Physicians’ opinions of a health information exchange

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ABSTRACT
Background Arizona Medicaid developed a Health Information Exchange (HIE) system called the Arizona Medical Information Exchange (AMIE).

Objective To evaluate physicians’ perceptions regarding AMIE’s impact on health outcomes and healthcare costs.

Measurements A focus-group guide was developed and included five domains: perceived impact of AMIE on (1) quality of care; (2) workflow and efficiency; (3) healthcare costs; (4) system usability; and (5) AMIE data content. Qualitative data were analyzed using analytical coding.

Results A total of 29 clinicians participated in the study. The attendance rate was 66% (N=19) for the first and last month of focus-group meetings and 52% (N=15) for the focus group meetings conducted during the second month. The benefits most frequently mentioned during the focus groups included: (1) identification of “doctor shopping”; (2) averting duplicative testing; and (3) increased efficiency of clinical information gathering. The most frequent disadvantage mentioned was the limited availability of data in the AMIE system.

Conclusion Respondents reported that AMIE had the potential to improve care, but they felt that AMIE impact was limited due to the data available.

INTRODUCTION
The United States healthcare system is highly fragmented.1 As a consequence of the lack of continuity of care, healthcare expenditures are higher, and patient health outcomes may be negatively affected.2 While there is evidence that physicians have limited information with which to make clinical decisions at the point of care, this limited information may endanger patient safety.3–5 Limited information also generates healthcare service duplication such as duplication of therapy, laboratory tests and medications.6,7 Moreover, administrative resources are higher due to the need to look for the missing information (ie, more phone calls, faxes), and the search for information may cause delays in care and negatively impact the efficiency of healthcare providers across the continuum.4

Health information exchange (HIE) is a potential solution to providing timely and effective clinical information at the point of care. HIE is based on the premise that if providers have access to additional patient-specific clinical information, their clinical decision processes should improve with the ultimate goal of improving patient outcomes.8 Improved decision-making should result in decreased costs, improved health of patients, reduced medical errors and other benefits.9

Although there are few established HIEs, the majority of exchange initiatives are in the initial phases of development and implementation.7–11 Numerous studies have examined the potential clinical benefits of HIE by assessing physicians’ attitudes.12–14 These studies have also evaluated aspects related to the establishment of HIE such as the determination of the desired capability functions, perspectives on financial sustainability, and motivators and barriers to HIE implementation and adoption.14–16 Overall, physicians and other healthcare stakeholders are enthusiastic about HIE and consider that this technology may improve the quality of care, efficiency, patient safety, and decrease healthcare costs. Funding and privacy concerns are considered barriers to HIE.17–19 Few studies have assessed HIE outcomes or opinions of an operational HIE, and more information about physicians’ experiences with HIE is still required.

The Arizona Health Care Cost Containment System, Arizona’s single Medicaid agency, was awarded a Federal Medicaid Transformation Grant from the Center for Medicare and Medicaid Services (CMS) in 2007 to create a statewide web-based, secure HIE utility. Using these grant funds, Arizona Medicaid developed the Arizona Medical Information Exchange (AMIE). AMIE is an information-sharing utility that facilitates sharing of patient-specific clinical information using a web-based browser at the point of care.20

To create AMIE, Arizona Medicaid customized the “MA-SHARE” open-source software, originally developed for the Nationwide Health Information Network for the Massachusetts Health Data Consortium in 2003.21 The MA-SHARE application provided a connection between drug data from pharmacy benefit managers (PBMs) and hospitals. The AMIE team enhanced the core software, adding Health Level Seven (HL7) interfaces with hospital transcription systems and laboratory systems, a patient matching engine, robust audit capabilities, and a web-based browser for results viewing. Other related information can be found elsewhere.20 22–24 Provisioned healthcare providers received access to medication history, laboratory test results, and discharge summary information for over 1.1 million unique patients. Medication history included up to 12 months’ history from Arizona Medicaid health plans’ PBMs, while the discharge summaries and laboratory results were payer-agnostic, and accumulated only from dates of service after the go-live date in October 2008. This limited the value of the exchange data in the 3 months of operations. When AMIE was launched, only medication history records were available. Shortly thereafter, laboratory reports and discharge summaries were uploaded to AMIE progressively during the period of evaluation. AMIE participants...
had access to medication history that included medications funded by federal programs under the Confidentiality of Alcohol and Drug Abuse Patient Records (42 CFR Part 2).25 Thus, five medications associated with substance abuse treatment (acamprosate, buprenorphine, methadone, and naltrexone) were filtered from the display set to be in compliance with federal guidelines.

