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Technology-facilitated care coordination in rural areas: What is needed?

Emily Gill^{a,*}, Patricia C. Dykes^b, Robert S. Rudin^c, Marianne Storm^d, Kelly McGrath^e, David W. Bates^f

^aBrigham and Women's Hospital and Harvard Medical School, Division of General Internal Medicine and Primary Care, 1620 Tremont Street, 3rd Floor, Boston, 02120-1613, USA

^bBrigham and Women's Hospital and Harvard Medical School, Division of General Internal Medicine and Primary Care, 1620 Tremont Street, 3rd Floor, Boston, MA 02120-1613, USA

^cBoston Office RAND Corporation, 20 Park Plaza, 9th Floor, Suite 920, Boston, MA 02116, USA

^dFaculty of Health Sciences, Department of Public Health, The University of Stavanger, P.O. Box 8600 Forus, N-4036 Stavanger, Norway

^eClearwater Valley Orofino Health Center, 1055 Riverside Ave, Orofino, ID 83544, USA

^fBrigham and Women's Hospital and Harvard Medical School, Division of General Internal Medicine and Primary Care, 1620 Tremont Street, 3rd Floor, Boston, MA 02120-1613, USA

Abstract

Background: Health is poorer in rural areas and a major challenge is care coordination for complex chronic conditions. The HITECH and 21st Century Cure Acts emphasize health information exchange which underpins activities required to improve care coordination.

Objective and methods: Using semi-structured interviews and surveys, we examined how providers experience electronic health information exchange during care coordination since these Acts were implemented, with a focus on rural settings where health disparities exist. We used a purposive sample that included primary care, acute care hospitals, and community health services in the United States.

Findings: We identified seven themes related to care coordination and information exchange: 'insufficient trust of data'; 'please respond'; 'just fax it'; 'care plans'; 'needle in the haystack'; 're-

*Corresponding author. Present address: General Practice and Primary Health Care, School of Population Health, Faculty of Medical and Health Sciences, University of Auckland, Private Bag 92019, Auckland Mail Centre, Auckland 1142, New Zealand. emily.gill@auckland.ac.nz.

Author's contributions

Emily Gill developed the protocol, was awarded the fellowship that provided funds for this project, developed the data collection instruments, collected and analyzed the data, and wrote the paper. Patricia Dykes and David Bates supervised every aspect of this project.

Robert S. Rudin contributed to the research protocol, development of the data collection tools, interpretation of findings, and editing of the paper. Marianne Storm contributed to the development of the interview guide, the analysis of the data, and the editing of the paper. Kelly McGrath assisted with recruitment of participants, contributed to analysis of the data, and assisted with editing of the paper.

Transparency document

The Transparency document associated with this article can be found in the online version.

Declaration of Competing Interest

None.

documentation'; and 'rural reality'. These gaps were magnified when information exchange was required between unaffiliated electronic health records (EHRs) about shared patients, which was more pronounced in rural settings.

Conclusion: Policy and incentive modifications are likely needed to overcome the observed health information technology (HIT) shortcomings. Rural settings in the United States accentuate problems that can be addressed through international medical informatics policy makers and the implementation and evaluation of interoperable HIT systems.

Keywords

Health information Exchange; Primary health care; Continuity of patient care; Rural health; Health information technology; Electronic health records

1. Introduction

Health is poorer in rural areas in the United States [1] and internationally [2,3]. Fourteen percent of the U.S. population resides in rural areas [4] and rates of age-adjusted mortality, disability, and chronic disease are higher than in cities [1,5,6]. These disparities suggest disproportionate high-needs and complex medical care, and therefore greater requirements for care coordination in rural settings.

Improving health information exchange capacity for care coordination of complex chronic conditions has the potential to reduce this disparity. The American Recovery and Reinvestment Act of 2009 specifies that its Health Information Technology for Economic and Clinical Health (HITECH) Act promotes "electronic use and exchange of information" and "improves health care quality, reduces medical errors, reduces health disparities, and advances the delivery of patient-centered medical care", as the second of eleven stated purposes [7]. The 21st Century Cures Act of 2016 established the Trusted Exchange Framework to assist providers in "secure exchange of electronic health information [..] without special effort on the part of the user" [8]. The aim of both is to promote care that is equitable, affordable, sustainable and of high quality [9]. These acts prioritize improved care coordination for high-needs, high-cost patients [10], especially for providers serving rural residents [11,12] and those with complex chronic conditions [13-16].

