American College of Emergency Physicians®

Telemedicine in Emergency Medicine

Information Paper

Purpose

The purpose of this paper is to provide practicing emergency physicians with an introduction to telemedicine technology, and to stimulate the emegency medicine community to think about ways in which this emerging technology might be of value to our practice and to our patients – now, and in the future.

We first define and then discuss emerging efforts at utilizing telemedicine in ways that may be pertinent to emergency medical practice. Economics of telemedicine practice are examined, followed by some futuristic thoughts about telemedicine in emergency medicine.

Current Uses and Application of Telemedicine

Telemedicine is the use of telecommunications for medical diagnosis and patient care. Telecommunication technology allows for the provision of medical services to sites that are physically separated from the provider. The telemedicine communication link usually involves standard telephone service through high speed, wide bandwidth transmission of digital signals in conjunction with computer enhancement. Evolving alternative communication links for telemedicine include fiber optics, satellite connections, and other sophisticated peripheral equipment and software. Telemedicine can be divided into three areas: decision-making aids, remote sensing, and collaborative arrangements for real-time management of patients at a distance.

Decision-making aids: The simplest application of telemedicine is the use of on-line computer databases in the clinical practice of medicine. Search engines list abstracts from selected texts and journals that address specific or cross-referenced topics. This is the oldest application of telemedicine.

Use of search engines by non-medical persons has become more common. Easy access of detailed medical information to laypersons creates new opportunities for self-diagnosis, or misdiagnosis, by those seeking to escape the financial and time burdens of standard medical care.

Remote sensing: Remote sensing involves the transmission of patient information from one site to another. This includes electrocardiographic (ECG) and digital x-ray data. Remote sensing raises the issues of patient record confidentiality and patient consent.

Collaborative real-time patient management: This represents the most innovative category of telemedicine and is the primary focus of this review. Collaborative video management, or videoconferencing, allows a remote practitioner to observe and discuss symptoms with a patient or another practitioner. Two-way workstations produce quality digital motion pictures across long distances. Equipment needs include a communications network and peripheral equipment, such as an electronic stethoscope, otoscope, ophthalmoscope, and dermascope. The costs of building a telemedicine suite are reviewed in Appendix A. Endoscopy equipment is used by some

telemedicine centers. The promise of higher-speed transmission technology in the near future will allow transmission of cinematographic data, such as angiography and echocardiography. Videoconferencing raises pivotal issues of credentialing, liability, cross-state licensing, referral practices, and reimbursement.

The most prevalent applications of video telemedicine are for rural health services, remote specialty and subspecialty consultation, correctional facility health care, and military health care. Videoconferencing is used by a growing number of medical specialties, including cardiology, dermatology, home health care, oncology, psychiatry, radiology, surgery, and wound management. The deceleration in health care spending prompted by decreased governmental funding, coupled with the influence of managed care will encourage the broad application of telemedicine in the near future. Currently, the majority of telemedicine programs are funded by government grants and are based in academic centers. In October 1996, the National Library of Medicine announced 19 multi-year telemedicine projects designed to affect rural, inner city, and suburban areas.

Telemedicine in US Academic Centers

1. Kentucky TeleCare: The Kentucky TeleCare program, located at the University of Kentucky Medical Center (UKMC) in Lexington, began in 1994. This program's interactive video network links hospitals throughout the state with UKMC-based services in adult and child psychiatry, dermatology, pediatric cardiology, and pre-operative anesthesia. TeleCare has performed trials in at least ten other clinical specialties, including emergency medicine, and forecasts the opening of regular video clinics in five of these specialties. UKMC's emergency medicine application of telemedicine involves the prevention of unnecessary transfers. A case example cited included a posterior pharynx puncture wound that was discharged home from a rural hospital emergency department (ED) following video consultation with a UKMC-based physician.

2. East Carolina University School of Medicine: The East Carolina University School of Medicine (ECU) initiated a telemedicine program in 1992 when Central Prison, the state's largest maximum security prison, contracted with ECU to provide telemedicine services. The video network is connected to six rural hospitals and four medical centers in the region and provides telemedicine and distance learning programs. ECU's future plans include the testing and implementation of virtual reality tools in the telemedicine environment.

