TELEMEDICINE AND TELEHEALTH IN THE PACIFIC ISLAND REGION: A SURVEY OF APPLICATIONS, EXPERIMENTS, AND ISSUES


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1. ABSTRACT

"Telemedicine" and "telehealth" are promising and important applications of the revolution in telecommunication and information technologies. These applications, for the most part, will be based on inexpensive broadband telecommunication and information networks, which in the next 10 years, will be "ubiquitous" in developed countries. These applications, however, are not certain for lesser developed countries that may only have access to narrowband telecommunications, even though there are significant experiments in telemedicine and telehealth in the Pacific Islands Region. The purposes of this paper are to: (a) broadly describe telemedicine and telehealth and review some of the emerging applications; (b) discuss some of the experiments that are being conducted in the Pacific Islands Region; and, (c) identify some of the issues and questions that have emerged at the forefront out of the experiments with Pacific Islands Region telemedicine and telehealth.

2. INTRODUCTION

Telemedicine and telehealth are the emerging medical and health applications of telecommunications and information technologies. (1) Telemedicine applications are those directly related to medical applications and treatment. Telehealth applications are focused more on the holistic health related programs defined generally by practitioners in public health. Both rely heavily on the use of distance education and learning technologies.

Telemedicine applications use audio, text, image and video through computer, facsimile,
scanners, camera light box, cameras, multimedia, electronic mail, remote monitoring systems, video conferencing, and other associated technologies to enable the delivery of medical care as an attempt to lessen the gap between the availability of expertise and services at remote locations. Some of the medical and support services of these technologies include:

- medical consultation;
- diagnostics;
- CAT scan, electrocardiogram, x-ray, and ultra-sound data transmission and interpretation;
- patient transfers/referrals;
- medical records transfer;
- transmittal of prescriptions and doctor's orders;
- medical database access;
- general administration;
- research links;
- central data collection and organization;
- retrieval of medical literature;
- continuing education for doctors, nurses, and other medical personnel; and,
- training.

Telehealth, as a complement to telemedicine, uses many of the same technologies as telemedicine but focuses on the holistic treatment of medical and health needs. "Telehealth" encompasses the larger concerns involved in both public health and medical care. Some of the telehealth applications supported by these technologies include preventive programming, education and training for health care providers, medical staff, patients and the community in the following areas:

- prevalent health problems and promotion of methods of prevention and/or control;
- personal health care and proper nutrition (wellness programs);
- promotion of environmental concerns, especially for an adequate supply of safe water and basic sanitation;
- maternal and child health care, including family planning, pre-natal care and well child care;
- immunization against major infectious diseases;
- prevention and control of locally endemic diseases;
- appropriate treatment of common diseases and injuries; and,
- training in and provision of essential life saving therapies (drugs to control hypertension, insulin for diabetes, etc).

Telecommunications can assist local physicians, health care givers, policy and decision makers to: (a) reach out to their communities (b) acquire a better understanding of basic primary health care goals, and (c) discuss and analyze appropriate interventions. In essence, the term "telehealth" connotes the use of telecommunications technologies for the enhancement of the health of a population, and does not limit that use to medicine alone.

3. TELEMEDICINE AND TELEHEALTH IN REMOTE AREAS

Telemedicine and telehealth applications have advanced rapidly during the past five years and may have a significant, practical impact on improving the delivery of medical and health care in remote areas that suffer from isolation, small size, sparse and dispersed populations, a limited resource base, and great distances. As noted by Dena Puskin (1995: 54) of the Office of Rural Health, U.S. Department of Health and Human Services, telemedicine and telehealth "have the potential to reduce the isolation of rural practitioners and patients, and facilitate integration of services across communities that individually cannot sustain a full range of health services."

Significant portions of the Pacific Islands Region populations are underserved by their health care system due to geographic and socio-economic constraints. Some of the areas in which health care systems may lack sufficient support are: (a) in the number of or the lack of physicians and/or specialists necessary to serve the population; (b) continuing education for existing health care providers; and, (c) appropriate facilities and technologies to serve their populations. Telemedicine and telehealth applications can improve Pacific Island health care
Telemedicine and telehealth may also help to lessen the cost of services. For example, the current practice of the U.S. affiliated countries is to evacuate patients in the Pacific Islands once a determination for critical or acute care is made. Family members are often allowed to accompany the patient. The cost of evacuation is extremely excessive and represents a large proportion of health and medical expenditures in the Pacific region. Telemedicine could conceivably help to lessen the number of evacuations and the attendant costs by assisting in diagnosing the need for evacuation and by providing remote consultation.

