Health Information Technology in California’s Rural Practices: Assessing the Benefits and Barriers

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_by_
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About the Foundation
The California HealthCare Foundation is an independent philanthropy committed to improving the way health care is delivered and financed in California. By promoting innovations in care and broader access to information, our goal is to ensure that all Californians can get the care they need, when they need it, at a price they can afford. For more information, visit www.chcf.org.
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I. Introduction

Health care in rural America has faced significant challenges for many years. Compared with urban and suburban areas, rural areas have fewer health care providers per capita and people must travel longer distances to reach them. In addition, rural residents are more likely to be hospitalized for medical conditions that might have been avoidable had they received better ambulatory care, and their adherence to guidelines for screening exams is lower than in urban and suburban areas. They also are older, suffer more chronic illness, and are more likely to be poor.1

Research shows that effective use of health information technology (IT) can improve the efficiency and quality of health care, and address chronic illness and other health care disparities.2 However, most of the research has focused on urban and suburban settings; it has not systematically identified the benefits of health IT in rural settings.

IT tools can connect patients with providers across long distances, help capture and analyze the data necessary to improve population-wide treatment of chronic illness, and facilitate the exchange of information about patients and thus help providers effectively manage care. But to realize these potential benefits, rural areas must overcome numerous barriers. Among them are a lack of broadband, a shortage of IT professionals, and the financial inability of most rural providers to make significant investments in IT.

This report explains how innovative use of IT in rural areas can improve the health and health care of rural populations, and discusses the challenges to its implementation. It also presents three case studies of IT initiatives in rural California that illustrate the related issues, trends, and opportunities.
II. Rural Characteristics

The challenges of delivering health care in rural areas stem from differences between them and nonrural regions in terms of populations, the make-up of health care, and the communications infrastructure. Twenty percent to 25 percent of Americans and 8 percent of Californians live in rural areas as defined by the federal government. Of California’s 541 medical service study areas, 150 are rural (250 or fewer residents per square mile) or frontier (11 or fewer residents per square mile). Nearly every region of the state has rural areas, each with a unique topography, economy, climate, and environment.

Rural residents come from all walks of life and vary greatly among regions in terms of age, gender, level of education, family income, race, and ethnicity. Yet there are general characteristics that distinguish rural and nonrural populations. Data from the 2007 Behavioral Risk Factor Surveillance Survey (BRFSS) by the Centers for Disease Control and Prevention indicate that more people in rural areas report fair or poor health (19.5 percent) and have diabetes (9.6 percent) than people in the general U.S. population do (15.6 percent and 7.3 percent, respectively). Women in rural areas are less likely to receive mammograms and Pap smears at intervals consistent with accepted guidelines and all rural residents older than 50 are less likely to have been screened for colorectal cancer.

Similar disparities exist in California, according to BRFSS data. Rural residents, compared with their urban counterparts, are more likely to have missed work due to physical health problems (16 percent vs. 12 percent) or mental health problems (6 percent vs. 5 percent). Between 2004 and 2006, the mortality rate among rural residents (789 deaths per 100,000 people) was far greater than that among urban residents (665.5 deaths per 100,000 people). The incidence of diabetes, heart disease, and suicide was higher.

In California, as in other states, rural residents tend to be poorer and to receive assistance through public programs such as the federal government’s Temporary Aid for Needy Families or California Work Opportunity and Responsibility to Kids. On average, they are also older than urban residents and more likely to be Medicare or Medi-Cal beneficiaries. Finally, in a shift that has occurred over the last five years, a larger proportion of rural than urban Californians is uninsured (16 percent vs. 12 percent).

The health care sector in rural America is quite different as well. Although rural residents make up more than one-fifth of the U.S. population, only one-tenth of physicians practice there. Consequently, rural residents may have difficulty finding doctors and may need to travel for hours or days to receive care, especially from specialists, subspecialists, tertiary care hospitals, mental health care providers, and dialysis clinics. One study showed that 83 percent of rural parents with children who have special health care needs drive more than an hour to consult an appropriate specialist. The literature is replete with stories of families that must disrupt their lives and relocate after a family member is diagnosed with a disease or condition that cannot be adequately treated in their region.

Compared with urban areas, rural areas are also at a disadvantage in terms of IT adoption due to shortages of IT personnel, limited broadband.
infrastructure, fewer providers of telecommunications services and IT vendors, and poorer financing options, which mean fewer opportunities to procure and use technology. Oftentimes, these areas cannot take advantage of access to software hosted by application server providers because connectivity is not fully reliable and broadband is lacking or too expensive.

Table 1 summarizes the many health care challenges that rural areas face.

