

Using Health Information Exchange to Support Community-based Innovations

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Abstract

Objective: Health information exchange (HIE) involves sharing information across organizations. Effective HIE gives providers across organizations a comprehensive view of the patient that can improve the accuracy of health information to support clinical care. We sought to understand how grantees funded by the Centers for Medicare and Medicaid Services Health Care Innovation Awards used HIE for community resource planning. We also sought to identify barriers and facilitators influencing the use of HIE within these interventions.

Methods: We analyzed three years of data collected in the course of the grant program, including progress reports, site visits, and notes from telephone interviews. We uploaded documentary data into qualitative analysis software, coded the data according to a literature-based codebook, and identified themes relevant to interoperability and to barriers and facilitators for HIE. Coders achieved a final kappa of 0.8, suggesting excellent interrater reliability.

Results: We found that community-based interventions required attention to HIE at the community (e.g., public health) and organizational (e.g., hospitals, laboratories, doctor's offices) levels. Systems and processes included methods for incorporating information from HIE, managing errors, and staffing. At the community level, implementation guides and standard definitions were key components of guidance. At the organizational level, process and technical factors including stakeholder engagement, interoperability, and data standards affected HIE use.

Discussion and Conclusion: HIE can connect organizations in a community so that healthcare workers can share patient information to support coordinated care. However, communities must overcome challenges such as the impact of HIE on workflow and the variation of data standards across organizations to effectively use HIE. Planning for technical, organizational, and governance factors is required to realize the benefits of HIE in community interventions.

Keywords: health information exchange (HIE); information exchange; standards; workflow

Introduction and Background

Community-based health interventions seek to improve quality of care and reduce spending through improved care coordination and information sharing.¹ Community-based health interventions seek to improve care and outcomes beyond a particular organization and for the community as a whole.² These interventions can help communities overcome traditional challenges of caring for patients across organizations, such as delayed reporting, incomplete information, repeat testing, and resource limitations, through a coordinated approach and information sharing.³

Community-based health interventions and associated public and population health activities rely on information sharing among healthcare providers^{4,5} to improve the coordination of patients' care. Health information exchange (HIE) facilitates the availability of information to support these activities.^{6,7} Information can be exchanged through data sharing, querying, and alerts.⁸ HIE can support community-based interventions by enabling remote lookup of patient records, making information from disparate sources available for importing into patient care records, and integrating data to support analytics. HIE can also support notifications to the primary care provider or care coordinator when patients experience designated events, such as emergency department visits or positive laboratory results for reportable diseases. This way, the primary care provider or care coordinator can be aware of the patient's interaction with the healthcare system in the community. Through these uses, HIE allows providers across organizations to have a complete picture of the patient, which can result in improved accuracy of demographic and clinical information to support clinical care. Providers use this information to identify significant clinical or behavioral risk factors, inform orders, complete surveillance reports, and intervene with patients and caregivers more effectively.

HIE often occurs through regional health information exchange organizations (RHIOs), which have varying support at the state and federal levels. An example of support at the state level is found in New York State, which developed a program to support RHIOs by providing infrastructure to overcome barriers to HIE such as variable data structures, formats, and vocabularies.^{9,10} Federal support comes from many sources, including the Office of the National Coordinator for Health Information Technology's State Health Information Exchange Cooperative Agreement program, which provided funding support and technical assistance for HIE. In addition, the programs provide support to increase HIE penetration and to overcome interoperability challenges that can influence the use of HIE for reporting, alerts, coordination of care, and public health. Some communities included HIE as part of their programs for the Centers for Medicare and Medicaid Services (CMS) Health Care Innovation Awards (HCIA), which provided funding and technical assistance to grantees for innovative community-based interventions.¹¹ Some regions use the term *RHIO* and others use the term *HIE* to describe the overall health information exchange infrastructure. We refer to it as *HIE* in this article.

