuity of care, and help address gaps in communication and completeness of information at the point of care (Adler-Milstein, Bates, & Jha, 2009; Patel et al., 2011; Wright et al., 2010).

The Keystone Health Information Exchange (KeyHIE) is a regional HIE and a system in development. Currently, there are nearly 40 care delivery organizations (hospitals, family practices, clinics, home health and long-term care organizations) in 31 counties in Pennsylvania connected to the system, and more healthcare organizations will be added. Further, the process of getting *patient authorization* to share their information among providers and Health Care Organizations (HCOs) is ongoing (Pennsylvania law mandates that patients consent to record sharing via an HIE: an opt-in requirement). Finally, KeyHIE currently contains limited information (History and Physical Examinations (H&Ps), discharge summaries, lab results, radiology reports, patient demographics and outpatient notes), but more functionalities will be added to the system in the future. The success of an HIE is strongly dependent on the amount of (useful) information that is in the system and the usability of the system (see Figure 1).

In this study, we had an opportunity to study a system in development during various stages of implementation. We surveyed clinicians to evaluate KeyHIE from their perspective including: (1) KeyHIE level of acceptance and use; (2) factors contributing to acceptance and use and (3) work system barriers. Survey data were used as feedback to stakeholders (e.g., management, clinics, vendor) to improve the design and implementation of KeyHIE.

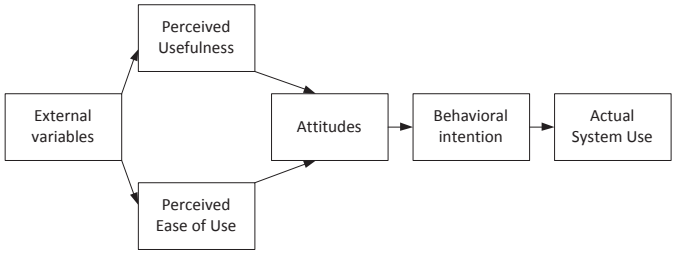

Figure 1 Extended Technology Acceptance Model (TAM) (Davis, 1989; Venkatesh, Morris, Davis, & Davis, 2003)

2. Methods

We used a questionnaire survey to examine KeyHIE from the clinician's perspective. Two rounds of data were collected in a repeated cross-sectional design.

1.1 *Procedure*

The survey was web-based. In Round 1 (R1), all 246 clinicians who had registered for KeyHIE received an email invitation to participate in the survey with a link to the survey. Following the initial email, three reminders were sent over a period of three weeks. The same procedure was followed in Round 2 (R2) of data collection, one year later. In R2 the survey was sent out to 1254 registered KeyHIE users. Institutional Review Board (IRB) approval for this study was obtained.

1.2 Setting

At the time of the second survey, 38 care delivery organizations, 284 care sites, and more than 1,000 individual users in central Pennsylvania were connected to KeyHIE.

1.3 Sample

In R1, 81 people responded to the survey (response rate: 33%). In R2, 245 people responded to the survey (response rate: 20%). Respondents included primary care physicians (R1: 9%; R2: 17%), medical specialists (R1: 11%; R2: 9%), ED physicians (R1: 13%; R2: 3%), mid-level providers (NPs and PAs, R1: 13%; R2: 13%), nurses and nurse managers (R1:34%; R2: 29%), case managers (care coordinators, socials workers, discharge planners, R1: 4%; R2: 10%) and others (R1: 6%; R2:17%). Respondents worked in a physician's office (R1: 54%; R2: 41%), in an emergency department (R1: 23%; R2: 2%), hospital inpatient unit (R1: 6%; 13%), and other healthcare facilities (R1: 17%; R2: 44%) such as rehabilitation facilities, care centers or pharmacies. Respondents had on average been working for their healthcare organization for more than nine years in R1 and nearly 8 years in R2.

1.4 Questionnaire

The questionnaire was designed to assess clinician use of KeyHIE, usability, satisfaction with KeyHIE, and barriers to acceptance and use of KeyHIE. The questionnaire was developed based on previous studies that evaluated health information technologies in healthcare settings (Hoonakker, Cartmill, Carayon, & Walker, 2011; Simon et al., 2007). The questionnaire was pilot tested.

3. Results

1.1 Use of KeyHIE

Many respondents (R1: 31%; R2: 48%) never used KeyHIE (see Table 1). Less than 20% of respondents used KeyHIE on a regular basis (i.e., at least once a week). Significantly fewer respondents used KeyHIE in R1 than in R2 ($z=2.67$, $p<0.01$). Reasons for not using KeyHIE include: not being informed about KeyHIE; KeyHIE not fitting in one's workflow; not enough time to use KeyHIE; and other reasons related to difficulties in accessing KeyHIE or data. Respondents who never used KeyHIE could skip to the end of the survey.