<table>
<thead>
<tr>
<th>DOMAIN</th>
<th>CHALLENGES</th>
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<tbody>
<tr>
<td>Demographics</td>
<td>• Older residents</td>
</tr>
<tr>
<td></td>
<td>• Greater prevalence of chronic illnesses</td>
</tr>
<tr>
<td></td>
<td>• Lower income</td>
</tr>
<tr>
<td></td>
<td>• More uninsured and publicly insured residents</td>
</tr>
<tr>
<td></td>
<td>• Lower use of computers and the Internet</td>
</tr>
<tr>
<td>Health care</td>
<td>• Shortage of primary care physicians</td>
</tr>
<tr>
<td></td>
<td>• More small, independent health care providers</td>
</tr>
<tr>
<td></td>
<td>• Too few specialists and subspecialists</td>
</tr>
<tr>
<td></td>
<td>• Limited administrative and IT expertise</td>
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<tr>
<td>Infrastructure and</td>
<td>• Limited and expensive electronic connectivity</td>
</tr>
<tr>
<td>business environment</td>
<td>• Limited public transportation</td>
</tr>
<tr>
<td></td>
<td>• Long distances to specialists</td>
</tr>
<tr>
<td></td>
<td>• Few vendors of hardware, software, and professional services</td>
</tr>
</tbody>
</table>
III. The Promise of IT

IT tools can address some of these challenges, at least in principle. Computer applications, data management processes, communications protocols, and standards enable more structured and efficient capture and exchange of essential patient information. Although such tools must be adopted within a broader strategy for improving access to and the quality of health care, sometimes just the opportunity they present fosters discussion of how to realize necessary improvements. Table 2 lists technological functions that are relevant to rural health care.

Table 2. IT and Rural Health Care

<table>
<thead>
<tr>
<th>Function</th>
<th>Relevance to Rural Health Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structuring and normalizing health care data</td>
<td>Access to structured electronic data can aid billing, reporting, and tracking patient care and outcomes, which is particularly important in treating chronic illnesses and associated risk factors. It is also essential for data exchange.</td>
</tr>
<tr>
<td>Videoconferencing</td>
<td>Linking patients and health care providers through audiovisual connections enables some assessment and diagnostic activities to take place without one party having to physically move to the other’s location. This creates a tremendous opportunity to improve access to care, especially for specialist referrals, and to reduce the cost of care-seeking.</td>
</tr>
<tr>
<td>Transmitting physiological data</td>
<td>This is particularly important for older patients who live independently and cannot easily access local health care providers or caretakers. Vital signs such as heart rate, blood pressure, blood glucose levels, and level of ambulation can be regularly monitored.</td>
</tr>
<tr>
<td>Connecting patients and health care providers online</td>
<td>This extends clinicians’ ability to provide education, follow-up treatment, and basic assessments.</td>
</tr>
<tr>
<td>Connecting providers electronically</td>
<td>Connecting providers across specialties and care settings streamlines the referral process and facilitates telemedicine. It potentially can improve care for chronic conditions, as patients need not travel away from their medical home as often to consult specialists.</td>
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</table>

Electronic Health Records

Although still relatively rare in ambulatory care settings, electronic health records (EHRs) are a predominant tool for enhancing health care delivery. They typically replace paper charts as the main source of documentation for clinical encounters. Users can enter structured clinical data into the record and perform automated queries of the data from a back-end database. EHRs also accommodate clinical decision-support tools that generate reminders and alerts at the point of care, give physicians access to clinical guidelines for decisionmaking, and facilitate health information exchange, especially test orders, lab results, and prescriptions for pharmacies. Many health care providers consider EHR adoption to be the first step toward effective use of IT for clinical operations. Electronic records may be particularly well-suited for rural primary care doctors: patient
data in standard electronic format is a necessary step toward exchanging the information with specialists in other locations, and given that rural residents tend to be in poorer health, they may have the most to gain from better decision support at the point of care.

**Clinical Decision Support**

Automated clinical decision support (CDS) applications typically are incorporated into EHRs or hospital information systems. The applications often prompt providers to order necessary screening tests or to perform diagnostic exams on patients who have specific demographic characteristics. CDS systems can also deliver messages, such as a prompt to order HbA1c tests regularly for diabetics, that help clinicians manage chronic illnesses. Because there is low adherence by rural health care providers to diabetes screening guidelines, CDS could be especially important in rural regions.

**Automated Disease Registries**

Many federally qualified health centers and other safety net providers use automated disease registries, also known as chronic disease management systems, to track aggregate health care utilization by and outcomes among patients who have certain health conditions, such as diabetes or asthma. Interfaces pull data from information systems and automatically populate the registry with de-identified patient information, which limits the need for data entry and enables providers to readily generate reports about particular types of patients. Thus, region-wide quality metrics can be tracked over time.

**Health Information Exchange**

Health information exchange (HIE) is the exchange of standardized, electronic clinical data, such as test results or information about a clinical encounter or procedure, between individuals who are authorized to see the data. HIE can be point-to-point—for example, between doctor and patient or between a clinician and lab or pharmacy—or involve a broader community of participants who have established processes and rules to facilitate exchange, often through a shared software application.

Regional health information organizations (RHIOs) are community, regional, or statewide entities whose participating providers exchange patient data electronically. RHIOs facilitate information exchange by enabling participants to query each other’s information systems through an in-house application they all use or by brokering data delivery through a Web portal. While there is ongoing debate about the pros and cons of establishing these entities, active RHIOs in some parts of the country have demonstrably increased information portability. In rural regions, where long distances may separate providers as well as providers and patients, RHIOs can be especially beneficial.

