California HealthCare Foundation

Telemedicine in California:
Progress, Challenges, and Opportunities

July 2008

Telemedicine in California:
Progress, Challenges, and Opportunities

Prepared for
CALIFORNIA HEALTHCARE FOUNDATION

by
Barbara Johnston
Neil A. Solomon

NAS Consulting Services

July 2008

About the Authors

Barbara Johnston, MSN, is the former executive director of the California Telemedicine & eHealth Center in Sacramento. She now serves as executive director of the Medical Board of California. Neil A. Solomon, M.D., is the founder and president of NAS Consulting Services in San Francisco and clinical director of the California Quality Collaborative.

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.

Contents

I. Executive Summary

Telemedicine has the potential to improve health care by bridging time and distance barriers, giving patients in rural and other underserved areas greater access to a broad range of clinical expertise, and reducing delivery costs. It also has the potential to dramatically alter the doctor-patient relationship and referral patterns among physicians.

Yet even though telemedicine has been around for a number of years, and despite the success of telemedicine programs in rural pockets of California, its use in the state is not widespread. Reasons include the up-front cost of new equipment, uncertainty about return on investment, clinicians' resistance to change, the lack of broadband connectivity, and issues related to obtaining reimbursement and providing medical care across state borders. In addition, some clinicians feel uncomfortable about not seeing patients face-to-face, and telemedicine technology raises concerns about privacy, confidentiality, and security.

This report briefly examines the evolution of telemedicine in California, describes successful programs in the state and elsewhere, and cites the technological, financial, regulatory, and user-related hurdles that may be stifling further progress. It concludes by posing key questions related to broader adoption of this promising technology.

II. Overview

TELEMEDICINE IS THE USE OF TELECOMMUNICATIONS and information technologies—primarily real-time videoconferencing and asynchronous store-and-forward systems—to provide health care remotely.[1] One of its major goals is to overcome time and distance barriers, delivering health services and education to patients in their communities.

Ideally, the widespread adoption of telemedicine can link diverse aspects of the health care system; increase patients' access to all types of care, including specialty and tertiary care; enable services to be provided where they are needed most; and ameliorate the shortage of primary care physicians and specialists in certain geographic areas. It also makes subspecialty decision support readily available to primary care physicians who would otherwise lack it, allows clinicians to improve productivity by supervising nurses and interns remotely, and can help overcome language barriers by providing access to translators.

Together, these advances have the potential to improve the quality of clinical care, enhance patient satisfaction, and reduce health care delivery costs.

Although telemedicine has been available in various forms for several decades, it is not a common fixture in American health care. California has benefited from early innovators who transformed some inventive technology projects into statewide telemedicine programs and e-health networks. "E-health" is a broad term that encompasses telemedicine applications as well as electronic health records, remote disease monitoring, online education, and many other electronic tools for delivering services and information.

But these efforts, while offering promising opportunities for growth, do not reflect pervasive use of telemedicine in the state. In a recent survey, only 3 percent of California consumers said they had participated in a telemedicine session within the previous 12 months.[2]

The time may be ripe for wider adoption of telemedicine, given the explosive growth in Internet use, technological innovations, the expansion of remote information and communication models

in other industries, rising consumer expectations for convenient and ubiquitous communications, and demands for more efficient and cost-effective health care delivery. The attention that California Governor Arnold Schwarzenegger has devoted to health care reform and his particular interest in promoting telemedicine to improve care and affordability also may accelerate change.

This report seeks to provide a better understanding of telemedicine's impact and potential in California by briefly examining its history, describing successful programs in the state and elsewhere, identifying barriers to broader adoption, and presenting key questions related to the wider adoption of telemedicine technology.

III. History of Telemedicine in California

In the early 1990s, a combination of disparities in access to health care (especially in rural areas), an aging population with greater health care needs, and an alarming shortage of health professionals prompted innovators in California to consider telemedicine as one possible solution. Several health care providers in the state began experimenting with telemedicine for home care, radiology, remote monitoring, and patient consultations.

The University of California, Davis launched a telemedicine program in 1992 that focused on fetal monitoring in rural communities. The program subsequently expanded into multi-specialty videoconferencing at remote sites throughout the state. Kaiser Permanente in Sacramento launched an innovative home telemedicine program in 1994 to accommodate the rapid growth in home health services. In subsequent years, Blue Cross of California and the California prison system also developed substantial telemedicine programs.

As the telemedicine landscape evolved, pioneers in the state educated and collaborated with the Legislature. Consequently, California became one of the first states to pass a law—the Telemedicine Development Act of 1996—requiring that health care providers be reimbursed for delivering services via telemedicine.[3]

The commitment of multiple organizations to bridge the digital divide and address the growing disparities in access to health services in rural areas and underserved communities is a key reason that telemedicine has made significant progress in California. As the UC Davis and Kaiser programs demonstrated positive patient outcomes, foundations in California provided substantial funding for numerous other telemedicine and e-health projects.

Early on, the California Endowment promoted telemedicine as a principal element of its rural health initiatives and provided millions of dollars for telemedicine projects. A number of health organizations have received funding in the last decade from federal and California-based foundations to launch pilot projects.

An important asset in California is the Telemedicine Learning Center at UC Davis. Its educational programs for health professionals, administrators, and technologists provide instruction about how to develop a telemedicine program and navigate questions about equipment, telecommunications, billing, legal issues, and dealing with change management. In addition, the center has hosted many state, national, and international leaders and staff interested in learning how to establish and maintain successful programs. In May 2007, the University of California, San Diego School of Medicine received a $1 million grant from the California Telemedicine & eHealth Center (CTEC, www.cteconline.org) in Sacramento to fund a second telemedicine learning center in Southern California.[4]

CTEC was created in 1997 with initial support from the James Irvine Foundation and the Sierra Health Foundation and, since 1999, has received funding from the California Endowment. Its resource center provides information and tools to promote the expansion of the field and new programs. CTEC has funded multiple pilot projects and ten rural telemedicine and e-health networks that collectively link specialists to underserved communities across large geographic areas statewide. Thanks in part to the success of these projects and networks, the development of long-term, sustainable business models that would benefit all California residents has become a state priority.

The effort gained steam in 2003 when the California Endowment awarded CTEC a five-year, $9 million grant to develop, expand, and support regional telemedicine and e-health networks across rural areas in the state. Matching funds for this undertaking came in 2005 from the Blue Shield of California Foundation (more than $1 million) and the California HealthCare Foundation ($630,000).[5] In November 2006, voters approved Proposition 1D, which allocated $200 million for designing, building, and equipping facilities in the UC system that enhance medical education, with an emphasis on telemedicine.[6] The new facilities and equipment will support higher enrollment in UC's Programs in Medical Education, which aim to improve health care for underserved populations and communities in California.[7]

In 2007, Governor Schwarzenegger's administration collaborated with key stakeholders and the University of California to obtain $22 million in funding from the Federal Communications Commission to develop and expand a statewide telehealth network that will build upon existing rural networks.[8]

IV. Programs in California

THE MAIN OBJECTIVE OF THE MOST COMMON telemedicine applications—real-time videoconferencing and store-and-forward systems—is to increase access to health care, especially for rural and underserved populations. The following are examples of some of the more prominent telemedicine and e-health ventures in California. (Appendix B describes telemedicine programs elsewhere.)