3. The Oklahoma Telemedicine Network (OTM): The OTM is a collaborative effort between the Oklahoma Department of Commerce, Oklahoma State University, and Oklahoma University. The OTM consists of five hub centers connecting approximately 40 participating hospitals.

4. The Medical College of Georgia (MCG) Telemedicine Center: The MCG Telemedicine Center, founded in 1992, is a statewide network linking 59 health care and correctional facilities. MCG's telemedicine initiatives include an early intervention program that links the families of children with special needs with a team of MCG-based practitioners. This team includes a pediatric neurologist, occupational therapist, physical therapist, speech and hearing specialist, nutritionist, and developmental pediatrician. Dodge County Hospital in Eastman, Georgia maintains a telemedicine suite in its ED. The suite links Dodge County Hospital patients and physicians with real-time consultants at Medical College of Georgia, which is 130 miles away.

5. University of Tennessee (UT) Knoxville Medical Center: The UT Knoxville Medical Center telemedicine program is managed by Sam Burgiss, Ph.D. and emergency medicine specialist Patrick O'Brien, MD. The program provides video telemedicine services to suburban and rural facilities throughout Knox County, Tennessee.

6. University of Maryland at Baltimore: This program investigates the transmission of real-time vital signs and video images of ambulance patients from the ambulance to the hospital's trauma center.

7. The Alaska Telemedicine Project: This four-year old project deployed telehealth informatics to Russia and the Far East and signed a letter of intent with the Ministry of Health in Romania.

Other states with university-based telemedicine programs include Colorado, Massachusetts, Vermont, California, New York, Missouri, Wyoming, Montana, Utah, Idaho, Ohio, Washington, Iowa, and Oregon.

International Applications: A landmark case of international telemedicine use occurred in April, 1995 when an "SOS" e-mail message from China led to the Internet diagnosis of Zhu Lingling, a young female university student, with Guillian-Barre syndrome. IMPHONE is a European teleradiology project developed through the partnership of a European research commission, known as AIM, and US-based medical supply corporations, including General Electric Medical Systems and Hewlett-Packard. As part of this project, a teleradiology system was implemented at the University of Pisa Hospital in March 1994. AIM also supports the Framework for European Services in Telemedicine, which provides support for individuals and corporations seeking to establish telemedicine networks in Europe. In December 1995, the French and Italian Ministries of Health launched Global Emergency Telemedicine Service, a conjoint project to study the implementation of a worldwide emergency telemedicine network. In Canada, a joint initiative by eight health care organizations and three private sector technology partners created the Healthlink Clinical Data Network Corporation. Healthlink provides electronic medical records transfer. Real-time video telemedicine is in its infancy in Canada, where the geographic distances separating citizens from medical centers creates an ideal setting for telemedicine use.

Military Applications: The US military is on the forefront of telemedicine application. Telecommunication linkages between base hospitals and remote military outposts have existed for many years. Endoscopic surgical procedures, including laparoscopy, are performed through videoconferencing. Cutting-edge applications include the use of real-time battlefield imaging devices mounted on a soldier's helmet. Also, sensors mounted on a soldier's vest capture the radio transmission of ECG data from a fellow soldier's leads from a distance of up to 8 feet. In the future, ECG and skin sensors will allow battlefield tracking data, with communication of individual soldier location and physiologic information to base health care personnel.

NASA: The US space program uses both remote sensing and videoconferencing to monitor the health of US astronauts during missions.

Economics of Telemedicine

Overview

Telemedicine technology is used for many reasons, including improved quality of care, better communication between providers, increased beneficiary access to specialists, reduced transportation expenses, and increased cost efficiency. The resurgence of telemedicine has been sparked by a variety of tensions in the health care industry, including: competition among providers prompted by the need to become profitable; the need to reduce the cost of care; and the notion that a broader network of patients can be built and managed more easily by using telemedicine strategies. Telemedicine has the potential to increase patient volume, lower cost, and generate greater market share.

As is true with many other technologies, economic forces will play a major role in telemedicine development and its ultimate application. Various forms of telemedicine have existed since the 1950s. Early expansion was confined by limitations in technology and subsequent high costs. Recent technological advances, however, such as fiber optics, satellite communications, methods of data compression, and real-time video transmission, have minimized many of the technological barriers for telemedicine growth. Costs of telemedicine networks are less of a hurdle as well. However, reimbursement issues still pose a significant barrier to widespread implementation. Only recently have formal reimbursement mechanisms been established on a limited basis.