The regulations that operationalized these Acts (a.k.a., Meaningful Use (MU), recently renamed Promoting Interoperability (PI)) drove adoption of electronic health records (EHR) [17] and electronic exchange of health data [18]. Given the health benefits found with EHR investment [19], the same, or greater, rates of EHR adoption in rural settings is reassuring [14]. However, rural providers simultaneously delayed verifying their eligibility for the MU programs' incentives compared with urban counterparts, causing financial disadvantage [14]. The attestation delays may relate to the limited technical supports rural healthcare faced [13,15,20]. Despite the policy's priority of improved health care and reduced health disparities, no study has examined how providers experience electronic health information exchange during care coordination for patients in the setting of rural inequity since these Acts were implemented.

1.1. Framework

The Agency for Healthcare Research and Quality (AHRQ) found a paucity of care-coordination-specific measures during systematic reviews. Their research guided development of an evidenced-based framework [21] that organizes coordination requirements into nine activities (Table 1). The framework highlights that care coordination occurs most often during and in response to care transitions, which includes between providers, across settings, between encounters or care episodes, and within same-service care teams. Health Information Technology (HIT)-enabled coordination, teamwork focused on coordination, Health Care Home, care management, and medication management, are identified as five broad approaches used to improve delivery of care coordination. HIT tools enable communication of health information between health care entities (e.g., providers, health organizations). Examples of how these tools enable coordination activities are listed in Table 1.

1.2. Objective

To understand how electronic health information exchange applies to care coordination in settings where health disparity exists, since the MU/PI programs were enacted, we interviewed and surveyed health providers in the United States, focused on rural sites, and asked about how health information technology (HIT) supports exchange of information during care coordination activities. This contributes to contextual knowledge about the clinical impact of HIT in a health care system that aims to reduce health disparities.

2. Methods

2.1. Data collection overview

We designed a mixed-methods study [23,24] and used the AHRQ care coordination measurement framework [21] to guide our data collection and analysis. In recorded, semi-structured interviews participants defined what is relevant and important to them [24]. A survey quantified respondents' perceived levels of EHR information exchange capabilities at each site. The appendix describes supplementary methodological details. Institutional Review Board approval was granted for this study.¹

2.2. Sampling strategy

We employed critical case and snowball sampling methods [26]. Our critical case sample was based on geography and clinical settings so results could be as applicable as possible in other settings through logical generalization [23,26]; e.g., if themes are consistent in this sample, they are likely to be true in other similar settings. The MU/PI programs had wider reach in states that accepted terms for expansion of their states' federal funding for Medicaid, the U.S. federal health program for people with limited income and resources. We selected sites in each of the four U.S. census regions to represent rural Medicaid expansion (n = 2) and non-expansion states (n = 2), using the county-based definition of rural (e.g. non-

¹Partners Human Research Committee- Notification of IRB Approval/Activation Protocol #: 2017P002340/PHS; January 16, 2018.

metro) [27]. Population characteristics and health outcomes differ between rural and urban settings, so our sample included urban sites ($n = 2$) to highlight divergent features.

We chose care transitions across clinical settings as the appropriate care transition for our critical case sample because the technically more complex electronic exchange between EHRs is more likely to occur across settings than exchanges that occur within the same service care team that uses a single EHR. The common care transition settings we selected are: 1) primary care clinics, 2) acute care hospitals, and 3) community health services (e.g., home care services, and skilled nursing facilities).

We used snowball sampling to identify rural participants from each U.S. census region, according to our critical case sample. Regional, rural knowledge was the criteria used to identify key contacts from the Practice Based Research Network registry [28] and from health systems that included rural regions and featured prominently at a national biomedical informatics conference. These contacts recommended rural sites that had primary care clinics and community health services that served counties of 10–30,000 people, had access to a federally funded Critical Access Hospital, and were located 60–120 min. drive from an urban hospital. Urban sites were identified from our 2012 study [29] that found little urban regional variation when exploring the state of HIT to support care transitions in the early years of implementing the HITECH Act, and were in cities with metropolitan areas of 2–5 million people.

Both rural and non-rural sites were approached by phone and sites that agreed to participate then identified a primary care provider to facilitate recruitment of care providers across the three target clinical settings.