We sought to more fully understand how community-based health interventions funded by HCIA used HIE to support their interventions. These interventions are predicated on organizations throughout a community sharing information and using it to influence health outcomes. Thus, understanding how these interventions use HIE and their experiences in doing so can be useful to HIE organizations throughout the country and for communities planning communitywide interventions that require HIE. To that end, our research questions are as follows:

- How did community-based interventions use HIE to support their interventions?
- What barriers and facilitators influence the use of HIE to support community-based interventions?

The following discussion presents the ways in which HIE can be used to inform patient care and public and population health activities.

Reporting

HIE can help improve the reporting rate and timeliness of a number of activities influencing community health. For these improvements to occur, health information needs to be available electronically through electronic health records (EHRs), lab systems, and other systems. In addition, this information must be interoperable, meaning that systems across the community must be able to share, read, process, and use the information. The CMS Meaningful Use criteria established requirements that EHRs must meet in order for providers to qualify for incentive payments. Because the Meaningful Use regulations include requirements that support reporting, EHRs are likely to support functionality for several reporting objectives. Types of reporting that can be facilitated by HIE include immunization rates, syndromic surveillance, reportable laboratory results, cancer reporting, and specialized registries.¹²

HIE can facilitate electronic reporting of laboratory results and associated physician diagnoses. Although reporting of positive laboratory tests for certain communicable diseases is mandatory,^{13, 14} not all laboratory results or physician diagnoses are required to be reported, and requirements vary by state. HIE can facilitate nonmandatory electronic reporting of laboratory results and associated physician diagnoses, improving data completeness.^{15, 16} HIE can facilitate reports and alerts based on diagnoses, medications, or other identifying factors. These uses of HIE can contribute to better coordination of clinical activities. HIE can facilitate reporting by enabling the following functions:

- Viewing and reporting information from disparate sources
- Matching laboratory reporting and diagnoses across organizations
- Updating patients' demographic information

Alerting

Timely communication of events across organizations is essential for coordinated care and informed decision-making. Clinical messaging, or alerts, are most effective when they include the right information at the right time. Traditional paper-based methods of sending public health alerts are time-consuming, rely on information that rapidly becomes out of date, and are not immediate.^{17, 18} Thus, clinicians may not receive alerts at all or may receive them too late to alter their clinical practices. In Indiana, HIE was used to facilitate a clinical messaging service to deliver public health alerts with improved efficiency and effectiveness of messaging.¹⁹ The HIE facilitated interorganizational electronic clinical messaging in a way that was consistent with intraorganizational messages. Thus, providers received alerts electronically in a timely manner and could use them to inform decision-making. By having more information available electronically and a mechanism to share it, providers can act on timely, accurate information from disparate sources.^{20, 21}

Coordination of Clinical Care

HIE can facilitate coordination of care by enabling organizations to share information. Information sharing is of particular importance in the treatment of medically complex patients, who may receive care from multiple providers. In addition, HIE can facilitate accurate and prompt referrals through timely sharing of information. Sharing full identifiers and history in a standardized format via HIE can enable all member organizations to access this key information. These examples show how the exchange of interoperable information can facilitate care coordination and improve outcomes.²² Similarly, quality improvement activities, such as performing chart audits and obtaining quality measures from EHR data, can be facilitated through HIE. Electronic chart audits have been shown to provide reliable data.²³ Historically, chart reviews to support quality improvement activities could not be completed offsite. In addition, paper chart audits were performed manually and were time-intensive. With electronic information sharing, reviewers can conduct chart audits without traveling to review paper charts on site or sending copies through the mail. Thus, quality improvement activities requiring chart review and manual extraction of data from the medical record can be facilitated through HIE because it provides offsite access.