AMIE physicians were trained in a single session that included the execution of a data use agreement, outlining health information exchange use responsibilities and itemizing consequences for misuse and breach. To conform to their already established workflows, some participants had authorized and provisioned delegates, such as a nurse or medical assistant to help retrieve data from the system.

The purpose of this study was to describe physicians’ perceptions of AMIE HIE utility implementation and their perceived effect of AMIE on health outcomes and healthcare costs during the first 3 months of operation.

METHODS

Participants

Practitioners were eligible to participate in AMIE if they: (1) had an Arizona Medicaid affiliation; (2) were licensed in Arizona; (3) were in active practice with an unrestricted license; (4) were endorsed or recommended by executive leaders from their places of employment; (5) demonstrated willingness to volunteer time for meetings, training, interviews, and engaging peers; (6) practiced in representative settings (ie, private practice, faculty clinic in academic faculty practice, resident clinic, free clinic, telemedicine clinic, emergency department, and independent contractor with site); or (7) represented a practice setting of interest (ie, family practice, primary care, internal medicine, pediatrics, and mental health practices). Providers who met the eligibility criteria were invited to attend a presentation about the HIE. Interested providers who met the criteria and were willing to commit to participation for at least 3 months and provide regular feedback were enrolled as AMIE pilot participants. The University of Arizona Institutional Review Board approved this study.

Focus groups

Focus groups were held monthly over 3 months with the AMIE users. The invitation to participate in the focus group was made by Arizona Medicaid personnel when AMIE training sessions were provided. In addition, Arizona Medicaid sent personal electronic mails or contacted providers by phone to remind participants of monthly focus groups. If, after the third attempt to contact, the physician did not respond to the focus-group invitation, the physician was considered non-responsive for that month. Focus groups, which were conducted by two investigators, TW and AH, lasted 45 min. During the focus-group discussions, physicians’ responses were recorded on an audiocassette while an assistant typed the participants’ answers and comments verbatim into a word-processing computer program. Written transcripts were checked with the audiocassette for accuracy. Each focus group included no more than eight participants to increase participation and discussion from all members of the group. Thus, multiple focus groups were held each month to accommodate all AMIE pilot users. A focus group guide, developed based on a review of existing literature, was designed to assess the value of health information technologies (eg, health information exchange, electronic medical records, and computerized physician order entry).26–28 The topics covered by the focus-group guide were oriented to obtain information about specific experiences with the information exchange in the realm of clinical decision-making, quality of care, patient safety, efficiency, and healthcare costs (see appendix available as an online data supplement at http://www.jamia.org).

Data analysis

Transcript-based analysis was used to evaluate the focus-group discussions. A qualitative coding approach was used to categorize comments as recommended by Richards.29 The coding technique involved: descriptive coding, topic coding, and analytical coding. Descriptive coding was used to code participants’ demographic characteristics. Topic coding was used to label the responses according to subject. Topic coding consisted of two steps: a general classification of categories and an iterative recoding process to include more subcategories. Analytical coding was applied to evaluate possible ramifications of responses. In addition, user demographics characteristics were collected during the first focus-group session and analyzed using SAS Statistical Analysis Software version 9.2.

RESULTS

A total of 29 physicians participated in the study. A total of 15 focus groups were held during the 3-month evaluation period. The response rate was 66% (N=19) for the first and last months’ focus groups and 52% (N=15) for the second month’s focus groups. The demographic characteristics of the participants are presented in table 1. The focus-group transcripts were coded, and the themes within respondents’ narrative were organized with respect to perceived AMIE’s impact on (1) quality of care; (2) workflow and efficiency; (3) healthcare costs; (4) system usability; and (5) AMIE data content as specified in the focus-group guide. Participant views on each of these themes are provided below.

