national telemedicine network specifically. To a large extent, it is a closed system and as such contains a designated-user population. Also, it can develop and implement specific clinical trials as well as system-wide protocols and standards and has a worldwide communication system at its disposal. Representatives from the military involved in the development of telemedicine provided descriptions of several projects as well as plans for a global telemedicine network.

Military telemedicine began in 1992 with deployments to various peacekeeping and humanitarian missions overseas. It focuses on the continued support of those missions and also on developing telemedicine in regional areas to care for patients and to teach and train military personnel. The goal is to provide a cost-effective means for delivering patient care as the forces are downsized.

Despite the uniqueness of the military sector, proponents of telemedicine within the military face many of the same problems encountered by the civilian sector in the development of telemedicine. Among these problems are "insufficient user acceptance," technological glitches in transmission, as well as definition of scope of practice and the need for universal standards. In addition, military telemedicine must consider consolidation of services, reduction in force, cost containment, and the need to provide greater access to specialty care. The indirect cost of care in the military involves not only travel cost but also productivity loss. The military is also interested in providing low-cost solutions for doing telemedicine.

Representatives from the military made presentations on a range of topics, including clinical trials in pediatric surgery, immunization delivery/tracking, and telemedicine aboard ships. The discussion here is necessarily limited to those issues concerning the development of an international network of telemedicine.

A Global Tracking and Delivery System

Of considerable interest was the discussion of developing an immunization delivery and tracking system. The World Health Organization (WHO) reported that the deaths of 3,000,000 children annually could be prevented by the timely use of vaccines. The delivery of vaccines and tracking vaccinations are not new problems. Despite the potential impact of immunizations on health status of an population, the programs are orphans in many medical communities and institutions.

Need for Universal Database

There is a "desperate need for a universal database" for the efficient tracking of immunizations within the military. With some 8.2 million beneficiaries distributed around the world for which the military does lifelong tracking, data must be entered, read, and reviewed in real time. Currently, the system gets calls from around the world because of limited resources in remote regions, hence the need for deploying technology, including hardware and software, to establish communication links and a database with universal standards.

The military has invested substantially in developing a business model for standard data elements and for data connectivity. Importantly, this model and system are in the public domain because they were publicly funded.

Currently, there are not enough specialists, including allergists, infectious disease experts, preventive medicine physicians, primary care physicians, or nurses, to provide all the services needed in the system. Thus, more productive modes of delivery must be deployed if the current capacity for use of vaccines is to be increased. One alternative is to permit pharmacists to deliver vaccines. Such a change cannot be accomplished without the development of "intelligent tools" and guaranteed protection for the recipients.

The fact that such an information system was developed within the military demonstrates the potential value of military telemedicine as a testbed for telemedicine development in the civilian sector. In this regard, it was suggested that there should be a Department of Defense–civilian problem-solving cooperative comprised of experts from a wide variety of related fields in order to facilitate the development of transfer of appropriate telemedicine expertise. It was also suggested that cultural

and linguistic barriers must be considered when operating in other countries.

The Problem of Time and Maintenance

Overcoming or collapsing distance between providers or clients is a significant impetus for the deployment of telemedicine. In global telemedicine, however, time is much more important. The U.S. Navy's experience revealed significant difficulties in data transmission and communication from one side of the world to another. Time differences make it much more difficult to function seamlessly.

In health care, patients' conditions change over time, and they need to be monitored periodically or continuously under certain conditions. Therefore, telemedicine must be considered in such operational settings, not as a single encounter, but rather as the entire duration of an illness and recovery.

Time or, better, duration also contributes to the maintenance of a telemedicine system. In a wide regional or global telemedicine network, in some instances, it may be very difficult to get technical assistance promptly. Therefore, it will be necessary to build telemaintenance capability into the system. Video conferencing equipment and "teletraining" can be utilized to minimize downtime and other technological difficulties that occur from time to time at remote sites.

Military and Private Sector Relations

Traditionally, work conducted in the military sector has not always transferred to the civilian sector. Historically, the value of the military to the nonmilitary lay in advancing technology. Then, through a trickle-down capability, benefits perhaps would flow to the civilian sector. A rapidly emerging model may make the relations between the military and the private sectors more important, both domestically and on a global scale.