Reimbursement

Generally speaking, telemedicine reimbursement policies by the Health Care Finance Administration (HCFA), by private insurers, and by the state Medicaid programs are spotty and limited. This lack of clear and consistent policy has made it difficult to cover the costs of telemedicine systems with reliable sources of revenue. Historically, private payors follow the way of HCFA when determining what and how much to pay for new treatment modalities. Both public and private payors are reluctant to set policy for telemedicine reimbursement without detailed information about the costs and effectiveness of specific telemedicine procedures and applications. To date, there has been a dearth of scientific literature clearly demonstrating these clinical benefits, and much about what is said regarding telemedicine's benefits is anecdotal. It is difficult to draft comprehensive business plans based on anecdotal data. There have been few or no applications of telemedicine to large populations to provide data for valid, scientific and financial analyses.

HCFA has not formally defined telemedicine for either the Medicaid or Medicare programs, and federal law does not presently recognize telemedicine as a distinct service. HCFA's *Evaluation and Management Services Guidelines* define a reimbursable consultation as, "…that time the physician spends face-to-face with the patient."[1] HCFA does currently allow payments for teleradiology (for transmission and interpretation of images), telepathology (for transmission and interpretation of images of specimens), and for telecardiology (for transmission and interpretation of ECGs and echocardiograms). These are areas that do not typically require face-to-face contact with the patient; the relevant data can be easily captured in an electronically transmitted image, and the clinical decisions can be made without having to examine the patient. Outside of these fields, reimbursement is available on a limited basis through both Medicaid and Medicare.

In October 1996, a three-year HCFA Medicare experiment was implemented that allows payment

for telemedicine services at five test-site Medicare-certified facilities in four states: North Carolina, Iowa, Georgia and West Virginia. With an emphasis on increasing access to persons living in rural areas, the demonstration project focuses on consultations in which a primary care provider with a Medicare patient at a remote site consults with a medical specialist at a medical center facility. A recent publication revealed that utilization, and subsequently payments made to the test sites, has been much lower than expected.[2]

Managed care organizations have solicited HCFA on whether they can provide telemedicine services to recipients, and HCFA has responded that Section 1876 of the Social Security Act permits risk contracting organizations (organizations that receive fixed prepayments from HCFA) to make those services available to their covered populations in the same manner as other services not covered by Medicare. For example, a risk contracting entity has the choice of offering telemedicine services as an additional service to the basic benefit package or as an optional supplement. This demonstrates that HCFA recognizes telemedicine's potential, but will presently only pay for it indirectly and under certain circumstances.

In contrast to Medicare, Medicaid is largely regulated by the states. States are given the option of using telemedicine as an alternative to the more traditional, face-to-face provision of care. At least nine states presently cover such services: Arkansas, California, Georgia, Iowa, Montana, North Dakota, South Dakota, Virginia and West Virginia. These state Medicaid programs often recognize physician consultation using interactive video teleconferencing, with payments on a fee-for-service basis made at both ends (i.e. to the "hub" for the consultation, and to the "spoke" for the office visit). These services are used less in urban settings and more in rural areas to provide otherwise unavailable specialty care.

A recent boon to telemedicine reimbursement was the passage of the Balanced Budget Act of 1997 Medicare and Medicaid Provisions (section 4206), and the Telemedicine Communications Act of 1996. Beginning January 1, 1999, part B payments will be made for professional telemedicine consultation provided to beneficiaries residing in rural counties that are designated as a "health professional shortage areas." These areas are determined by the National Health Service Corps and the Bureau of Primary Health Care, and at present total 745.

Government Initiatives

Over the last several years there has been an increased interest in telemedicine applications as evidenced by large capital investments by the public sector. From 1994-1996, the Government Accounting Office reported that 35 federal organizations invested at least $646 million in telemedicine projects, with the Department of Defense being the single largest investor ($262 million).[3] Other entities now funding or conducting large-scale, comprehensive evaluations of telemedicine include the Veteran's Administration, the National Library of Medicine, the Office of Rural Health Policy, and the Agency for Health Care Policy Research. State telemedicine investments have also increased, mostly to expand health care into rural areas. States such as Georgia and Texas that have more experience in telemedicine have taken legislative action to support telemedicine efforts, whether in the form of rate-setting for communications or establishing payment mechanisms for providers. Over 40 states have some form of telemedicine initiative underway.

