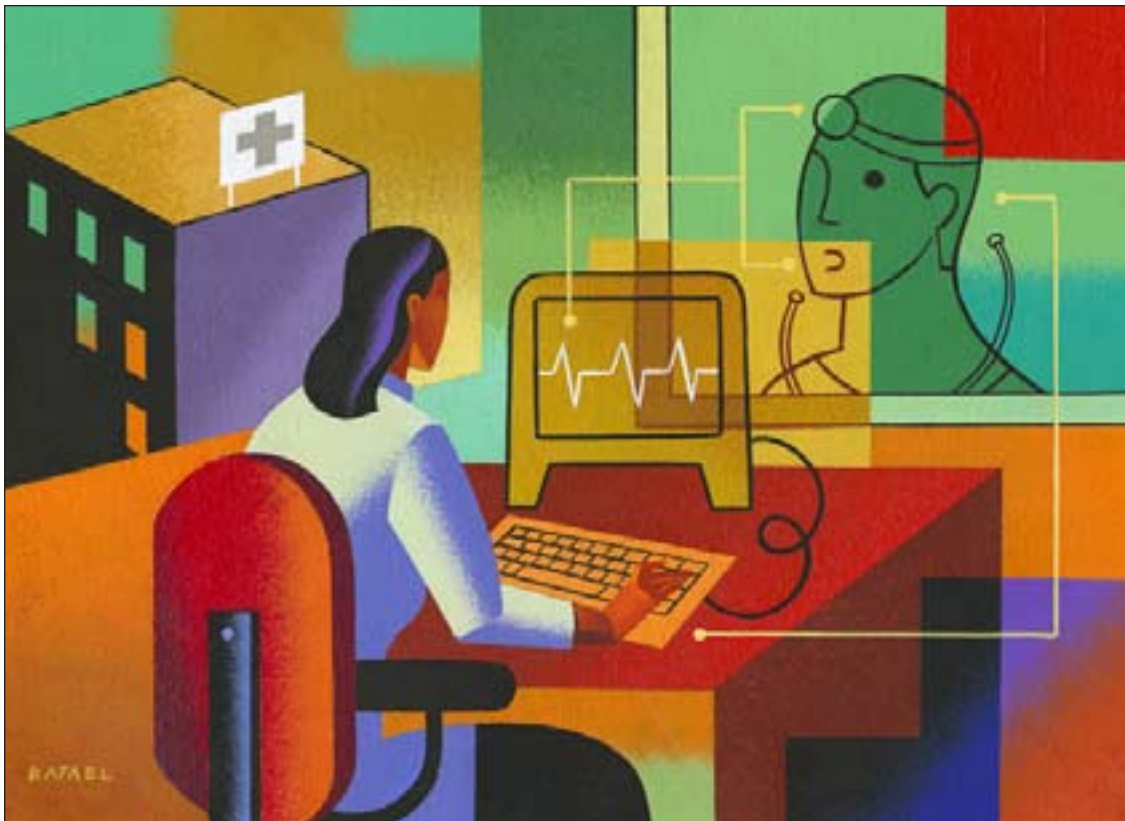




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The Santa Barbara County Care Data Exchange: Lessons Learned

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by

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About the Foundation

The **California HealthCare Foundation**, based in Oakland, is an independent philanthropy committed to improving California's health care delivery and financing systems. Formed in 1996, our goal is to ensure that all Californians have access to affordable, quality health care. For more information about CHCF, visit us online at www.chcf.org.

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I. Executive Summary

THE SANTA BARBARA COUNTY CARE DATA EXCHANGE (SBCCDE) was once one of the most ambitious and publicized efforts to develop health information exchange in the United States, and was considered a model for emerging regional health information organizations (RHIOs) elsewhere. Nearly eight years after its inception, and several months after providing some data to clinical end-users, the SBCCDE ceased operations. Although the venture had developed a peer-to-peer technology infrastructure that enabled authorized physicians, health care organizations, and consumers in the region to access some electronic patient information securely via the Internet, the once-promising exchange was unable to overcome major hurdles and thrive.

This case study looks at the history of Santa Barbara's RHIO and why it was not successful. It also presents lessons learned from that experience, briefly describes two other exchanges that have been more successful, and discusses the policy implications for nascent RHIOs elsewhere. Reasons why the project did not succeed include the lack of a compelling business case, distorted economic incentives, passive leadership among participants, vendor limitations and software delays, and, due to a variety of factors, the venture's poor momentum and credibility.

II. Introduction

THE SANTA BARBARA COUNTY CARE DATA EXCHANGE (SBCCDE), a regional initiative for securely sharing electronic clinical data among physicians, hospitals, ancillary centers, and consumers, was once one of the most ambitious and publicized health information exchange ventures in the United States. It brought together community health care organizations in a public–private partnership to improve the efficiency and quality of health care delivery. Many people considered it a model for other emerging regional health information organizations (RHIOs).

Yet in December 2006, almost eight years after the SBCCDE began, its board of directors voted to shut down operations, even though the RHIO, after many delays, had finally finished building a basic infrastructure and had started to provide data to clinical end-users.

This report reviews the history of the SBCCDE, explains what went wrong, presents lessons learned, describes two functioning RHIOs (in Indiana and Washington state) for comparison purposes, and discusses the policy implications for other nascent RHIOs.

