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# Telemedicine Today

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## Introduction

Telemedicine is a rapidly expanding technology that is one of the forces transforming our health care delivery system. It is the product that results from the marriage of improved telecommunications and automation technology applied to the problems we face in the delivery of health care. It is an innovation whose time has come and it will change the way we think of and practice our system of medicine.

## History

The history of telemedicine probably began when telephones and radios were first used to allow physician-to-patient or physician-to-physician communication to address patient problems. This technology was utilized in rural parts of our country as well as with ships at sea. Its growth paralleled the development of the supporting communications technologies. There is little literature but much anecdotal information on this subject. The information tells of its success in guiding, and influencing medical care. About 1958 we find the first mention in the literature of the use of a video image applied to the physician/patient encounter. There is sporadic mention of this technology over the next decade.

In the late 1960's there were numerous demonstration projects that produced a body of knowledge that was annotated in the medical literature. This experience was funded in large part by the federal government with the National Aeronautics and Space Administration playing a very large role. The NASA medical department realized the need to explore and understand the limitations and possibilities of addressing medical problems and indeed disasters in space, a location and environment where face to face care was unavailable. These numerous demonstration projects, though useful and productive, closed when the federal funding ran out. The technology was not user friendly. The economic utility was not demonstrable to the bill payers. The communications infrastructure was not robust enough to adequately support the endeavors. Lastly, like many new ideas, there was enthusiasm for it only in the minds of a few.

A decade later, starting about 1989, a resurgence began that has continued to the present time. The technology has improved significantly, both in the telecommunications arena as well as the automation arena. Not only has the technology improved, but it is more user friendly and has penetrated deeper into society. More homes have personal computers. ATM machines have become universal. Our children play computer games daily. Telecommunications and automation have both become much larger parts of our lives. This time a much broader constituency within the federal government enthusiastically supported telemedicine by initiating many and more varied demonstration projects. Additionally, many state governments have joined in supporting telemedicine projects. Both the telecommunications utilities and the automation industry have become much more robust and presumably can see the economic potential. Both have contributed significantly to this initiative.

## International

Growth of telemedicine has occurred primarily in areas with robust telecommunications infrastructure. This has been primarily the United States and Europe. Rural Norway has become a leader in the field. Individual demonstrations have occurred in most Western European countries. Long distance communications links for radiological interpretation and consultations have been demonstrated between several leading mainland US university hospital systems and countries in the Pacific rim as well as the Middle East. Some of the richer Pacific Rim countries are beginning to develop the technology. The US Military has been a leader in implementing telemedicine technology initially supporting the Armenian earthquake relief in the early 1970's and more recently in association with major troop deployments into the Caribbean and to Bosnia. Locally, Tripler Regional Medical Center has been supporting health care in the South Pacific for the past 4 years with full motion video teleconferencing and still frame visual communication to either remote or economically deprived areas of the South Pacific. Occasional contacts have been made between Tripler and military sites in Asia, the Middle East and the continental United States. One of the least heralded but most rewarding and least expensive telemedicine experiments was the linking of health care personnel in the Federated States of Micronesia, the Marshall Islands, and Palau. Physicians in these areas have been linked with still image capability over standard telephone connections. This link permitted consultations with specialists in Hawaii, consultations between local clinicians and Continuing Medical Education activities. This advance was a joint effort between Tripler Regional Medical Center, AT&T and the University of Hawaii at the Pacific Basin Medical Officers Training Program in Pohnpei State.

## Growth Patterns

The introduction of the technology today usually begins with the specialties that make high use of images. Radiologists and pathologists are the usual initiators. This is true in Hawaii. The next step is teleconferencing. Following this, more sophisticated and complex interactions take place utilizing physiological data and direct discussions by the patient and provider as a part of the consultation. The initial efforts are usually point to point, between two well defined geographic locations that already are related in a significant referral pattern. Once the first two locations are established, it is much easier to build other locations. Very quickly a network is established. The initial concept is usually a wheel and spoke operation, but in many cases this has given way to a web shaped network which makes better economic use of the utility.