2.3. Interviews

Our semi-structured interview guide asked participants to focus on patients with the highest care coordination needs, such as those with complex chronic conditions. The opening statement was: “Tell me about what happens at your organization when care is transferred across settings and/or between providers”. Follow-up questions focused on aspects of information exchange, AHRQ’s nine coordination activities (Table 1), and the perceived impact of the rural setting on their experiences (e.g., transportation and access to specialist services).

One investigator (EG) visited half the sites, enabling face-to-face interviews, and performed the remainder by phone. We discontinued recruitment of additional providers at each site after reaching saturation for identified themes. We transcribed, reviewed, and corrected audio data for transcription accuracy.

2.4. Survey

The 2012 National Electronic Health Records (NEHR) survey quantified health information exchange in a nation-wide sample of US office-based physicians [30]. Certified EHRs that are incentivized by the MU/PI programs are required to exchange data elements in the Common Clinical Data Set (CCDS) Summary Record [31]. We modified the 2015 edition of the NEHR survey [32] to include the CCDS standard and retain items related to health

information exchange. The number of EHRs used at each site was established during the interviews and one user of each EHR was identified among the interview participants.

2.5. Analysis

The transcriptions of interviews were entered in NVivo to manage the coding process. The interview data were analyzed with inductive and deductive reasoning using two-person (EG, MS) consensus, in keeping with standard practice. The first author, EG, conducted all the interviews which enabled continual data immersion. Deductive codes were assigned from AHRQ's nine care coordination activities (Table 1), and inductive codes were identified through an iterative process with emergent themes mutually agreed on by both coders. Triangulation [23] of the interview and survey findings guided deeper understanding of analysis and was achieved through iterative communication among the research team (authors) and primary advisors.

3. Results

3.1. Sample characteristics

We evaluated four rural sites and two urban sites with providers balanced across primary care clinics (n = 9), acute care hospitals (n = 6), and community health services (n = 6). The 21 participant providers included physicians (n = 10), nurse practitioners (n = 2), registered nurses (n = 7), and other healthcare professionals (n = 2). Data collection occurred between January and August 2018. The appendix describes supplementary sample characteristic details.

3.2. Interview themes

The 21 interviews ranged from 30–60 min, with a total of approximately 15 h of transcribed data. Theme saturation occurred rapidly. We identified seven themes related to how providers described their experience of information exchange to facilitate care coordination and aligned that with the AHRQ care coordination activities (Tables 1 and 2). The frustrations described across themes were magnified when information exchange was required between unaffiliated EHRs about shared patients, which was more pronounced for rural providers. The themes illustrated by representative quotes (Table 2) are described below.

3.2.1. Theme 1: insufficient trust of data—Providers reported information they receive is not comprehensive and accurate enough to guide decisions, either because of the source (e.g., from the patient; through a hand-off from indirectly involved clinician); or the manner and quality of the documentation. One common example is in medication reconciliation, where providers are wary of accepting the accuracy of medications listed in the EHR due to discrepancies between the list and other sources. This theme was not as marked for urban participants who used primarily one EHR that was shared across settings, though distrust was described in how other providers might use information they entered into their shared EHR.

3.2.2. Theme 2: please respond—Providers described their efforts to mitigate risk of information error by communicating directly with their patient's other care providers via phone or email and obtaining and/or verifying crucial information. Providers found arranging these phone conversations and email exchanges frustrating but felt obliged to do so because the information available to them was not enough for decision-making. Urban participants described similar frustrations for the small portion of patients who had shared care documented in unaffiliated EHR systems. In addition, urban providers described direct communication as a more efficient way to understand a case than reviewing a large, shared EHR patient record.

3.2.3. Theme 3: just fax it—Providers described manual processes to seek information external to their EHR that included phoning medical record departments or performing digital queries of Health Information Exchanges. Multi-page faxes or printed paper piles had to be scanned into EHRs as PDF documents. Rural providers described this challenge frequently because they generally did not share EHRs with other settings in their area. Urban sites described these processes mostly for care transitions to and from community settings, where unaffiliated EHRs were more common.

3.2.4. Theme 4: care plans—Patients with complex care needs have multiple care transitions that generate a lot of health information that requires a consistent care plan across settings. However, both rural and urban providers described existing care plans as being regulation driven, resulting in multiple care plans for an individual patient. For this reason, care plans were not used in routine decision-making and providers did not find them useful. For example, a patient with multiple medical problems, including heart failure, will have a heart failure care plan that describes self-management advice and medication treatment related to heart failure. Such a care plan does not, however, incorporate how the heart failure treatment is balanced against other comorbidities such as renal failure, respiratory failure and cognitive decline. Tailored plans that reconciled all the comorbidities were better described in the free-text narratives.