Public and Community Health Services

HIE also supports public and community health services such as investigations and quality measurement. These services depend on public health organizations' having real-time access to information across healthcare organizations. The improved availability of information from HIE can support public health activities such as investigation of foodborne and waterborne bacteria disease outbreaks, contact tracing, and food safety investigations.^{24, 25} Having information about the patient and other individuals, such as sex partners, available in a legible, timely fashion can facilitate epidemiological investigations.²⁶ As more providers implement and use EHRs, the benefits of HIE will continue to accrue because more information will be available electronically.

Methodology

The data in this study are from an evaluation of 24 organizations that received community resource planning HCIA grants from the Center for Medicare and Medicaid Innovation (CMMI). Nine of the grantees used HIE as part of their community health intervention. Awardees represent a variety of organizational types, including hospitals, community health centers, specialty care providers, universities, nonprofits, health plans, and health technology firms. These awardees implemented innovative community-based programs to enhance the quality of healthcare, improve health outcomes, and reduce the cost of care provided to Medicare, Medicaid, and Children's Health Insurance Program beneficiaries. The programs included healthcare transformation using care coordination/patient navigation, health information technology, and delivery of preventive or health promotion services. We focused on a subset of awardees who had HIE as a key component of their intervention.

The authors conducted this study as part of a larger evaluation of the community resource planning HCIA grantees. We used three years of qualitative program evaluation data captured through progress reports, site visits, and telephone interviews. Awardees prepared quarterly progress reports to provide updates on implementation activities and document the results of self-monitoring analyses. Evaluators trained in qualitative methods conducted site visits and telephone interviews with clinical, administrative, and technical stakeholders at each site, using semistructured discussion guides that were tailored to each role. The questions in the interview guide addressed program design, implementation progress, partnerships, organizational resources and capacity, workforce development, and lessons learned.

We analyzed evaluation data relevant to interoperability and to barriers and facilitators for HIE. Using an inductive analytic approach to elicit themes from the collected data, all authors independently reviewed a sample of the data and identified preliminary themes for a working codebook. Using QSR International's NVivo qualitative analysis software (version 11.0), we then used the preliminary themes for a second round of independent coding. Ambiguous passages were flagged and discussed within the group or adjudicated by a third reader, informing refinement of the codebook. To ensure consistency in coding, approximately 40 percent of the qualitative text was double-coded and then adjudicated by a third reader. Coders achieved a final kappa of 0.8, suggesting excellent interrater reliability.

Results

Thematic analysis of documents and interviews uncovered several themes that influenced the success of regional HIE. Each HIE had systems and processes that guided information exchange. In addition, each organization that contributed information to it (e.g., hospitals, laboratories, doctor's offices) also had systems and processes related to HIE. Systems and processes include methods for incorporating information from the HIE and managing errors and staffing. Collectively, we refer to this as governance for the HIE level and for the contributing organizations that submit information to the HIE.

Governance structures had to take both technical and process factors into account. Technical factors included messaging and standards interpretation, among other things. Process factors included workflow and inconsistent processes for obtaining patient consent across organizations.

The awardees used data from a variety of contributing organizations. Figure 1 outlines the types of organizations that contributed to the grantees' interventions. Contributing organizations included doctor's offices, hospitals, laboratories, radiology providers, public health departments, and imaging services. Each contributing organization had its own governance structure, as did the overall HIE.

Governance of the HIE and Contributing Organizations

In community-based health interventions, the HIE is a shared resource for the community. Organizations that are part of the HIE are both contributors and end users of data. Developing, implementing, and using HIE to support community health means that the HIE itself and the contributing organizations play interrelated roles.

Governance at the HIE level involves community-based decision-making, and governance at the contributing organizations involves local decision-making. A shared governance structure allows organizations to maximize their use of the HIE and develop common strategies to overcome technical challenges, such as the application of data standards, patient matching, and data aggregation. Contributing organizations participated in HIE-level governance to varying degrees. For example, in addition to monthly or quarterly governance meetings, one awardee engaged stakeholders at pilot sites to identify similar challenges and opportunities across contributing organizations to share findings with the HIE. Another awardee created interdisciplinary working groups about specific topics, such as clinical partners, workforce development, and quality improvement. They then used feedback from these working groups to inform the design of their information exchange tool and prepare for pilot testing.