Methodology

The authors interviewed more than 40 managers and staff who were key participants in the SBCCDE, as well as leaders at two functioning RHIOs in Indiana and Spokane, Washington. The authors' analysis is based on these interviews, project progress reports, other SBCCDE and California HealthCare Foundation documents, and presentations and articles about the exchange and RHIOs in Indiana, Spokane, and elsewhere. They used standard techniques in case study research to identify themes that emerged.¹

III. Background

SANTA BARBARA COUNTY, LOCATED ABOUT 80 MILES north of Los Angeles, had a population of 400,000 in 2000. Its three main cities—Santa Barbara (population 92,000), Santa Maria (77,000), and Lompoc (41,000)—are adjacent to smaller cities, towns, or unincorporated areas. The three cities are geographically separate enough to have relatively self-contained health care systems, with one dominant hospital or hospital system in each: the 600-bed Cottage Health System in Santa Barbara and nearby Goleta, the 125-bed Marian Medical Center (part of the Catholic Healthcare West hospital system) in Santa Maria, and the 60-bed Lompoc District Hospital in Lompoc.

In SBCCDE's history, there were three main periods between late 1998 and the fall of 2005: organizing and planning, technology concept development and prototyping, and technical revamping. The primary constraints on progress arose in the second and third periods, and were related to technology. After September 2005, community business decision-making, rather than technology, became the chief hurdle.

Early Evolution (LATE 1998–SUMMER 1999)

Key organizations came together when the medical director of the Santa Barbara Regional Health Authority, a county-sponsored Medicaid health plan, sought funding opportunities from the California HealthCare Foundation (CHCF), including funding for health information technology. CHCF and the authority discussed a wide range of potential projects, as the Foundation was looking for innovative initiatives to complement others it supported in hopes of creating uniform health information exchange standards.²

Around that time, David Brailer, chief executive officer of Care Management Science (later CareScience, a company that provided software and services for care management, clinical analysis, and clinical quality improvement) and a faculty member at the University of Pennsylvania's Wharton School of Business, approached CHCF about a possible health information exchange demonstration project. Brailer had previously done research on community health information networks, or CHINs—regional organizations with centralized databases that formed in the mid-1980s, but whose promise faded after the early 1990s.³

SBCCDE Collaborators

- Santa Barbara Regional Health Authority
- Santa Barbara Department of Public Health
- Sansum–Santa Barbara Medical Foundation Clinic
- Cottage Health System
- Marian Medical Center/Catholic Healthcare West
- MidCoast IPA
- Lompoc District Hospital
- Santa Barbara Medical Society
- Pueblo Radiology
- Unilab Corporation
- University of California, Santa Barbara
- Veterans Health Administration
- CareScience (later Quovadx)
- California HealthCare Foundation

The Promise of Peer-to-Peer

Brailer and Sam Karp, then chief information officer at CHCF, were interested in applying “peer-to-peer” information technology to health information exchange. Napster, with its online file sharing and especially its song-sharing capabilities, had popularized peer-to-peer technology, reducing the need for expensive and complicated centralized data storage. Users could tap Napster’s meta-database of song titles and locations stored by song providers, who supplied songs directly to users’ computers via the Internet. This peer-to-peer concept influenced the SBCCDE architecture.

Brailer, Karp, and other proponents of health information exchange believed that because most health care is delivered locally, Internet-based and communitywide electronic health information exchange might improve the efficiency and quality of care if an authorized provider could go to a single Web portal to obtain data generated by *all* providers who had cared for a given patient. The alternatives then were to receive test results, progress notes, reports, and other patient information by mail or fax or from a dedicated lab-results printer, or to retrieve some of these data from multiple Web portals,

each requiring sign-on and a password, each with a different graphical user interface for navigation, and each providing data generated by that particular provider, not by all providers in the community who had cared for the patient.

Proponents of health information exchange argued that communitywide electronic exchange offered numerous potential benefits. Among these would be patient data that were more timely, legible, organized, and accessible and that could lay the foundation for, or improve, electronic lab and prescription ordering, reminders, lists of patients needing services, and performance reporting. Such exchange might also cut costs if it eliminated paper distribution of results, reduced the number of duplicate lab tests, and fostered more appropriate primary, specialty, and emergency room care, thus lowering health care use.

Exchange Deemed Feasible

In February 1999, after preliminary discussions, CHCF asked CareScience to study the feasibility of a health information exchange demonstration project in Santa Barbara County. Brailer and a team of consultants conducted more than 70 interviews to determine if community organizations could overcome competitive differences and work cooperatively on health information exchange, if technology existed to support such exchange, and if the necessary operational and governance structures could be built.

Brailer reported that a system of communitywide health information exchange was indeed feasible and that Santa Barbara County was a near-ideal community for a demonstration project. Interest and cooperation in Santa Barbara were sufficient, the operational and governance structures could be built, and sufficient off-the-shelf software was available to integrate health care information systems with peer-to-peer networking technologies, enabling regional health information exchange. Product, culture, workflow, and financial barriers appeared to be surmountable.

The exchange system prototype would reinvent the CHIN concept by relying on Internet technology instead of a central database, by credentialing the vendors of appropriate technology rather than dictating the use of particular products, and by establishing rules for a looser business coalition than the CHIN model.

Organizing and Planning

(FALL 1999–WINTER 2000)

In September 1999, CHCF awarded a \$10 million, three-year grant to CareScience and participating health care organizations in the Santa Barbara area for the Community-wide Health Information Demonstration Project, soon to be called the Santa Barbara County Care Data Exchange. The goal was to create a health information exchange model that would “use the full capability of the Internet to facilitate community information sharing, provide complementary products and services, and protect privacy and confidentiality,” and serve as “the benchmark site for future communities.”⁴

CHCF contracted with CareScience to serve as program manager. CareScience would disperse funds, organize the participants, set up and staff governance structures, certify that software vendors complied with standards, contract with vendors, and provide general technical oversight as well as “products and services that address key barriers to success” of the SBCCDE.⁴

Alliances and Governance

To encourage cooperation, CareScience established four Care Data Alliances—clusters of participating health care organizations with substantial clinical transactions among them. Each alliance had an anchor organization (see box on page 7).