AMIE and quality of care

Typical comments related to the clinical benefits of the web-portal are shown in box 1.

Emergency department (ED) physicians made the majority of comments related to the benefits of AMIE. These practitioners stated they were able to identify patients exhibiting “drug seeking” behavior, thereby decreasing duplicate prescriptions. The ability to detect chemical dependency allowed providers the opportunity to enroll the patient into a chemical assistance program when appropriate. ED physicians noted that “Dr shopping” and “drug seeking” behavior are commonly faced in the ED setting.

Overall, participants who located patient information in AMIE indicated that it helped them to: (1) make better decisions; (2) clarify treatment plans; (3) evaluate patient medication adherence; and (4) improve the physician–patient relationship. Some participants who used AMIE periodically (eg, those who had clinical duties only a limited number of days during the week, or who had few Arizona Medicaid patients in their practice) were less positive about AMIE and indicated it had little benefit.

AMIE and users’ workflow and efficiency

Representative comments related to workflow and efficiency are listed in box 2. During the focus-group sessions, it was evident that participants incorporated AMIE into their workflow in different ways. Some queried the HIE utility before seeing each patient, while others preferred accessing AMIE during or after the patient visit. During clinical routine, some physicians
Table 1  Demographic characteristics of physician respondents

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Respondents (N = 22*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years), mean/SD</td>
<td>46.6 7.1</td>
</tr>
<tr>
<td>Age (years), by groups, N/%</td>
<td></td>
</tr>
<tr>
<td>35–44</td>
<td>10 46</td>
</tr>
<tr>
<td>45–54</td>
<td>8 36</td>
</tr>
<tr>
<td>55–64</td>
<td>4 18</td>
</tr>
<tr>
<td>Total</td>
<td>22 100</td>
</tr>
<tr>
<td>Gender, N/%</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>7 32</td>
</tr>
<tr>
<td>Male</td>
<td>15 68</td>
</tr>
<tr>
<td>Total</td>
<td>22 100</td>
</tr>
<tr>
<td>Specialty, N/%</td>
<td></td>
</tr>
<tr>
<td>Family practice</td>
<td>6 27</td>
</tr>
<tr>
<td>Emergency medicine</td>
<td>3 13</td>
</tr>
<tr>
<td>Internal medicine</td>
<td>7 32</td>
</tr>
<tr>
<td>Pediatrics</td>
<td>3 13</td>
</tr>
<tr>
<td>Other</td>
<td>3 13</td>
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<tr>
<td>Total</td>
<td>22 100</td>
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<tr>
<td>Academic appointment</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>15 68</td>
</tr>
<tr>
<td>No</td>
<td>7 32</td>
</tr>
<tr>
<td>Total</td>
<td>22 100</td>
</tr>
<tr>
<td>Practice of medicine (years), mean/SD</td>
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</tr>
<tr>
<td>Previous use of electronic records, N/%</td>
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</tr>
<tr>
<td>Yes</td>
<td>14 64</td>
</tr>
<tr>
<td>No</td>
<td>8 36</td>
</tr>
<tr>
<td>Total</td>
<td>22 100</td>
</tr>
</tbody>
</table>

*Only 22 of 29 AMIE users provided demographic information, which was collected during the first focus group session.

indicated that they were more likely to use AMIE for patients with complex medical conditions or patients they suspected were presenting “drug-seeking” behavior.

Focus-group sessions revealed that AMIE’s impact on workflow depended on the practice setting or practice size. Those who had medical assistants retrieving information from the AMIE system (usually larger practices) reported that workflow and efficiency stayed constant or improved. Medical providers reported an improvement in efficiency when the information for the patient they were looking for was available in AMIE because the process of obtaining records via HIE was faster than obtaining them from other practitioners or directly from the patient. In contrast, some physicians expressed that AMIE reduced their work efficiency when the information needed was not available because of the fruitless time spent searching for data. Obviously, in these situations, the use of AMIE was considered a “waste of time.” In addition, findings from the focus groups suggest that users accustomed to using electronic medical records were able to incorporate AMIE more easily into their workflow.