This model derives from the rapidly emerging involvement of the military in "operations other than war." The U.S. military has become increasingly involved in partnerships with other armed forces, especially those of European nations. Delivery of medical care in these operations presents unique problems, which require greater connectivity with civilian capabilities for support. As resources are constrained, day-to-day care is being transferred to a greater degree to the civilian sector through contractual arrangements. The military is involved in disaster relief, ration assistance, drug interdiction, and peacekeeping support.

The change in focus and the involvement of the civilian sector is not serendipitous. The military believe that the more the foreign military personnel becomes involved in community maintenance and building, "the less they become involved in coups." Thus, the "retooling" of the military relations with citizens of some countries is linked to building democratic and regional stability. Cooperative arrangements will link military medical institutions in the United States through a central processing center in Brussels with various military entities of the European Command.

It is obvious that military telemedicine can contribute to the development of the ARN telemedicine initiative in both the short and the long term. In the short term, it can serve as a testbed for the development of technology, protocols, and standards in the various aspects of telemedicine. In the long term, the emerging international military–civilian telemedicine joint activities should facilitate international cooperation and collaboration. Parallel efforts to develop such cooperation will be required between the military and civilian sectors among the regions of the Atlantic Rim.

ACTION PANEL ON MEDICAL RECORDS AND PATIENT INFORMATION

The panel on records and information was charged with identifying and addressing problems pertaining to health information systems in telemedicine. The issues of security of medical records systems, confidentiality of patient information, and medical record content were addressed at some length. Statements framed the importance of these issues: "the electronic patient record is central to that (telemedicine) process"; and, "if there's any application that's going to kill telemedicine, it's the issue of security and confidentiality . . . at least in the United States." Nonetheless, the discussion

here is limited to issues pertaining to the development of international cooperation in telemedicine.

Medical Record Content

From the perspective of the European Commission, it was suggested that member countries were following the Institute of Medicine report, which specified the functionality of the patient records, including data entry, presentation, and retrieval, as well as decision support. Further, it was suggested that the technology is "more or less" here for electronic patient records as well as information system architecture. The main problems among the Europeans were identified as security and confidentiality as well as terminology and languages. With regard to the latter, a solution to multilingual patient records is under development. Therefore, the unresolved issues are security, confidentiality, and terminology.

Indications of problems in international cooperation were evident early in discussions of standards for electronic records. The European representative was queried as to whether the same standards for electronic records existed in Europe as in the United States. The European reply challenged the assumption that electronic records in North America adhere to a universal standard, "which they do not." The panel moderator suggested that the Europeans "are probably a great deal ahead in terms of developing standards."

The need for international data, although not present on an individual patient basis, is important for broader issues such as research outcome studies. To date, there is no program for exchanging data between countries, nor is there appropriate standardized terminology to do so.

At least two levels of terminology and exchange are possible. First, there is the representation of certain facts, such as serum potassium concentration that comes off an autoanalyzer or a date of birth. Here, it would be relatively easy to achieve consensus on standards. Second, there is the "concept level" of information, which is also important to decision support. For example, information might indicate whether the patient has a rigid or a soft abdomen. The patient record must include both levels of facts in order to serve the purposes of research and diagnostic support. Patient records must include the full range of information, hence the need for standardized nomenclatures.

There is also a need to view the electronic medical record as something different from the ordinary patient record. In most instances, the electronic record is merely a replication of the paper record and fails to take advantage of the possibilities of the technology. For example, technology now has the ability to capture heart sounds and other vital signs. A standard minimum set of data for each medical record must be established that serves medical, bureaucratic, and legal purposes. Standard protocols enable a seamless exchange of information.

Security and Confidentiality

Serious concerns were expressed about security and confidentiality of patient information. Representatives from each country shared this concern. Several security models were discussed, ranging from a Berlin rule-based intrahospital access security procedure to developing unique patient identification. Panel participants agreed that prevention of illegal and unethical access to patient records could be critical to the ultimate acceptance and, hence, the success of telemedicine.