Typically, in bringing health care stakeholders together under a nonprofit umbrella, RHIOs define the technical options that best serve participants’ needs and build a governance model and legal structure, which is a broader and more formal arrangement than point-to-point HIE. In addition, RHIOs may report data to public health agencies, establish patient portals or personal health records, and generate data sets for research and analysis. Because many RHIOs seek to “lower the bar” so more providers will adopt health IT and participate in information exchange, they may be particularly advantageous in rural areas. The fewer number of health care providers in a rural area may make
it easier for a smaller rural RHIO to identify and assemble exchange participants, even if some of them must travel farther for face-to-face meetings.

**Telemedicine**

Telemedicine — defined by the American Telemedicine Association as direct communication of medical information, often in multiple formats (audio, video, images, or messages), from one site to another in order to facilitate patient care — continues to become more sophisticated. It predates most other IT tools. Among numerous telemedicine capabilities are videoconferencing, store-and-forward of still images or audio files, and home monitoring of patients’ vital signs.

Video doctor visits, the most common use of telemedicine, are an obvious asset in rural areas where long distances may make it nearly impossible for patients to physically access some types of health care. As recording and transmission technology advances, an increasing number of clinical functions, such as checking heart sounds with an electronic stethoscope and tracking vital signs via patient-operated home monitors, can be performed remotely.

**Personal Health Records and Online Networking**

Online applications such as personal health records (PHRs) and social networking Web sites oriented to health care are becoming increasingly viable in rural areas as access to computers and online connectivity grow. PHRs vary widely in terms of function: some offer a relatively limited view of a patient’s information in a static form, while others enable patients to look up information on health conditions, communicate with their doctor through secure messaging, and see lab results at the same time the results become available to their physician.

There has been little research on the value of health care social networking sites, but they could prove useful to sick people in rural areas who feel isolated. Evidence suggests that patients benefit from engaging with an online community of individuals who are facing the same health care challenges.\(^\text{10}\)

Table 3 shows which types of IT can meet particular rural health care needs.

<table>
<thead>
<tr>
<th>TABLE 3. Technologies That Meet Rural Health Care Needs</th>
</tr>
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<tbody>
<tr>
<td><strong>NEEDS</strong></td>
</tr>
<tr>
<td>Caring for elderly patients</td>
</tr>
<tr>
<td>Caring for chronically ill patients</td>
</tr>
<tr>
<td>Isolated patients</td>
</tr>
<tr>
<td>Ensuring access to physicians despite physician shortage</td>
</tr>
<tr>
<td>Long distances and no transportation</td>
</tr>
</tbody>
</table>

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IV. Rural IT Barriers

Health care providers who are least likely to have adopted IT share some common characteristics. They tend to be small, nonprofit, independent, and community-based. These same characteristics generally apply to rural health care providers. Despite the U.S. government’s recent focus on IT as a way to improve health care efficiency and effectiveness, IT adoption by providers still lags. Perhaps the biggest reason is a lack of financial incentives, especially for small independent providers. The American Recovery and Reconstruction Act of 2009 (ARRA) addresses IT adoption incentives, but other major challenges remain.

Scarce Resources
Fewer rural providers than providers overall are using IT to deliver health care, surveys show. One reason is that the financial and personnel constraints are greater in rural areas.

Because rural providers tend to be community-based nonprofits unaffiliated with a national or regional health system, and because a larger proportion of their patients are on Medicare or Medicaid, they often lack the capital to adopt and maintain health IT. They typically cannot afford such a significant investment nor obtain corporate financial backing absent unequivocal evidence that IT will bolster the bottom line. If a large project fails, the financial consequences are greater for rural providers than for their urban and suburban counterparts.

Recent analyses demonstrate problems with adequate staffing of health care IT projects in general, which suggests that finding IT professionals in rural areas is particularly difficult. The shortage of IT professionals who specialize in health care is especially challenging, given the unique combination of training in informatics, health care, and project management necessary for successful implementation of clinical systems in complex environments. Some provisions in ARRA address workforce readiness and health IT education, but it is unclear whether or how they will resolve disparities between the rural and nonrural workforce.

Finally, organizational leaders are often the people who initiate successful IT projects, identifying problems or inefficiencies in current operations and seeking to resolve them through better use of technology. This is more likely the situation in larger organizations: they employ staff from a variety of educational and professional backgrounds, and have a steady turnover of staff, which leads to constant evaluation of existing processes from new perspectives. Rural providers may be at a disadvantage in this regard because they draw employees from a smaller labor pool and because their leaders tend to stay on the job longer compared with those in urban and suburban areas.

No Broadband or Poor Connectivity
Providers who use telemedicine and other technologies must be able to exchange large amounts of electronic data quickly. During a telemedicine visit involving multiple electronic instruments and enhanced video and audio, a substantial volume of data needs to move fast in order to preserve the visit’s real-time aspect. Application service providers (ASPs) or other entities can host the necessary telemedicine hardware and software, offering relatively affordable
access to advanced IT solutions that require minimal in-house IT expertise. However, this assumes that clients have easy access to broadband Internet. Because broadband infrastructure in many rural areas still does not exist, providers often must find another networking solution, such as a T1 line. An alternative is to pay a premium for broadband service from a utility, but support for such service in rural areas is not as good as in urban and suburban areas.