The chief governance structure was the Care Data Exchange Council, which was comprised of high-level managers at participating health care organizations who met monthly. Each anchor organization had one voting seat. Top technical experts and clinical leaders on a technical advisory

committee and a clinical advisory committee also met monthly and advised the council, contributing their different perspectives. The council and committees convened for the first time in the fall of 1999.

Organizations in the four alliances were to receive more than half of the \$10 million grant to pay for the development of interfaces between the SBCCDE and their legacy data systems that had not been designed for Web use, and to help the organizations upgrade their computer infrastructure to be better able to participate in the SBCCDE. These funds were powerful financial inducements for key organizations to join the venture.

Technical Concept Development and Prototyping

(WINTER 2000–MID-2003)

Initially, CareScience believed it could acquire much of the technology it needed by purchasing “off-the-shelf” software or by contracting with technology vendors to adapt or evolve existing commercial products. CareScience certified whether a vendor’s products complied with recognized technical standards and could be integrated with legacy information systems, and whether a vendor was financially viable. Participating organizations were led to believe that the SBCCDE could be developed rapidly.

However, in the fall of 2000, during the product certification process, CareScience concluded that off-the-shelf software did not exist that would enable health information exchange to move forward as planned—in particular, that adapting existing “middleware” could not easily enable legacy health information systems to participate in a network system like the SBCCDE. This was a crucial reversal of CareScience’s initial findings. CHCF and CareScience subsequently agreed that CareScience should become the software developer and vendor for the project while also continuing as the project manager.

Alliance Anchors

As of late 1999, the SBCCDE comprised four alliances, or clusters of participants, each anchored by a health care organization. They were:

Sansum-Santa Barbara Medical Foundation Clinic, a large, multispecialty medical group with 125 physicians. Sansum received more than \$2 million in SBCCDE grant funds to develop health information exchange interfaces between it and the SBCCDE for lab, radiology, and notes, and to upgrade its clinical data storage hardware and other information technology infrastructure.

Sansum already had a great deal of ambulatory care data on its patients because the medical group was somewhat “closed”—that is, many patients received most of their primary and specialty care from within the medical group. Although it also already had an electronic lab interface with Unilab (which later merged with Quest Diagnostics), the SBCCDE offered the possibility of providing some new electronic ambulatory care data to Sansum.

Cottage Health System was Sansum’s most important alliance partner and the dominant hospital system in the local health care market. Its HealthVision Web portal gave most physicians in the Santa Barbara area substantial access to data in Cottage’s information systems.

The Santa Barbara Regional Health Authority, the first county Medicaid health plan in the nation and one of the few county-organized health entities in California. It served about 40,000 Medicaid beneficiaries through Sansum and a wide network of community health centers and solo physician or small group practices.

The regional health authority received about \$1.8 million in SBCCDE grant funds to develop interfaces between the exchange and the authority’s eligibility system. Separately, the authority aimed to create its own Web site so physicians could get eligibility, authorization, formulary, and claims-processing information.

Its main alliance partner was the Santa Barbara City Public Health Department, which agreed to create an interface for its lab system to the SBCCDE. Other partners included the Santa Barbara County Medical Society and community health centers in Santa Barbara.

The authority’s governance structure partly explains its role as a leader among community organizations. Its governing board consisted of representatives from the main provider organizations in Santa Barbara County, so decisions it made regarding the SBCCDE often reflected broad community interests rather than narrow organizational interests.

MidCoast Medical Care IPA, an independent practice association in Santa Maria with 24 primary care physicians and 35 specialists who served the enrollees of HMOs that contracted with it.

MidCoast IPA received \$160,000 in SBCCDE grant funds for interfaces to Unilab/Quest. Its primary care physicians and capitated specialists already had access to a Web site with information about HMO enrollees’ eligibility, benefits, and referrals. MidCoast IPA aimed to provide more clinical data directly to physicians, to prepare doctors for greater use of clinical information systems, and potentially to increase its physician profiling and feedback.

MidCoast IPA’s main alliance partners were Unilab/Quest and Marian Medical Center.

Lompoc District Hospital in Lompoc, the 60-bed community facility initially aimed to provide enhanced information system functions to local physicians, whose information technology capabilities and dependence on the hospital for information varied.

It received nearly \$700,000 in grant funds to develop lab, radiology, pharmacy, and notes interfaces to the SBCCDE. The funds also were to pay for purchase of information technology infrastructure and for a patient database that the hospital wanted to use for emergency care, preventive care, and other clinical and public health purposes.

Lompoc District Hospital’s alliance partners were physician groups in the Lompoc area, the local public health department, and local community clinics.

Concept Development and Prototyping

CareScience employees, supplemented by experts at Los Alamos Labs, Health Level Seven (HL7), and other organizations who had specific domain expertise, began developing the technical concepts for the SBCCDE in early 2001. By October of that year, prototyping of key software components (see sidebar) was well under way, although initial testing was confined to demographic data and lab results from only four participating organizations.

Prototyping proved to be slower and more difficult than anticipated. While the different software components were conceptually distinct, changes in any one of them typically required changes in the others. Because much of the prototyping took place through trial and error, many changes had to be made.

Connecting to Legacy Systems

Integrating SBCCDE software with the many different legacy systems that were not designed to be part of a network was especially challenging. By the end of 2001, CareScience realized that its initial solution—to develop individual data exchange interfaces directly between the SBCCDE and legacy system databases—required a major architectural change because connections between the information locator service, which identified the location of a patient's data, and source databases were not working properly.