3.2.5. Theme 5: needle in the haystack—Providers described barriers to searching for pertinent information from data obtained external to their EHRs, and within a shared EHR. Care transitions identify changes in health needs that are documented as new information that providers must monitor and respond to, such as changes or additions to medication and problem lists; discharge documentation; specialist ambulatory assessments; allied health reports; reports of investigations and imaging; etc. Providers filter through individual items, especially progress notes, summary records and discharge summaries, to find out "what happened to the patient." For patients with shared care documented in unaffiliated EHRs, all participants described gathering and then searching through external information, which was emphasized in rural settings. Urban participants described the searching process alone, in relation to large, shared EHRs.

3.2.6. Theme 6: re-documentation—Shared care across unaffiliated EHRs meant large quantities of external information were received in inoperable, difficult-to-search formats (e.g., verbal communications, PDF documents, free-text narratives), which occurred

more frequently in rural settings. Providers perform labor-intensive, duplicative data entry of the “trapped” information into more readily-accessible sections of their EHRs.

3.2.7. Theme 7: rural reality—Urban and rural participants described similar manual efforts to coordinate care particularly when care is shared across services using different EHRs, which is the majority of patients for rural providers but a minority for urban providers. Rural providers spoke about the compounding impact of poverty on care coordination activities. The lack of transportation to appointments with specialists; geographic location between multiple larger health systems; and, the lack of access to extensive specialty services were highlighted. Phone communication was enabled when they personally knew the providers with whom they exchanged information.

3.3. Survey results

Twelve unique EHR systems were used across the six sites. Twelve users of each of these EHRs were asked to complete a survey and eleven surveys (92 %) were completed (Table 3).

Table 4 lists respondent characteristics and responses to the items related to their EHR and its capacity to exchange health information. Vital signs, clinical text, current medications, demographics, and smoking status were electronically recorded data used routinely in all the EHRs, regardless of capabilities to send or receive them. Laboratory and imaging data were the most frequently received data elements that automatically integrated into the receiver’s EHR.

4. Discussion

4.1. Main findings

We evaluated care coordination and how health information is exchanged in rural and urban health care settings and found numerous gaps. The most important of these were provider uncertainty about trustworthiness of information, the need for direct communication with other providers, inefficient data gathering, frustration with care plan regulations, and lack of routine interoperability. The aim of interoperable capabilities that facilitate activities of care coordination has not yet been realized. Issues encountered for rural and urban settings were similar in kind but may be worse in magnitude for rural settings because of a higher proportion of patients with data from unaffiliated EHRs and greater high-need, low-resourced populations.

Our findings relate to four of the nine care coordination activities and the broad approach of HIT-enabled coordination, identified by AHRQ’s framework (Tables 1 & 2) [21]. HIT tools that target activities providers find frustrating may improve health information exchange and will likely impact most activities of care coordination (Table 5).

4.2. Relation to literature

Accountability for coordination of complex care might improve if future secure instant messaging (IM) tools enable collaborative verification of exchanged health data and negotiation of responsibilities (*AHRQ activity 1*). IM has potential to facilitate

communication, efficiently verify received data, and improve provider collaboration [33,34]. The way participants in our study described efforts to establish direct communication (*AHRQ activity 2*) is consistent with findings from homecare [35] and outpatient settings [36]. Our results highlight that seeking this communication is driven by providers' concerns about available information.

A longitudinal care plan (LCP) tool (*AHRQ activity 5*), the idealized system of functional and effective exchange of health information to support care coordination across settings, was described a year after MU programs began [29]. Despite the intervening five years, we found little progress on the ground. Care plans described in our study offered limited support for sequential transitions or to improve outpatient care coordination. Implementation of effective LCPs is impeded by the lack of functional health information exchange [35,37-40], which may explain the challenges found in care transitions to community-based care [41].

Mention of automated electronic tools that facilitate the monitoring and follow-up responses to information generated by care transitions (*AHRQ activity 6*) was minimal in our study. Instead, providers described significant efforts to gather information consistent with the finding that physicians did not receive information necessary for care coordination [30] and nurses describe complex practices to manage health information [42]. Follow-up activities involved manual searching for succinct assessment and plan information in free-text format, as previously observed [43], and reconciling structured data, which includes the challenge of incorporating received medication information [44]. We highlighted that providers duplicate data entry [45] of information within their EHRs for future access.