AMIE and healthcare costs

Focus-group participants reported that AMIE use helped them prevent redundant testing, especially computerized axial tomography (CAT) scans, magnetic resonance images (MRI), and cardiac imaging procedures. Controlling healthcare costs was a perceived benefit for the majority of participants. However, some of the participants expressed that it was premature to suggest any definitive cost savings due to AMIE.

Box 1 Representative quotes from focus-group discussions regarding AMIE and quality of care

Identification of “drug seeking” behavior

“It’s very powerful. We dismissed a patient from a practice, we contacted Arizona Medicaid. We found the Dr Shopper.”—Emergency Medicine Physician.

“This particular patient had been seen by five physicians…She was getting 20 or 30 prescriptions every 2 or 3 days from a variety of physicians.”—Internal Medicine Physician.

Better decision-making

“As emergency physicians, we are in a unique position having to make decisions quickly often with limited information. So the more information I get the better decision I can make, certainly it’s more comfortable and safe for the patient and legally correct.”—Emergency Medicine Physician.

“When searches are fruitful, it does have a tremendous impact because I am able to make sure I’m not duplicating labs, duplicating meds, it just really helps in everything. It enables me to know what other providers the patient’s seeing, because often they don’t know that.”—Internal Medicine and Psychiatry Physician.

Clarification of treatment plans

“(I talked to a patient about)…a medication he was unclear about for seizure disorder and the patient thought he had been taken off of it but it turned out he was still on that. So that helped to clarify the treatment plan. And it was at night and I wasn’t able to reach the primary physician… so that was helpful too.”—Emergency Medicine Physician.

Ability to check on patient compliance

“(… knowing what medications patients are on…. I found several patients that were supposed to be picking up drugs and we can see these gaps in compliance… It is something you can call them on…. otherwise they would just say “oh yes I take those medications everyday.” Now I can show them…. print out the list and say this is what we have here.”—Internal Medicine and Psychiatry Physician.

Improvement of physician—patient relationship

“I had a suspicion a patient was abusing narcotics. I found that through the AMIE the patient was telling the truth, thus now I have more trust in the patient.”—Internal Medicine Physician.

System usability

When asked what the best part of AMIE was, participants mentioned the technical aspects of the project. Participants repeatedly stated that patient searches were easy to conduct, and the results were displayed quickly. Participants had a positive opinion of the system design. They also commented that customer support was excellent. Participants expressed that AMIE was easy to navigate, and because it was web-based, it could be used from any computer without the need to install additional computer programs.

Opinions of the system success finding patients’ records varied among providers. Some providers expressed disappointment with the lower-than-expected match rate for patients and therefore viewed AMIE as not useful. This was particularly true for one provider who served a large homeless population. In contrast, emergency department physicians and cardiologists expressed satisfaction with their search success rate.
It was clear from the sessions that attitudes and opinions concerning AMIE changed over time. During the first focus-group session, many misconceptions regarding the system were addressed. For example, a few participants expressed difficulties finding the printing option, and others did not recall that authorized medical assistants could retrieve information from the utility.

The focus groups also provided essential evaluative information for the AMIE development team. During the first focus group, some participants suggested ordering the medication history chronologically to facilitate navigation, and others expressed that AMIE should be integrated into electronic medical records to facilitate information access.

### AMIE clinical data content
Most participants made statements concerning the lack of certain types of clinical information as the major barrier to AMIE use (box 3). In general, participants requested that more data be included. Some requested that data be included from all PBMs, not just those contracting with Arizona Medicaid plans, for the medication history information. Others expressed that they would be satisfied with the addition of emergency discharge summaries and radiology test results, while a few indicated that they would like to see actual radiographs. Eleven out of 19 respondents indicated the need to include data from other laboratory providers. Pediatricians stated that it would be difficult for them to get an overview of all patient data, especially in the morning. On average, they see 25 patients per shift. Some participants indicated that they would like to see actual radiographs. Eleven out of 19 respondents indicated the need to include data from other laboratory providers. Pediatricians stated that it would be difficult for them to get an overview of all patient data, especially in the morning. On average, they see 25 patients per shift.