State Prisons

Twenty-six state correctional systems, including the California Department of Corrections and Rehabilitation (CDCR), use telemedicine to care for inmates.[9] CDCR's program began as a pilot project in 1997 for mental health inmates at Pelican Bay State Prison in Crescent City. The prison's remote location had made it difficult for the department to hire or contract with on-site psychiatrists; consequently, inmates with mental health problems, including bipolar disorder and schizophrenia, had little access to mental health services.

Mental health patients at Pelican Bay now receive diagnosis and treatment via telemedicine from psychiatrists in Sacramento who are employed by CDCR on a contract basis. In an exam room equipped with a monitor and camera, health care staff at the prison introduce inmates and present their cases to a psychiatrist at a remote location, such as a community hospital, clinic, or private office, that also is equipped with interactive videoconferencing equipment. The psychiatrist can observe and speak with inmates about their medical or mental health condition without seeing them in person. The mental health pilot project was so successful that the telemedicine program soon expanded to include both mental health and medical specialty services at several other prisons in California.

CDCR has found that telemedicine preserves public safety because inmates who otherwise would have had to be transported into the community for treatment remain inside prison walls. This approach also saves fuel and other vehicle costs, as well as the cost of staff to escort inmates to outside appointments. By relying on telemedicine, CDCR estimates it saves an average of about $850 in transportation and escort expenses per outside visit. Savings totaled

about $4 million in the 2004–05 fiscal year. The cost of providing remote, versus in-person, physician consultations is lower also because CDCR solicits contract bids from a large pool of physicians in the state, not just from those who practice inside or relatively close to a prison.

Since 1997, California prisons have benefited from more than 70,000 telemedicine consults, an average of more than 10,000 annually.

With the advantages of telemedicine in mind, CDCR has been focusing on program improvements. It found, for example, that of 9,090 telemedicine consultations in 2004–05, nearly two-thirds (5,740) took place at just five of the state's 27 prisons. Nine prisons equipped with telemedicine equipment did not use it and thus did not realize any of the savings that would have been generated by avoiding trips to outside medical facilities.

As this example suggests, telemedicine in prisons can be efficient and cost-effective. However, the lack of a system-wide strategic plan to coordinate CDCR telemedicine efforts has limited the return on investment at some facilities. The department is developing a new strategic plan that will better coordinate those efforts and thereby improve efficiency, cost controls, and access to health services. In January 2006, CDCR began installing telemedicine equipment at 22 prisons and providing trained staff. It also committed to establishing telemedicine services at all prisons statewide by January 2008.

University of California, Davis

The UC Davis telemedicine program has provided a variety of specialty services to rural clinics and hospitals statewide since 1997, beginning with remote monitoring of ultrasound images at Colusa Community Hospital in Colusa.[10]

A main driver of the program, which now includes 26 medical and surgical specialties, is its strong commitment to improving health care and health education in rural areas. Over the years, the most common specialty consults have been in psychiatry, dermatology, neurosurgery, orthopedics, and endocrinology. In 2007, UC Davis reported that it had provided more than 2,700 consults via telemedicine.

A significant focus at UC Davis, an academic medical center, has been on medical education via telemedicine and studying the technology's use in various medical domains, especially psychiatry and pediatrics. Its Telemedicine Learning Center has educated more than 1,000 administrators, information technology staff, doctors, nurses, and others from around the state about what it takes to build a successful telemedicine program. High satisfaction with these efforts prompted plans to establish a second learning center at UC San Diego and to offer an online telemedicine course through UC Davis Extension.

Collaboration and education have been cornerstones of the telemedicine program's success. Evaluators study and report on its achievements and challenges so others may benefit.

The Telemedicine Learning Center arose primarily in response to the failure of community telemedicine projects whose promoters lacked the knowledge necessary to develop and maintain them. UC Davis has been working with entities in California—other UC campuses, medical schools, state agencies, and interested parties—to establish a statewide telemedicine and e-health network, one that could ultimately serve as a model for other states.

VA Palo Alto Health Care System

In collaboration with the Palo Alto Institute for Research and Education, the VA Palo Alto Health Care System has developed a unique, user-friendly touch screen application for e-health kiosks.[11]

These secure computer workstations, which cost about $22,000 and are located in several U.S. Dept. of Veterans Affairs (VA) medical clinics so patients

who come in for an appointment can conveniently use them, provide multimedia health information about diabetes, cancer, asthma, stroke, back pain, pesticide exposure, lead poisoning, and other topics, as well as links to relevant Web sites.

The information, which focuses on prevention, is available in English or Spanish, as well as an audiovisual format intended for patients who cannot read. After users are done, they can print out vouchers redeemable for certain types of preventive services, such as diabetic eye care or flu shots, that help curb unnecessary hospitalizations and emergency room visits. They can also electronically order prescription refills.

Blue Cross of California

The telemedicine program at Blue Cross of California (BCC) began in July 1999. It has since grown to include more than 60 sites where patients can seek treatment and works with eight specialty centers.[12]

Specialists in more than 25 medical fields provide live videoconferencing and store-and-forward telemedicine consults, mostly in dermatology, psychiatry, endocrinology, and pediatrics. BCC, which says it is the only private health plan in California with a comprehensive statewide telemedicine program to improve access to care, equips and trains rural clinical sites at the outset; and its Web site has clear billing instructions and other valuable information.

Participating sites receive reimbursement from BCC for telemedicine sessions. They can also get a discount on per-minute charges for high-speed connections related to specialty consults. To date, the program has logged more than 11,000 clinical encounters and more than 3,500 non-clinical sessions related to community services, training, and continuing medical education.

The Managed Risk Medical Insurance Board, a unit of the California Health and Human Services Agency that seeks to reduce the number of uninsured state residents, has provided substantial support to BCC's telemedicine program. In addition to improving access to care in rural areas, the program tries to make diagnosis and treatment planning more timely and to improve the quality of care.

Open Door Telemedicine and Visiting Specialist Center

Located on California's rural northern coast, the Open Door Telemedicine and Visiting Specialist Center in Arcata made important strategic decisions from its inception in the spring of 2006.[13] It decided: (1) to improve access to health care services that were unavailable to underserved residents, as well as enable local specialists to offer their services to other rural areas in California that lacked their particular expertise; and (2) to develop a financially sustainable program by creating a separate Telehealth and Visiting Specialist Center (TVSC) as part of its network of clinics.

Patients have access to expertise in behavioral health; diabetes education, counseling, and treatment; ophthalmology; pediatrics; cardiology; and orthopedics. In addition, the center delivers remote health education programs via a videoconferencing network. Telemedicine equipment in clinical-exam and other patient-care rooms makes the technology part of the workflow. Each room has a large, flat-panel television screen and is set up to be used for either in-person or telemedicine encounters.