CLINICAL APPLICATIONS

The panel on clinical applications focused on creating an agenda for trans-Atlantic clinical telemedicine. Participants were directed to provide commentary based on national experiences that might be extrapolated to the international setting. Considerable discussion focused on assessing clinical utility in telemedicine and how to establish international networks. Discussion here is limited to statements derived from both foci that pertain to the international setting.

International Differences

Assessment of clinical utility must consider at least two factors. The first is differences between health care systems. These differences

include variation in financing mechanisms and the training and roles of various health professionals in the medical care decisionmaking process. Second, there is a need to agree on common definitions of value-improved medical outcomes. To do this, an integrated multidisciplinary team of physicians, engineers, corporate people, and insurers is required. Hence, the policy perspective and the research perspective converge in determining the clinical value of telemedicine. Both biomedical and health services research should be designed to inform development of intelligent policy.

Need for Social Scientists

There was general agreement that measuring telemedicine utility falls within the realm of the social sciences and requires an understanding of medical cultures that differ from place to place. Social scientists must be brought to the table in order for the enterprise to succeed.

Establishing Linkages

The panel addressed how linkages could be forged, where, and between what specialties. The most basic need was for the establishment of an index of standards to be used in measuring clinical utility. However, the lack of international protocols precludes cooperation and collaboration among clinical projects.

Europe is leading the way in multinational research. The EU is currently supporting about a dozen projects on this scale. However, the EU has no funding mechanisms for supporting or cosponsoring American partners. Either NATO or the Department of Defense might be approached for funding for collaborative studies on the clinical utility of telemedicine.

Ethnocentricity Questioned

The need to expand the range of nations included in discussions was identified. It was noted that Europe and the United States seemed to be overrepresented at the Summit. In order for there to be a truly comprehensive and effective development of an Atlantic Rim Telemedicine initiative, it is necessary to include countries that do not necessarily share the Western values of medicine.

Proposals for Collaboration

Several proposals were offered for developing collaborations between countries around the Atlantic Rim.

- Common registry. One proposal was for the development of a common registry of databases from all clinical telemedicine trials. It would serve researchers, policymakers, and others desiring information on telemedicine clinical utility. The registry would be based on a uniform format, and it would include various specialties and applications.
- Expand/reorient focus. There should be an expansion or reorientation of focus away from the G-7 countries or between the EU and North America. Telemedicine projects should be directed toward newly market-oriented countries and other industrialized countries facing difficulties. These countries have a real need for specialty consultations.
- Joint working group. A joint working group on telemedicine between the North America, G-7 countries, the EU, and other Atlantic Rim countries should be established.
- Explore funding. Funding sources must be identified/sought for multinational collaborative projects on clinical applications of telemedicine. As in other instances, these studies require the development of standard protocols and evaluation measures.

DISEASE MONITORING

Over the past 20 years, some 30 new disease-causing organisms have been identified. In addition, some old diseases are reemerging. New concerns have arisen about the ability of infectious agents to cross the species barrier from animals to humans, and international travel and trade have rendered humans rapidly moving vectors of infectious disease. While communicable diseases continue to be a significant cause of illnesses and deaths in developing countries, industrialized countries have become increasingly aware that they, too, are at

risk. International cooperation in the monitoring of and communication about infectious diseases is imperative. In this section, highlights of the action panel discussions pertaining to this topic are presented.

Representatives from the Pan American Health Organization, EU, and WHO made pres-entations on the collection and dissemination of information about disease outbreaks and health conditions in various locations. These agencies concentrate on bringing together laboratories and disease surveillance systems to share information, attempt to ensure that the information can be rapidly and widely disseminated to those who need to know, develop national and regional preparedness to ensure local disease surveillance and control, and provide for international preparedness. However, there are barriers to full implementation of these systems and projects.

