

How do you define regional? The geography of health information exchange.

Principal investigator:
Joshua R Vest, PhD, MPH

Organization:
Weill Cornell Medical College
New York, NY

Project dates:
09/01/2013 - 12/31/2015

Federal Project Officer:
Ellen Makar

This project was funded by the Agency for Healthcare Research and Quality

Grant Award Number:
R03 HS20304-01A1

ABSTRACT

Purpose: Through a series of related studies, this project sought to clarify the concept of geographical area that is fundamental to health information exchange activity in the US by exploring the practical and policy implications of how exchange service areas are defined and measured.

Scope: Multiple organizations facilitate health information exchange activity in the US. Community health information organizations (HIOs) historically seek to provide exchange services for a geographically defined community, such as a region or state. Estimates suggest that there may be as many as 200 community HIOs. Nearly a billion dollars in public funding, plus substantial private investments, has supported the development and ongoing operations of these organizations.

Methods: Geographical information systems (GIS) analyses and methods were utilized to identify and quantify the extent of community HIO activity in the US. A qualitative GIS analysis built on these findings to explore how health care organizations and policy makers defined community HIO market areas. A qualitative analysis compared the barriers and enablers of a community HIO strategy with a non-geographically based health information exchange strategy – enterprise health information exchange (HIE).

Results: Mapping analyses indicated gaps in community HIO activity and overlapping community HIO efforts. Findings indicate geography is not an effective organizing principle. Qualitative interviews and data suggest that the role of geography is changing. Specifically, organizing health information exchange activities along politically defined geographies is becoming less important and less practical.

Key Words: Health information exchange; health information technology; health policy; organizations

PURPOSE

Health information exchange, the process of electronically sharing patient-level information between different entities, is facilitated by various organizations. Community health information organizations (HIOs), which developed during the past two decades, are one of the more common types of health information exchange facilitating organizations. Community HIOs are generally collaborative efforts aimed at providing health information exchange services for a specific location. Community HIOs are often referred to as “public” health information exchanges (or HIEs), because of their objective of facilitating health information exchange for any willing provider and often being supported by public funds. Organizations with titles like regional health information organizations or State Designated Entities (SDEs are the agencies or organizations funded by the Office of the National Coordinator to build health information exchange capacity within each state) are examples of community HIOs. A common and historical feature of the community HIOs is their focus on providing exchange services within a defined geographical area. These organizations can serve a city, county, regional, metropolitan area, an entire state, or multiple-states.

Service of a geographically defined community is an important component of health information exchange history in the US, but the potential benefits and challenges of this approach are generally unknown. Through a series of related studies, this project sought to clarify the concept of geographical area that is fundamental to health information exchange activity and explore the practical and policy implications of how exchange service areas are defined and measured. Specially, this project sought to:

- Describe the extent of community health information organization activity in the US.
- Use health care markets to better define community health information organization exchange activity in the US.
- Examine the implications of how leaders of health information exchange organizations and healthcare organizations define exchange service areas.
- Contrast the benefits and challenges of community HIOs with those of enterprise health information exchange, a non-geographically defined approach to exchange activity organization.

SCOPE

Community HIOs provide a region or state with the technical infrastructure and collaborative governance necessary for providers to share patient information electronically (the process formally known as health information exchange).^(1, 2) The past decade has witnessed a significant growth in the number of community organizations facilitating health information exchange nationwide. Whether they are called Regional Health Information Organizations (RHIOs), Health Information Organizations (HIOs), Health Information Exchanges (HIE) or Local Health Information Infrastructures (LHIIs), five years ago around 100 such efforts existed. Out of that number only 25 were fully operational.⁽³⁾ Now, there may be as many as 200 efforts in existence and more than 60 are operational.^(4, 5) In the US, nearly a billion dollars in public funding has supported the

development and ongoing operations of these community health information organizations (HIOs).⁽⁶⁾