Unlike the many telemedicine programs that heavily depend on grant funding, the TVSC contracts and bills for most of its services. Each month, the center averages 60 to 70 telemedicine consults and two or three remote continuing medical education presentations. It fosters local economic vitality, and helps recruit and retain local specialists, by enabling these specialists to provide health services and education remotely to other rural areas in the state. The center receives an enhanced Federally Qualified Health Center reimbursement rate for its

telemedicine patients that helps offset the costs of necessary equipment and staff.

At the outset, the center developed a business plan that addressed funding and return on investment, education, training, technical support, and evaluation. It heeded the challenges that previous telemedicine programs had encountered, such as limited reimbursement for services and, for clinicians, the difficulty of leaving their offices to do telemedicine consults at other work sites.

Central California Teleophthalmology Network

Via a telemedicine network linking 13 rural health clinics in California's Central Valley, staff and consultants at the University of California, Berkeley School of Optometry evaluate the retinal scans of thousands of low-income diabetic patients using store-and-forward technology.[14] The team built a license-free software application, the Eye Picture Archiving Communication System (EyePACS), to transmit images and receive reports.

The principal beneficiaries are the underserved in the Central Valley. Forty percent of residents there are Latino, and a large proportion of people in the region are uninsured. The incidence of diabetes among Latinos is nearly three times higher than it is among the general population, which places them at particularly high risk of diabetic retinopathy. They also are less likely to obtain the care they need because of economic, language, or distance barriers. For community clinics, a common difficulty is finding ophthalmologists to perform dilated retinal exams on Medi-Cal or uninsured patients, especially those in rural areas. Most primary care physicians do not have the necessary skills.

During a patient's primary care visit, clinics in the EyePACS program use a special retinal camera to take a picture of the back of the eye. The image is sent to a team at UC Berkeley, which reads the images remotely. The team can detect sight-threatening retinopathy as accurately as—or even more accurately than—ophthalmologists who perform dilated retinal exams. Diabetic patients who visit one of these clinics benefit in two ways: They receive primary care for their diabetes and, at the same location, get specialist care in the form of an annual retinal exam that may reveal retinopathy.[15]

Some physicians in the clinics also use the images to assess the rest of a patient's microvascular system.

The UC Berkeley team and the clinic-based primary care physicians participating in EyePACS receive reimbursement from Medi-Cal, which pays for ophthalmology services delivered via store-and-forward telemedicine. The team bills Medi-Cal for eligible patients; for uninsured patients, it bills the clinic a per-patient fee under a contract it has with the clinic, which receives reimbursement for both primary care visits and EyePACS exams. Originally, the telemedicine program expected it would break even within two years. But due to high demand, it became profitable earlier than projected and has expanded to include other clinics in California and Mexico.

EyePACS has been successful for three key reasons: It meets a specific need, has an acceptable cost (optometrists, rather than more expensive ophthalmologists, provide the service), and is easy to use. Diabetics need annual retinal exams in a primary care setting at a price community clinics can afford, and research had shown that clinics can integrate retinal photography into their primary care workflow. The retinal camera at each site costs about $20,000, an initial expense funded by foundation grants. This cost will likely fall as new devices become available. The open-source EyePACS software is easy to use and means that clinics need not pay for potentially expensive software licenses. Finally, health care providers and patients who use the services have been very satisfied with them.

A toolkit makes it easy to install the system at clinics, and technical support is available from the UC Berkeley team. The toolkit includes a training

program, a certification program for photographers, a standard memorandum of understanding for clinics, an explanation of billing options, and financially sustainable models of operation that, among other things, address the issue of sufficient patient volume.

As the UC Berkeley team has discovered, training clinic staff, which initially can be time-consuming if a telemedicine network covers a large geographic area, is a key element of success. So is reaching out to the local community and garnering support.

Kings View Behavioral Health

A telemedicine and e-health network developed by Kings View Behavioral Health, a private practice group of clinics based in Fresno, delivers remote psychiatry services to rural areas in California and also hosts telepsychiatry- and telepsychology-related software applications for county agencies.[16]

Kings View provides contract services for an hourly fee, but the remote sites are responsible for all scheduling and billing of Medi-Cal and other insurers. This business model is sustainable in part because Kings View collects payment even for "no show" patients, the numbers of which have been consistently low. In a two-year period up to 2005, it had provided more than 4,000 hours of telepsychiatry services to nine agencies in the state.

V. Barriers to Widespread Adoption

While the programs described above and many others around the state and country have made great strides in improving access to health care, there still are significant technological, financial, regulatory, and user-related hurdles preventing widespread adoption of telemedicine. To enter the mainstream, this technology must be far-reaching, easy to use, and economical for large numbers of physicians, patients, and insurers.

Perhaps the biggest impediments are provider resistance to change and the lack of a clear return on investments of time and money. Many physicians and other providers are unaware of the opportunities that telemedicine offers. Those who have not done telemedicine consults express concern that telemedicine may damage the doctor-patient relationship, they feel uncomfortable adopting new technologies or redesigning office operations, or they cannot envision a viable business model.

Technology

Two key technological challenges are telemedicine equipment that is too complex for physicians to implement and operate easily, and slow data transmission.

Providers are skeptical about technologies that increase the time it takes for them to do clinical consults and require additional equipment and space, as well as significant training, workflow changes, or new personnel. In addition, most telemedicine applications require a faster connection than typical phone lines can provide. Many rural areas are not yet wired for broadband or other high-speed capabilities, and broadband connections have so far proven prohibitively expensive for health care providers in many urban areas.[17]

Equipment Costs

The cost of new equipment also may be a barrier. Medical practices, especially those devoted to primary care, rarely set aside a portion of earnings to make capital purchases. As innovation and competition force prices down over time, this may become less of an obstacle. Some technologies, such as Internet-based teleconference software and off-the-shelf digital cameras for use in teledermatology, are not unique to telemedicine and are likely to

become less expensive as better and faster products are developed.

Hospitals, which typically have larger capital budgets, may purchase or subsidize some telemedicine technologies, including those for teleradiology and systems for intensive care units. However, hospitals face many competing demands for capital investment. Reimbursements are such that a new surgical suite may offer a more certain and quicker return on investment than telemedicine equipment for physicians who are not yet comfortable using it.

Visitors to the American Telemedicine Association Web site (www.atmeda.org) can compare and purchase technologies and services. A large telemedicine trade show at the association's annual conference is an opportunity to learn about equipment and vendors.

Health information exchange via the Internet has become a much lower barrier in the last five years. Current transmission speeds are typically adequate for most store-and-forward telemedicine interactions. As more areas of California are wired for broadband, real-time videoconferencing will become more widespread. But in the near term, broadband is likely to remain unavailable in some remote areas where there is a compelling need for telemedicine.

Financing

Most telemedicine programs have been developed to improve access to health services in rural and underserved communities. They typically have been funded by grants, with funders and program proponents hoping that if telemedicine demonstrates it provides enough value—by creating an economical connection between patients and health professionals despite geographic barriers—it will warrant subsequent contract funding or induce fee-for-service market demand.