Our findings highlight that HIT-enabled coordination activities are limited by EHRs that do not exchange information electronically about shared patients. Even though most hospitals electronically exchange information for public health reporting purposes, significantly fewer routinely send electronic information to unaffiliated hospitals and providers for patient care [46]. Providers prefer automatic electronic receipt of data into EHRs [47], but our survey supports previous findings that this function is limited to laboratory and radiology data [47,48]. The additional manual efforts needed to coordinate information across unaffiliated EHRs likely impacts provider frustration with clinical documentation [49,50] and may cause patient harm [51]. There are likely many factors that contribute to the lack of electronic information exchange between unaffiliated systems such as local dynamics, financial incentives to not exchange information, fears about privacy, and policy regulations.

Finally, rural geography highlights HIT limitations because providers share patients with bordering larger health systems which necessitates the manual efforts of exchanging health information across unaffiliated EHRs. Inadequate broadband infrastructure in rural areas [20] likely compounds this problem of inefficient HIT processes, which contributes to physician burnout [18,52]. Functional rural HIT systems that electronically exchange information has potential to reduce rural health inequities that are global and impact half the world's population [2,3].

4.3. Policy implications

Our study contributes to evidence [29,49,53] that the regulations from the HITECH and 21st Century Cures Acts have substantial gaps to using HIT for facilitating care coordination. The latest regulations for incentive payments [54] may advance interoperability goals through the revised HIE criteria “Support Electronic Referral Loops by Receiving and Incorporating Health Information” measure. However, these incentives still do not ensure information is electronically exchanged between unaffiliated organizations that share patient care [46] nor stipulate user-facing display functionalities of data reconciliation and incorporation.

The \$37 billion EHR MU/PI incentive program [55] emphasizes exchange of health information as a key function of HIT to improve care coordination. Though some increase in health information exchange has occurred [18], functional electronic exchange remains poor [37,46,48,53,56-59] and may relate to how policy incentives were implemented. The criteria for successful receipt of funds from the MU/PI EHR programs included “Care Coordination” and “Health Information Exchange (HIE²)” as two of eight policy objectives in place during this study. Manual data download for “Care Coordination” and data entry for “HIE” were allowed, but neither objective required bi-directional electronic health information exchange [31,60]. The lack of policy mandate to verify how exchanged information is presented to the receiver may explain the poor function and integration of data from external sources into EHRs. Electronically received information needs to be displayed in ways that make it easy to consume, reconcile into existing records, and respond to. Though simultaneous display of data, in a single view, from two sources has been required by MU/PI programs since late 2012 [61], specific display of CCDS data elements parsed from electronically received summary records was not stipulated in attestation criteria. To drive improved usability of received data, policies may need to focus on improving information systems that parse and incorporate CCDS data elements into EHRs.

A complementary approach might be mandating conformance testing, which would likely have an important impact if linked with mandates of exchange but may be politically challenging [62]. Conformance testing could require accuracy and completeness when comparing data in a sender’s EHR with data in the interoperable document, including deleting duplicate aggregated data.

HIT regulations also need to address rural factors since delayed attestations to MU programs caused financial disadvantage for rural providers [14] and our findings suggest rural providers contend with more data from unaffiliated EHRs than urban providers. The federally funded Regional Extension Centers (REC) that provide technical support for individual and small provider practices may help rural health services benefit from evolving HIT requirements and federally regulated incentives. Lessons learnt from the successes of the health coverage expansion programs that improved care quality for rural patients [12]

²The “HIE” term used in the regulations describes the process of information exchange, which is described elsewhere by a range of wordings, and is distinct from the ‘Health Information Exchanges’ which describe web-based electronic services for health providers to exchange information.

might enhance REC rural services and inform international efforts to improve rural HIT systems.

Finally, support is needed to evaluate how these HIT capabilities can advance care coordination. Research could develop information systems for collaborative communication tools, reconciliation of aggregated data including longitudinal care plans, define measures of interoperability, and assess cost-benefits of these endeavors to improve population health. Rural populations where health disparities exist should be included in demonstration projects, especially if quantitative analysis demonstrates rural providers indeed deal with more data from unaffiliated EHRs than urban providers.