In early 2008, the California Broadband Task Force released its assessment of broadband Internet adoption and availability in the state. The study revealed that California leads the nation in terms of adoption and that about 96 percent of residents could access broadband Internet from their home. But it also showed that nearly 2,000 communities, most of them in rural regions such as those in Northern California and the Central Valley, did not have access to broadband Internet in 2007. In addition, while broadband is increasingly available around the state, costs vary considerably and are higher in rural areas.¹⁵

**Vendor-Related Shortcomings**

Even if rural health care providers can marshal the resources to outsource the implementation of advanced IT and have the necessary connectivity to take advantage of it, they face an IT marketplace ill-equipped to meet their needs. Vendors and consultants may have little experience in or knowledge about rural health care, and their software and services are usually geared to larger, urban providers and care settings. For example, most EHRs do not include standard forms that would enable ambulatory care providers to document trauma, yet many such providers in rural areas treat or stabilize trauma patients because of long distances between emergent care centers or hospital emergency departments. Some rural providers complain that vendors give them short shrift: as smaller customers, they offer little promise of more business down the road for vendors, and their unique IT challenges can test the limits of software products, which may need to be customized.

**Interoperability Problems**

Like their counterparts elsewhere, rural health care providers struggle to adopt systems compatible with those that other local providers or RHIOs use. Because the vast majority of them are community-based and not connected to other institutions, interoperability may be a more pressing issue than in urban areas, where larger multispecialty group practices, large hospital systems with extensive outpatient services, or integrated delivery networks predominate. The Commission on Certification of Health IT and the Health Information Technology Standards Panel have worked to create more uniformity among information systems, but the implementation and use of standards for health information exchange and other IT functions remain elusive in the United States.
V. Rural IT Efforts in California

A number of rural initiatives around California are using IT tools to improve health care delivery. The following sections describe some of these efforts and applications in more detail.

Home Health Monitoring
As the population ages and family caregiving declines, more elderly people are relying on home-based monitoring of their health status, which often involves regular visits by nurses or other health care professionals. An increasing number of these arrangements incorporate technology that enables remote monitoring by professionals.

Technology that combines medical devices and telecommunications for remote monitoring of vital signs, physical activity, and other measures has been available for some time. However, few providers have taken advantage of this capability, largely because there are no reimbursement incentives for delivering home health care and because using and maintaining the equipment is costly. An exception is the Veterans Health Administration (VHA), which, by mandate, must provide comprehensive health care to veterans and, unlike commercial providers, does not bill third parties. Its innovative use of IT to enhance health care delivery is exemplary.

The VHA delivers a full range of health care services to rural areas throughout California and other states. Veterans everywhere tend to rely on other health care providers and turn to the VHA mostly for goods and services that private insurers or Medicare do not typically cover. Consequently, the VHA has established itself as a supplemental niche provider. Thanks to its extensive telemedicine and home health care capabilities, the VHA recently established programs that combine these IT functions to cost effectively care for and monitor nearly 36,000 veterans at home. Home-based equipment enables remote monitoring of vital signs such as blood pressure, pulse, and heart rate, and patients can consult with nurse practitioners or physician assistants in unplanned telemedicine sessions. This system has reduced hospitalizations and emergency room visits.16

Health Information Exchange
RHIOs and other HIE initiatives may focus on particular IT functions, such as electronic records, the accessibility of inpatient and ambulatory care records for emergency departments, or e-prescribing. In the short term, their biggest contribution is creating a governance structure, setting exchange policy, and generating the necessary financial and political support for better data-sharing.

The California Regional Health Information Organization is facilitating and supporting HIE on a state level. Meanwhile, efforts are under way to establish smaller, more regional RHIOs to meet the specific needs of rural providers in different parts of California. These efforts include the Eastern Kern County Integrated Technology Association and Redwood MedNet, based in Mendocino and Sonoma counties (described in the case studies below).

Telemedicine
Several active telemedicine programs serve rural Californians. The California Telemedicine and eHealth Center (CTEC), a nonprofit resource center in Sacramento funded in part by the federal Health Resources and Services Administration, is within the
California Health Foundation and Trust, a nonprofit affiliated with the California Hospital Association. CTEC’s mission is to advance the application of telemedicine and telehealth technologies to improve access to and the quality of health care, and to foster the education and training of clinicians. Under funding from The California Endowment, CTEC supported the development of regional rural telehealth networks across the state.

The California Telehealth Network (CTN) seeks to establish a robust, sustainable broadband network for delivering a wide range of telemedicine and telehealth services to underserved areas throughout the state, beginning with rural communities. The CTN was established in 2009 with a Federal Communications Commission grant of more than $22 million, and will connect between 500 and 900 rural and underserved urban health care sites to a high-speed broadband network. The University of California is the fiscal agent and managing partner in this consortium, which includes public agencies, health care providers, and foundations. The CTN will move to an independent non-profit and begin delivering services in early 2010. Among other objectives, CTN also plans to link to a nationwide broadband backbone so providers in California would have better access to continuing education, research, and peer networking.

**Safety Net Health Care Networks**

Much has been written about the importance of fostering innovative uses of IT in the health care safety net. Safety net providers care for predominantly uninsured, underinsured, or publicly insured individuals and families that are socioeconomically disadvantaged. Their wide range of services, including triage of patients who have suffered extensive trauma or other emergencies, help overcome provider shortages and long distances between different types of health care facilities. Some federal programs specifically fund rural safety net providers. For example, federally qualified health centers (FQHCs) and certain rural health clinics receive funding from the Health Resources and Services Administration and benefit from reimbursement advantages. However, these safety net providers often have limited access to IT resources.