CareScience's solution was to create a uniform clinical data repository for each organization; the repository integrated with the organization's legacy information systems, serving as an intermediary that continually imported and standardized data from those legacy systems, and sent data to SBCCDE users. Ultimately, the information locator service interacted with a layer of uniform, network-capable repositories. This greatly improved overall system performance, especially security. The new design also created a more stable and scalable system.

The SBCCDE's Software Components

- Identity correlation service, later called the master patient index. It indexed and stored patient-demographic and provider-identification data. The initial prototype was completed in March 2001.
- Information locator service. It identified the specific location of a patient's data. Originally designed to point directly to databases in the diverse, idiosyncratic legacy systems of participating organizations, the service eventually pointed to data locations in standardized clinical data repositories. A repository was created for each organization to integrate with its legacy systems; the repository continually imported and standardized data from those systems.
- Certificate management system, which identified system users.
- Access control services, which regulated data access. The clinical advisory committee and technical advisory committee developed the Facility/Patient Intersection Policy—rules for determining if providers were authorized to access a patient's data.
- Graphical user interface, which presented SBCCDE screens that data users viewed when accessing the system.
- Administrative and monitoring tools for auditing who used the system, when, and for which patients.

The clinical data repository approach meant that CareScience had to overhaul the existing data exchange interfaces, further delaying the project throughout 2002.

The Impact of Rising Costs

Costs mounted as CareScience changed the SBCCDE software architecture. The company's net investment (separate from the CHCF grant funds) ranged from \$5 million to \$11 million, interviewees estimated. Meanwhile, CareScience faced intense pressure from investors to improve its quarterly financial performance; since the company's initial public offering in mid-2000, which raised \$48 million, it had not been profitable.

According to some interviewees, ever-increasing software development costs contributed to CareScience's decision to begin, in early 2003, to restrict SBCCDE software development efforts and thereby conserve resources. The decision reflected a deepening split within CareScience. A group led by Brailer argued that the knowledge and technology resulting from development of a robust SBCCDE could enrich CareScience's existing offerings and eventually generate profits. But the prevailing group at CareScience wanted only to meet the essential requirements of the agreement with CHCF to achieve profitability sooner.

End-user testing proceeded fitfully, as some software components needed substantial improvement. The Santa Barbara County Public Health Department, which had done most of the initial end-user testing, became increasingly dismayed with the rudimentary state of the software. Mismatched data and duplicate patient records were among the data problems. Because testing was costly in terms of staff time, the health department eventually abandoned testing and participated less in the SBCCDE. News of the software problems circulated among exchange participants. These problems and the pattern of software development delays contributed to a growing sense of distrust between the Santa Barbara community and CareScience.

CareScience's financial woes and its negotiations with Quovadx to sell the company created what one interviewee called a "stagnant" software development period in mid-2003. Brailer, the charismatic SBCCDE champion, left CareScience in July 2003, citing differences with the firm's board over the direction of the company. Quovadx acquired CareScience in September 2003.

Technical Revamping

(FALL 2003–SEPTEMBER 2005)

By the time of the Quovadx acquisition, SBCCDE software had been prototyped, but it was not adequately efficient, effective, or scalable. Interfaces between each clinical data repository and a

participating organization's legacy systems, and between the data repository and the SBCCDE, needed to be more reliable. Quovadx used its integration engine expertise to revamp those interfaces, create a consistent database structure for the clinical database repositories across organizations, harmonize and standardize patient information, and develop filters to screen out confidential data.

Additionally, Quovadx had to establish "gold standard" monitoring of participants' information systems to ensure that the SBCCDE did not lose data when those systems were not online. Such monitoring also had to be able to distinguish between instances when there were no repository data for a patient and instances when data existed but local databases were not online.

Finally, issues regarding the usability of the graphical user interface surfaced in the fall of 2003 and prompted an interface redesign.

Development Still Slow

Due to the Quovadx purchase of CareScience, most software development efforts continued to lag until mid-2004, when full redevelopment of the clinical data repositories began—the third major revamping of interfaces between the SBCCDE system and the source systems. CareScience, with fewer staff, started full testing of the quality of data in the clinical data repositories in August 2004. It found that only 95 percent of the data were acceptable, so the CareScience team often had to customize interfaces between the repositories and the SBCCDE to eliminate errors.

CareScience completed all software development in September 2005.

Community Organization Decision-making

(BEFORE AND AFTER SEPTEMBER 2005)

From the beginning, SBCCDE participants had worked on business issues regarding health information exchange, including which data were to be exchanged or excluded, who would be

authorized to view data, who would be liable if data were improperly exchanged, and who should pay for information exchange after grant funding ended. Work on these issues and rules, and the level of participating organizations' activity in the SBCCDE, waxed and waned, depending on the project's technical progress, turnover of key persons and CareScience staff, and changes in participants' priorities.

In March 2004, the Santa Barbara participants created a new 501(c)(3), not-for-profit entity with a new board to carry on governance and administration. This legal entity had to revise or renew previous data-provider and data-user agreements, a slow and tedious process.

By September 2005, all participating organizations could transmit test data via the SBCCDE, but only two of them could transmit data to end-users. Vendor-related technology delays were no longer a chief constraint on the venture's progress and no longer a reason to put off making final business decisions about participants' liability risk and financial investment.

The Liability Hurdle

Liability emerged as a key hurdle that stifled progress. The SBCCDE not-for-profit entity needed three main agreements—with the vendor (the master agreement), the data providers (data provider agreements), and the data users (the user entity agreements)—to assign legal liability in case a lawsuit arose over data errors. The agreements would cover situations in which an organization sent the wrong data to the SBCCDE.