Frequently, however, even if a program demonstrates success through a combination of clinical outcomes, patient satisfaction, and increased efficiency, funding beyond grants has not been forthcoming. As a result, ventures have failed to expand or have terminated. Although many of the programs described above have transitioned from grants to contracts, few have evolved to become viable, stable, and long-term reimbursement models under fee-for-service or capitation.

Under current reimbursement methods, contracts and other lump-sum payment agreements involving telemedicine are most feasible when government-sponsored insurance pays for services delivered to low-income patients, such as Medi-Cal patients and those who visit community clinics. The other financially viable telemedicine setting is large integrated delivery systems, such as the VA and Kaiser Permanente, that manage health and costs concurrently, serving as de facto single payers.

Aggregate Savings

More common reimbursement models in the commercial sector that pay either for increments of care (such as fee-for-service) or risk-adjusted care for a population (such as Medicare Advantage) tend not to promote telemedicine. New models may emerge in this sector as momentum for health care payment reform grows.

In a recent report, the Center for Information Technology Leadership estimated that the nation could potentially save $3.61 billion annually if, via widespread use of telemedicine, health care providers consulted with each other to intervene early in patient treatment and avoid redundant and unnecessary tests.[18] The report focused on the cost-effectiveness of several telemedicine approaches in certain settings, including emergency departments, health systems, and provider-to-provider. It found that combining store-and-forward techniques with real-time videoconferencing was most cost-effective and that prison systems, nursing homes, and emergency departments realized the greatest savings because telemedicine eliminated ambulance and travel expenses.

Despite the considerable aggregate savings projected in the report, the day-to-day business concerns of individual medical practices might preclude many from acting; physicians may not be eager to invest in new telemedicine equipment if the business model is unproven or the financial rewards must be deferred.

Implementation Costs

Even if the equipment is free, the cost of implementing the technology and altering practice routines can be challenging. A medical practice must first feel confident that investing money, time, and "change capital" in telemedicine will increase reimbursements or reduce costs. Yet estimating the potential increase in revenues is difficult because telemedicine rules and reimbursement formulas vary among insurers, and the prospect of having to sort out the different requirements for claims submission can be daunting. (Table 2 in Appendix A illustrates such variations using six telemedicine scenarios.)

The federal government and commercial insurers are developing and testing payment models and financial rewards for health care providers who implement information technologies such as electronic health records and e-prescribing. But there are no such efforts to promote the use of telemedicine.[19]

Practice Models

Primary care physicians can earn minimal revenues from some insurers by referring patients for telemedicine consults and making their office available as the origination site for such consults. In the future, these physicians may be more attracted to telemedicine if a new concept—the "patient-centered medical home"—takes root. In this model of care, which primary care specialty societies favor, primary care physicians would coordinate most of the care for and advocate on behalf of patients, and receive compensation that reflects their central role. Some insurers are experimenting with the model, which could make telemedicine more financially attractive for primary care physicians.

Certain specialties lend themselves more readily to telemedicine than others. For example, there has been rapid growth in the number of radiologists who view digital images transmitted via the Internet because the technological and workflow requirements are relatively straightforward. Other specialties especially ripe for telemedicine include dermatology, pathology, and cardiology. As these specialties mainly involve the interpretation of data or still images, store-and-forward methods can handle much of the workload.

Some specialists who practice at centers of excellence, such as transplant centers, regional surgery centers, or burn centers, use telemedicine to conduct remote initial consults and follow-up visits with patients after they leave. Providing care this way is more efficient for both clinicians and patients when a patient is not on site, and it can promote a center's profile, thereby increasing its catchment area. UC Davis, a major trauma center, does many telemedicine consults for post-surgical care of neurosurgery, dermatology, and orthopedic patients. Elsewhere, several plastic surgery programs also use telemedicine to follow patients remotely.

Questions about Need and Insurers' Costs

Most specialists in private practice do not see a need to add a telemedicine capability—especially if their practice is full—nor believe it would benefit their business. In some specialties, more consults as a result of telemedicine could reduce the time available to perform procedures, but it might also make post-procedure follow-ups more efficient or draw new patients. In other specialties, telemedicine could be an opportunity to increase patient volume at little cost, as radiologists who transmit images electronically have discovered.

The widespread adoption of telemedicine might also benefit commercial insurers because competition in the broader health care market, rather than rigid fee schedules, could lower the cost of some common specialty services. However, the authors interviewed three commercial carriers in California

who said they worried that offering telemedicine services would increase health care costs. Blue Cross of California—which, as noted earlier, supports telemedicine consults for its Medi-Cal members—does not plan to expand its program into the commercial sector, according to one interviewee. There was concern that service volume might rise, thus increasing overhead, if primary care physicians could more easily obtain a specialist's opinion or if this greater ease enabled specialists to garner more patients and incur more reimbursable costs than they would have otherwise.

Another insurer pointed out that the unit cost of specialty services provided by urban, academic physicians tends to be higher than that for an equivalent service rendered by non-urban, non-academic physicians. Because teaching hospitals in urban areas provide a large portion of telemedicine consults, the unit cost could actually increase in the short term if the technology were widespread. For this reason, no major insurers in California have expressed enthusiasm about expanding telemedicine in the state.

Funding Challenges

In the capitated HMO market, insurers interviewed indicated that they assume telemedicine would be a concern for the medical groups or independent practice associations to whom the health plans delegate care responsibilities. The health plans did not express interest in subsidizing telemedicine equipment or enabling capitated medical groups to exploit telemedicine opportunities in other ways. They doubted that most groups have the resources or desire to implement telemedicine services themselves. To date, medical group use of telemedicine has been minimal.

Many current telemedicine efforts are taking place in integrated health care systems where incentives are at least partially aligned. Such systems include Kaiser Permanente, the VA, state-run prisons, and national health care programs abroad. While integrated systems do not represent the majority of health care in the United States, they are examples of alternative delivery models that legislators and regulators can study when contemplating policy changes related to telemedicine.

Some referral programs in academic settings—such as the one at UC Davis, where encounter-based reimbursement pays for most patient care—are attempting to shift to a model in which rural health systems and insurers pay a retainer. For example, the university might be compensated for ten hours per month of telemedicine services in one specialty and eight hours in another. Retainers are a strong incentive for the referring providers to ensure that patients attend telemedicine sessions.

Regulation

Twenty-first century technology makes unfettered global telecommunications easy, offering opportunities that many industries have exploited. The exchange of health care services across state lines, however, remains strictly regulated.

With some exceptions, physicians licensed in California, including those who reside anywhere out of state, can use technology to practice medicine without any legal restrictions, regardless of whether the services they provide are face-to-face or delivered by telemedicine. They cannot legally prescribe medication via the Internet, and there are large fines if they prescribe without first physically examining the patient. (Having the patient simply fill out a questionnaire does not qualify.) But examinations need not be in-person if the technology a clinician uses—real-time videoconferencing, for example—yields the same information.