Rural FQHC networks are consortia that primarily seek economies of scale in terms of IT, administration, purchasing, managed care contracting, and other functions. They leverage their strength as network infrastructures to pursue IT projects that will improve the efficiency and quality of care at member sites. Some are using IT in innovative ways. An example is the Central Valley Health Network (CVHN) in California, which has received funding from the Community Clinics Initiative to implement i2i Tracks, a chronic disease management system, in member health centers.
VI. Case Studies

The following three case studies illustrate innovative uses of IT to address the challenges of delivering health care in rural settings. These initiatives especially seek to improve efficiency, quality, and safety.

**Open Door Community Health Center**
The Open Door Community Health Center (ODCHC), a FQHC located in rural Humboldt County in Northern California, has more than 10 years of telemedicine experience. It predominantly serves uninsured and Medicaid beneficiaries but also some employer-insured residents. In addition to primary care, ODCHC, like most safety net and rural providers, offers specialty, dental, and mental health care and case management. The health center relies on telemedicine to deliver wide-ranging services across a broad geographic area using limited resources.

ODCHC serves a population of about 165,000 between the Oregon border and Mendocino County to the south. An estimated 20 percent to 30 percent of the target population receives services at 10 satellite clinics in about 120,000 encounters per year. The health center employs 50 full-time-equivalent clinicians, including primary care providers and specialists. While Open Door has telehealth programs throughout its network of clinics, much of the telehealth activity takes place in the “Telehealth and Visiting Specialist Center” in Eureka, where a range of specialists provide remote consults to patients and primary care providers at sites across the state.

Since the telemedicine program began in the late 1990s, ODCHC has also leveraged the technology to reduce the cost of delivering care, recruit and retain clinicians, participate in training and distance medical education, and improve internal communication. Grants for the purchase of hardware and software, and reimbursements from third parties for telemedicine services, enable it to conduct more than 10,000 telemedicine sessions annually.

**Telemedicine Basics**
Telemedicine encounters between the Telehealth and Visiting Specialist Center and its satellite clinics take place over point-to-point, 10-megabyte connections. Each site has one to three mobile telemedicine units for videoconferencing and sending store-and-forward static photographs, radiographic images, and physiologic sounds that aid in diagnosis and treatment. The mobile units are equipped with advanced recording and diagnostic devices such as electronic stethoscopes. In an equipped exam room at the Telehealth and Visiting Specialist Center, a clinician can assess and diagnose patients remotely. Most telemedicine encounters take place between the center and satellite clinics, but the clinics can also connect with each other.

Clinicians either consult real-time via videoconference or record and store video, image, and audio files from an encounter, then forward the files to themselves or other clinicians for later review to establish or confirm a diagnosis. A variety of specialists—cardiologists, dermatologists, ophthalmologists, and radiologists, among others—can access a queue of online files using this store-and-forward capability.
Staffing and Technical Resources
ODCHC employs a small staff of IT professionals—about five full-time equivalents (FTEs)—relative to the number of satellite clinics and patient encounters. Only 1.25 FTEs maintain the telemedicine system. The health center trains one FTE at each of the 10 satellite clinics who, as a “super-user,” helps clinicians and patients during telemedicine sessions. This pared-down staffing approach is increasingly viable as the telemedicine technology becomes easier to use.

Benefits
ODCHC has used telemedicine to improve connections between providers across the region, state, and nation. Patients can go to the Telehealth and Visiting Specialist Center for remote subspecialty care and for consultations with experts at academic medical centers elsewhere in the state, such as those at University of California (UC) campuses in Davis and San Francisco, and around the country via the ODCHC’s North Coast Telemed Network. The health center is particularly proud of the better access it provides to pediatric specialists, which has reduced travel time for families whose children have special health care needs.

In addition, telemedicine enables ODCHC clinicians to remotely receive continuing medical education and participate in grand rounds at UC Davis, UCSF, and UC San Diego. The technology streamlines training for clinical and administrative staff, and, through videoconferencing, is an extremely valuable way to administer and manage ODCHC. For example, videoconferencing yields significant savings by reducing the travel time necessary for face-to-face administrative meetings.

Finally, telemedicine means some families need not move elsewhere to ensure that their children receive necessary care. It has also helped ODCHC recruit and retain specialists and subspecialists, who can see a range of patients across the state and region, and thus maintain an adequate patient volume in the sparsely populated area.

Challenges
Somewhat surprisingly, ODCHC staff do not cite financing as the chief barrier to telemedicine. Aside from equipment and software costs, which are largely funded by grants and charitable contributions, the main expense is the level of connectivity necessary to conduct store-and-forward telemedicine sessions. The health center partially recoups costs through third-party reimbursements for telemedicine encounters and direct fees that other providers pay for using the equipment.

One noteworthy challenge was finding an optimal way to incorporate telemedicine into clinicians’ daily workflow. Initially, clinicians did a full day of telemedicine consults at the Telehealth and Visiting Specialist Center in Eureka. Over time, however, they found that mixing telemedicine and face-to-face encounters enabled them to treat more patients and was less tedious. ODCHC created more exam rooms at the facility to accommodate this mix.