One criticism of publicly funded projects is that they are artificial environments that may limit meaningful data analysis. Such projects lack the influence of a market-driven, genuinely

competitive environment that would ordinarily drive the development of the field. Currently, the majority of telemedicine systems are supported by state, federal, and private demonstration grants that do not provide stable sources of revenue. When grant monies run out, many projects cease and desist. The Institute of Medicine notes that only one telemedicine project that was started before 1986 is still in existence.[4]

Private Initiatives

Estimates of private sector involvement are difficult to quantify because much of the cost data is proprietary and difficult to separate out from health care delivery costs. As mentioned, the majority of comprehensive telemedicine initiatives are funded with public monies. Some private sector organizations, such as Allina Health System in Minnesota, have established complete systems, usually for their own internal use. Allina, a large managed care organization, formed a network with a group of rural communities within the state to provide consultations, teleradiology, medical education, administration, and community education. They are also one of the largest systems to apply telemedicine to the emergency department.

The majority of private companies, however, concentrate on making end-user equipment such as digital stethoscopes, video monitors/cameras, telecommunication lines (e.g. ISDN or T-1 lines), and data compression software. *HealthNet* is one such company that has developed a briefcase-sized portable telemedicine system for ambulances, remote clinics, or for home-health monitoring.

Market Potential

Because telemedicine is in the early implementation stages, there are no firm data by which to estimate market potential. However, the Koop Institute estimates that the US market is in the billions of dollars, perhaps even as large as $100 billion, but there is little substance to justify this claim.[5] As noted by the Council on Competitiveness, two market drivers have emerged that will force serious consideration of commercial telemedicine as a means of providing health care.[6] The first is the need for providers, whether practitioners or the health care settings in which they work, to achieve the optimal balance between low cost and high quality health care. The second is the need for health care organizations to gain market share. Telemedicine has the potential to flourish because it has clear benefits to both patients and providers. For payors, however, the benefits of telemedicine may be less recognizable since total health care dollars paid out may actually increase.

Despite the failure of government-backed national health care reform efforts, the health care marketplace has changed dramatically. For providers, this means changes in reimbursement schemes, closer monitoring by payor organizations of practice behaviors, and a general re-thinking of traditional, clinical practice patterns. Coupled with the trend toward outpatient management of medical illnesses and more rapid discharge of patients who may still need monitoring, these changes are causing many providers to examine the potential benefits of telemedicine. In addition to its impact on revenue streams, telemedicine may offer providers secondary benefits such as affording the consulting physician the chance to sharpen clinical skills by linking more easily with expert consultants.

In addition to reducing costs, health care delivery organizations must also secure market share to maintain the revenues necessary to provide health care services and to finance advanced medical research and education. Rural health systems will likely embrace telemedicine as it enables the

patient to seek specialized care at a remote facility while keeping the patient "at home." The impact of a hospital closing reverberates through a small community, as both the ability to provide much-needed health care is lost, and an "economic anchor" that provides jobs to the community and attracts and maintains businesses is destroyed. Telemedicine may lessen the rate of hospital closure.

Large urban medical centers gain revenue from increasing their market share of specialty services by linking with rural hospitals; telemedicine yields the opportunity to deliver these services to an otherwise under-served population. However, total revenues at the urban site may be less, for telemedicine enables the rural patient to remain at the community hospital for routine health care needs.