These community HIOs have the potential to transform the healthcare system and make it safer.⁽⁷⁾ Through reliance on multiple providers, changes in insurance and isolated databases, our healthcare system encourages the creation of more and more data in disparate locations.⁽⁸⁾ Exchanging patient level data between organizations creates the opportunity for critical information to be available to a patient's provider to inform diagnoses, provide patient advice, or make better treatment decisions.⁽⁹⁾ The availability of this additional information could help reduce adverse events by alerting providers to treatments made in other settings.⁽¹⁰⁾ Also, community HIOs can provide a more comprehensive medication history, which further improves patient safety by revealing potentially dangerous drug combinations.⁽¹¹⁾ Moreover, the efficient and accurate electronic exchange of information is widely expected to improve the communication about the patient and therefore the overall level of coordination between providers.^(1, 12-16) Additionally, one report suggests community HIO's services may increase the time physicians have available to spend with patients, which might improve patient-physician interaction.⁽¹⁷⁾ In addition to patient specific benefits, through aggregation of data, community HIOs can improve population and public health for the communities they serve. Working with public health, community HIOs can monitor populations for disease outbreaks or potential adverse drug events.^(18, 19) Likewise working with health services researchers, efforts can measure performance, costs and utilization for the community.⁽²⁰⁾

We know much about the history of community HIOs, their objectives, financing, technological issues and governance,⁽²¹⁾ but ironically we are fairly ignorant concerning one of their defining characteristics: geographical coverage. While defining what area is included in community HIO efforts is a historically tricky problem,⁽²⁰⁾ health information exchange and geography are still inextricably linked. The Office of the National Coordinator,⁽¹⁾ the Healthcare Information & Management System Society (HIMSS),⁽²²⁾ researchers,⁽⁵⁾ and AHRQ⁽²³⁾ all identify the restriction of exchange activities to a defined geographical area or community as a key feature of community HIOs. Furthermore, the names of current community HIO efforts (i.e. regional & local) and their predecessors, Community Health Management Information Systems and Community Health Information Networks, reinforces this geographical component as does the Office of the National Coordinator's State Health Information Exchange Cooperative Agreement Program.⁽²⁴⁾

While the idea of a geographically defined exchange service area is apparently straightforward, it is actually fraught with complications in terms of conceptual clarity and accuracy. HIMSS recognizes local community, region (multiple states), states, and areas within states each as valid geographical description;⁽²⁵⁾ the eHealthInitiative annual survey includes: county, multi-county, state, metro, and city levels. Some of these geographies are nondescript, providing observers with little information concerning the scale and scope of efforts, or they are open to wide variation in definition in different areas of the country. Second, the geography community HIOs have chosen to define as their area of exchange service may not accurately represent the full extent of their data stewardship activities. While self-reported definitions may imply that activities stop at city limits or county lines, patients do not respect politically contrived borders. Patients seek care in different cities, counties, and even states,⁽²⁶⁾ therefore the actual area served by any one community HIO may be much different than advertised. Health information exchange facilitating efforts

ostensibly operating within one state may find that it serves patients from other states and we know multi-state HIO efforts exist.^(27, 28) Likewise, city-based community HIOs may include data from a larger metropolitan or even regional populations included in another community HIO's efforts. In the US, 58 metropolitan and micropolitan areas cross state borders.⁽²⁹⁾ Thirdly, examples of geographically adjacent or even overlapping exchange efforts exist in places like New York City and other cities like Houston and Austin have seen more than one exchange effort launched.

While geography is a key organizing principle for community HIOs in the US, we don't actually know the extent of the health information exchange coverage offered by community HIOs across the country. This not simply an interesting anomaly, but questions whether geography is serving as an effective organizing principle or what challenges are created by a geography-based approach to health information exchange.

METHODS

This final report summarizes three distinct, but related geographical and qualitative investigations. Geographical information systems (GIS) analyses and methods were utilized to identify and quantify the extent of community HIO activity in the US. A qualitative GIS analysis built on these findings to explore how health care organizations and policy makers defined community HIO market areas. Finally, a qualitative analysis compared the barriers and enablers of a community HIO strategy with a non-geographically based health information exchange strategy – enterprise health information exchange (HIE).

DATA

A comprehensive inventory of operational community HIOs in the continental US was derived from existing HIO tracking surveys, lists of organizations facilitating health information exchange, lists of entities funded by the ONC's State Health Information Exchange Grant Program, and primary data collection from publicly available websites. The sample only included community HIOs, defined as those organizations receiving public funding and operating with a goal of facilitating health information exchange services for all health care organizations within a geographic area (e.g. "public exchanges," "local exchanges," regional health information organizations, and state-level HIOs that facilitated exchange directly among providers). Decisions regarding community HIO inclusion were made in conjunction with Healthcare Information & Management Systems Society staff who work with community HIOs on operations and policy nationwide.