Further, and just as significant, are the travel costs for follow-up care. Family members are often allowed to travel with the patient even for follow-up care. By delivering health and medical services through telecommunications, the cost of follow-up care could be lessened, thereby enabling resources not spent for evacuations to be reallocated to other areas of health and medical program needs.

Certainly, there are indications that the economic condition of the '90's may require health care systems to discriminate among priorities in critical and acute care based upon available funding and resources. Delinquent hospital and medical bills in Fiji, Guam, Hawaii and elsewhere might not be tolerated. The use of telemedicine and telehealth applications should be examined as a means to improve medical and health care while reducing costs in the Pacific Islands Region.

4. TELEMEDICINE EXPERIMENTS IN THE PACIFIC ISLANDS REGION

There are several current and planned telemedicine and telehealth experiments in the Pacific Islands Region. These experiments are intended to develop a base of experience and knowledge that will help to determine the usefulness of these telecommunications applications. Since these trials are still in the initial stages of development and experimentation, it is far too early to determine their long-term programmatic value and costs.

These trials are further important to: (a) assess the needs within communities, which vary significantly across the region; (b) identify cultural and other issues with the introduction of such services; and, (c) identify other barriers and problems that might affect the usefulness of these applications in the region. These experiments in telemedicine and telehealth applications may provide the base of experiences that will lead to substantive, appropriate services and programs to promote health, increase medical responsiveness, and lessen the costs of providing these services and programs in remote island environments.

4.1 Tripler Army Medical Hospital and Kwajalein Missile Range Hospital

One of the first experiments in the Pacific Islands Region was initiated by the Tripler Army Medical Center (TAMC) located in Honolulu, Hawaii. The TAMC Telemedicine Program was originally developed to support the hospital services at Kwajalein Missile Range (KMR) Hospital in the Republic of the Marshall Islands. The TAMC uses a Department of Defense T-1 link between TAMC and Kwajalein for video-based teleconsultation twice a month between doctors and patients. Results of experiments demonstrate that TAMC has had a significant impact on the number of medical referrals by the KMR Hospital.

Adjacent to Kwajalein is Ebeye which supports a dense population of 14,000 on an atoll comprising less than two square miles. Since medical conditions are unsatisfactory on Ebeye, patients on Ebeye are also seen through teleconsultation under TAMC's mandate to provide specialty care to the Republic of the Marshall Islands.

Over the past two years, more than 200 teleconsultations in 23 specialties have been conducted. The TAMC telemedicine program provides the means for intervention before the condition of the patient deteriorates to the point of requiring costly referral and evacuation.

The initial goals of the TAMC telemedicine program are to provide: (a) primary care services; (b) specialty consultations; (c) continuing health education programs; (d) patient and community health education; and (e) communications links among providers in the region.

In order to achieve these goals, TAMC is collaborating with the Pacific Basin Medical Officers Training Program (PBMOTP), in Pohnpei, Federated States of Micronesia (FSM), and
The Pacific Basin Medical Officers Training Program, located in Kolonia, Pohnpei, was introduced to the Telemedicine Program at Tripler Army Medical Center (TAMC) in early 1994. Through experimentation with the AT&T Picasso Still-Image Phone, TAMC began to expand its telemedicine program to specific sites in the U.S. affiliated Pacific Islands in the Western Pacific.

The Picasso Still-Image Phone is a still-frame, video phone system which, when used with a video camera and a TV monitor, can digitize and transmit freeze frame color pictures of high quality over regular telephone lines. The Picasso Phone unit, which is the size of a desk top executive telephone, is a computer capable of storing, sending, and receiving high quality, freeze-frame color video pictures with simultaneous voice communications. The Picasso Phone unit costs under $5,000 and certain models have battery storage capacity to insure against loss of picture memory due to power failures. Connected to a camcorder, a TV monitor, and a dedicated telephone line, the unit is user friendly and operates much like a VCR.