Telemedicine and the Cost of Health Care

Theoretically, the question concerning telemedicine's usefulness would focus on whether the consumer of health care benefits from having access to telemedicine services, what the utility of having telemedicine is, and what society is willing to pay for these services. Stated differently, it may be acceptable if telemedicine causes total health care costs to rise as long as tangible value is brought about by the services rendered, and the health status of society as a whole is improved. In such a payor-driven health care system such as ours, however, economic notions such as these seldom lead to change. Accordingly, new health care technologies such as telemedicine are judged on whether they improve health outcomes *and* lower costs. For payors, the costs of easier access to specialists, as would be enabled by telemedicine, may be substantially increased. At least one estimate projects that Medicare reimbursement alone for telemedicine services could increase that budget by $30 billion over the first three to five years of use.[7] In a fee-for-service environment, the impact of telemedicine reimbursement is of prime importance. As previously discussed, without proper reimbursement, hospitals will not be willing to incur infrastructure development costs, and consulting physicians will likely not be interested in providing their services. However, in a risk-bearing, prepaid environment, issues of reimbursement become inconsequential. Rather, the focus becomes whether telemedicine enables effective medical care delivery at a reduced cost compared to traditional, face-to-face care. Telemedicine offers the potential to lower fixed costs by using less practitioners more efficiently.

So the question arises, will this technology increase or decrease costs? Except for one analysis done in 1992 that estimated annual cost savings of over $200 million,[8] insufficient data exists to answer that question accurately. In the short term, costs may increase because of: 1) easier access to specialists, leading to increased per-patient charges levied against insurers; 2) inappropriate, excessive utilization of specialized care; 3) high infrastructure start-up and maintenance costs; 4) high operational costs. However, short term costs may in part be offset by: 1) making the correct diagnosis early and avoiding costly complications (the notion of preventive medicine); 2) making the correct diagnosis initially through a more focused approach, thus avoiding the costly "shotgun approach;" 3) decreasing hospital lengths-of-stay through both quicker diagnosis and treatment.

Other areas of potential cost savings may come from decreased transportation costs, which has relevance for prisoners who need extensive travel arrangements to ensure safe travel to treatment facilities, or for overseas military deployments in which transporting sick/wounded personnel is difficult and dangerous. The home-health care sector is interested in telemedicine because it allows for home monitoring of patients who are still sick at discharge and who need continued

monitoring. Home monitoring is congruent with the shift toward outpatient management, and reduces costs by avoiding the proven high costs of inpatient care. Telemedicine will become increasingly important as the population begins to age disproportionately. There are the more difficult-to-measure gains as well, such as patients taking less time away from work and family to have their health care needs met, resulting in increased worker productivity and subsequent gains for society.

Interestingly, those who do not have access or have limited access to specialized care may stand to benefit the most from telemedicine, but they also may be the least able to pay for these services. In this case, private health care organizations may not be able to cost-justify establishing telemedicine outposts, running fiber optics or providing satellite, T-1, or ISDN transmission lines, etc. to this end-user population.

Telemedicine in Emergency Medicine

Telemedicine is used sporadically in the emergency department, and a review of current literature reveals little published information on how practice patterns or revenue streams have changed since its introduction. Logistically, the emergency department may be an ideal place for telemedicine set-up as it serves as a meeting place for physicians that is always open, and is therefore able to accommodate the sporadic influx of telemedicine consults. ED telemedicine, as with all telemedicine applications, may initially flourish most in rural areas.

The impact on ED revenues depends on local telemedicine infrastructure. If telemedicine becomes a reimbursable venue, revenues will come directly from consulting fees paid to the hub institution at which the consult is being sought. If the referral is for emergency care, then the emergency physician will collect the fees. However, if a non-emergency medicine specialist is being consulted, and if this occurs in an ED where the telemedicine equipment is stationed, revenue allocation becomes less clear. The ED might be in a position to collect a portion of the fees if it "brokers" the deal by facilitating communication between the consulted party and the consultant, houses the equipment, etc. Total revenues for the hub-site department, however, may be decreased with the introduction of telemedicine. Imagine the scenario where telemedicine enables patients to be seen and treated at a distance, no longer requiring them to actually visit the ED. Evaluation and management fees will still be collected, but there will be no generation of revenue from facility fees. Again, the impact of this must be weighed in context with the local economic environment. For example, treating a patient within a large managed care network at a network site, as might happen in the Allina health care system, may be the cheapest way to deliver care. In a fee-for-service environment, however, or where different systems are competing with each other, incremental revenues will be lost.

There is some concern that telemedicine may cut into emergency physician employment opportunities. It may decrease the demand for physicians to staff all sites of emergency care, especially at spoke sites, by enabling mid-level providers to staff the locations instead. A nurse practitioner, for example, might work remotely at a moderate acuity facility, having as a back up the ability to consult a hub site staffed with emergency physicians for more complex cases. Saint Francis Health System in Tulsa, Oklahoma is one example of a system currently using such a model.