Table 1: Self-reported use of KeyHIE

	R1 (N=85)	R2 (N=164)
Never	30.6%	48.2%
A few times a year or less, almost never	27.1%	19.5%
Once a month or less, rarely	9.4%	12.8%
A few times a month, some-times	16.5%	7.9%
Once a week, rather often	7.1%	6.7%
A few times a week, nearly all the time	5.9%	3.0%
Everyday	3.5%	1.8%
Total	100.1%	99.9%

There are no difference in use (or non-use) of KeyHIE in setting (hospital, clinics, etc.) or job titles (physicians, mid-level provider, nurses, etc.).

1.2 Usability of KeyHIE

Respondents were asked to rate the usability of KeyHIE on a scale from 1 (low usability) to 10 (high usability) (see Figure 2). Respondents rated the usability of KeyHIE around the scale midpoint (5.5). Overall usability in R2 –as compared to R1- significantly improved (t=-2.25, P<0.05).

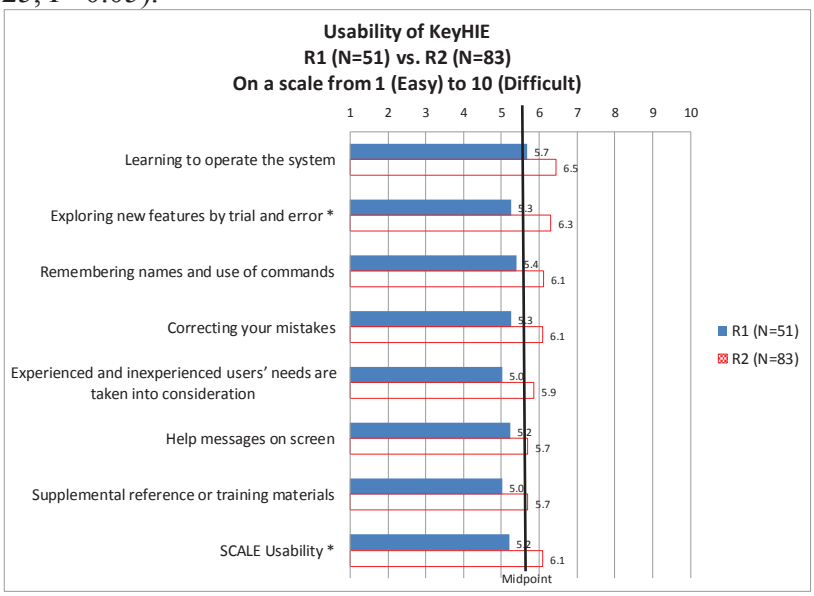

Figure 2: Usability of KeyHIE, R1 and R2

1.3 Usefulness of KeyHIE

On average, users found KeyHIE moderately useful (see Figure 3). Respondents believed that KeyHIE improved quality of care and the information in KeyHIE had an impact on their decision making.

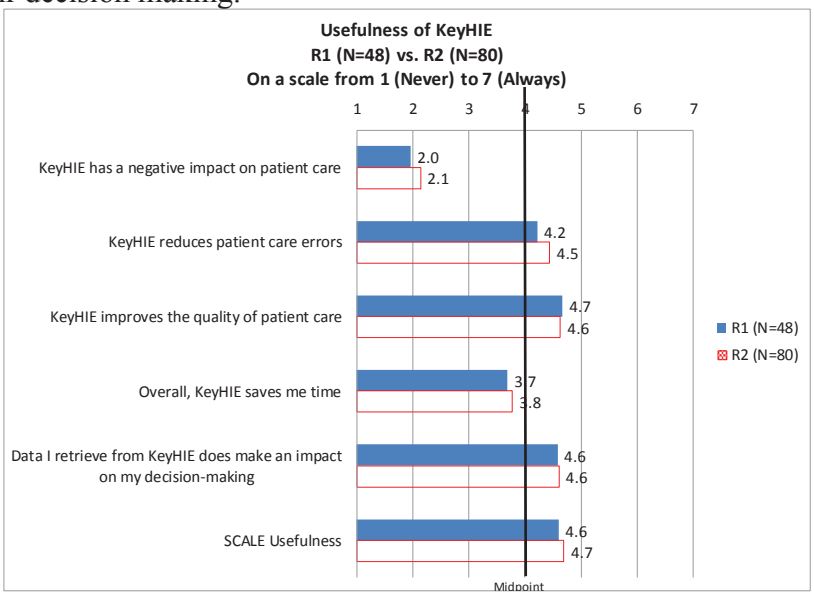

Figure 3: Usefulness of KeyHIE, R1 and R2

1.4 Barriers to the use of KeyHIE

Figure 4 summarizes the main barriers to the use of KeyHIE in R1 and R2. The three most important barriers were: lack of time to learn about KeyHIE (R1: 29%; R2: 12%; P<0.05); fitting KeyHIE into regular work (R1: 19%; R2: 13%); and having to use many

different information systems (R1: 23%; R2: 32%).