4.2.1 PACIFIC BASIN MEDICAL OFFICER TRAINING PROGRAM EXPERIMENTS

Since 1994, the Pacific Basin Medical Officers Training Program has participated in and has documented the following telemedicine experiments:

- At the Charter Meeting of the Pacific Basin Medical Association (PBMA), April 3-5, 1995, in Pohnpei, the TAMC Telemedicine Program team gave two demonstrations using the Picasso Phone to over 75 participants of the meeting: (a) a patient consultation from Pohnpei to the Republic of Palau, which assisted in the prevention of a costly, off-island referral, and (b) a lecture from TAMC in Honolulu to the PBMA conferees on Pohnpei regarding "HIV in the Pacific - 1995."

- Facilitated by TAMC, AT&T donated four Picasso Still-Image Phones to the region. PBMOTP (Pohnpei) received 2, Kosrae State Hospital (Kosrae) received 1, and PEACESAT (Headquarters, Hawaii) received 1. Since then, other demonstration activities have been documented using the Picasso Still-Image Phone for teleconsultation and distance learning.
  - PBMOTP Weekly Director's Rounds and Lectures have been teleconferenced with participants in the PBMOTP campus in Pohnpei, the Pohnlangas Dispensary (a 2 hour drive from Nett, Pohnpei), and the Kosrae State Hospital (KSH) which is 45 minutes away from Pohnpei by air;
  - Teleradiology experiments involving teleconsultation over pediatric x-rays between PBMOTP, Pohnpei, and TAMC, Honolulu, have been initiated. PBMOTP pediatricians present problematic x-ray films over the Picasso Phone system to pediatric pulmonologists at TAMC. Pohnpei is nine hours away from Honolulu by air, separated by three time zones, and the International Date Line.
  - PBMOTP has also documented emergency telemedicine applications. For example, KSH physicians in Kosrae requested emergency x-ray teleconsultation services. The PBMOTP internist in Pohnpei assisted KSH physicians in the management of a trauma patient with a hemothorax.
  - At the Annual Waianae Primary Health Care Conference held on Oahu, Hawaii, in which 146 representatives from the Community Health Centers of Hawaii and the Pacific Islands participated, there were two telemedicine demonstrations from Pohnpei and Palau: (a) the PBMOTP Associate Director lectured from Pohnpei to the Waianae Conference on the "Management and Treatment of Leprosy," and (b) Dr. Victor Yano, President of the Pacific Basin Medical Association, and Dr. Stevenson Kuarte, the Medical Director of the Palau Community Health Center spoke from the Republic of Palau to the Waianae Conference participants about integrating telemedicine into the Pacific health care system.

- On July 7, 1995, the PBMOTP Director lectured from Pohnpei to the Western Alaska Telemedicine Conference in Nome regarding "Telemedicine Demonstration Projects in the Western Pacific." The Alaska audience included senior representatives from the following
On July 26, 1995, the PBMOTP gave a telemedicine presentation to the 14th General Assembly of the Association of Pacific Island Legislatures on Pohnpei connecting the legislative representatives from the Pacific Islands with both the Telemedicine Program at TAMC, Honolulu, and the Kosrae State Hospital (KSH) for a brief introduction lecture on telemedicine and an x-ray teleconsultation with the staff of KSH. Every Wednesday, the PBMOTP supports scheduled medical teleconsultations with KSH medical staff in Kosrae. KSH physicians have the opportunity to present patients and x-rays and obtain second opinions by the PBMOTP specialty physician staff. Additionally, the PBMOTP provides mini-lectures in continuing medical education for the KSH medical staff.

4.2.2 CURRENT STATUS OF PBMOTP TELEMEDICINE EXPERIMENTS

Efforts are underway to link the Picasso Still-Frame Phone system through the PEACESAT satellite system to introduce this technology to remote Pacific Island countries supported by PEACESAT earth stations. Experimentation may then focus on the regular use of Picasso-based telemedicine applications among remote island countries and become the experimental base for the documentation and evaluation of its potential, audio conferencing and still-frame video, to benefit Pacific Island health care.

The major expense in the PBMOTP experiments has been the international transmission costs incurred. When the still-frame video phone technology is adapted to the PEACESAT Public Service Telecommunications Network, transmission cost will no longer be a deterrent in the growth of this telemedicine network. Utilization of PEACESAT’s 44 earth stations in 22 countries will create a virtual geographical extension of the experiments with very few new funding dollars.