## Bandwidth Availability

Cost of the bandwidth is a major determinant of the particular technology utilized in these projects. If the only available bandwidth is that provided via regular telephone service, then the experiment includes only voice and single frame images, EKG's,

etc. for the interaction. On the other end of the bandwidth spectrum is full motion video and several channels of data running simultaneously. This is very expensive today but broad band width provides the opportunity for the distant consultant to visualize and process as much or more information than is available if co-located with the subject. Multiple simultaneous video channels may be especially important if the consultation is a complex event such as telementoring a surgical procedure. Demonstrations of this technology have occurred locally at Tripler Regional Medical Center as well as at the Kaiser Hospital. One of the most cost effective approaches being developed is the so-called "store forward" technology where information is acquired and packaged in a computer and then forwarded to the consultant at a later time. There are versions of these store-forward systems that can include full motion video. Store-forward technology plus advanced data compression will bring much more information to the consultant without the expense of large bandwidth and without the requirement for three individuals (patient, primary physician and consultant) to be precisely located at the same point in time, as is required for real time, face to face, consultations. These differences make store-forward a more flexible alternative that is less expensive and therefore more acceptable than real-time connectivity.

### Effectiveness

The experiences gained over the past three decades have shown the effectiveness of utilizing these technologies to deliver health care. Certainly, the greatest utility has been in underserved areas where access is a significant problem due to the lack of skilled personnel and time and distance separation. A great many studies have demonstrated patient and provider acceptance of this technology. Numerous examples in many specialty fields including Internal Medicine, Pediatrics, Ob/Gyn, Neurology, Psychiatry, Dermatology and many surgical specialty areas have shown successful utilization of the technology. Most of the literature is anecdotal and uncontrolled. What are not available are business case studies that demonstrate the economic utility of the technology. Further, more rigorous studies need to be undertaken to demonstrate the limits of the technologies. There is simply not enough data currently to provide this information.

### Impediments to growth

A Telemedicine Policy Review Group convened by the Western Governors' Association, identified six problem areas that served as barriers to the implementation of Telemedicine. This was reported by Rashid Bashur, et al.

**Problem 1**—Inadequate Information Infrastructure and Uncoordinated Infrastructure. State policymakers need to understand the complimentary nature of many societal functions utilizing this technology and develop policy in support of this concept. Social services, education, police, and health departments all need a networked solution to improve their efficiency - and it can be the same solution.

**Problem 2**—Regulatory Distortions, Limitations on Competition and Fragmented Demand for Telemedicine Services. As most telemedicine is developing in rural areas with limited availability of communication companies, there is little competition to drive down communication prices. We will have adequate competition within the borders of Hawaii. Our problem occurs when we apply this technology to the rest of our Pacific constituents.

**Problem 3**—Restrictive Reimbursement Policies for Telemedicine Services in the Public and Private Sectors. This is a major issue for the survival and growth of this technology. Third party payers need to be educated about the benefits of increased access to care and ultimately of diminished cost.

**Problem 4**—Restrictive Physician Interstate Licensing and Intrastate Credentialing. States are grappling with this issue now and the trend is to require some special licensing for practice in another state. This will be an increased expense to the system and will restrict the growth of the technology.

**Problem 5**—Malpractice Liability Associated with Telemedicine. This issue has not been tested in the courts as yet.

**Problem 6**—Confidentiality of Patient Information. This is a major concern and adequate safeguards need to be built in.

### Future directions

Future development is going to be determined by a complex interrelationship of capital availability and solutions to the impediments listed above. Most importantly, though, this technology is becoming more universal and accepted by both providers and patients. It will grow. The issue is how fast and where. Most of the literature and demonstrations to date have focused on sites characterized by their physical remoteness because of great distance or time differences. Very little effort has looked at how this technology will effect the more usual practice of medicine in urban areas. My suspicion is that this is ultimately where the technology will have its greatest impact. The ubiquitous television will become part of a bi-directional communication system of high band width. The "electronic house call" is not a remote concept. The ability to improve access for all patients is a real possibility. There are several experiments that have been federally funded that are looking at the utilization of various forms of telemedicine utilization directed at not geographically remote recipients, but focused instead on local individuals who for a variety of reasons make high use of the health care system. If these studies prove successful and are able to decrease clinic or ER visits and prevent hospital admissions, perhaps the third party payers will support the development of the technology and the bill payers will demand it. In the meantime, high band width technology will continue to grow in availability and decrease in cost so that more experiments with the technology can be undertaken.

### Conclusions

Telemedicine, after a halting start, has now become a part of our health care system and will only grow over the next several years. It will have a major impact on the way health care is delivered. In so doing it will significantly increase access to care for many people. There are a number of impediments in our system that will slow its growth and may influence and divert its development. Cost remains a major issue influencing the development of the technology and we may need to wait until another approach to financing health care is available. Under our current system of fee for service reimbursement, the economic disincentive to developing this technology is significant. Countering this will be the demands of our patients for the increased access and quality this technology offers.

### References

1. Bashur RL, Neuberger N, Worsham S. Telemedicine and Health Care Policy: The New Federalism Taking Hold. *Telemedicine Journal* 1995; 249-255