Trained masters-level students reviewed each community HIO's publicly available webpages, annual reports, and/or grant applications and abstracted information on self-reported service areas and participating organizations using a common template. Community HIOs self-reported geographic service areas were classified as regional or state (including multi-state) level.⁽³⁰⁾

Crowd sourcing served as the face validation method. A dynamic, interactive, publicly accessible, online map allowed visitors to view each community HIO's self-reported service area and participation statistics, and contained instructions for providing confidential feedback (on corrections or additions). Announced via relevant listservs,

organizations, and conferences, the public comment period ran for 45 days. An archived version of the website is available at <http://pages.iu.edu/~joshvest/archive/index.html>.

GEOGRAPHICAL INFORMATION SYSTEMS ANALYSES OF COMMUNITY HIOs

First, we mapped each community HIO's self-reported service area. Next, a series of GIS overlay analyses of these self-reported service areas determined the occurrence overlapping efforts. Second, we created an alternative definition of a service area based on patient care patterns as defined in the Hospital Service Areas (HSAs) associated with each participating hospital.⁽³¹⁾ We aggregated the individual HSAs associated with the participating hospitals into a total geographic market served by the community HIO. This approach defines HIOs' service areas as the geographic market areas served by the participating hospitals. GIS overlay analyses compared these alternative market-based service area geographies to the community HIOs' self-reported service areas.⁽³²⁾

QUALITATIVE GIS

We interviewed 42 policy makers, community HIO leaders and health care executives from 3 states (NY, TX, ME). The sample represented experiences with 6 different community HIOs and 20 different health care organizations and government agencies. Interviewees were purposefully selected to represent both rural and urban markets as well as community HIOs serving both local regions and entire states. Interviews followed a semi-structured format supplemented with state and/ or local maps of each community HIO's self-reported market area. The maps were used to record interviewees' perceptions of the care patterns of patients at their organizations, visualizations of their local health care market areas, attributes of the local health care environment (e.g. competition among providers) and views of how their respective community HIO's reported service areas related to actual market areas. Interviews were conducted both in person and over the telephone. In person interviews used paper maps and telephone interviews were supplemented with an online whiteboard application to facilitate discussions and geographical mark up. Interviews averaged 52 minutes.

Data analysis followed a general, inductive approach and identified 5 categories of themes: market area determinants, challenges with market area definition, market area benefits, and views on geographically defined market areas. Maps were annotated with specific comments and interviewees' markings and notations to create overall summaries of geographically related factors and influence.⁽³³⁾

QUALITATIVE ANALYSIS OF COMMUNITY HIOs AND ENTERPRISE HIEs

We interviewed 40 policy makers, community and enterprise HIE leaders, and health care executives in New York and Texas. We selected these two states because of their multiplicity of community HIO and enterprise HIE efforts and diverse geographical health care markets. The sample represented 19 different entities. The community HIOs had robust hospital and outpatient provider participation in their markets. Four of the 7 health systems represented were pursuing enterprise HIE. Interviews followed a semi-structured format and covered: health information exchange activity; benefits/challenges of different approaches; market characteristics, and perceptions of impact/effectiveness of different approaches. Language was tailored to match the interviewee's organizational association and each topic was introduced in a neutral manner. Analysis followed an

iterative, general inductive and comparative approach. To describe the barriers and enablers of each approach to health information exchange, we used weighted frequency lists expressed as cloud tags.^(34, 35)

RESULTS

GEOGRAPHICAL INFORMATION SYSTEMS ANALYSES OF COMMUNITY HIOs

Community HIOs' self-reported services areas did not match well with the actual health care markets served by their participating hospitals. Actual market areas served were generally smaller than reported services areas, but at the same time actual markets increased the number of states in which community HIOs operated. Overall, community HIOs appear to be inefficiently distributed across the country. Parts of the US have multiple, overlapping community HIOs, while others do not have any providing health information exchange services. In markets served by multiple community HIOs, 45% of hospitals were participants of only one HIO.