Of particular concern was the hesitancy of some countries to report specific disease outbreaks because of the negative impact of such information on trade or tourism. Another obstacle is the lack of standardized disease reporting. In an attempt to rectify both problems, the World Health Assembly will implement a pilot project in 1998 that will encourage countries to move from disease-specific reporting to "syndromic" reporting. That is, report of a series of symptoms will be substituted for reporting a disease as classified in the ICD9CM. This approach will both encourage more reporting by countries and contribute to more standard and definitive data sets on extant and emerging diseases.

Eurosurveillance

Because the borders between the member countries of the EU are rapidly vanishing, there is a need for a Eurosurveillance program. Travel and migration will increase, thereby increasing exposure of populations to a wide variety of etiologic agents. The situation will intensify as new countries are added to the EU. In turn, it was realized that there was a need for better information and communication between countries on disease outbreaks, new syndromes, routine surveillance, and "suspected sources."

Even within the EU, differences between countries impede full implementation of a comprehensive system. For example, it was reported that only 10 of the 15 current members have surveillance institutes such as the U.S. Centers for Disease Control. Further, it was noted that, even within the EU, national feelings preclude establishing a "European Center for Disease Control." The TIS was viewed as a first step toward the development of a "virtual" CDC for the member countries of the EU.

Nonprofit Initiatives

Sovereignty and political and economic consequences are reportedly of little concern to SatelLife, a nonprofit enterprise involved in disease monitoring and communication. Telecommunications links are used to fill the information gaps between the developed and developing world. A low earth-orbiting satellite was launched. The purpose is to improve the health in developing countries and in remote areas of the world using telecommunications to link health workers with each other and with information resources. The satellite orbits the earth at about 550 miles, as opposed to geostationary satellites that orbit about 23,000 miles above the earth, because this approach allows the use of a standardized off-the-shelf transmitter/transceiver with a small antenna. The system permits the periodic transmission of electronic messages to the satellite, which are stored and subsequently transmitted to a central facility in Boston. Some medical journal publishers permit the transmission of abstracts and occasional condensed full-text articles into a daily news journal. A bulletin board system was established for different areas of research, and discussion groups formed around particular articles. Thus, journal clubs have been emerging in developing countries.

Several instances were described in which the information was certified as correct by larger health organizations and then disseminated electronically. For instance, a physician in Switzerland reported to the bulletin board that a patient visiting from Brazil had died from yellow fever. The information resulted in at least some tourists being vaccinated before entering Brazil or postponing trips to that

country. The information was verified and reported from the WHO about a month after it appeared on the SatelLife network.

DISTANCE LEARNING AND CONTINUING MEDICAL EDUCATION

The action panel on distance learning was presented with a rather wideranging set of issues to consider, including distance learning, continuing medical education, licensing, and certification. In addition, credentialing was proposed as a topic for consideration. As with others, this panel consisted of some 30 members from a wide variety of backgrounds united by a common interest in the issues being raised.

Telemedicine and Telehealth

Discussion turned almost immediately to the definition of the use of telecommunications in the health sector. It was suggested that the definition of telemedicine had not changed and was accurate insofar as it referred to the provision of medical care/consultation at a distance to remote providers and populations. However, it was felt that, as the opportunities to provide applications in the health field had become much broader, it might be useful to expand the concept and term it *telehealth*. Telehealth would encompass activities that link telecommunications and health in order to improve the health and well-being of individuals and communities. This could include greater access, improved health care services, disease prevention, and health promotion. (It should be noted here, however, that these functions have previously been subsumed under the telemedicine umbrella. Even the initial experiments in telemedicine, conducted in Nebraska in the late 1960s and dealing with psychiatry, included distance learning.) According to this perspective, therefore, telemedicine would become a component of telehealth.

The belief was expressed that, rather than being merely an issue of semantics, revised terminology could very well lead to an improved environment for cooperation and collaboration among all players in the health care system, including consumers/patients. If such an enhanced environment would arise from greater cooperation, then the creative development of applications; for example, virtual reality as a learning tool, and increased economic development as a result of new applications of technologies would result. It is difficult to imagine that a simple change in terminology would lead to so many good things; nevertheless, the redefinition or, better, reclassification of telecommunications in the health sector was offered. Further debate centered on what would be included under the term "telecommunications" and the suggestion that, in the context of the discussion, it included technologies beyond ordinary telephone lines.