Governance was also relevant at the contributing organizations. All of the awardees' innovative programs consisted of many sites, each of which had its own structures and processes. Organizations had to identify how HIE fit into their own workflows and associated structures and make any necessary changes. For example, sites contributing to one awardee's HIE used different approaches for obtaining patient consent to have their information included in the HIE and shared with other participating organizations. Other governance needs that contributing organizations had to address included identifying technical and clinical points of contact and identifying roles and responsibilities for data managers. The technical team at the contributing organization faced workforce implications related to management of the data feeds and error management. The clinical team faced workflow implications when responding to alerts and reports.

Process and Technical Factors Considered by the HIE and Contributing Organizations

The awardees and contributing organizations considered how HIE data were to be used; workflow and usability issues are particularly significant. Figure 2 shows the kinds of process and technical factors awardees encountered in planning for the implementation of the HIE. Awardees noted the importance of planning at both the HIE level and within each contributing organization.

Process Factors

Awardees noted that stakeholder engagement and the characteristics of individuals and teams who participate are the most important process factors to consider. Awardees referenced the importance of physician and administrative champions at each contributing organization. They found that designated contacts were also helpful for building relationships and resolving issues. Clinical champions build trust locally and keep clinical sites engaged. One awardee's contributing organization identified a physician champion who understood the technology and the potential benefit; that person engaged other providers. As a staff member at that site explained, "We always had an internal clinical champion to convince them along with us to help build local trust." An awardee at a different site emphasized the importance of having champions at each site. Another awardee noted that having a designated contact at each site to attend regular meetings proved invaluable. Although the sites were diverse, they experienced similar issues and challenges and used similar approaches to overcome these challenges.

Awardees noted issues with data interoperability and sharing information across organizations. Although physician champions at sites were helpful, other clinicians, administrators, information technology staff, and others needed to be involved in using the HIE. Interdisciplinary involvement, awardees noted, helped overcome implementation barriers, gather diverse opinions, and produce a more complete understanding of concerns across occupations.

In addition to involving stakeholders, awardees noted the importance of planning. The flow of information among numerous sites meant that multiple sets of documentation, contracts, and other approvals were required. In some cases, awardees noted delays due to these administrative requirements.

Another aspect of planning is considering how HIE will be used, including workflow and usability issues. At one site, the staff conducted 12 structured, 90-minute clinical observations to understand how contributing organizations documented and shared data. Understanding the workflow and information

flow helped to inform implementation and identify how services would be captured in the HIE. At a different site, codes and elements to be transmitted were identified on the basis of feedback from stakeholders about how they interpreted standards for documentation and sharing of information.

Other awardees used central governance as part of planning, involving multiple stakeholders to address interoperability issues. This centralized planning resulted in a technical implementation guide that included file formats, interpretation of standards, error logs, and guidance on the management of incomplete or inaccurate data. At the sites referenced above, the clinical observations and the identification of codes and elements informed the implementation guide.

Technical Factors

Interoperability is of particular importance when data are aggregated across organizations through HIE. Awardees said that different EHRs have their own nuances that must be considered when interfaces and algorithms are constructed. Sites also use different elements in different ways as data standards allow for flexibility in implementation. Thus, additional work was needed to harmonize standards within the HIE. At the HIE governance level, one awardee decided to prioritize commonly transmitted fields, such as history and discharge, instead of the problem list, selecting fields that were consistently completed in the same way, captured current health issues, and captured diagnosed chronic conditions. This process enhanced the interoperability of the data.