Liability-related disputes increased when testing showed that several data providers had sent confidential information to the exchange—including information about HIV patients and minors—thereby violating privacy laws. Community organizations did not want to be held individually liable for mistakes, while the not-for-profit SBCCDE entity argued that it was far too

small to shoulder all liability. The vendor, Quovadx, did not want to bear any liability.

Quovadx signed its agreement with the SBCCDE, but only four organizations—Cottage Health System, the Santa Barbara Regional Health Authority, the Sansum-Santa Barbara Medical Foundation Clinic, and Lompoc District Hospital—had signed data provider agreements as of fall 2006 and only two in Santa Barbara were supplying data for end-users. Quest Diagnostics, after two years of negotiations, as well as several other local data providers still had not signed agreements, although they were technically able to provide data.

Limited Data Exchange

By fall 2006, the SBCCDE had built and tested 28 interfaces to 10 types of data from eight participating organizations. The two organizations providing data to end-users at that point were Cottage Health System (lab results, clinical reports, radiology images and reports, and demographic data for hospital patients) and the Santa Barbara Regional Health Authority (pharmacy claims, eligibility information, referrals, authorizations, and demographic data regarding Medicaid HMO enrollees). Once data filters were in place, Sansum would be able to provide lab results, radiology images and reports, and demographic data, and Lompoc would be able to provide lab results, radiology reports, and demographic data. However, Sansum and Lompoc still had not installed all necessary data filters for sensitive data, and, consequently, were not supplying data.

Grants Run Out

As the SBCCDE exhausted its grant funding (the original CHCF grant, subsequent and smaller CHCF grants, and a 2005–06 grant from the Foundation for eHealth Initiative), participants could no longer postpone resolving the issue of “who would pay how much” for ongoing operations and the development of new services. According to one estimate, the SBCCDE needed about \$500,000 per

year to provide basic information exchange services such as patient data look-up.

In 2006, the Foundation for eHealth Initiative rescinded its grant funding—the SBCCDE’s primary funding source—citing the venture’s slow progress. SBCCDE leaders tried to raise funds from Santa Barbara participants and outside organizations, including CHCF, to pay for Quovadx services and for an executive director and several staff members to help operate the RHIO for at least a year. Although participants raised some money, it was not enough. The SBCCDE Board of Directors voted in December 2006 to cease exchange operations.

IV. Why Progress Was Slow

No Compelling Value Proposition

Lack of a compelling business case was the main chronic, underlying problem, although technology-related delays and CHCF's initial grant obscured this difficulty. For years, in the absence of SBCCDE technology, participating organizations did not know what the operating costs would be, what particular services the SBCCDE would provide, or what benefits they would reap. Nor could they find a proven business case for health information exchange services elsewhere, as only the Indianapolis area and a handful of other regions had functioning exchanges. Even in those cases, costs and benefits were not fully documented.

Unanswered Business Questions

Over time, CHCF prodded SBCCDE participants to confront the business case issue. Questions the Foundation asked in its November 2001 request for research proposals are still valid today:

As the project enters the last 12 months of implementation... the long-term future of the initiative—both locally and potentially in new markets—remains to be determined.

In general, exploration is needed on two fronts. First, who will benefit from the project in Santa Barbara and who should be expected to maintain it? Are there viable business models that would allow for the dissemination of this novel technology without requiring significant investments from third-party institutions? What will happen to the participating organizations in November 2002, when the three-year project is scheduled to finish and when Foundation obligations have been paid?

Second, what is the expected impact of the project in Santa Barbara from both a financial and quality of service perspective? What are the financial, operational, technical, and market factors that would predict successful diffusion of the SBCCDE technology? Are there other communities or markets that would benefit from using what has already been learned or developed in Santa Barbara?⁵

An intensive, CHCF-sponsored study by the consulting firm McKinsey & Company in early 2002 of the value of regional health information exchange made neither a favorable nor unfavorable business case specific to Santa Barbara. McKinsey reached this conclusion because its consultants did not know what technology the SBCCDE would use or how much the technology would cost, and they could not estimate clinical benefits.⁶ Rather, based on a simulation analysis, McKinsey concluded that, generally, as community size and the number of participating organizations in a RHIO increase, the value of information exchange would increase.

That was comforting for large communities with many competing health care organizations that participated in information exchange. But it was not good news for communities the size of Santa Barbara that were small and had few competitors.

Little Perceived Financial Value

Ironically, the same factors that made Santa Barbara County so attractive as a demonstration site—the simplicity of the market and a lack of intense, acrimonious competition among local health care organizations—made it more difficult to establish a business case for the SBCCDE.

In Santa Barbara County, patients tend to use local health care facilities, one hospital dominates in each city, and one lab dominates in the county, so providers could get a lot of patient information from a few Web portals that health care organizations themselves had developed. For example, in the city of Santa Barbara, most physicians could get much of the information they needed from the Cottage Hospital and Quest Diagnostics portals, although not data generated by other physicians. Most organizations that already were providing data had reaped potential savings from lower paper-handling costs by having physicians log in to their Web portals. This reduced the SBCCDE's potential pay-off.

By the time the SBCCDE ceased operations, few professionals were using it because they could only view data from the two organizations that provided information through the SBCCDE. Failure to conclude an agreement with Quest Diagnostics, the dominant lab, was pivotal because physicians had expressed substantial interest in using the SBCCDE to see all lab results for a patient, regardless of which doctor had ordered a test for that patient.

In interviews in 2006, managers at health care organizations in Santa Barbara County bluntly assessed the potential near-term value of the SBCCDE. For example, a Cottage Health System interviewee said Cottage had participated because it was the “right thing to do” for the community and inexpensive up to that point, not because the SBCCDE generated financial value. A representative of the Santa Barbara Regional Health Authority made similar statements.