The use of the Picasso Still-Frame Phone System as a telemedicine application is an example of a relatively low cost, user-friendly, narrowband system. The system requires purchase of the phone system, access to the public switched telephone network, and/or use of PEACESAT for the remote link. Additional equipment for remote sites could be added as budgets permit.

The PBMOTP experiments in telemedicine applications have shown the utility of the system in many arenas: (a) international telecommunications between developed and developing country urban centers (Hawaii to Pohnpei, Hawaii to Kosrae), (b) telecommunications among developing countries (Pohnpei to Kosrae, Pohnpei to Palau), and (c) domestic telemedicine applications from developing urban centers to remote dispensaries (Nett, Pohnpei to Pohnlangas, Pohnpei).

4.3 TELEMEDICINE AND FIJI: THE FIJI SCHOOL OF MEDICINE

The Fiji School of Medicine (FIJI-SM) has trained well over one thousand medical officers.(2) More than one-third of the graduates are nationals of American Samoa, Western Samoa, Tonga, Cook Islands, Tokelau, Niue, Tuvalu, Kiribati, the Solomon Islands, Vanuatu, Nauru, the Republic of the Marshall Islands, the Federated States of Micronesia, and the Republic of Palau.

The FIJI-SM recently implemented a unique layer to its undergraduate medical training program. Fourth year FIJI-SM students are attached to rural health care facilities in their own communities. As an apprentice, the student receives practical, on-the-job training, and is required to undertake an applied health research project in primary health care. For this phase of training, the students come under the supervision of practicing medical officers from within their own communities who have been specifically selected and trained to be supervisors and Public Health Care tutors. These medical officers are also appointed as Honorary Clinical Instructors to FIJI-SM and, in this way, become non-salaried members of the faculty. In this context, the FIJI-SM is effectively decentralized throughout the region by the actual physical presence of students in the region and the Honorary Supervisors in those communities.

The FIJI-SM and the Fiji government have endorsed the School of Medicine as an institution
The FIJI-SM is currently developing a strategic plan for the implementation of postgraduate training and continuing medical education within the region. The decentralization of FIJI-SM resources throughout the Pacific Islands in support of the undergraduate medical training program has strengthened the regional nature of the institution. Consequently, the FIJI-SM has established an enhanced human network among Pacific Island health care centers through its tutors and students which could support other cooperative and collaborative endeavors to improve medical and health services throughout the region.

The FIJI-SM is also strengthened through its affiliation with the Colonial War Memorial Hospital (CWMH), which has recently expanded and upgraded its technology and services in support of diagnosis and management of secondary and tertiary care problems. Currently, remote Pacific Island countries can not access these resources or facilities remotely.

At this time, a cost-effective telecommunications capability does not exist to support real-time, interactive voice, data, or video applications between and among the FIJI-SM and the participating Pacific Health Care Centers.

In order for the FIJI-SM to successfully implement its undergraduate medical training, postgraduate training, and continuing medical education programs, the FIJI-SM must have access to public health care constituents in the Pacific Islands region on a real-time, interactive, and daily basis. The FIJI-SM followed the PBMOTP experiments very closely, and will adapt these experiments and applications under its new Office of Postgraduate Training and Continuing Medical Education.

4.4 PACIFIC ISLAND HEALTH OFFICERS ASSOCIATION

The Pacific Island Health Officers Association (PIHOA) is a non-profit organization with members in the six Pacific countries and territories affiliated with the United States: American Samoa; the Commonwealth of the Northern Mariana Islands; the Federated States of Micronesia; the Territory of Guam; the Republic of the Marshall Islands; and the Republic of Palau. The members of PIHOA are the principal health officials from each island jurisdiction. PIHOA is committed to improving health within the region, and focuses on health issues and special projects of regional significance.

In 1995, the U.S. Public Health Service funded a PIHOA training project to work collaboratively with PEACESAT to ensure that health personnel in the region would be able to use remote dial-in services for access to Internet electronic mail and file transfer services. PIHOA and PEACESAT have implemented this network and are examining other alternatives for improving information access and electronic mail communications in the region.