4.4. Strengths and limitations

We used a critical case sampling strategy [26] to capture geographic and clinical setting differences, but our findings may not generalize across diverse settings. Information acquired during the interviews suggest that non-clinical staff play significant roles in aspects of health information exchange, notably sending information. Therefore, survey responses about sending information was limited by respondents' understanding of this process.

5. Conclusion

Providers across clinical settings consistently described onerous manual efforts during care transitions for patients with complex chronic conditions, despite the significant United States federal investment in HIT systems that aim to reduce health disparities, with the problem more pronounced in rural settings due to more fragmentation of EHR systems. Going forward, our findings can inform international medical informatics policy makers and HIT system designers to more effectively use electronic tools for care coordination, including vulnerable rural populations. A focus on health information exchange between unaffiliated EHRs is needed that ensures functional interoperability and the development and use of integrated systems for collaborative communication, longitudinal care plans, and reconciliation of aggregated data.

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Appendix A.: Methodology & sample characteristics

We contacted eight rural sites and agreement to participate was obtained from one site in each rural target region (n = 4). Contact was reestablished with three of the previously studied urban sites and agreement to participate obtained from two.

One user of each EHR identified during the interviews was asked to complete the survey about their EHR's exchange capabilities. Study data were collected and managed using REDCap electronic data capture tools hosted at Partner's Healthcare [63].

More details about the distribution of participant roles across the sample can be seen in Table 6 below.

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Summary

What was already known on the topic

- EHR incentive programs that emphasize exchange of health information, as a key function of Health Information Technology (HIT) systems to improve care coordination and improve health, drove adoption of EHRs; improved exchange of health information; and, have health benefits.
- Rural populations have health disparities which HIT policies aim to reduce.
- Rural health providers in the United States have been financially disadvantaged when adopting EHRs, compared to urban counterparts.

What this study added to our knowledge

- Rural health providers, who coordinate care for patients with poorer health, emphasize HIT limitations; may contend with more data from unaffiliated EHRs than urban counterparts; and, should be included in evaluation of policy that addresses interoperable health IT systems.
- EHR incentive programs should explicitly require functional exchange between unaffiliated EHRs about shared patients.
- Policy support may be needed to accelerate the development of usable integrated information systems that facilitate collaborations, create longitudinal care plans across the entire care team, and incorporate reconciled data automatically into EHRs.

Care coordination activities from the AHRQ measurement framework collapsed into three levels, [22] with example HIT tools.

Table 1

Care Coordination Activities	Level	Example HIT tools
1 Establish accountability or negotiate responsibility	Provider-level	Secure Instant Messaging facilitates real-time negotiation of responsibility and care coordination communications.
2 Communicate		
a Interpersonal communication	Patient-level	EHRs and patient portals support digital documentation of health information, including goals and plans, that can be electronically exchanged.
b Information transfer		
3 Facilitate transitions		
4 Assess needs and goals		
5 Create a proactive plan of care	System-level	Databases enable patient and population level analysis to inform treatment planning and resource use.
6 Monitor, follow up, and respond to change		
7 Support self-management goals		
8 Link to community resources		
9 Align resources with patient and population needs		

Table 2

Prevailing Challenges from Group interview results.