The SBCCDE did not have much financial value for Sansum and MidCoast IPA, according to their representatives, in part because physicians already could see electronic data about their patients from within each of the two organizations' relatively closed patient care systems.

In addition, some interviewees said they believed that SBCCDE-related benefits would accrue to stakeholders that had not funded the RHIO. Health plans might reap savings at the expense of providers, as physicians would order fewer duplicate tests or procedures and thereby create a business disincentive for physicians and hospitals to participate in the exchange; solo practitioners and physicians in small medical groups would gain access to electronic data that doctors in larger practices already could access; and patients might benefit from providers having better patient data. Health plans, solo practitioners, and those in small group practices were not contributing to the SBCCDE. Nor were patients.

For participants, the lack of three things elevated the importance of liability and funding issues,

which became major obstacles: no compelling short-term financial value proposition, no clear vision of favorable long-term value propositions, and no dominant player to shoulder the SBCCDE's cost regardless of short-term value. Participants were reluctant to assume the risk of a large financial loss resulting from a lawsuit over the exchange of wrong data, even though such a loss was highly unlikely, and they were reluctant to invest more resources, if there was not a good chance they would realize a sizable financial gain.

Foundation Grant Funding Distorted Economic Incentives

By partially funding the demonstration, CHCF served as a social venture capitalist, undertaking a project that had substantial financial risk but also offered potential pay-offs for health care quality and efficiency. The Foundation believed that a separate entity like itself should pay for some SBCCDE development costs because a successful health information exchange prototype would produce important benefits that would not accrue to private Santa Barbara investors, such as more communities implementing RHIOs sooner.

“Moral Hazard”

Like other agencies that fund demonstration projects, CHCF inevitably distorted participants' economic incentives and behavior by creating a “moral hazard,” a situation in which consumption, production, and risk-taking increase as a result of below-market prices to buyers and/or sellers. The grant funding that SBCCDE participants received for their own information system projects spurred them to participate in the exchange, regardless of whether or not they were enthusiastic about the SBCCDE, optimistic about its eventual success, or believed there was a strong business case for it.

And CareScience invested more in health information exchange than it otherwise would have. One interviewee commented that foundation money had “polluted” the process.

In effect, too little initial risk (moral hazard) helped create too much risk later on, slowing progress. Although CHCF was willing to assume much financial risk to get local organizations and CareScience to participate, the Foundation still needed them to invest in the project eventually. However, when external funds and subsidized prices were ending, participants found themselves facing more risk than they were willing or able to bear, absent a clear value proposition.

Passive Community Leadership

CHCF and CareScience were the key drivers and the most eager participants in the SBCCDE. They assumed that community leadership would grow over time and strengthen the effort.

But CHCF's largesse and CareScience's expertise engendered relatively passive community participation. SBCCDE technology, governance, and administrative structures; expertise; business cases; and momentum arose externally, not “organically” at the local level. CareScience had the most decision-making authority; it served as the program manager, software vendor, governance organizer, and often the public face and champion of the project. Participants did not have enough interest in the SBCCDE or financial “skin in the game” to counterbalance and provide a reality check for CareScience's assumptions and decisions.

Vendor Limitations

CareScience wrongly believed that assembling or adapting off-the-shelf software for exchange purposes would be relatively easy. When this effort failed, it also mistakenly believed it could develop the necessary software on a fixed budget, despite the many technological and cost unknowns. Furthermore, because the company, as program manager, was supposed to oversee the work of all software vendors (including itself), there was no independent, overall technical evaluation of the limitations of CareScience's own software until the McKinsey study in 2002, and no independent, day-to-day technical oversight until September 2003.

CareScience encountered other difficulties as well. Its additional, unanticipated investments in the SBCCDE put financial strain on the small, publicly traded, for-profit firm. As it struggled to develop the software, CareScience consistently promised more than it could deliver. That, along with the mounting delays and vendors' exaggerated claims in national forums about the state of SBCCDE functioning, increasingly disillusioned participants. Substantial turnover among CareScience staff exacerbated problems by disrupting the continuity needed to develop the technology and manage relationships with participants. Some interviewees argued that another, larger firm with more resources could have done a quicker and less expensive job.

Poor Momentum and Credibility

Successful projects require positive momentum. The SBCCDE's seemingly endless delays dulled interest

among managers at participating organizations who had many other, more pressing priorities. Delays created doubts about the credibility of the RHIO and dimmed the vision of what it could become. Delays also prevented it from evolving by means of constant service improvement and service innovation, which could have generated optimism among participants about more robust, useful, and valuable services over time.

Comparatively Few Services Were Included

The SBCCDE was relatively modest compared to RHIOs elsewhere, especially the Indiana Network for Patient Care and the related Indiana Health Information Exchange (see box below).

Exchanges in Indiana and Washington State

RHIOs in Indiana and Washington state provide perspective on Santa Barbara's efforts. Despite many announcements about the formation of RHIOs, relatively few actually exchange data.⁷

The Indiana Network for Patient Care and the Indiana Health Information Exchange*

The Indiana Network for Patient Care (INPC), a clinical data exchange network in the Indianapolis area, grew out of years of medical informatics research and development at the Regenstrief Institute. Wishard Memorial Hospital in Indianapolis had used the Regenstrief Medical Record System since 1972, and Clarian Health Partners subsequently used it, too. After 2002, several other hospital systems, the local county health department, the State Department of Health, Medicare, Medicaid, commercial health plans, and RxHub all provided data to INPC.⁸

Virtually any physician in central Indiana—and an increasing number elsewhere in the state—can access a patient's INPC data from many sources if there is evidence of a provider-patient relationship and some eligible triggering event, such as recent delivery of a lab-results message for that patient. Inpatient use is extensive; a relatively small but growing number of ambulatory physician practices access the system as well. Patient summaries contain "normalized" data. The INPC reports data-quality problems to organizations that provide the information.