According to the California Business and Professions Code, a physical examination is not necessary if two physicians confer between each other about a patient.[20] Thus, a specialist can legally make management recommendations to a primary care physician without examining the latter's patient as long as the primary care physician has established a relationship with the patient and takes responsibility

for prescribing and monitoring his or her medications and devices.

Other issues include liability and, for physicians who conduct telemedicine sessions across state lines, licensure and malpractice coverage.[21] Traditional doctor-patient encounters often involve only two parties in one location; telemedicine sessions, in contrast, could involve multiple parties in more than one state. In some cases, it may be unclear which laws and rules apply and whether malpractice coverage extends beyond a state's borders.[22,23]

Provider Issues

The few avid telemedicine providers are early adopters willing to experiment with innovative approaches because they recognize the potential benefits, despite the costs and possible disruption of traditional practice routines. Many doctors are unaware of such benefits or are skeptical that telemedicine is relevant to their practice. As members of a typically cautious professional culture, many prefer methods that have proved successful. Furthermore, with the exception of radiology, specialty societies are not actively promoting telemedicine.

The concerns primary care physicians have about telemedicine may be different from those of specialists, as the following sections explain.

Primary Care Physicians

These doctors typically embrace telemedicine when local specialists are lacking or do not accept certain types of insurance, such as Medi-Cal.

Interviews revealed that primary care doctors who have access to local specialists are not much interested in telemedicine consults with remote specialists because they:

- Prefer to rely on the network of local specialists they have cultivated.
- Feel uncomfortable referring to remote specialists whose clinical and interpersonal skills are unknown to them.
- Worry that an initial specialty consult for a purely cognitive purpose, like evaluating hepatitis serologies, might later require a more extensive, face-to-face relationship between the specialist and patient—for example, to conduct a physical exam or perform a procedure, such as a liver biopsy.
- Are concerned about erosion of the doctor-patient relationship if specialists are remote.

Mature telemedicine programs have overcome most of these challenges. Strategies that help primary care physicians become more comfortable with the technology include:

- Discussing the related issues up-front to allay their concerns. Primary care physicians need to know, for example, that most remote consults by specialists do not require in-person follow-ups.
- Presenting surveys that show high patient satisfaction with telemedicine.
- Having primary care physicians view video profiles of, and other biographical information about, specialists with whom they may consult.
- Providing opportunities to participate in telemedicine demonstrations and trials to gain a hands-on understanding.

Some primary care physicians also are concerned about how telemedicine could affect their business operations. All of those interviewed for this report said they worried that referring patients to remote rather than local specialists could prompt the latter to withhold referrals to the primary care doctors. Although such an outcome may be more theoretical than real, it nevertheless is a perception that may be inhibiting widespread adoption of telemedicine. Quantifying the extent to which this actually occurs could help allay physicians' concerns.

Implementing a new technology like telemedicine and changing office processes to accommodate it are challenging propositions for primary care physicians and their staff. The fact that few physicians use secure e-mail messaging to communicate with patients—despite the ease and ubiquity of e-mail and the many opportunities for electronic information exchange in health care—is telling. A recent survey of California physicians found that only 19 percent often or sometimes communicate with patients by e-mail.[24]

Finally, the intense focus on transitioning to electronic health records may leave little time, money, and energy for medical practices to invest in telemedicine.

Specialists

The impediments for specialists are largely related to convenience and economics. Like all ambulatory care doctors, specialists are accustomed to having patients come to them. Telemedicine may make life easier for patients, but it reduces convenience for those specialists who must use a different physical space to do consults and adopt new procedures for accessing data, communicating with patients remotely, and documenting and billing for telemedicine encounters.

Inconvenient and unfamiliar processes slow the delivery of care, which for nearly all physicians translates into frustration and a loss of potential income. In addition, telemedicine patients who miss their appointments reduce physicians' income and productivity, and preparing the patient and equipment for a consult can take extra time. Consequently, many specialists—especially those who do not view telemedicine in the context of patient-centered or system-wide health care—may believe that the technology's disadvantages outweigh its benefits.

Strategies for overcoming these hurdles include simplifying the telemedicine interface and paperwork that accompany a referral as much as possible—for example, by conducting store-and-forward rather than real-time videoconferencing consults when appropriate—and convincing insurers to pay more for telemedicine sessions than they do for face-to-face visits to compensate for the additional expenses.

An analysis of 106 telemedicine studies suggested that "the best evidence for the effectiveness of telemedicine is in medical specialties for which verbal interactions are a key component of the patient assessment, such as psychiatry and neurology."[25] Although physicians, particularly those who have not used telemedicine, are skeptical about diagnosing and treating patients without seeing them in person and making a personal connection, research in multiple clinical disciplines suggests that diagnostic skills are not compromised when patient care relies on this method of information and image exchange.[26]

The concerns of some providers that telemedicine compromises patient care highlights the importance of educating clinicians about the results from telemedicine initiatives and ensuring that they are trained to use the technology effectively.

Expanding telemedicine in California will depend partly on solid investment in training for future clinicians. The Telemedicine Learning Centers at UC Davis and UC San Diego, and the California Telemedicine & eHealth Center in Sacramento, suggest that California is ahead of other states in terms of training, resources, and expertise.

Patients' Role

Most patients rely on physicians to make decisions about their care, especially regarding referrals to specialists. Consequently, patients are unlikely to request telemedicine services if their doctor does not promote them. Although very few consumers seek medical care provided via the Internet, many do use the Web to seek medical information and evaluate clinical options.

Research has demonstrated that patients value telemedicine encounters and services, and, like physicians, are highly satisfied with them.[27,28] A study of seven rural communities in Northern California suggested that residents who were aware of locally available telemedicine services had a higher opinion of health care quality in their community.[29] Patients may like telemedicine in part because it gives them an opportunity to consult a specialist at a high-profile academic institution to which they would not otherwise have access.

However, telemedicine technologies may raise some privacy, confidentiality, and security concerns. There could be circumstances in which personal health information is inappropriately exposed, possibly without the patient's knowledge. For example, someone "off camera" could witness a telemedicine session, or someone other than the clinician and patient may be present to make technical adjustments.[30] Most telemedicine learning centers, including the one at UC Davis, provide training on privacy and confidentiality.

A report to Congress by the National Telecommunications and Information Administration identified a number of other challenges that have implications for both patients and physicians, including:

- A lack of uniformity among state laws governing privacy and confidentiality. Telemedicine sessions that take place across state lines could cause confusion about which laws apply.
- Telemedicine communications involve a larger amount of data and technical complexity than a traditional doctor-patient session does. Securing the data may be more difficult.[31]

VI. Key Questions and Conclusion

THE FOLLOWING QUESTIONS SHED LIGHT ON THE FUTURE of telemedicine generally and how developments could affect its proliferation in California.

Will advances in technology and connectivity accelerate adoption? Wider availability of cheaper broadband access will help providers—particularly those in rural areas—take advantage of telemedicine applications. Web and "Health 2.0" technologies will simplify connections between providers and consumers statewide and beyond California's borders. These advances could dramatically increase access to, and lower the cost of, telemedicine technologies.