Two market drivers will influence the evolution of mid-level provider staffing practices. The first is the supply of emergency physicians available to meet staffing demands, and their willingness to

work in less desirable geographic areas. The second is the spread of cost pressures from the urban market, where they first flourished, to the rural market. Decreased reimbursement, coupled with difficulty attracting quality providers, creates a demand for mid-level providers in rural regions. The use of mid-level providers in clinical settings where telemedicine is used is new, and ultimate cost-effectiveness has yet to be proven. In the long term, the sum of costs incurred from telemedicine infrastructure set-up and operation, fees paid out for consultations sought by mid-level providers, and possibly higher malpractice claims totals (*if* indeed malpractice risk is higher with mid-level providers) may outweigh any short-term gains from decreased fixed costs of staffing.

In addition to decreasing demand for physicians at spoke sites, an ED telemedicine network may also lessen demand at hub sites. Consults from a spoke site could conceivably be routed to the hub site within the network that, at that exact moment, has excess capacity due to a temporary lull in patient flow. The overall effect of this would be to drive up the efficiency of hub site physicians by decreasing down time.

Barriers to Telemedicine

In addition to overall lack of reimbursement of telemedicine by payors, other barriers stand in the way of telemedicine and threaten to slow its widespread application. Perhaps of equal magnitude are the questions surrounding legal liability. To date, telemedicine has largely been limited to *intrastate* medicine, and there is currently no case law regarding the *interstate* practice of medicine. In what state the case law should be applied (i.e. the state where the telemedicine physician delivers care or the state where the patient receives care) remains an unanswered question. Many states have expressed reluctance to allow physicians to practice medicine across state lines, as would occur with telemedicine, without formally passing state licensing exams. Some states have already passed legislation forbidding it. Telemedicine proponents argue for the development of specific legislation allowing physicians to practice via telemedicine across state lines without having to undergo formal, state-by-state licensing, but nothing has yet been formalized. Further questions arise regarding joint liability and product liability. Will both the presenting and consulting physician be held liable in cases of negligence? Will the maker of telemedical devices be named in a suit? FDA regulatory policies regarding telemedicine hardware and software applications are evolving but unclear.

Cultural barriers also deserve attention. The majority of physicians have appeared reluctant to embrace telemedicine despite its relatively obvious potential applications. Telemedicine is not a standard of care from physicians' perspective at present, and will not be until good scientific data demonstrating benefits is generated. Administrators may see the economic benefits readily, but without physician acceptance telemedicine will not flourish. The same holds true for patient acceptance. Will patients value the ability to receive care quickly and easily more than they value the face-to face interaction with physicians? Again, acceptance depends on patients realizing, and experiencing first-hand, the benefits of telemedicine if it indeed exists.

Future Ideas and Implications of Telemedicine

The year is 2020. A tertiary care facility has just received notification from our manned community on the moon that someone has received a head injury. The neurosurgeon is consulted. He arrives at the telemedicine center where he puts on his virtual reality headset and gloves.

The head injury patient is in an MRI where the base physician has set up non-metallic surgical equipment, including the latest neurosurgical microscope. From his teleradiology station on Earth, the neurosurgeon successfully evacuates an epidural hematoma using the robotic arm at the space station.

While this may sound a little far fetched at this time, there is no doubt that telemedicine will reach a point where remote surgery will be performed using robotics and telemedicine. Currently, the Department of Defense is investigating battlefield robotic surgery.

Though this may be quite a way down the line, there are many other current, and soon to be, uses for telemedicine, including remote consultation; nurse practitioners staffing rural emergency departments; the use of video telemedicine in ambulances by specially trained paramedics or nurse practitioners; a tertiary or quaternary EMS system; nationwide or worldwide consultation of specialists; remote telemedicine for disaster control; remote monitoring for home health care; electronic house calls; contracts with correctional facilities to provide medical care; telemedicine use on airlines and for travel services for Americans traveling internationally or on wilderness expeditions; expansion of teleradiology to telecardiology, teledermatology, psychiatric intervention, and pathologic consultation.