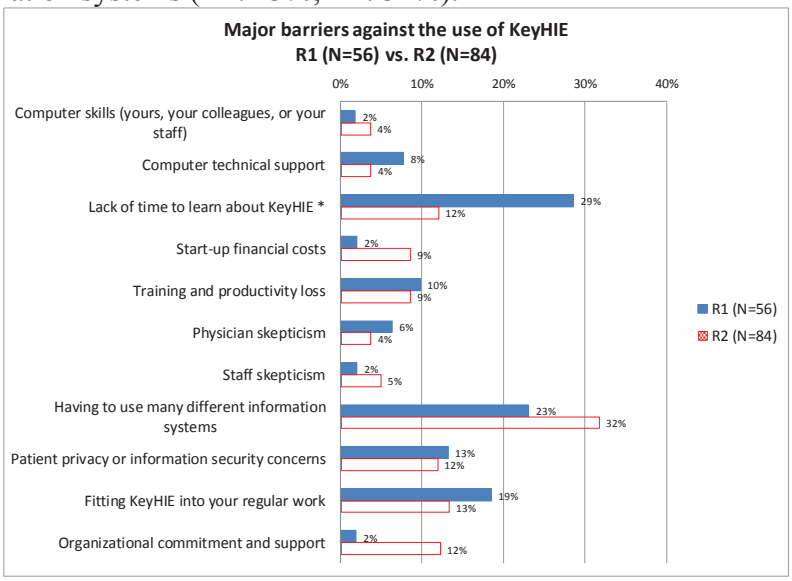

Figure 4: Major barriers against the use of KeyHIE, R1 and R2

4. Discussion and Conclusion

In this study we examined use, factors contributing to use, and barriers to use of KeyHIE in a repeated cross-sectional design. There are two different groups of respondents in this study: a group of respondents who had signed up for KeyHIE but never used it (and these respondents could skip the additional questions about barriers, usefulness and usability of KeyHIE); and a group of respondents who had signed up for KeyHIE and used it. For the first group it is important to determine reasons why respondents did not use KeyHIE; for the second group (apart from establishing usability and usefulness of the system) it is important to examine the barriers to use.

Almost a third of respondents who had registered for KeyHIE in R1 and nearly 50% in R2 had never used it. Most reasons for not using KeyHIE involved technical and organizational issues. Only 10% of those who did not use KeyHIE believed that the information was not useful to them. Major reasons for not using KeyHIE were related to lack of training of clinicians, lack of participation in the HIE by other healthcare organizations and patients, and fitting KeyHIE into clinicians' workflow. Friedman and colleagues (2006) highlighted the importance of analyzing workflow in EDs to prepare for HIE in order to avoid clinician resistance to implementation.

The second group of respondents consisted of clinicians who use KeyHIE. Use of KeyHIE increased from R1 (59 users) to R2 (85 users), but as a percentage of all people who had signed up for KeyHIE it did not increase. Major barriers to using KeyHIE included clinicians having to use many different IT systems, lack of time to learn about KeyHIE, and fitting KeyHIE into their regular work. Interestingly, while most barriers became less important over time, having to use many different IT systems became more important. Clinicians rated usability of KeyHIE below the scale midpoint in R1 and slightly above midpoint in R2. Between R1 and R2 adjustments were made that significantly improved usability. Most respondents found KeyHIE relatively useful but indicated that it did not save them time, which is another indication of the importance of workflow. It is important to note that KeyHIE is a system in development. More organizations, patient information, and types of medical information will be added to KeyHIE. By providing feedback on the use and facilitators and barriers to use of KeyHIE to the developers and

implementers, changes can be made in the design and implementation of the system.

4.1 Study Limitations

The samples used for the clinician surveys on KeyHIE consisted of clinicians who had previously registered for KeyHIE. This does not necessarily mean that they were still interested in using KeyHIE when the surveys were conducted, which can explain the low response rates. The samples consisted of many different types of clinicians: case managers, nurses and nurse managers, mid-level providers (nurse practitioners and physician assistants), primary care physicians, ED physicians and specialty physicians. Such a diverse sample –and as far as we know this is one of the first studies that asked all HIE users about their opinion of the system- has the advantage that results can be generalized to all users. On the other hand, the diversity of the sample with a small sample size does not allow us to compare responses across different groups. Finally, this study had a repeated cross-sectional design and not a longitudinal design which makes it very difficult to examine real change.

5. Conclusion

Implementation of health IT is a complex process with many actors involved. Several studies have described barriers and challenges to implementation and use of HIEs. This study confirms those findings. End user involvement in the design and implementation of HIE can help resolve such barriers and increase clinician acceptance of HIE (Karsh, 2004). We also recommend taking into consideration clinicians' work system and workflow when designing and implementing an HIE.

Acknowledgments

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