AHRQ activity		Themes that emerged	Representative quotes [*] <i>Initials indicate source: Rural (R), Urban (U), Primary care (P), Hospital (H), Community (C)</i>
Provider Level	1. Establishing accountability & responsibility	Insufficient trust of data	'I get the information from the patient or family, which is really hard because.... I don't necessarily not trust but totally trust that they understood exactly what the specialist told them.' <i>R.P.</i> 'It's almost always medications. There's just something that didn't happen.' <i>R.C.</i> 'we have some patients that see multiple different providers, and it's really difficult to manage that patient just because different orders, different impressions coming from everywhere. So it's challenging.' <i>R.C.</i> 'some of the physicians are hesitant to even do... the acute care plan... because they don't know how that information will be used. [For example, a plan suggests] a blood alcohol be done [because] some questions about some recent falls, but [then a] physician will read that and say to a patient without a conversation 'well, your primary care thinks you've got a problem and we need to check your blood alcohol.' <i>U.P.</i>
	2. Communicate	Interpersonal communication ('Please respond')	'it seems no matter how much computer we use, we're on the phone a lot.' <i>R.P.</i> 'Someone's got to give up their cell phone and no one likes to do that. No one likes to do that necessarily because they're getting calls all the time. There's always a fear that, that will land in the notes.' <i>U.P.</i>
		Electronic exchange ('Just fax it')	'A social worker may call me [about whether a] bed is available. I'll tell them yes. They'll fax me. [Rural hospitals] may fax me 25 pages... From the larger systems, sometimes it can be up to 120–140 pages.' <i>R.P.</i> 'where the doctors aren't connected to the hospital, they're kind of going at it blind... I think that the patients probably feel like they're starting all over again in every setting they go to.' <i>U.C.</i> 'which is why I faxed... not everybody is technology savvy or understand how to do it and we're just one hospital. They have patients who get discharged from other hospitals in the surrounding area. Remembering how to log in, the process. That is the tedious part.' <i>R.H.</i> 'There's no need [to fax], because the inpatient side... use 'our EHR'.... So, as soon as that document is completed we're able to view it, and see it on the inpatient side.' <i>U.H.</i>
Patient Level	5. Proactive care plan	Care plan regulations ('Care plans')	'some people will have anywhere from one to six pages of care plans, and there's multiple care plans on each page.' <i>U.C.</i> 'we write a care plan and Medicare tells us what needs to be on it.' <i>R.C.</i>
	6. Monitor/follow up/respond to change	Information gathering ('Needle in the haystack')	'It's just really hard to read and follow those 32 pages scrolling.' <i>R.P.</i> 'without the information I need to make decisions, that requires myself talking to my support staff for them to call the clinic that the patient was at and talk to somebody there, then get that faxed.' <i>R.P.</i> 'I'm looking for their assessment and plan, really because that's the meat of it.' <i>R.P.</i> 'if I have a patient that went to... an outside [facility]... that we're not connected to... [I] hunt information out... It's always phone calls... it's by fax... that's 15 plus [pages]... I go through them and then primary care goes through them.' <i>U.P.</i> 'There's so much information in the [EHR] that it's almost too much to decipher and... tease out... it's so overwhelming... that there's no way anyone can really own all of it.' <i>U.H.</i>
Rural factors ('Rural reality')		Duplicative data entry ('Redocumentation')	'If there's pertinent information on [the fax], say a new diagnosis, then I log into that patient's electronic chart and add that new diagnosis to their problem list.' <i>R.P.</i> 'I had the admissions director give me the screens and I entered all the diagnoses, allergies, code status.' <i>U.C.</i>
			'It really becomes a question of logistics. There's a lot of poverty down in A. Just the money for gas to come up, could be prohibitive for some patients.' <i>R.H.</i> 'some of these are even going out of state which makes it even more complex. And, everybody is on different electronic medical records. Obviously, that makes it a little bit more complex too.' <i>R.P.</i>

* Activities numbered to align with Table 1.

Table 3

Sources of EHR surveys.

Care Setting	Unique EHR systems used			Completed Surveys
	Rural sites n = 4	Urban sites n = 2	All sites n = 6	
Primary Care & Hospital share EHRs	2	2	4	4
Primary Care & Hospital EHRs differ [i.e., 2 EHRs/site]	2	0	4	4
Community EHRs				
Exists	3	1	4	3
Does not exist	1	–	–	–
Unknown	1	1	–	–
TOTAL	8	3	12	<u>11</u>

Table 4

Survey Results.

Characteristics	Responses ^{†‡}
Provider Roles	n = 11
MD, NP	9
RN	2
Respondent traits	
Average age	46 years
Female:Male	5:6
Average years seeing patients	19 years
Rate computer skills above average of peers	8 (73 %)
Accountable Care Organization (ACO[^]) participation	
Yes	7
No	1
Unknown	2
Average estimated % Medicaid care delivered (n = 11)	24 %
Unique EHR systems	n = 11
Number of Vendors	7
Data Available within EHR [respondent uses routinely]	
Vital Signs	11 [11]
Relevant Clinical Text	11 [11]
Current Medications	11 [11]
Demographics	11 [10]
Smoking Status	11 [10]
Encounter Diagnosis	10 [10]
Problem List	10 [8]
View Lab Results	9 [9]
View Imaging Reports	9 [9]
Procedural Information	8 [7]
Immunization history	8 [6]
Cognitive status	8 [6]
Identify Care team members	8 [5]
Functional status	8 [5]
Designated Plan section	7 [6]
Summary Record creation function	7 [5]
Implantable Device(s) ID	5 [5]
Methods to send patient information to external providers, with frequency of use:	n = 11
mail/fax/efax Often or Sometimes	9 (82 %)
email Sometimes or Rarely	5 (45 %)
Hand-delivery Ever	8 (73 %)
Methods to receive patient information from external providers, with frequency of occurrence:	
mail/fax Often or Sometimes	10 (91 %)