Another challenge has been determining which type of equipment would be appropriate for the telemedicine functions necessary in each stage of the program. Telemedicine opens up many possibilities; a key task has been deciding which capabilities the health center should aggressively pursue to achieve maximum gain. Despite the rapid advance of telemedicine technology and new products on the market, ODCHC has strategically sought only those capabilities that will help it meet its clinical objectives and that are within the limits of available resources.
The nonprofit Eastern Kern County Integrated Technology Association (EKCITA) is one of the few active, community-based RHIOs in California. Located about two hours north of Los Angeles in the rural Central Valley, EKCITA grew out of a funding initiative by the federal Agency for Health Care Research and Quality, which began awarding planning and implementation grants, mostly to rural communities, in October 2004 to foster discussion about improving or planning for communitywide or regional data-sharing. The RHIO, with a board of directors that oversees technological and policy issues, serves as a forum for community-based governance. EKCITA’s nature and scope are still evolving.

The Tehachapi Valley Healthcare District serves about 30,000 residents in a 1,600-square-mile region designated as a health professional shortage area. Tehachapi Hospital is the district’s acute care facility. EKCITA links the hospital with six rural health clinics, a FQHC, and seven medical practices. Participants can view patients’ lab results, medication and allergy lists, and encounter summaries prepared by ambulatory-care, hospital, and emergency-room clinicians.

In the four-and-a-half years since implementation began, EKCITA has blossomed from a hospital-centric venture to an active RHIO that enables all health care providers in the region to share data. Physicians and the community have equal or greater clout than the hospital does, giving everyone a significant ownership stake. The current structure is partly the result of an election that replaced some leaders of the Tehachapi Valley Healthcare District who had resisted a highly collaborative model.

### Needs and Obstacles

EKCITA established priorities for key exchange functions and the technical infrastructure necessary to support them by talking with health care providers and residents in Eastern Kern County to assess their needs. It also investigated the availability of vendors and potential relationships with entities, such as payers, labs, and pharmacy benefits managers, that kept patient data. This environmental scan revealed a number of significant barriers.

First, while it was essential that the RHIO capture structured patient data, clinicians—especially ambulatory care physicians—had very limited capability to record or store data electronically. Second, while some ambulatory care providers expressed great interest in adopting EHRs, others were not ready or willing to do so. Third, many clinical labs already had agreements with potential RHIOs in the state that precluded the labs from engaging with other exchanges. Fourth, the Tehachapi Valley Healthcare District was not enthusiastic about data-sharing.

### Planning and Implementation

To overcome these obstacles, EKCITA leaders reached out to the community very deliberately but carefully to foster an environment more conducive to HIE. For example, information uncovered in the planning stages motivated local physicians to take a more active role in decisionmaking at the hospital. This ultimately led to a successful campaign to replace resistant members of the health care district board, which enabled project leaders to establish a governance model and formulate initial agreements and policies regarding data exchange.

The complexity of needs guided decisions about the technical platform and initial exchange functions. EKCITA chose OpenHRE, an open source platform for linking and exchanging patient records.
OpenHRE, a hybrid, federated model, pulls key data from provider systems and houses them in “edge servers,” one for each provider. A clinician treating a patient who has consented to the sharing of his or her personal data can request information about that patient in the edge server databases by tapping a master patient index and record locator service in OpenHRE. Each patient has a unique identifier. For any individual patient, OpenHRE also integrates and aggregates data generated by multiple queries to create a single, communitywide view of all health care the patient has received in Eastern Kern County.

EKCITA offers technical assistance to providers who want to adopt EHRs so they will be able to feed data into, and receive data from, the communitywide record. Providers without EHRs can access patient information through a Web portal.

The RHIO decided to focus initially on patient data originating at Tehachapi Hospital and medical practices with EHRs that would be the easiest to gather and structure. This information includes the time and location of encounters, and the patient’s chief complaint; medications; allergy lists; and lab results generated by Tehachapi Hospital and some laboratories. EKCITA realized that meeting its long-term goals required a phased approach. For example, it is still working toward information exchange with specialists in other regions, which would enable better access to care for patients who need services unavailable in Eastern Kern County.

Benefits
Anecdotal evidence suggests that clinicians participating in EKCITA believe they now provide more effective, more efficient, and safer care, and that HIE reduces duplicate tests. In addition, HIE has made it easier for clinicians to cover for each other when one is away because they can readily access patient information electronically.

Challenges
EKCITA leaders are pleased with the accomplishments to date, but they also anticipate needing project enhancements to meet broader goals that motivated their work from the start. The current focus is on driving broader information exchange, particularly among providers who, without the necessary IT, can only access patient data through the Web portal. Some specialists also lack the necessary technology.

Another challenge is obtaining consent from patients before their personal information can be shared. EKCITA has found that an opt-in approach to patient consent necessitates extensive training of clinicians, as clinicians must explain the benefits of HIE to patients and document their consent. EKCITA’s relatively small size also poses a challenge: for large labs and payers, such as pharmacy benefits managers, bigger RHIOs are a higher priority because they offer greater potential value as a result of information exchange.