Because telemedicine is in its infancy, many of the future uses of telemedicine have not even been thought of. It's an exciting new field with unlimited opportunities.

References

1. GAO. *Telemedicine: Federal Strategy is Needed to Guide Investments.* Chapter Report, 2/14/97, NSIAD/HEHS-97-67, p. 65.
2. Kincade K. News uplink: Low payments, red tape hinder sites in HCFA demo. Telemedicine and Telehealth Networks, Feb 1998.
3. GAO. *Telemedicine: Federal Strategy is Needed to Guide Investments.* Chapter Report, 2/14/97, NSIAD/HEHS-97-67, p. 3.
4. National Academy of Sciences, Institute of Medicine, Washington D.C. *Telemedicine: A Guide to Assessing Telecommunications in Health Care.* Available at http://www.nas.edu/readindroom/books/telemed.
5. Banks, H. *A White House Challenge to Telemedicine.* Forbes, Aug 14, 1995.
6. Council on Competitiveness. *Highway to Health: Transforming U.S. Health Care in the Information Age.* 1994. Available at http://nii.nist.gov/coc/coc.html.
7. GAO. *Telemedicine: Federal Strategy is Needed to Guide Investments.* Chapter Report, 2/14/97, NSIAD/HEHS-97-67, p. 51.
8. Arthur D. Little Foundation. 1992.

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Appendix A

Costs of a Telemedicine Suite

Both fixed costs, such as equipment costs, and variable costs, such as usage fees, for telemedicine are evolving. Equipment costs are likely to decrease over time as new competitors enter the market. Variable costs may rise as hub facilities initiate new usage and connection fees that are charged to spoke facilities. These fees may help offset expenses as telemedicine centers shift from cost centers used to provide public relations to revenue centers.

A full-service, state-of-the-art telemedicine spoke suite costs between $70-95,000 and includes the following items:

- Dual 27 inch monitors that allow the patient and physician to view both the patient/patient liaison and the remote consultant. Visualization of the consultant improves patient-consultant and physician-consultant relations.
- Document camera, which allows transmission of 12-lead EKG and plain radiographs (albeit without digital transmission quality).
- Patient camera, which allows visualization of the entire patient and zoom images to 1 inch diameter.
- Electronic stethoscope, dermascope, otoscope, and ophthalmoscope, at a cost of approximately $5-10,000 each.
- Connection fee/usage fee, which is variable but may cost approximately $10,000/year.
- Network communication fee.
- Installation.

System costs may be reduced through elimination of some items. A single monitor allows effective transmission with audio receipt of the consultant's comments, and without visualization of the consultant. Facsimile transmission of EKG data is possible, although this does not entirely remove the utility of the document camera, which also transmits rough radiographic images. If the suite is used primarily to assess patient condition, wounds, or relatively large dermatological lesions, the peripheral equipment such as the stethoscope, dermascope, otoscope, or ophthalmoscope may be omitted. This basic system costs between $20-45,000.

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Appendix B

Telemedicine Resources

The Journal of Telemedicine and Telecare. Public Subscription Department, Royal Society of Medicine Press, P O Box 9002, London W1A OZA, United Kingdom.

Telemedicine: A Medical Liability White Paper. Physician Insurers Association of America (PIAA), 2275 Research Blvd, Suite 250, Rockville, MD 20850. 301-947-9000.

Telemedicine: Analysis of Market Status and Industry Trends. 800-444-4881.

Telemedicine. Office of Local and Rural Health Systems, Kansas Department of Health and Environment. 913-296-1200.

Rural Telehealth, Telemedicine, Distance Education and Informatics for Rural Health Care. US Department of Health and Human Services Office of Rural Health Policy. 301-656-3100.

Telemedlaw. 800-368-9593.

Telemedicine Today. 800-388-8632

American Telemedicine Association. (ATA) 901 15th St. NW, Ste. 230, Washington, DC 20005-2339, 202-408-0677. www.atmeda.org

Association of Telemedicine Service Providers (ATSP). 7276 SW Beaverton Hillsdale Hwy, Ste. 400, Portland, OR 97225, 503-22-2406. www.atsp.org

Telemedicine and Telehealth Networks. 415-905-2655. www.telemedmag.com