Can a business case for telemedicine applications be demonstrated? Telemedicine proponents and health care providers are still struggling with the economics of integrating telemedicine into the delivery system. Making a sound business case for telemedicine will require more-focused efforts to collect data from existing programs, a thorough analysis of those programs, and measurement tools in new programs to gauge if and how much they improve value. Such efforts need to be tailored to each of the many different types of business entities in health care. A truly forward-looking examination of the telemedicine business model must consider potential health care reforms that would promote adoption of valuable new technologies by rethinking reimbursement and payment arrangements.

What can California do to take advantage of the telemedicine knowledge that successful programs in the state and elsewhere have gained over the last decade? Active telemedicine programs have demonstrated that they can deliver tremendous value to providers and consumers in geographically isolated areas. Successful programs have used various models of staffing, financing arrangements, and technologies. As California contemplates a major expansion of telemedicine into underserved communities in rural and urban areas, it is crucial that the valuable lessons learned from early programs—both the successes and failures—and the personal experiences of early adopters be collected and applied to new ventures.

Given the resources that are available for infrastructure and equipment, how should California prioritize the use of investment capital to roll out telemedicine services? The availability of funds and attention to the potential of telemedicine technologies create an exciting opportunity for those who want to improve health care access in California. But to achieve economically viable and sustainable change, priorities must be set and forces aligned. Regulators, payers, providers, and consumers must all be engaged and work together to integrate new technologies and practices, and develop the relationships and financing mechanisms necessary to sustain telemedicine ventures.

Conclusion

In recent years, there have been important developments on the telemedicine front in California. Creation of the California Broadband Task Force by executive order of the governor in July 2006 set the stage for greater focus on using telemedicine to improve access to health care in rural and underserved communities.[32] The potential role of the University of California in that effort gained considerable attention when, in late 2006, voters approved a $200 million education bond that will support expanded telemedicine education at UC. The following year, California received a $22 million award from the Federal Communications Commission to develop and expand a statewide telehealth network.

In addition, a number of active projects in rural and urban clinics have been expanding the use of telemedicine for clinical services in specialties that have demonstrated they lend themselves well to this technology, including ophthalmology, dermatology, and psychiatry. The state prison system is also making major infrastructure improvements to boost its telemedicine capacity.

All of these developments are signs that telemedicine in California is progressing. However, widespread adoption of this promising technology still faces significant challenges.

Appendix A. Telemedicine Reimbursement Scenarios

Table 1. Variation in Reimbursement Rules for a Hypothetical Dermatologist in California

TYPE OF INSURANCE/PAYER	RURAL* PATIENTS ONLY	STORE-AND-FORWARD ALLOWED?	REFERRING SITE PAID A FACILITY FEE?	COMMENTS
Medi-Cal or through federally qualified health center	No	Yes	No	Use same current procedural terminology (CPT) with telemedicine modifier.
Medicare	Yes	No, only real-time videoconferencing	Yes	Use same CPT code with telemedicine modifier.
PPO insurance	No	No	No	No PPO insurance reimbursements found in California.
HMO insurance via independent practice association (IPA)	No	Depends on contract	No	Few examples found. Payment terms set between dermatologist and IPA.
Self-pay	No	Determined by dermatologist and patient	No	Based on dermatologist making services available on the Internet or through a consumer-directed health plan. No examples found.

*"Rural" is defined as a "health professional shortage area" or any place in a county that is not included in a "metropolitan statistical area."

Source: Author research.

Table 2. Examples of How Telemedicine Scenarios Are Reimbursed in California, by Clinical Relationship

REFERRED BY*	CONSULTING MD*	PRESENTING MEDICAL PROBLEM	CLINICAL ACTION	TYPE OF INSURANCE	REIMBURSABLE BY INSURER?	CAVEATS AND COMMENTS
Physician-Patient						
Primary care physician	Dermatologist	Raised rash with ulceration	Evaluate digital images; prescribe Rx	Medi-Cal, Medicare	Yes, equal to face-to-face visit under Medi-Cal; Medicare reimburses only if patient is located in rural area and only if the session is done in real time	Explicitly covered under California law passed in 2005
Primary care physician	Psychiatrist	Depression; unresponsive to Rx by primary care physician	Provide telepsychiatry via videoconference; prescribe Rx	Medicare	Yes, equal to face-to-face visit under Medicare	Patient must be located in rural area; originating site eligible for partial facility fee
Patient (self-referral)	Primary care physician	Wants oral contraceptives	Evaluate patient; prescribe oral contraceptive pills	Consumer-directed health plan	No, patient has high-deductible plan and pays from pre-tax savings account	California law requires an appropriate physical exam before prescription via telemedicine; physician must be licensed in California
Physician-Physician						
Primary care physician	Gastroenterologist	Abnormal, atypical hepatitis serologies	Review serologies and interpret for primary care physician	Commercial preferred provider organization	Yes (commercial insurers)	No regulation precludes this service
Emergency department physician	Radiologist (licensed in California but located elsewhere)	Emergency department evaluation of head trauma for bleeding	Interpret computed tomography images of head	Commercial preferred provider organization	Yes, equal to usual fee for reading by radiologist	Hospital-based radiologists must be credentialed at hospital where patient presents
Primary care physician (in independent practice association)	Rheumatologist	New diagnosis of rheumatoid arthritis that needs therapy	Review case; recommend therapy; follow case with primary care physician	HMO	Terms set by capitated medical group or independent practice association	Very few such arrangements identified in California

*Located in California unless otherwise indicated.

Source: Author research.

Appendix B. Other Telemedicine Programs

National

Veteran's Health Administration

The Veterans Health Administration (VHA), which operates a fully integrated health care delivery system, began using telemedicine more than 30 years ago for a mental health project in Nebraska.[33] Its efforts have greatly expanded since then. The VHA now performs more than 243,000 telemedicine consultations a year in a variety of medical disciplines, placing it among the world's top hospital providers of telemedicine services.

Most of these services involve mental health, radiology, ambulatory care, audiology/speech pathology, dermatology, pathology, and nuclear medicine. Other specialty areas include home health, care for spinal cord injuries, transplantation, remote management and assessment of implanted cardiac devices, and assessing diabetics for retinopathy using teleretinal imaging.

Telemedicine is particularly suited to veterans who, grappling with war trauma, are reluctant to visit a hospital for counseling and mental health services. Today, such services can be delivered to them remotely.

The VHA uses videoconferencing, store-and-forward methods, and other technologies to provide care at community-based outpatient clinics. It integrates these technologies with its electronic health record system, VistA, the largest in the country.

Patients receive care through one of nearly two dozen administrative units around the United States called Veterans Integrated Service Networks. A data and communications networking strategy calls for connecting all 170 VA medical centers via high-speed bandwidth. Such a platform is ideal for voice, data, and videoconferencing capability.

Programs in Other States

Alaska

Alaska, the largest state geographically, has a small population distributed across remote areas, a doctor shortage, a significant number of indigenous people, and few roads.[34] The Alaska Federal Health Care Access Network (AFHCN) relies on satellites that, in addition to telephone service, deliver telemedicine services to the more than 200,000 residents receiving federally funded health care through the Department of Defense, Veterans Affairs, the Public Health Service, and other entities.