Other INPC services include biosurveillance and outbreak detection—through real-time capture of chief complaint information from hospital emergency rooms—and biomedical research.^{8,9}

The Indiana Health Information Exchange (IHIE), a RHIO that includes most major health care organizations in central Indiana, provides some INPC-developed services to its participants. An acceptable IHIE service must have a business rationale—that is, community organizations are willing to pay the marginal cost (including the cost of ongoing infrastructure) of providing it. The not-for-profit RHIO currently offers clinical report messaging whereby a physician can get electronic reports—for example, lab results and dictation—that he has ordered or authored, or as a "copy to" recipient. Technical support is included in these services.

Exchanges in Indiana and Washington State, *continued*

A critical mass of data providers in Indiana has enabled the Regenstrief Institute to develop a new generation of clinical quality services; IHIE will provide only those services whose marginal costs are covered by subscription fees. Potential future services include provider performance reporting across multiple payers (tied to pay for performance incentives) and lists of, and point-of-care reminders for, patients who need services. (The Regenstrief Institute created both the INPC and the IHIE. The INPC developed health information exchange infrastructure and services, and it has used grants to pay for the development costs, which private health care organizations are typically unwilling to pay. The IHIE then adopts only those exchange services its participants want and that can be profitable—that is, participating organizations pay the marginal cost of these services.)

The usefulness of the Indianapolis system will increase as more practices implement ambulatory care electronic health records (EHRs), integrate Health Level Seven (HL7) messages into their EHRs, and provide ambulatory care scheduling and EHR data to the system. (HL7 is a structured protocol for communications between health care applications.)

The Northwest Regional Health Information Organization

This RHIO was created in 2005 as a governance structure for already existing health information exchange. Such exchange was a byproduct of years of collaboration among hospitals in the area around Spokane, Washington, that belonged to two health systems: Empire Health Services and Providence Health System.

In the late 1990s, the hospitals agreed to contract with jointly owned Inland Northwest Health Services to implement and provide support services for one common EHR system (Meditech). Subsequently, Inland Northwest provided services to hospitals within a 200-mile radius of Spokane and became an EHR application service provider to some physician practices.

This system, which underlies the Northwest RHIO, and its database enables physicians to view hospital information about any patient registered for an inpatient or outpatient hospital service. Eventually, they could also view ambulatory care lab results from the dominant area reference lab about patients at Providence Health System (but not those at Empire Health Services). The dominant radiology firm also provides images and result notes.

Inland Northwest provides simply formatted data files to some of its EHR users; physician practices are responsible for correctly importing data into the EHRs.

Santa Barbara County's exchange aimed initially to enable minimal viewing of information, mostly of hospital, Medicaid eligibility, and limited outpatient data.

prescriptions. Nor could they import data into EHRs, let alone obtain the kind of more advanced exchange services that increasingly were available in Indiana.

However, participants already could access much of the same information online at a handful of portals (although a physician who ordered a test could view only those results, not the results of tests other physicians may have ordered).

Moreover, SBCCDE participants initially were unable to access data not already online, such as information regarding a patient's health plan, Medicare eligibility, health care encounters, or

V. Project Outcomes

THE SBCCDE ONLY PARTIALLY MET ITS MAIN GOAL OF becoming a lab for RHIO innovation, and therefore is unlikely to serve as a model for other exchanges. Without a fully operational exchange network, participants and staff could not learn by doing. Nor could they incrementally evolve the RHIO so that it might increasingly offer useful data and services. Its shutdown was especially unfortunate because it finally had created the infrastructure and agreements for exchanging some data and had tested the exchange of more data.

Nevertheless, the demonstration project did produce some beneficial byproducts, including:

- **A higher profile for RHIOs.** Touted in public meetings as a leader in health information exchange, the widely publicized SBCCDE undoubtedly piqued policymakers' and stakeholders' interest in regional health information exchange elsewhere.
- **Replicable exchange model components.** Other communities have used portions of the SBCCDE software architecture to guide their own development efforts. Some of the RHIO's agreements, such as those for data providers and liability insurance, also could become helpful models.
- **Open source software.** Because CHCF owns the intellectual property rights to any unique software that CareScience developed, the Foundation can license it as a product for the open source community to develop further. While the cost of software is only one of several key roadblocks for RHIOs, the availability of open source software might at least modestly accelerate such ventures.
- **Local health care issues addressed.** SBCCDE meetings—especially those between 2000 and 2003, in the RHIO's early years—provided a forum where health care executives could discuss issues facing the community. Several interviewees considered this to be a major benefit of the project.

VI. Lessons Learned and Policy Implications

SANTA BARBARA'S EXPERIENCE RAISES A NUMBER OF issues for other communities that are establishing RHIOs. These issues include the following.

Time Needed for RHIO Development

As the SBCCDE and other RHIOs have learned, building trust and establishing comprehensive business agreements among health care organizations in a community, then constantly revising those agreements, takes years of time and effort.

RHIOs can avoid the delays and heavy spending that plagued the SBCCDE's software development efforts by using software other ventures have already vetted. Yet even then, off-the-shelf software requires labor-intensive adaptation, such as creating consistent and stable interfaces to numerous databases.

Different Types of Value Propositions

The SBCCDE experience illustrates the differences between private and social value propositions, and among short-, medium-, and long-term value propositions, for different health information exchange services.⁹ (A private value proposition includes benefits to private stakeholders who invest in a venture. A social value proposition includes the total of all net benefits that accrue to all stakeholders.)