The staff at one site mapped and standardized raw data across 12 different sources at 12 contributing organizations and found the process challenging, time consuming, and error prone. They tested data files to identify and correct errors to facilitate future information sharing. In one case, a major error caused by data truncation required rebuilding the data feed into the analytic database. As a result, the staff implemented additional routine testing as data sources changed or were added based on the contributing organizations' technical requirements. A staff member stated, "This plan includes review of all rules and transformations applied to raw data as it enters the RHIO's data feeds from all 12 data sources. This methodology will be applied in the future to plan for additional data from all new sources." As contributing organizations are added to the HIE, the site will use the process for mapping to integrate these data feeds.

At another site, staff found errors caused by address verification functions that were inconsistently implemented across EHRs. Identifying community-based resources that were convenient for patients was central to this intervention, so address verification was critical. The HIE then adopted a system-level verification function to check addresses.

Discussion and Future Directions

Effective community-based interventions need reliable data that can be shared with many organizations. Hospitals, physicians' offices, laboratories, imaging services, public health organizations, and long-term and post-acute care units are just a few examples of organizations that generate, share, and use health information. HIE can connect these organizations so that healthcare workers can share information across organizations to support care.

Interventions that leverage HIE to connect workers in new roles, such as community health workers and patient navigators, add another layer of complexity to the familiar HIE challenges, including inconsistent application of data standards, variation in privacy and security solutions across organizations, and the need to address the impact on workflow. Despite these challenges, HIE can assist workers in these new roles by streamlining communications and facilitating coordination of care.²⁷

As part of an overall community strategy, HIE has the potential to help reduce spending and improve care. Sharing information across organizations can reduce duplicate tests and procedures, improve communitywide alerts, and provide a consistent source of demographic information. Planning and structures to address the technical, organizational, and governance aspects is required to realize these benefits.

Innovative applications of HIE create new opportunities to streamline communications and facilitate coordination of care but also introduce new challenges. These challenges, such as the impact on workflow and variation in data standards and privacy and security solutions across organizations, must be overcome to leverage HIE to reduce spending and improve care. When effectively planned and implemented, HIE can help integrate new roles such as community health workers and patient navigators into the care team. Leaders of community-based health interventions need to understand how to overcome these challenges.