5. THE TELECOMMUNICATIONS BARRIER

One of the major barriers to extending telemedicine and telehealth applications throughout the Pacific Islands Region is the state and cost of the telecommunications and information infrastructure. In this regard, the international telecommunications and information infrastructure is viewed as an important and significant barrier in the development of telemedicine and telehealth applications. If the region is to benefit from the sharing of resources and the emerging telemedicine and telehealth experiments, the international telecommunications infrastructure must be able to support these applications.

The problem of the state and cost of the telecommunications infrastructure is not limited to the Pacific, but extends to rural communities in the United States and other developed countries as well. The barrier of the telecommunications infrastructure to telemedicine and telehealth applications is clearly stated by Dena S. Puskin of the U.S. Department of Health and Human Services. In an article describing barriers to the development of rural telemedicine systems in the U.S., Puskin notes that:

"[t]he best designed systems still face barriers to implementation. While much has been said about building the nation’s electronic highway, we in rural America are often dealing with the equivalent of the dirt road. The lack of an adequate telecommunications infrastructure is a key barrier to development of telemedicine systems in rural communities." (1995:55)

Puskin is not only concerned with the nature of the infrastructure, she is also concerned with costs. She states that:

"Clearly, transmission costs must be lowered if telemedicine is to become economically..."
feasible for many rural communities."

The statements of Puskin regarding the telecommunications infrastructure and costs are appropriate not only to rural areas in the United States, but also applies to the Pacific Islands Region as well.

Unfortunately, for reasons beyond this paper, the cost of international telecommunications is prohibitive and is a deterrent to more experimentation. For example, a direct dial telephone call from Honolulu to the Pacific Islands region varies from U.S. $1.20 per minute to over U.S. $2.00 per minute. The cost of a call from the FSM to Fiji is close to $3.00 per minute. These costs severely restrict the ability of health and medical organizations from sharing resources and expertise, and prohibits other countries in the region from participating in the trials.

Fortunately, in the Pacific Islands Region, there are two public service telecommunications test-beds for telemedicine and telehealth application experiments. One is Japan's PARTNERS network. Another is PEACESAT.

5.1 PARTNERS

The Japan Ministry of Posts and Telecommunications (MPT), following technical experiments on the Engineering Test Satellite-V or "ETS-V," made the satellite available for application experiments in 1989. The project was named the Pan-Pacific Regional Telecommunications Network Experiment and Research by Satellite or "PARTNERS" Project.

There are two types of network systems supported by the PARTNERS Project. Network I was designed by the Communications Research Laboratory (CRL) of MPT as a 64-Kbps digital satellite link to support video conferencing for distance learning.

The PARTNERS Network I distance education program includes the King Mongkut's Institute of Technology Ladkrabang (KMITL) in Thailand, the Institute of Technology Bandung (ITB) and LAPAN in Indonesia, the University of Technology (UNITEC) in Papua New Guinea, the University of the South Pacific (USP) in Fiji, the University of Hawaii (PEACESAT) in the U.S.A., the Communications Research Laboratory (CRL) of the Ministry of Posts and Telecommunications in Japan, the National Institute of Multi-Media Education (NIME) of the Ministry of Education in Japan, and the University of Electro-Communications in Japan.

Network II was developed by Tokai University, Japan, for the transmission of precise still pictures via an FM satellite link, making it useful for telemedicine experiments in teleconsultation and diagnoses. Network II includes seventeen hospitals in Thailand, Papua New Guinea, Fiji, and Cambodia.

After five years of experimentation, the ETS-V PARTNERS Project plans to migrate to another satellite system in 1996.

5.2 PEACESAT

PEACESAT is a Pacific region satellite telecommunication network supporting application experiments in narrowband satellite communications and international public service telecommunications. (3) Public service telecommunications is defined as non-commercial, international communication services used by educational institutions, government, medical, and other non-profit organizations to support distance education and learning, emergency management, medical and health, research, technical assistance, economic development, and community service programs.

PEACESAT uses the Geostationary Observation Environmental Satellite (GOES-2) on a dedicated basis for use by the Pacific Islands Region. This is an obsolete weather satellite with a functional, although limited, communication transponder. The network may not be used for personal or commercial communications.

PEACESAT currently has 44 earth stations in 22 countries within the Pacific Basin. PEACESAT offers voice and data services, but also provides access to Internet in both on-line and batch transfer modes. The earth stations are 3m in size, have a 50W HPA, audio processor, phone patch, and analog data modem.