By the end of the SBCCDE, participants focused mostly on the short-term, private value proposition of enabling physicians to view electronic data. This proposition was unfavorable in the sense that private stakeholders did not see sufficient benefits to justify needed investment in the venture. Participants were not focused on the potential medium- and long-term private and social value propositions of using data from multiple sources for better population health services or more effective measurement of pay for performance indicators. Nor were they focused on providing electronic data and software services to consumers that would enable them to better manage their care.

The Santa Barbara example illustrates the danger that, in some communities, unfavorable short-term private value propositions for simpler health information exchange services may delay

more advanced exchange services that offer greater potential medium- and long-term private and social pay-offs.

The Role of Grant Funding in R&D and Determining Value Propositions

A handful of communities have received grants from national funding agencies to conduct research on and develop health information exchange technology, agreements, and services. These efforts will benefit RHIOs throughout the United States.

Expanding R&D grant funding to more communities is critical for gaining new insights into value propositions, including the following:

- The different value propositions for different stakeholders and services, and how the propositions change as the scale, service scope, and size of RHIOs increase.
- How value propositions change as health care organizations migrate to EHRs.
- The effects of regional market characteristics on value propositions.
- Which services have substantial social, but few private, pay-offs.
- Who should pay for the initial and ongoing infrastructure, and for developing and providing services, beyond public R&D funding.

In Indiana, external funding agencies paid for much of the initial infrastructure and development of information exchange services. Health care organizations pay for services whose marginal financial benefits exceed marginal costs (including current infrastructure). Grants enabled health information exchange efforts in Indianapolis to progress farther and faster than they would have otherwise. In Spokane, the absence of much grant funding may partly explain why Northwest RHIO provides only basic services, despite very favorable conditions for more advanced services.

Grant-assisted exchange efforts offer a glimpse of the future value propositions of exchange services. Experience from the INPC and IHIE in Indiana suggests that once a basic RHIO infrastructure has been built, new services have been piloted, and the network encompasses many providers and users, a RHIO can benefit from economies of scale (for example, by adding data updates at low cost), economies of scope (for example, by adding new services at relatively low marginal cost), and network economies (the more data providers and users there are, the more useful the system becomes).¹⁰

These, in turn, increase the likelihood of favorable private value propositions and thus the willingness of private parties to pay for the ongoing cost of services, which can speed the diffusion of more new services. In essence, once a RHIO is up and running, new and potentially more attractive value propositions may be created or discovered.

Unfortunately, there is little information about how all these value propositions change in a world of ambulatory care and inpatient EHRs.

The Santa Barbara experience shows how regional factors such as the number of large hospital systems, physician organizations, and payers; past cooperation among participants; the extent of existing IT infrastructures; and the penetration of managed care in the local market, can be critically important in determining private value propositions and thus the pace of RHIO development. Expanding R&D grant funding to more communities would shed additional light on the effect of these factors.

Public R&D funding, as the ventures in Indiana illustrate, can help identify and determine the cost of services that could have much social but little private value, such as biosurveillance and disease outbreak detection. In addition, such funding can help answer the “who should pay” question.

Funding Sources for Infrastructure and Development of Services

The most critical issue is who should invest in developing a RHIO's infrastructure and services to a point where it can offer some services at a price that participants are willing to cover, at least partially. In some communities, private health care organizations may easily agree on paying most or all the marginal cost of some services that have a favorable private proposition, but disagree on who should pay for the initial infrastructure and development of services.

Public Funding

Public funding for a venture typically is an option when many potential participants must coordinate investments, the benefits are uncertain, and social and private value propositions diverge, as is the case for RHIO development. Certainly, such funding would be needed to pay for specific exchange services that have a favorable social but unfavorable private value proposition.

Health Plan Incentives

Health plans can speed the pace of RHIO development by paying the cost of providing patient data or providers' use of the data, and by paying for their own use of specific RHIO services, like reporting the quality of physician performance across organizations.

Other Possible Funding Sources

These include drug companies, medical device manufacturers, or other firms that would pay for aggregate patient data stripped of identity information. As health information exchange services that are focused on consumers and self-managed care gain in importance, more RHIO funding may come from sources such as Web advertising.

Government Mandates

The Santa Barbara experience suggests that mandates from the Centers for Medicare and Medicaid Services or state government may eventually be necessary to spur the development of infrastructure and services when communities fail to perceive

a positive private value proposition for health information exchange, even when grants, incentives, and funds from other sources are available. Mandates would force regional market participants to pay for some or most of the RHIO cost.

Key Questions Remain

The rise and fall of the SBCCDE raises important questions, including these:

- How large should grants be for creating and developing infrastructure and services to the point where they produce economies of scale and scope, as well as network economies?
- What financial incentives should the grants contain?
- For each stakeholder, what are the private and social value propositions for each type of health information exchange service, including the effect of specific services on quality of care?
- What factors in the regional market affect value propositions for specific exchange services?
- Given local factors, which specific services can become profitable, which should be subsidized, and which should be de-emphasized?
- What effect do pay for performance incentives have on the demand for exchange services and how effectively do incentives reward data users and providers for such exchange?

VII. Conclusion

ALTHOUGH THE SBCCDE DID NOT SUCCEED, ITS experience offers valuable lessons for other regions that may consider establishing RHIOs. Chief among them is the need to make clear the value proposition (or lack thereof) for each exchange service so participating organizations understand the potential costs and benefits.

Also necessary are a realistic timetable for developing a RHIO, given that resolving technological and business issues requires considerable time and effort, and local commitment and leadership if a RHIO hopes to achieve enough momentum to evolve and provide new, useful services.

Key issues in the future will be the source and level of funding, including incentives, for nascent exchanges and whether mandates may be necessary to spur their development.

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