Access

Access was perceived as a serious obstacle to the dissemination and use of telecommunications technology in distance learning programs and continuing medical education. Regardless of the setting—domestic, international, civilian, or military—the questions of access were seen as irrelevant if people choose not to access the technology and information available through telecommunications. How to make the technology *truly* easy to use is a serious challenge facing proponents of the use of telecommunications in distance learning.

Access was viewed as a three-level concept. One issue is *access to technology*. The problem domestically as well as internationally centers on lack of access to health care. There is concern that the populations without such access are the same ones who do not have access to telecommunications technology to improve access to health care.

A second level of access pertains to the actual *use of technology*. Even at its simplest level; for example, stationary visual displays in public places, people do not access the information available. If this is the case in the use of the most straightforward and "lowest" mode of delivery of information, how can we expect people (consumers/patients, health providers) to use more sophisticated means to access information? By and large, potential consumers and, in particular, remote populations most in need of education are technologically challenged in terms of availability, familiarity, and

skills necessary to access available information. Thinking globally, it is most important move away from an ethnocentric focus and look to the needs of populations beyond domestic borders.

A third level to access pertains to *accessing information needed at any particular point in time.* The question here is how to make the most reliable and up-to-date information on a wide range of health education matters or items available in the most timely fashion to a spectrum of users with special needs.

Standardization

With regard to continuing medical education and distance learning, the issue of standards was considered important. One objective is the development of a global continuing education system for physicians such that credits earned in the United States, for example, would also meet the French physicians' continuing education needs. This system could be extended to include members of the other health professions such as nurses.

Community Education

Across the vast distances of Canada, the perspective was not one of educating the medical practitioner or the nurse practitioner, although these were seen as great challenges, but rather the continued updating of and stimulating the education of the community-based health worker. These people provide assistance with a spectrum of problems, including mental health programming, alcohol counseling, family abuse counseling, and the like. In these situations, similar to the situations in many rural areas and developing countries, it becomes cost-prohibitive to have these people travel for continuing education, yet they may be the most critical personnel to consider for distance education technology in the areas of continuing medical or health education.

RECURRING THEMES

The discussion in the various sessions of the Summit covered a whole range of issues and opinions. Here, an attempt is made to identify and summarize the basic themes that recurred throughout.

Standards

The lack of standards was emphasized repeatedly. Standards include legal and regulatory matters associated with the implementation and practice of telemedicine, clinical utility, medical record content and form, disease reporting, licensure and scope of practice, education and training, and interoperability of equipment. In each instance, there was a general consensus that the lack of development of standards would hinder efforts to create a seamless Atlantic Rim telemedicine network.

Human and Cultural Factors

In almost every session, the importance of human and cultural factors was emphasized. Frequently, differences between cultures and health systems create problems in developing and agreeing on international standards for care, education, scope of practice, medical record content, security and confidentiality, and disease monitoring and reporting. Ultimately, culture affects the acceptance and, hence, diffusion of telemedicine. On several occasions, it was suggested that social scientists should be involved in the debate and discussions to facilitate development of standards for the practice of telemedicine.

Expanding the Circle of Participants

The imbalance in the discussions resulting from the relative dearth of representatives from countries from South America and Africa was noted. Hence, many discussions were limited to dialogues between American and European representatives. The underrepresentation of Latin American and African perspectives contributed to the presentation of the Western medical model as the "correct" model of medical care.

Sovereignty

The issue of sovereignty was raised in a number of sessions. For example, national sovereignty as it pertains to medical recordkeeping procedures and dissemination of disease data presented an obstacle to international collaboration. Protectionism/professional territoriality was also raised as an issue in relation to scope of practice and competition as these relate to the impact of telemedicine on the spe-

cific roles of various health professionals. International agreements and the reduction of barriers to the provision of medical care should consider potential threats to jobs as well as standards of care in the respective countries.