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Figure 1

Grantees' Health Information Exchange Information Sources

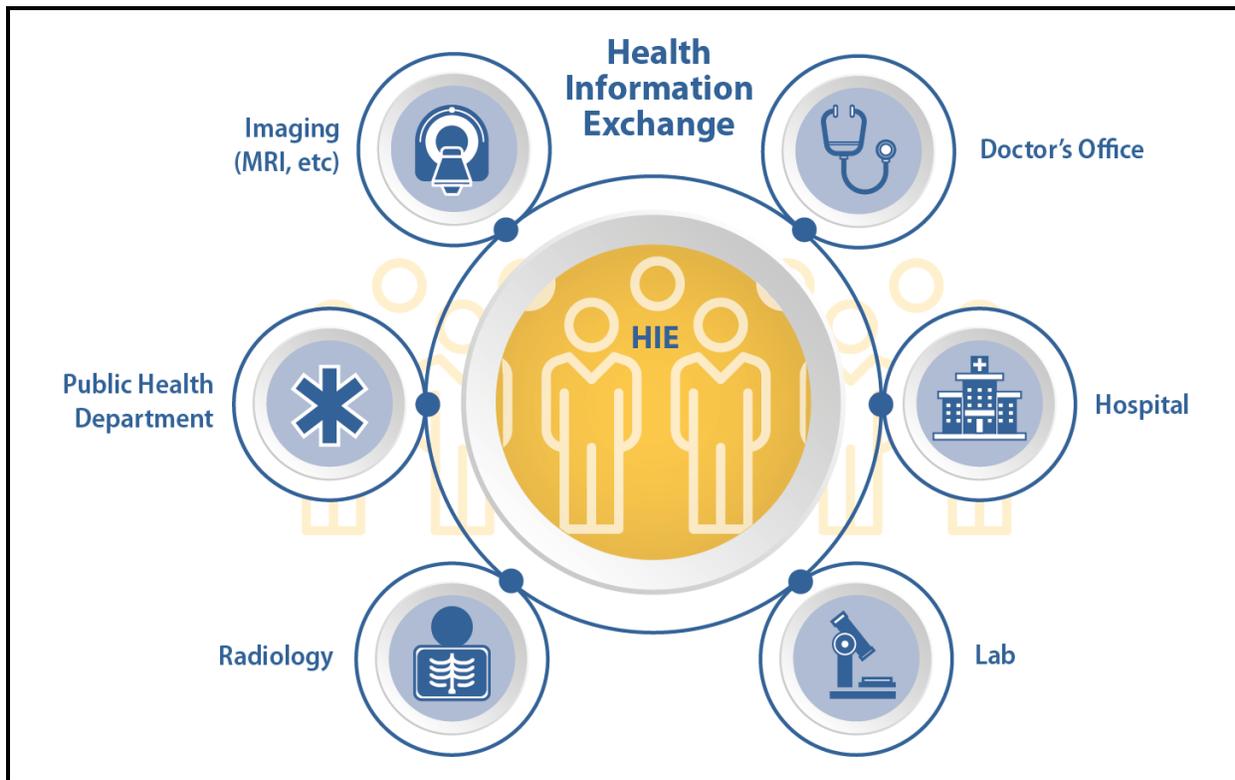
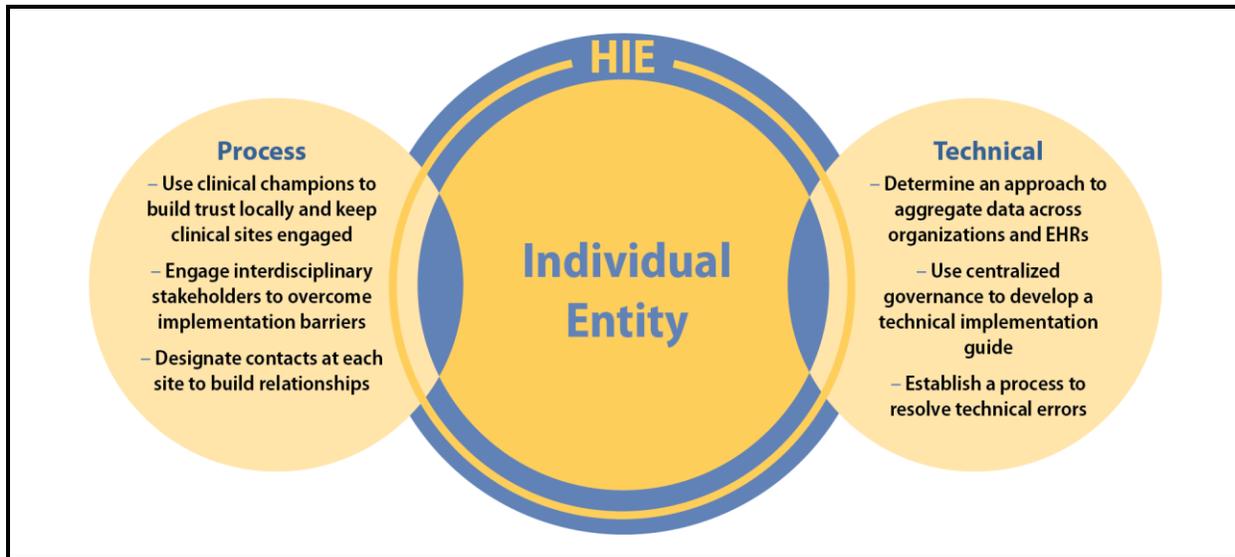


Figure 2

Process and Technical Factors at the Health Information Exchange and Contributing Organization Levels



Abbreviations: EHR, electronic health record; HIE, health information exchange.