The current geography of community HIO activity does not provide comprehensive patient information to providers, nor community-wide information for public health agencies. The discord between the self-reported and market geography of community HIOs raises concerns about the potential effectiveness of health information exchange, illustrates the limitations of geography as an organizing principle, and indicates operational challenges facing those leading and working with community HIOs.

QUALITATIVE GIS

Community HIOs service areas were often an aggregation of their participants' own health care market areas shaped by political factors, such as the requirements associated with grant funding, as well as a desire for local autonomy. Over time, market areas were redefined by the inclusion of new community partners. Interviewees suggested the idea of a definitive geographic market area might be difficult to establish. Examples of the annotated maps are provided as Figures 1 and 2.

A definable geographic market area is a longstanding feature of US community HIO efforts, but the emphasis on a definable geographic area for community HIOs was decreasing among interviewees. As institutional influences decline (e.g. with the expiration of public funding there was a lessening of importance on reaching geographically set milestones or reporting geographically based measures), community HIO service area may be more influenced by the inter-organizational relationships between participating organizations, such as desired trading partners and competition, and entrepreneurial activities. Importantly, patient care patterns did not always reflect market service areas indicating the need for inter-community HIO connectivity.

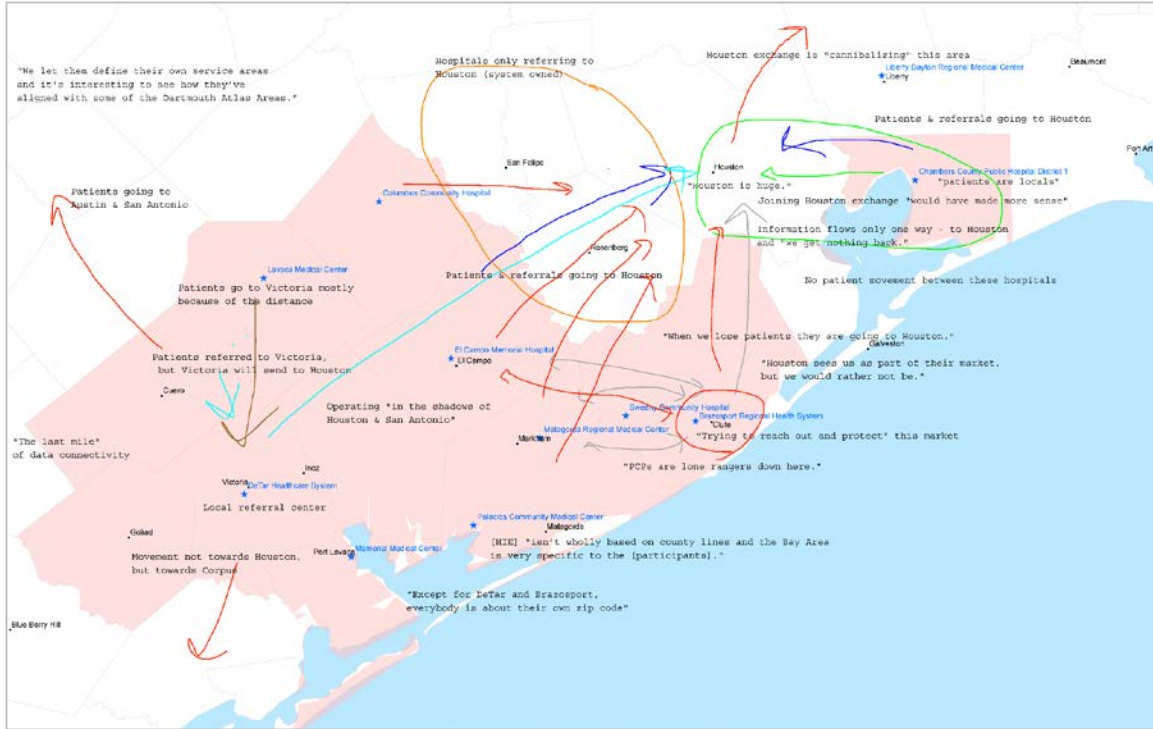


Figure 1. Composite commentary on market served by a Texas community health information organization.