RECOMMENDATIONS AND CONCLUSION

The TTS encouraged the interaction of a large group of telemedicine proponents, practitioners, observers, vendors, and policymakers. The diversity of the participants and of their areas of expertise provided a unique opportunity for them to think beyond their individual specialties and contribute to a larger discussion. In effect, the ARN provided a neutral forum permitting sometimes-competitive players to discuss common problems and goals. At the conclusion of the TTS, recommendations were developed for a plan of activities for the ARN Telemedicine Initiative. These recommendations are presented below.

A Continuing Forum

The ARN should continue to provide a forum for cooperation in which projects, activities, plans, policies, and research undertaken separately in Atlantic-oriented countries, as well as beyond, can be shared and discussed on a regular and timely basis.

Telemedicine/Telehealth

Telemedicine should be considered within a broader framework of telehealth. It was proposed that this action would facilitate and enhance participation and involvement, as well cooperation and collaboration, of the widest possible range of health professionals. And as such, it would encourage a range of creative developments and economic development and reduce barriers to implementation of appropriate and effective distance learning programs.

Education

Access to education about technology should be directed toward providers in health education and training programs. Furthermore, distance learning education should be developed within a multimedia environment, allowing for a variety of appropriate levels of education for the wide range of health professionals in institutions and the community. Furthermore, the technology level incorporated into the educational programs should be the simplest, lowest cost, and most prevalent that is appropriate to achieve the goals.

Projects

The ARN should foster and coordinate a network of trans-Atlantic initiatives in telemedicine. These are to include bilateral and multilateral efforts in the private and public sectors, and they should encourage military and civilian cooperation where appropriate. The projects should extend geographically around the Atlantic Rim, including countries from each sector. The immediate objective here is to identify a minimum of three projects to serve as demonstration models for international cooperation in health care. Further, these projects should be made part of the G-7 Nations' Global Health Care Applications agenda. The projects are to be developed jointly and proposals submitted to both international and appropriate national funding sources.

Tentative List of Suggested Projects

The following projects were recommended for initial consideration:

- Registry database. Production of å registry database consisting of telemedicine research programs and related activities worldwide and implemented with common searchable parameters;
- Advisory group. Development of a multinational advisory group to assist policymakers and regulators with impartial information regarding such issues as security and confidentiality, legal and regulatory issues, and cost-benefit assessments. The purpose of such a group is to assist and enhance the Transatlantic Business Dialogue and other international health care initiatives and activities;
- Licensure experiments. Creation of licensure projects at the domestic and international levels. Domestically, regional pilot projects should be developed and supported that facilitate interstate collaboration of health professionals. At the international level, a project based on pre-

liminary interest shown by the EU and the Western Governors Association should be followed up. The project should be a 2- to 3-year study to identify issues and resolve problems concerning international licensing and credentialing;

- Demonstration projects. Several demonstration projects were proposed for consideration, including the following.
  —Diplomatic corps. A limited international telemedicine service might be developed for foreign diplomatic corps and expatriate populations in remote stations;
  —Tourism. A prototype "globalization of access to health care" project should be considered that would be part of international tourism support services;
  —Patient records. A multinational project was suggested to standardize electronic patient records to permit the timely, efficient, and secure transfer of data across national borders;
  —Cross-cultural comparisons. A project was recommended that would design and assist in implementing trans-Atlantic comparison of patient and physician acceptance of telemedicine as an enabling technology.

CONCLUSION

In its broadest sense, telemedicine and telehealth can be a positive force in improving the medical care and, ultimately, the health status of populations. However, as demonstrated in the preceding discussion, there are numerous barriers and obstacles to both intranational and international cooperation and collaboration in the use of telemedicine to address issues such as access, quality, and cost. The first Atlantic Rim Network Transatlantic Telemedicine Summit provided the opportunity for a large and diverse group of health care practitioners, policymakers, vendors, and technology experts to examine these issues in an open dialogue. The United States, the G-7 countries, the European Union, and other interested parties from around the Atlantic Rim should be encouraged to contribute to and participate in this assessment of telemedicine, the exchange of experiences, and the development of an effective and enlightened basis for engaging in collaborative and cross-national projects.

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