Redwood MedNet
Redwood MedNet is a new rural initiative based in Northern California’s Mendocino and Lake counties, which comprise Bay Area commuter communities, agricultural operations, and a substantial safety net population. The two counties have a combined population of nearly 150,000.

Since it went live in April 2008, Redwood MedNet has connected a hospital lab and a lab that specializes in esoteric tests to its network of ambulatory care providers. The addition of two more labs awaits final sign-off of governance documents and completion of software customizations. There are about 200 physicians and 150 medical practices in the area, so aggregating patient information from these numerous sources and exchanging it offers tremendous potential. Among the pilot projects
at Redwood MedNet are a master patient index, e-prescribing, and transmission of radiology results. Ultimately, it hopes to offer HIE among health care providers.

Early on, Redwood MedNet realized that full exchange of patient data would require capital investment beyond the grant funding on which it still heavily depends. Health care providers in the region use a variety of medical recordkeeping tools, including paper charts and legacy EHRs that are incompatible with other systems. Consequently, Redwood MedNet is workflow-agnostic: instead of expecting participants to have a certain type or level of IT, it generates value for all. It accommodates paper-based medical practices, those with EHRs that display lab results, and those that access lab results through Redwood MedNet’s Web portal.

An initial goal was one-way delivery of lab results to providers. The exchange retrieves data from the labs’ information systems, repackages the data into a standard format (compliant with Health Level 7), and archives a copy for future use. Providers receive the results electronically or as a hard-copy fax, depending on their technological capability. Such flexibility will enable Redwood MedNet to easily adapt to providers’ changing IT infrastructure as federal stimulus funds foster wider adoption of EHRs.

A near-term goal is to fully populate the fledgling master patient index. A trial in the summer of 2008 added data about 10,000 patients from six affiliated ambulatory care practices. The master patient index will be crucial for broader HIE, a subsequent goal. Ambulatory care providers see value in electronic delivery and archiving of lab results, but hospitals have been reluctant to invest in the necessary infrastructure. When the master patient index is completed, hospitals will be able to access the medical-home records of patients upon admission, reducing most paperwork. Hospital emergency departments, especially, will benefit from quick access to patient information.

How often a master patient index can locate the records of a newly admitted patient is the key measure of its value. The pilot directory of 10,000 patients may not yield matches frequently enough to persuade hospitals that electronic retrieval of patient information is a worthwhile endeavor. However, as more providers contribute data to the exchange, Redwood MedNet expects this approach will become more compelling and enable it to move closer to fully functional HIE, with ambulatory-care and inpatient providers and labs able to send and receive full patient records.

**Benefits**

Because the California Department of Public Health covers such a large and diverse geographic area, Mendocino and Lake counties rely on local public health departments to handle significant threats. From the outset, Redwood MedNet has worked closely with these departments. Although labs are required to report potential health hazards to public health authorities, Redwood MedNet’s master patient index is likely to substantially improve data collection and reaction times to such hazards.

One broader benefit of Redwood MedNet is the dialog it has fostered among skeptics and believers regarding health information technology—a dialog that probably would not have occurred otherwise. Participants in the exchange have a very immediate incentive to consider upgrading their technology infrastructure. Redwood MedNet gives providers an opportunity to learn from colleagues about information systems they may not have considered, to see functional systems at work in other medical practices, and to take away lessons that could aid their own adoption efforts.
Challenges

Technological
Among the biggest technological challenges is the interoperability of information systems. Many health care providers in the region have legacy EHRs that predate standards set by the Certification Commission for Healthcare Information Technology (CCHIT) and they use a wide variety of vendors and software packages. So far, given the lack of cross-platform support, Redwood MedNet has had to customize the software for delivering lab results—sometimes extensively—at every participating site, which adds to overhead. Future implementations at additional sites may proceed more smoothly because Redwood MedNet now has versions of the software that are compatible with several major EHR systems.

An initial difficulty for Redwood MedNet was finding lab results software that could meet all of its needs. It discovered that even if a commercial product complies with CCHIT interoperability standards, certain necessary functions may exceed the software’s capability.

Funding
Among the funding challenges Redwood MedNet faces are these:

- Many health care providers in Mendocino and Lake counties do not have capital improvement funds to pay for customization of the lab results software at their site. Redwood MedNet has received grant funding that covers some of these capital costs, but grants are unreliable. Future expansion will require additional grants;

- Even if Redwood MedNet were to bring every provider in the two counties into its network, the venture would not break even. To accomplish that, the exchange will have to attract more providers and patients from neighboring counties;

- The exchange cannot expect that the fees providers pay as participating members will generate much income; and

- Rural broadband access is more expensive and less reliable than elsewhere, which dampens providers’ enthusiasm to invest in health information technology and drives up costs for all parties.