About 250 sites, including public health nursing stations, clinics in villages, regional hospitals, health facilities for Alaska natives, and military installations are linked to the network, most of them via subsidized broadband. AFHCN, which launched in 1998, initially deployed store-and-forward technology; since then, it has added live videoconferencing capability and greatly expanded its range of clinical services. Each clinic has a personal computer and peripherals, such as a digital camera, electrocardiogram, and electronic otoscope for ear infections.

From the beginning, AFHCN was designed to be sustainable. Among other things, it developed its own software, used off-the-shelf equipment whenever possible, made sure that equipment and training were not too sophisticated for users, and focused on primary rather than specialty care.

AFHCN greatly reduces the time it takes to dispense care (patients need not wait weeks or months for a clinician to visit their area nor travel long distances for services), improves quality of care by preventing the deterioration of medical conditions that can result from delays in treatment, saves on the high cost of emergency evacuations by airplane, and cuts patients' transportation expenses.

Arizona

Twenty communities in the state receive medical services via store-and-forward and real-time videoconferencing through the Arizona Telemedicine Program (ATP), based at the University of Arizona.[35] The centralized program also offers distance learning, informatics training, and assessment of telemedicine capabilities. This far-reaching collaboration involves a variety of for-profit and non-profit health care organizations and state agencies.

ATP began in 1996 when the state legislature allocated start-up funds for telemedicine services to be provided to isolated communities, rural prisons, and Native American tribes. Building on that foundation, it solicited and received additional funding from third-party payers, state and federal resources, and numerous health care systems.

An ATP e-health venture enables state agencies to work together on children's health care, home health nursing, public education, disease prevention, and other broad efforts. In addition, ATP has launched remote services for children who need physical and occupational therapy, patients who need nursing care at home, and heart patients who are waiting for a transplant.

The program attributes much of its success to strong ties among the University of Arizona College of Medicine, the state legislature, and health care providers. It notes: "Bridges built between state agencies, local governments, and legislative bodies are fostering a high level of awareness of the importance of telemedicine and e-health to achieving the state's health care goals."

Idaho

Privately owned NightHawk Radiology Services, based in Coeur d'Alene, reads radiographs around the clock, seven days a week for more than 700 radiology group practices and nearly one-quarter of all hospitals in the country.[36]

Its team of radiologists—located in the United States, Australia, and Switzerland—are U.S. board-certified, hold state licenses, and have hospital privileges. They interpret radiographs of all organ systems using a range of technologies, including computed tomography, magnetic resonance imaging, ultrasound, nuclear medicine, and x-ray. Clients can transmit images to NightHawk reading centers via high-speed Internet connections or a virtual private network.

Maryland

VISICU, a publicly traded company based in Baltimore, remotely manages patients in intensive care units at large, multi-hospital health systems using proprietary hardware and software.[37] Via telemedicine, intensivists and other members of a care team at an "eICU" facility monitor and care for hundreds of patients 24 hours a day, similar to the way air traffic controllers direct the flow of many airplanes.

This approach is based on the notion that constant surveillance of patients in ICUs, where there is a national shortage of intensivists, and immediate attention from physicians can detect problems earlier and thereby prevent complications, which reduces mortality, improves outcomes, and generates savings. A study focusing on the use of eICU at a multi-hospital system in Virginia found that it reduced mortality among intensive care patients by 27 percent, pared length of stay among these patients by 17 percent, and generated per-patient savings of $2,150.[38]

As VISICU's software monitors patients, it evaluates physiological thresholds and trends, and sends electronic alerts if something is awry. Clinicians can also access an online decision-support tool.

Montana

A telemedicine "network of networks" in Montana (where the entire population is smaller than

that of Sacramento) links multiple health care organizations.[39] This enables the organizations to share specialists who are in high demand but geographically separated. Health care delivery is more efficient because many rural areas in the state have access to a greater number of specialists, and there are more opportunities for specialists to provide consulting services.

The network is structured on secure, high-capacity broadband. From a business standpoint, this simplifies the business model because there are fewer telecommunications companies involved. California, in contrast, has many telecommunications companies whose core business is telephony, not secure broadband.

Because Montana is largely rural, the state has won a number of grants targeted to improving health care access in underserved communities.

Texas

The University of Texas Medical Branch (UTMB) in Galveston operates the largest statewide telemedicine program in the country through its Electronic Health Network.[40] UTMB partnered with the Texas Department of Corrections in 1994 to provide managed care services to inmates. Today, 150,000 inmates at 120 facilities receive medical care via telemedicine.

The Electronic Health Network combines sophisticated videoconferencing, electronic health records, and disease management monitoring to deliver integrated, multi-disciplinary services. The telemedicine program is more efficient and cost-effective than traditional care because it eliminates the need to transport patients to specialists (at least two armed guards must travel with prisoners when they visit a doctor's office). A 2006 audit found that the telemedicine services are cheaper and of higher quality than those provided to inmates in equivalent prison systems in other states.[41]

Prison health care currently constitutes 60 percent of the UTMB telemedicine program. In recent years, the program has greatly expanded to include people in rural and underserved areas, employees at work, children at school, cruise ship passengers, and scientists in remote locations such as Antarctica.

Each year, the Electronic Health Network enables more than 60,000 real-time videoconferencing sessions and many thousands of store-and-forward consults. The main focus has always been on providing primary care (for example, advice from a general practitioner to a remote nurse) and emergency room consults; specialty care, especially psychiatry and dermatology, is secondary. UTMB bills the remote health care providers rather than patients for half- or full-day telemedicine services, which motivates providers to make sure that patients show up for their appointments.

The success of UTMB's telemedicine program is due in large measure to the long-term contracts it has signed for population-based services. This approach, compared to grant funding, generates a steady revenue stream that keeps the program viable over time and enables it to grow and invest in infrastructure and training.