### Box 2 Representative quotes from focus-group discussions regarding workflow and efficiency

- “It’s easier to go in AMIE and get the information instead of having the patient request it. It can take a week or 10 days before we get information from the hospital. So that definitely improves efficiency and patient care.”—Emergency Medicine Physician.
- “Getting the pharmacy information is so difficult. I can’t tell you how difficult and how we fight on a daily basis with all of our patients.”—Emergency Medicine Physician.
- “It’s part of my natural workflow now. I have three programs that I load up in my shift. On average I see 25 patients or 30 patients per shift, I’m using AMIE… probably three times in that shift. … I plan on using it more now that I know that there are these other patients that apply too. It’s another tool that I have just right at my finger tips so that is part of my workflow.”—Emergency Medicine Physician.
- “I keep an icon on my computer to log on, I can very efficiently get on and query on a patient if I wish to, and I don’t have to spend a lot of time messing around, it saves me time.”—Emergency Medicine Physician.
- “I have a view open periodically, it’s interesting that in my hospital that’s all I do, I use the computer. We don’t have paper charts. [AMIE] is just one more computer application opened.”—Family Practice Physician.
- “I have a view open periodically, it’s interesting that in my hospital that’s all I do, I use the computer. We don’t have paper charts. [AMIE] is just one more computer application opened.”—Family Practice Physician.

### Box 3 Representative quotes from focus-group discussions regarding AMIE data

- “Right now we can’t have access to things like behavioral health medications that are crucial to complete care. There is a huge void in denying a physician this access.”—Internal Medicine and Psychiatry Physician.
- “I think it would be helpful if ultimately the HIE became statewide and included primary care provider data on the list. Because our patients sometimes come to see us in addition to see doctors in other centers … and they don’t necessarily tell us nor [do] they tell that the medications were changed there. And we don’t have data.”—Family Practice Physician.
- “I would check for labs probably two or three times a day, labs that were done after September 29 and did not find much. This was frustrating.”—Family Practice Physician.
- “Not being able to get info on labs is the most frustrating.”—Internal Medicine Physician.

**Satisfaction with the AMIE system**

Focus-group participants generally agreed that the potential benefits of HIE were enormous but currently limited by the lack of clinical information contained in the AMIE system. Overall, focus-group participants indicated that AMIE fulfilled their expectations. Thus, they would recommend it to other providers with the data-limitation caveat (box 4). In addition, respondents expressed that they felt AMIE was needed in the medical community, and it should continue operating after the pilot evaluation.

### DISCUSSION

This study examined physicians’ perceptions regarding AMIE’s impact on health outcomes and healthcare costs. Physicians’ opinions of AMIE varied in terms of its potential clinical benefits, AMIE’s effect on workflow, and efficiency. Overall, study participants expressed satisfaction with AMIE and would recommend it to other providers. Emergency department (ED) physicians who participated in focus-group sessions were more likely to report that the HIE had positive clinical benefits. In contrast, non-ED providers generally did not perceive benefits in healthcare provision mainly because of the limited data available and their inability to find patients in the system. One possible explanation for ED physicians extolling benefits of AMIE is that ED physicians, in general, encounter a high volume of patients per day.12 This might also relate to a higher probability of finding patient information in the HIE as compared to other practitioners. Additionally, ED physicians commonly provide care and make decisions with significant information gaps.12 Thus, any improvement in data availability at the time of care is perceived as an important impact on healthcare quality and safety.

Results from this study are consistent with similar studies that have assessed emergency physicians’ opinions of health...
Results from this study suggest that AMIE accomplished its objective of being a usable, user-friendly tool and that HIE functionality was not a technical barrier. Comments from the focus-group participants suggested that AMIE design and user support were outstanding. In contrast, the most frequently repeated negative feedback from focus-group participants was the limited data available. For example, the AMIE medication data included only Medicaid patients (from pharmacy benefit manager (PBM) claims data), laboratory results were included from one of the two large laboratory providers in the state, and discharge summaries were included from three participating hospital systems.