Characteristics	Responses [‡]
web portal Ever	7 (64 %)
email Sometimes or Rarely	4 (36 %)
hand-delivery Ever	8 (73 %)
all/most data via EHR Sometimes	5 (45 %)
limited data (e.g., Lab results) via EHR Ever	9 (82 %)
Referrals are sent to [but never electronically]:	
External ambulatory care	9 [4]
Internal ambulatory care	9 [2]
Unaffiliated hospitals	8 [6]
Affiliated hospitals	8 [3]
Behavioral Health	8 [1]
Long-term care	6 [5]
Information received from other providers [but never electronically]:	
External ambulatory care	8 [3]
Internal ambulatory care	7 [1]
Unaffiliated hospitals	7 [3]
Affiliated hospitals	6 [1]
Behavioral health	6 [3]
Long-term care	6 [4]
Ability to integrate electronically received patient information WITHOUT manual entry or scanning [only responses > 1 presented]	
Demographics	3*
Encounter diagnosis & Problem List	2*
Vital signs	2*
Smoking status	2*
Current medications	2*
Laboratory Results & Imaging Reports	5*
Procedural Information	3*
Immunization history	2*
Implantable Device(s) ID	2*
Summary record	2
*[includes 2 unrelated sites using different EHR systems, but same EHR vendor]	
Capacity to electronically search for patient information from external organizations (e.g., remote access to other facility, Health Information Exchange organization)	
Yes	5 (45 %)
Don't know	3
No	3
If electronic search capacity present (n = 5),	
• frequency of performing search	
Rarely	2
• type of information searched for (results presented for types with > 2 responses)	
Encounter diagnosis	3
Current medications	4

Characteristics	Responses [‡]
Medication allergies	4
Laboratory Results	4
Imaging Reports	5
Procedural Information	3
Agree positive impacts of exchanging information externally include:	n = 10
Improves care quality, efficiency, test ordering	10
Prevents medication errors	9
Provides complete current & historical information	7
Agree external information exchange is:	
Cumbersome with our EHR	9
Limited	9
Trustworthy	8

[‡]Responses: This column represents the number of responses by section of the survey, as some sections were left blank by some participants. All participants responded to questions where percentages (%) were calculated. Some questions had two parts, so responses to the second part are denoted as [n].

[^]ACOs tie provider reimbursements to quality metrics and reduction in care costs, normally through capitation payment models.

Terms used for frequency in survey: *Often, Sometimes, Rarely, Never*.

Term used in this table: 'Ever' = combined responses from *Often + Sometimes + Rarely*.

Table 5

How HIT tools might improve care coordination activities.

AHRQ activity*	HIT tool	Features
1. Accountability	Secure Instant Messaging (IM)	<ul style="list-style-type: none">• Collaborative verification of exchanged health data• Negotiate responsibility
2. Direct communication	Integrated secure IM	<ul style="list-style-type: none">• Patient EHR integration to avoid duplicative data entry• Scheduling integration to arrange synchronized communication
5. Plan of care	Longitudinal care plan	<ul style="list-style-type: none">• Dynamic plan over sequential transitions• Integrated with patient portal and EHR• Role-specific user display across care team (e.g., patient vs specialist)• Unstructured goal, assessment, & plan fields, for succinct and unique patient narrative
6. Follow-up	Reconciliation automation	<ul style="list-style-type: none">• Automate received structured data → verification/modification → incorporate into EHRs• Integrate verification step with Secure IM for bi-directional communication exchange
	Advanced search tool	<ul style="list-style-type: none">• Data filters, and keyword search capability across structured and unstructured data
HIT-enabled coordination activities		Interoperability across <u>unaffiliated</u> EHRs

* Activities numbered to align with Table 1 & 2.

Table 6

Interview Sources.

Care Setting	Provider Role	Rural	Urban	Total
Primary	PCP (MD, NP)	5	1	9
	Coordinator (RN, other)	2	1	
Community	Skilled Nursing Facility (NP, RN, other)	3	1	6
	Home based (RN)	2		
Hospital	Critical Access Hospital (MD)	1		6
	Tertiary Hospital (MD)	2	2	
	Coordinator (RN)		1	
Total Interviews				n = 21