There are two major limitations of the network. First, the earth stations can only perform one function at a time. For example, the PEACESAT 3m earth station can be used for voice...
teleconferencing over a simplex circuit, voice teleconferencing over a full duplex circuit, or
data communications over a full duplex circuit. However, it is not possible to perform more
than one of these functions at the same time.

A second limitation is that there are only 3 full duplex circuits. This essentially means that
the users must schedule data transmission time for use of these circuits.

PEACESAT has developed plans for a digital "Hub Site" network using the residual bandwidth
and power of the GOES satellite which will significantly improve services.(4) Each of the Hub
Sites will support multiple concurrent voice circuits, a dedicated data (28.8 Kbps) circuit, and
shared use of compressed digital video circuits. These Hub Sites will use a 6m antenna, 75W
HPA, and other digital compression and switching capabilities to provide a medium for the
Pacific Island countries to offer and to connect to public service telecommunications
programs and services throughout the region and the world.

The digital network will further enable a significant extension of the TAMC, Kwajalein,
FIJI-SM, PARTNERS, PEACESAT experiments and other telemedicine/telehealth initiatives.
Some of the planned health and medical users and uses of the PEACESAT Hub Site network
are briefly described below:

- Medical teleconferencing using Picasso type systems or compressed digital video
teleconferencing at 128 to 256 Kbps.
- Hospitals and clinics would be able to communicate with the Tripler Army Medical Center
and other physicians for remote health and medical consultations.
- The Pacific Basin Medical Officers Training Program in the Federated States of Micronesia,
in collaboration with the Fiji School of Medicine, the University of Hawaii School of
Medicine, and School of Public Health will be able to provide continuing education to
medical officers in the field throughout the Pacific Islands Region and receive instruction
as well as diagnostic assistance from hospitals and other educational institutions.

- Medical officers and clinicians in the field will be able to transmit their digital image data
through inexpensive dial-up devices to medical institutions located in Guam, Honolulu,
and elsewhere for medical consultation.
- Public health and medical personnel will have access to Internet electronic mail, file
transfer, and gopher applications through dial-up modems.
- On a scheduled basis among the countries, the public health and medical institutions and
staff will have access to the World Wide Web of Internet.
- Distance learning and educational programs (e.g. seminars and workshops) will be held
through one-way digital video with voice and data return.(5)

This network should be in place in 1996, providing that appropriate funding for the Hub Site
technology is obtained. The Hub Sites will include American Samoa, the Commonwealth of
the Northern Mariana Islands, the Federated States of Micronesia, Fiji, Guam, the Republic of
the Marshall Islands, the Republic of Palau, and the Solomon Islands.

6. ISSUES AND QUESTIONS

The initiation of the trials in telemedicine and telehealth in the Pacific Islands Region are
valuable in helping to raise questions and identify issues. Although the experiments are only
in its infancy, the trials have already raised many issues and questions. The following is a
brief discussion of a few of these issues and questions.

6.1 ISSUES

The following describes some of the application specific issues that have emerged during
these trials.

- Language. Language has emerged as a problem among some of the sites, especially in
the PARTNERS network. Working in the field of telemedicine may require considerable
working knowledge of a common language such as English.

- Standards and Licensing. Does a physician have to be licensed in a country receiving the
service? If so, what are the standards and how should they be administered?

- Operational Protocols. The protocol for providing a telehealth or telemedicine service has
Financial Reimbursements. How should the cost of medical consultation and other services be valued and assessed across the region? Relationships and commitments for support of the Pacific Islands region are complex given the different relationships among the territories and Freely Associated States. When one adds in the complexities of other countries, the financial relationships may become extremely complex.

Culture. Telemedicine is certainly not the only or sometimes even the best answer to medical problems suffered by people in developing countries. In fact the same kind of coordination needed to achieve success without telemedicine will be required with the technology:

- physicians at the referral site and at the local jurisdictional hospital will need to discuss the case at some length sharing what physical findings and laboratory evaluation they have available (this will take time and patience and will often be frustrating for both professionals);
- the follow-up or discharge planning necessary to return a patient from a referral hospital to a hospital set in a developing country will be required in the future as it is today (and just as it is not always done today, technology will not ensure that it will be done tomorrow);
- the local customs and traditions will play as large a part in medical interventions with telemedicine technology in the future as it does today. And the providers of care at the referral or consultation site must endeavor to understand these customs/beliefs today and in the future.