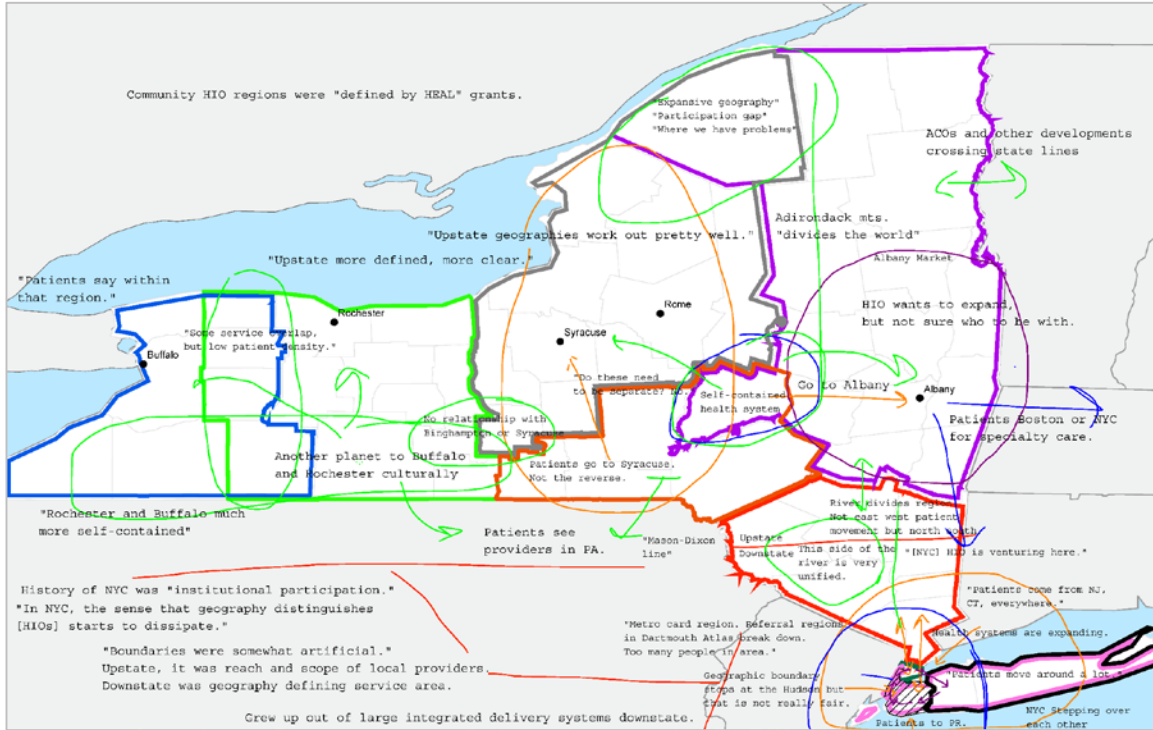


Figure 2. Composite commentary on community health information organization service areas in New York State.

QUALITATIVE ANALYSIS OF COMMUNITY HIOs AND ENTERPRISE HIEs

Importantly, interviewees provided easy to understand and measurable definitions of enterprise HIE and community HIOs. Based on the thematic analysis of health care, health policy, and health information exchange leaders, enterprise HIE can be defined as a strategy for sophisticated health systems to pursue population health and new reimbursement opportunities with their desired trading partners by leveraging their own rich, aggregated clinical information and technology. In contrast, a community HIO is a collaborative method, with elements of a public or community good, for obtaining patient information from the broadest set of providers in response to patient care patterns and increased expectations to share information. Community HIOs and enterprise HIEs both support aggregating clinical data and following patients across settings.

Health care providers do not face an either/or decision with community HIO and enterprise HIE. The two organizational approaches can be complementary and can fit together as part of a broader strategy to obtain and manage patient information. However, community HIOs and enterprise HIEs are competing for finite organizational resources like time, skilled staff, and money. Additionally, both approaches are competing for providers' attention and participation. However, both face challenges due to vendor costs and less-than-interoperable technology. Health policy might aim to encourage the types of widespread health information exchange embraced by the community HIO model, but the business case for enterprise HIE appears to be much stronger. The sustainability of the community HIOs, a potential public good, may necessitate ongoing public funding and supporting regulation.