Endnotes

1. In real-time videoconferencing, an encounter between a health care professional and a patient—or a consultation between physicians—occurs via a remote video feed during which the two parties interact simultaneously. In store-and-forward, digital images, clinical information, or other data are temporarily stored and then later transmitted.
2. *The State of Health Information Technology in California: Consumer Perspective.* California HealthCare Foundation: 2008 (www.chcf.org/topics/chronicdisease/index.cfm?itemID=133592).
3. Senate Bill 1665 (www.atsp.org/inc/HTML/pdf/CaliforniaTelehealthLegislation.pdf).
4. "UC San Diego School of Medicine receives $1 million telemedicine learning center grant." UCSD News Center: May 3, 2007 (ucsdnews.ucsd.edu/newsrel/health/05-07MedGrantLF-.asp).
5. History and Overview. California Telemedicine and eHealth Center (www.cteconline.org/history.html).
6. Ackerman, K. "California Could Become National Model for Telemedicine." *iHealthBeat:* October 30, 2007 (www.ihealthbeat.org/articles/2007/10/30/California-Could-Become-National-Model-for-Telemedicine.aspx?a=1).
7. Strategic Growth Plan Bond Accountability. Education. State of California (www.bondaccountability.ca.gov/Bonds/Education/default.php).
8. "UC receives $22 million FCC telehealth grant." University of California: November 20, 2007 (www.universityofcalifornia.edu/news/article/16856). For details about the proposed statewide telehealth network, see fjallfoss.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6519409722.
9. Information in this section comes from Judicial & Criminal Justice. 2006-07 Analysis. Legislative Analyst's Office, State of California (www.lao.ca.gov/analysis_2006/crim_justice/crimjust_anl06.pdf).
10. Information in this section comes from Kathy Chorba, personal communication, October 2007; and Attendees. Center for Health and Technology, University of California, Davis (www.ucdmc.ucdavis.edu/cht/services/telemedicine).
11. Information in this section comes from *2005 Annual Report. Status of eHealth in California.* California Telemedicine & eHealth Center (www.caltelassn.com/Reports06/MiscInfo/ctecstatus.pdf); and *Touch-Screen Kiosks: A New Tactic on the Patient Education Front.* Unpublished report. California Telemedicine & eHealth Center: July 2003.
12. Information in this section comes from w2.anthem.com/bcc_state/tm/info/index.asp and Introduction to Telemedicine. Blue Cross of California (www2.bluecrossca.com/bcc_state/tm/info/intro.htm).
13. Information in this section comes from Frank Anderson and Herrmann Spetzler, personal communications, June 2007.
14. Most of the information in this section comes from Jorge Cuadros, personal communication, July 2007.
15. For more information about the diabetic retinopathy screening project, see the video at www.chcf.org/topics/chronicdisease/index.cfm?itemID=133378.
16. Information in this section comes from www.kingsview.org and *Kings View, Central California eHealth Rural Network Collaborative.* California Telemedicine & eHealth Center (www.americantelemed.org/news/2006_presentations/w2e3.ppt#271,5,KingsView).
17. Brown, N. "Telemedicine coming of age." Telemedicine Information Exchange: January 2005 (tie.telemed.org/articles/article.asp?path=telemed101&article=tmcoming_nb_tie96.xml).
18. Cusack, C.M., Pan, E., Hook, J.M., and others. *The Value of Provider-to-Provider Telehealth Technologies.* Center for Information Technology Leadership: 2007 (www.citl.org/_pdf/CITL_Telehealth_Report.pdf).

19. The telemedicine program at Blue Cross of California, for example, offers a per-visit subsidy in addition to regular reimbursement, but there is no financial reward for implementing and using telemedicine.

20. California Business and Professions Code, Section 2290.5 (www.leginfo.ca.gov/cgi-bin/displaycode?section=bpc&group=02001-03000&file=2220-2319).

21. Ibid. "Telemedicine coming of age." Telemedicine Information Exchange: January 2005 (tie.telemed.org/articles/article.asp?path=telemed101&article=tmcoming_nb_tie96.xml).

22. Wachter, G.W. "Law and policy in telemedicine. Malpractice and telemedicine liability: The uncharted waters of medical risk." Telemedicine Information Exchange: July 2002 (tie.telemed.org/articles/article.asp?path=legal&article=malpracticeLiability_gw_tie02.xml).

23. Johnson, L.J. "Your risks when practicing telemedicine." *Modern Medicine:* January 18, 2008 (www.modernmedicine.com/modernmedicine/Medical+Economics/Your-risks-when-practicing-telemedicine/ArticleStandard/Article/detail/483043?contextCategoryId=40169&ref=25).

24. *The State of Health Information Technology in California. 2008.* California HealthCare Foundation (www.chcf.org/topics/chronicdisease/index.cfm?itemID=133552).

25. Hersh, W.R., Hickam, D.H., Severance, S.M., and others. "Diagnosis, access, and outcomes: Update of a systematic review of telemedicine services." *Journal of Telemedicine and Telecare* 2006;12 (Suppl. 2): 3–31. This analysis did not include studies on teleradiology.

26. *Telemedicine for the Medicare Population: Update.* Evidence Report No. 131, Publication No. 06-E007. Agency for Healthcare Research and Quality: February 2006 (www.ncbi.nlm.nih.gov/books/bv.fcgi?rid=hstat1b.chapter.28702).

27. Whitten, P., and Love, B. "Patient and provider satisfaction with the use of telemedicine: Overview and rationale for cautious optimism." *Journal of Postgraduate Medicine* 2005;51(4): 294–300.

28. Gustke, S.S., Balch, D.C., West, V.L., and others. "Patient satisfaction with telemedicine." *Telemedicine Journal* 2000;6(1): 5–13.

29. Nesbitt, T.S., Marcin, J.P., Daschbach, M.M., and others. "Perceptions of local health care quality in 7 rural communities with telemedicine." *Journal of Rural Health* 2005;21(1): 79–85.

30. *Conference Report—ATA 2001. Privacy, Confidentiality, and HIPAA.* Medscape TechMed eJournal (www.medscape.com/viewarticle/415043_4).

31. Telemedicine Report to Congress. Privacy, Security, and Confidentiality in Telemedicine. National Telecommunications and Information Administration: January 1997 (www.ntia.doc.gov/reports/telemed/privacy.htm).

32. Executive Order S-12-06 by the Governor of the State of California. July 24, 2006 (gov.ca.gov/index.php?/executive-order/2616).

33. Information in this section comes from Darkins, A. Telemedicine and Telehealth in the Veterans Health Administration. American Telemedicine Association (www.americantelemed.org/news/darkinsvha.htm); and www.va.gov/occ/THinVA.asp.

34. Information in this section comes from Hudson, H.E. Rural telemedicine: Lessons from Alaska for developing regions of the Asia-Pacific (www.ptc.org/ptc2004/program/private/monday/m13/m131_hudson.pdf); and ibid. "Rural telemedicine: Lessons from Alaska for developing regions." *Telemedicine and eHealth* 2005;11(4): 460–467.

35. The information in this section comes from Brief Description. Arizona Telemedicine Program, University of Arizona (www.telemedicine.arizona.edu/program/description.html).

36. Information in this section comes from www.nighthawkrad.net.

37. Most of the information in this section comes from www.visicu.com.

38. Breslow, M.J., Rosenfeld, B.A., Doerfler, M., and others. "Effect of a multiple-site intensive care unit telemedicine program on clinical and economic outcomes: An alternative paradigm for intensivist staffing." *Critical Care Medicine* 2004;32: 31–38.

39. Information in this section comes from Thelma McClosky Armstrong, personal communication, November 2007.

40. Most of the information in this section comes from Alexander Vo, personal communication, July 2007; and ehn.utmb.edu/EHN_Services.htm.

41. Boultinghouse, O. "EHN–Operational Telemedicine." Presentation at Mainstreaming Telemedicine, Understanding Sustainable Operations, Galveston, Texas, November 12–13, 2007.

California
HealthCare
Foundation

1438 Webster Street, Suite 400
Oakland, CA 94612
tel: 510.238.1040
fax: 510.238.1388
www.chcf.org