Appropriate expenditures. Should funds be allocated to the purchase of the telecommunication and information technologies or should they be used in other ways?

There are many other issues that should be examined, including, but not to be limited to: professional and/or educational level of medical organizations and individual physicians providing services through telecommunications; ethics and standards; reimbursement; liability; application of insurance benefits; and inter-cultural and inter-personal perspectives. These issues suggest a need for a parallel research effort into the many social, economic, and policy issues raised in telemedicine and telehealth. Unfortunately, the extent of these studies will be constrained by many of the same barriers of funding, distance, cost of telecommunications, and so on.

6.2 QUESTIONS

As with many application experiments in telecommunications, the initiation of a trial often raises more questions than answers. Some of the questions that have been raised are:

- Do the telemedicine technologies and applications improve medical services and/or the health of a community?
- Do telemedicine applications reduce the number of evacuations or lessen the amount of travel required for emergency and/or follow-up care?
- What is the actual value of the reduction in evacuations and travel for emergency and follow-up care?
- What level of documentation is necessary to measure such improvements?
- Are the technologies that are being tested appropriate?
- Has the use of these technologies "transferred" to the user community?
- If the success of an experiment is to be deemed limited or a failure, then, is it a theory failure or an implementation failure? How can we be sure that poor implementation or an external intervening factor did not affect the overall success of an application?

- How did the patients react to the use of these telemedicine applications (e.g. video conferencing)?
- How did the doctor and patient feel about video teleconferencing?
- Do the doctor and patient feel that video teleconferencing improved the level of service?
- How has the provision of information been transferred?
Do doctors and other medical officers access the available information services? 
Do they feel that the service was valuable?

These are only a few of the questions that have arisen. There is a need to codify and begin to analyze the experiments in relationship to the promises of the technology. However, as stated earlier, it is too soon to undertake such an evaluation since the trials have just begun.

7. SUMMARY

Telemedicine and telehealth applications are important emerging applications for the Pacific Islands Region. Experiments are being proposed and/or conducted in the Pacific Islands Region under many venues, such as PARTNERS, PEACESAT, Tripler Army Medical Center, the Pacific Basin Medical Officers Training Program (PBMOTP), and the Fiji School of Medicine (FIJI-SM). Although it is far too early for an in-depth evaluation of these programs, the efforts so far have been useful in identifying many important issues and questions.

International cooperation and collaboration in the development of telehealth and telemedicine programs in the Pacific Islands Region could expedite experiments exponentially. The basis of cooperation and collaboration among and within the region appear to be developing.

A dialogue on telemedicine and telehealth experiments should be initiated among the service providers, experimenters, end users, and beneficiaries. Such a dialogue could begin to discuss the need to document, evaluate, analyze, and report on the telemedicine technologies, services, applications, methodologies, and evaluation techniques; and will aid greatly in developing an understanding of appropriate applications of these technologies in the Region.

NOTES

1. There are philosophical differences in emphasis in the fields of public health and medicine that are also present in telemedicine and telehealth. These philosophical differences are not discussed here.
2. The official acronym for the Fiji School of Medicine is "FSM." For the purposes of this paper, the acronym "FIJI-SM" is used to minimize confusion with the acronym of the Federated States of Micronesia (FSM).
3. The PEACESAT program is funded, in part, through a Cooperative Agreement between the National Telecommunications and Information Administration (NTIA) of the U.S. Department of Commerce and the University of Hawaii (UH). The program has been in place since 1971, and has been mentioned in the ITU's Maitland Commission Report (International Commission, 1984) as critical in facilitating communications during outbreaks of diseases and other medical emergencies. It has also been mentioned in the U.S. Global Information Infrastructure: An Agenda for Cooperation for the same reasons.
4. The plan to upgrade the PEACESAT Network is called the PEACESAT Services Improvement Plan and is documented in Okamura and Mukaida (1995 and 1994).
5. This capability could be implemented among the Hub Sites. However, to extend the service beyond the Hub Sites, digital video receive only with voice or data return would have to be developed.

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