The Health Information Technology for Economic and Clinical Health Act of 2009 (HITECH) offers incentives for technology adoption, but its impact on different types of health care providers, be they safety net clinics with many publicly insured patients or ambulatory care providers with mostly privately insured patients, varies significantly. Some providers are not receiving any HITECH funding. Furthermore, HITECH does not solve the problem of EHR adoption for most small providers because its incentive payments for “meaningful use” (quality reporting, e-prescribing, and other functions) begin only after a system is in place; there is no funding for start-up costs, which are high.
VII. Take-Away Issues and Lessons

These case studies illustrate the opportunities, complexity, and challenges associated with IT in rural health care settings. They also show that health care providers who persevere despite course corrections, dilemmas, and false starts can ultimately implement beneficial solutions. Other take-away issues and lessons include the following:

**Successful rural collaborations incorporate all providers.** They typically give both large and small providers some leverage, a seat at the table, and a say in decisions regarding which technology to implement and its configuration and customization. While rural providers realize that collaborating with others to achieve economies of scale may offer the only opportunity for IT adoption, some are skeptical if collaboration will require a significant investment on their part, as failure could rapidly lead to their own financial failure. EKCITA adapted to this playing field by accommodating all local providers—for example, by not making EHR adoption a precondition for participation. It also achieved full consensus on some issues, such as vendor selection and how to configure HIE. Because the defection of one or two providers in a small, rural collaboration can destroy it, leaders who embody a collaborative spirit and strong, trusting relationships may be more important in rural settings than in urban or suburban settings.

**An up-front needs assessment can foster crucial buy-in and trust among stakeholders in provider organizations and the community.** This is especially true when project leaders come from the outside. Such assessments also help ensure that the investigation and purchase of technology are based on specific goals and, importantly, specific problems that must be solved. However, a needs assessment only represents a narrow initial case for IT adoption; a combination of highly variable technological, institutional, and personnel factors may produce surprising outcomes. During and after adoption, and as providers use a new technology, stakeholders’ understanding of their needs evolves along with their understanding of the role a given IT tool plays in addressing these needs. For example, while the main initial motivation for funding and implementing telemedicine in a rural area may be to improve access to and coordination of care, the effort ultimately may yield an unanticipated benefit, such as a better ability to recruit and retain specialists or reduce administrative overhead through videoconferencing.

**Flexibility is key.** A number of factors, including a lack of technological standards and incompatible or legacy information systems, can unexpectedly delay a complex IT project. Initially, project leaders may have to concentrate instead on larger structural or cultural issues, such as fostering EHR adoption. Collaborative efforts, despite political opposition, can be catalytic. Politics can stifle efforts to make innovative changes in health care. This may be especially true in rural settings, where there is less turnover in leadership and fewer staff to contribute ideas. However, collaborations organized around information exchange can also motivate health care providers to adapt. Federal grants and other funding opportunities for RHIO development may attract entrepreneurial leaders to communities or regions where such leadership has been lacking. Using IT to improve health care will only advance if a long-term political and organizational shift occurs.
A strong organizational structure, a sound technological infrastructure, and trust can lay a firm foundation for additional innovations in the future. For example, the Open Door Community Health Center recently joined a network of health centers for the purpose of collectively adopting an EHR system, which in turn created an opportunity to integrate electronic records with its existing telemedicine capability to improve coordination between primary care physicians and specialists.

Small size makes it difficult to achieve economies of scale. Business models built around a high volume of transactions to reduce the cost of each patient encounter may not work in rural areas, where the total number of transactions is smaller. Over time, rural RHIOs may have to consolidate some functions or collaborate to keep costs down. The value of rural HIE often hinges on cross-regional exchange, particularly when certain clinical specialists are unavailable locally.

New technologies can create new challenges while overcoming old ones. IT innovations may fall flat when they encounter practical realities. At Open Door Community Health Center, for example, physicians revolted against a “telemedicine only” day in their clinical schedule because interacting with one patient after another via videoconferencing proved tedious. So the health center adjusted its original telemedicine vision to meet on-the-ground needs by mixing remote and face-to-face encounters. This relieved the tedium and, as it turned out, enabled physicians to see more patients.

True innovation does not hinge on adopting a particular information system. Rather, it hinges on organizational characteristics and collaborative techniques that enable the best use of IT.

New Directions
The case studies in this report may represent the cutting edge of a broader movement to improve rural health care through IT. Federal stimulus funds, which seek to spur investments in broadband, technical assistance for health IT adoption, improvements in health care infrastructure, and “meaningful use” of EHRs, will undoubtedly move many more rural regions toward that innovative edge. One historical barrier—a lack of adequate funding and other resources—is likely to recede somewhat.

Meanwhile, the Office of the National Coordinator for Health IT is working to ensure that certified applications are based on standards and can support “meaningful use.” This will probably improve the ability of commercial products to support innovation and enhance the efficiency and quality of health care. But it is also likely that organizational inertia, political resistance, incompatible information systems, and false starts in IT adoption will persist.
VIII. Conclusion

Innovative IT applications can play an important role in improving health care in rural areas of California and other states by addressing the many challenges that rural health care providers face. However, there is no magic bullet that will comprehensively address all of the barriers. Disparities such as limited access to broadband and minimal IT resources and talent make it especially difficult for rural health care providers to take advantage of electronic records, telemedicine, health information exchange, and other potentially valuable tools. As more providers pursue IT, they will contribute to a better understanding of barriers that stifle innovation, how these barriers manifest in different rural health care settings, and how best to overcome them.
Endnotes


3. Medical service study areas, based on data from the U.S. Census, are geographic units that the Office of Statewide Health Planning and Development uses for analysis purposes.


7. Ibid.


13. See note 11.


17. Telehealth is the delivery of clinical or nonclinical health services. Telemedicine involves only clinical services.


19. See note 11.