Results from the focus-group sessions suggested that patient type and practice environment impacted information retrieval and therefore clinical use of AMIE. As mentioned earlier, some respondents had more success than others finding their patients in the AMIE HIE system. In particular, the group of physician practicing in a homeless center had the most difficulty. Several factors could have contributed to this. First, the homeless center supplies only medication samples, and dispensing records for these medications were not included in the PBM claims data because AHCCCS did not pay for the medications. Since AMIE medication data were aggregated from pharmacy claims data, dispensing records for these medications were not included in AMIE. Second, the homeless patients rarely obtained prescriptions filled at a pharmacy, and therefore no other medication history information was supplied to the information exchange. In addition, focus-group participants from this homeless center suggested that their patients often purposely provide incomplete or inaccurate names for various reasons, thus inhibiting HIE patient match.

Focus groups provided information to help evaluators and designers to understand physicians’ adoption behavior and attitudes, by identifying to whom the HIE was being most and least useful, and to explore possible reasons for this. During this study, focus-group discussions helped to clarify system misunderstandings and identify system deficiencies. Thus, opinions expressed by focus-group participants were valuable because they helped the AMIE team continually improve implementation of the utility. Moreover, focus groups allowed management of users’ expectations. It is important to manage expectations during pilot studies because unrealistic expectations of system users can result in disappointment that may affect system adoption and use.

The focus-group discussions allowed early adopters to share their experiences with less frequent HIE users, thus generating an environment of technology diffusion. In other words, the focus groups served as an educational space where the retelling of a respondent’s successful experiences with the HIE may have helped improve the adoption of participants who exhibited less frequent HIE use. In addition, the continued contact with users during the focus groups motivated participants to use the HIE. Specifically, the medical director of the project maintained personal contact with users which motivated participants to use the HIE. Therefore, it is important to recognize that successful implementation of an HIE requires an ongoing organizational commitment to maintain system use.

Results from this study suggest that it may have been premature to assess user perceptions of the HIE’s effect on dimensions such as clinical decision-making, quality of care and healthcare costs after only 3 months. Users presented examples of AMIE’s impact on healthcare costs during the focus groups (e.g., admissions prevented, decreased laboratory testing). Nevertheless, it is possible that impact on healthcare costs was
underestimated because laboratory reports and discharge summaries were uploaded to AMIE progressively during the evaluation period. That is, not all data were available during the full evaluation period. Health information technology research suggests that it is best to wait a minimum of 1 year after a technology is in operation before evaluation.30 Therefore, future studies ascertaining the clinical impact of health information exchange should be conducted when the system has sufficient technical capabilities, and enough time has passed for users to overcome the technology-learning phase.

Another lesson learned from this investigation is that for a short-term evaluation such as this one, monthly focus groups were not necessary. After the second session, no new information was presented by participants, thus indicating that information saturation was achieved. Perhaps a pre- and postmeasurement design would have been sufficient to gather data.

It is important to recognize the limitations of this study. The respondents volunteered for participation, and this could bias the results. For example, the majority of respondents had previously used electronically medical records, and research suggests that clinicians are more likely to adopt a new technology if they have had previous experience adopting a similar technology such as electronic medical records.34 Additionally, the fact that most of the respondents in this study had an academic appointment may suggest that the respondents may be more likely to be engaged in research and take part in innovations. A bias toward socially desirable responses is also possible, given the organization director’s endorsement of this study. The results of this study are limited by the response rate and to the clinical domain of the AMIE participants; and the population of this study was small, so the results cannot be generalized.

CONCLUSION
Physicians with exposure to the AMIE HIE generally expressed a positive attitude towards the web-based HIE. The perceived major benefits of AMIE were the ability to detect drug-seeking behavior and doctor shopping, and to decrease healthcare cost by reducing duplicative testing. However, future research is needed to definitively determine the economic and clinical benefits of HIE.

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Competing interests None.

Ethics approval Ethics approval was provided by the Human Subjects Protection Program Office for the Responsible Conduct of Research, University of Arizona.

Provenance and peer review Not commissioned; externally peer reviewed.

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