OVERALL FINDINGS

Historically, geography has been a longstanding feature of health information exchange activity in the US. These series of studies documented the geographical extent of health information exchange services offered by community HIOs in the US using both self-reported measures and a novel, market-based definition. The results indicate that exchange geography is complicated and possibly not an effective organizing principle. Qualitatively, these series of study found that the role of geography is changing and becoming less important over time.

LIST OF PUBLICATIONS AND PRODUCTS

Vest JR. Geography of community health information organization activity in the US: implications for the effectiveness of health information exchange. *Health Care Management Review*. in press.

Vest JR, Kash B. Differing strategies to meet information sharing needs: the publicly supported community health information exchange versus health systems' enterprise health information exchanges. *Milbank Mem Fund Q*. in press.

Vest JR. Defining Community Health Information Organization Market Area: A Qualitative Geographical Information Systems Analysis. *AcademyHealth 2015 Annual Research Meeting*; Minneapolis, MN. June 14-16, 2015.

Vest JR, Kash B. Enterprise Health Information Exchange: Motivations & Strategies. *AcademyHealth 2015 Annual Research Meeting*; Minneapolis, MN. June 14-16, 2015

REFERENCES

1. The National Alliance for Health Information Technology. Report to the Office of the National Coordinator for Health Information Technology on Defining Key Health Information Technology Terms: Department of Health & Human Services; 2008 [updated April 28, 2008March 3 2010]. Available from: http://healthit.hhs.gov/portal/server.pt?open=18&objID=848133&parentname=CommunityPage&parentid=5&mode=2&in_hi_userid=10741&cached=true.
2. Middleton B, Fleming M, Wiegand T, Merritt D, Bakalar R, Georgiou A, et al. Best Practices for Community Health Information Exchange Center for Community Health Leadership, 2007.
3. eHealth Initiative. Emerging trends and issues in Health Information Exchange: select findings from eHealth Initiative Foundation's second annual survey of state, regional and community-based Health Information Exchange initiatives and organizations. Washington, DC: Foundation for eHealth Initiative, 2005.
4. eHealth Initiative. Results of 2009 Survey on Health Information Exchange Washington, DC2009 [cited 2009 Aug 21]. Available from: <http://www.ehealthinitiative.org/HIESurvey/>.
5. Adler-Milstein J, Bates DW, Jha AK. U.S. Regional Health Information Organizations: Progress And Challenges. *Health Aff.* 2009;28(2):483-92.
6. Kern LM, Kaushal R. Health information technology and health information exchange in New York State: New initiatives in implementation and evaluation. *Journal of Biomedical Informatics.* 2007;40(6, Supplement):S17-S20.
7. Solomon MR. Regional health information organizations: a vehicle for transforming health care delivery? *J Med Syst.* 2007;31(1):35-47.
8. Brailer DJ. Interoperability: The Key To The Future Health Care System. *Health Aff.* 2005;24:w19-21.
9. Hripcsak G, Kaushal R, Johnson KB, Ash JS, Bates DW, Block R, et al. The United Hospital Fund meeting on evaluating health information exchange. *Journal of Biomedical Informatics.* 2007;40(6 S1):S3-S10.
10. Institute of Medicine. *Crossing the Quality Chasm: a new health system for the 21st century.* Washington, D.C.: National Academy Press; 2001.
11. Bieszk N, Patel R, Heaberlin A, Wlasuk K, Zarowitz B. Detection of medication nonadherence through review of pharmacy claims data. *American Journal of Health-System Pharmacy.* 2003;60(4):36-366.
12. Burton LC, Anderson GF, Kues IW. Using electronic health records to help coordinate care. *Milbank Q.* 2004;82(3):457-81.
13. Branger P, van't Hooft A, van der Wouden HC. Coordinating shared care using electronic data interchange. *Medinfo.* 1995;8 Pt 2:1669.
14. Kaelber DC, Bates DW. Health information exchange and patient safety. *Journal of Biomedical Informatics.* 2007;40(6, Supplement 1):S40-S5.
15. Bodenheimer T. Coordinating Care -- A Perilous Journey through the Health Care System. *N Engl J Med.* 2008;358(10):1064-71.
16. Department of Health & Human Services. *The ONC-Coordinated Federal Health IT Strategic Plan: 2008-2012.* Washington, DC: 2008.

17. Biondich PG, Grannis SJ. The Indiana Network for Patient Care: an integrated clinical information system infomed by over thirty years of experience. *J Public Health Management Practice*. 2004;November(Suppl):S81-S6.
18. de Brantes F, Emery D, Overhage J, Glaser J, Marchibroda J. The potential of HIEs as infomediaries. *Journal of Healthcare Information Management*. 2007;21(1):69-75.
19. Livingood WC, Coughlin S, Remo R. *Public Health & Health Information Exchange: a guide to local agency leadership*. Decatur, GA: The Public Health Informatics Institute, 2009.
20. Rubin RD. The Community Health Information Movement: Where it's been, where it's going. In: O'Carroll PW, Yasnoff WA, Ward ME, Ripp LH, Martin EL, editors. *Public Health Informatics & Information Systems*. New York: Springer; 2003.
21. Vest J, Gamm LD. Health information exchange: persistant challenges & new strategies. *Journal of the American Medical Informatics Association*. 2010;17(3):288-94.
22. Healthcare Information & Management Systems Society. RHIO / HIE: Definitions & Acronyms 2008 [cited 2008 July 3]. Available from: http://www.himss.org/content/files/RHIO_Definitions_Acronyms.pdf.
23. Agency for Healthcare Research & Quality. Health Information Exchange Rockville, MD2009 [cited 2009 Feb 13 2009]. Available from: http://healthit.ahrq.gov/portal/server.pt?open=514&objID=5554&mode=2&holderDisplayURL=http://prodportallb.ahrq.gov:7087/publishedcontent/publish/communities/k_o/knowledge_library/key_topics/health_briefing_01232006093812/health_information_exchange.html
24. US Department of Health & Human Services. State Health Information Exchange Cooperative Agreement Program 2013 [21 Feb 2013]. Available from: <http://www.healthit.gov/policy-researchers-implementers/state-health-information-exchange>.
25. Healthcare Information & Management Systems Society. Health Information Exchanges: Similarities and Differences. HIMSS HIE Common Practices Survey Results White Paper Chicago, IL: 2009.
26. The Center for the Evaluative Clinical Sciences, Dartmouth Medical School, . The Dartmouth Atlas of Health Care. Chicago, Il: American Hospital Association; 1996.
27. Lewis and Clark Information Exchange. What is LACIE? 2010. Available from: <http://www.lacie-hie.com/>.
28. Business Wire. Tri-Cities Healthcare Community Selects Care Data Exchange from CareScience for Clinical Data Sharing Solution 2004. Available from: <http://www.businesswire.com/news/home/20040811005102/en/Tri-Cities-Healthcare-Community-Selects-Care-Data-Exchange>.
29. Office of Management & Budget. Update of Statistical Area Definitions and Guidance on Their Uses 2008. Available from: <http://www.whitehouse.gov/sites/default/files/omb/assets/omb/bulletins/fy2009/09-01.pdf>.
30. NORC. Evaluation of the State Health Information Exchange Cooperative Agreement Program: Early Findings from a Review of Twenty-Seven States. Bethesda, MD: 2012.
31. The Trustees of Dartmouth College. The Dartmouth Atlas of Health Care: Research Methods 2014 [02 SEP 2014]. Available from: <http://www.dartmouthatlas.org/tools/faq/researchmethods.aspx>.

32. Vest J. Geography of community health information organization activity in the US: implications for the effectiveness of health information exchange. *Health Care Management Review*. in press.
33. Vest J. Defining Community Health Information Organization Market Area: A Qualitative Geographical Information Systems Analysis. *AcademyHealth 2015 Annual Research Meeting*; Minneapolis, MN. June 14-16, 2015.
34. Vest J, Kash B. Differing strategies to meet information sharing needs: the publicly supported community health information exchange versus health systems' enterprise health information exchanges. *Milbank Mem Fund Q*. in press.
35. Vest J, Kash B. Enterprise Health Information Exchange: Motivations & Strategies. *AcademyHealth 2015 Annual Research Meeting*; Minneapolis, MN. June 14-16, 2015.