Evaluation Report

OFFICE OF THE INSPECTOR GENERAL

EVALUATION OF AREAS OF CONSIDERATION FOR A DEPARTMENT OF DEFENSE CLINICAL TELEMEDICINE NEEDS ASSESSMENT

Report No. 96-074 February 22, 1996

DEPARTMENT OF DEFENSE

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DEPARTMENT OF DEFENSE
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February 22, 1996

MEMORANDUM FOR COMMANDER, U.S. ARMY MEDICAL RESEARCH AND MATERIEL COMMAND

SUBJECT: Evaluation of Areas of Consideration for a Department of Defense Clinical Telemedicine Needs Assessment (Report No. 96-074)

We are providing this research report for information and use. We performed the research in response to a request from the sponsor of the Department of Defense Telemedicine Testbed Project, the Medical Advanced Technology Management Office, U.S. Army Medical Research and Materiel Command. The research was conducted by the former Office of the Deputy Assistant Inspector General for Program Evaluation and the report was prepared by the Logistics Support Directorate, Office of the Assistant Inspector General for Auditing.

We hope this research report will be of value to you and we would appreciate your feedback, although no formal response is required. Should you need additional information or assistance in other areas, please contact Mr. Herbert Harvell, Evaluation Director, at (703) 604-8748 (DSN 664-8748).

Robert J. Lieberman

Robert J. Lieberman
Assistant Inspector General
for Auditing

cc: Assistant Secretary of Defense (Health Affairs)

Office of the Inspector General, DoD

Report No. 96-074 **February 22, 1996**
(Project No. 6LH-9008)

Areas of Consideration for a Department of Defense Clinical Telemedicine Needs Assessment

Executive Summary

Introduction. The research report was requested by the sponsor of the DoD Telemedicine Testbed Project, the Medical Advanced Technology Management Office, U.S. Army Medical Research and Materiel Command. The purpose of the research report is to provide the Medical Advanced Technology Management Office with telemedicine assessment approaches, wartime casualty data, and peacetime health care data that the DoD Telemedicine Testbed Project office can use to conduct a DoD clinical telemedicine needs assessment. Our research focused on the clinical applications of telemedicine. It did not address health care administration or education.

Objectives. Our objectives were to:

o identify and assess clinical telemedicine needs assessments and benefits analyses conducted in the private sector, in other Government agencies, and within DoD itself to provide the DoD Telemedicine Testbed Project office with data they can use to conduct a DoD-wide clinical telemedicine needs assessment, and to develop DoD-wide clinical telemedicine requirements.

o analyze DoD data bases for medical diagnoses that occur during war and during operations other than war to identify those medical conditions that could potentially benefit most from telemedicine applications. In addition, analyze resource intensive medical diagnoses within the peacetime Military Health Services System to identify those medical conditions that could potentially benefit most from private telemedicine applications.

Research Results. Using the DoD Telemedicine Testbed Project office goals as our criteria, we identified clinical telemedicine assessment methodologies within the private sector and the public sector, including DoD. Within the private sector, a combination of three private sector methodologies and approaches could be used by the DoD Telemedicine Testbed Project office to develop a needs assessment approach.

o the clinical telemedicine application planning guidelines of Rural Health Futures, Inc.

o the clinical telemedicine taxonomic scheme (the science, laws, or principles of classification) of the Center for Health Services Research.

o the clinical telemedicine analytical consortium approach of the Telemedicine Research Center and its Clinical Telemedicine Cooperative Group.

Based on our research of other Government agencies, the following should be considered for a DoD clinical telemedicine needs assessment.

o the continued participation of the DoD Telemedicine Testbed Project office in telemedicine utility determination consortiums.

o the economic costs model of the Health Care Financing Administration.

From within DoD, we identified strategic planning initiatives in the Office of the Assistant Secretary of Defense (Health Affairs) and the Joint Staff Directorate of Logistics, which present an opportunity to demonstrate the effect clinical telemedicine could have in reducing theater medical resource requirements and integrating clinical telemedicine into the information infrastructure and workload requirement of the Military Health Services System.

The following is a list of additional needs assessment methodologies and approaches we observed within DoD.

o U.S. Transportation Command has the capability to provide aeromedical evacuation cost data on the point-to-point costs of military aircraft.

o The Uniformed Services University of the Health Sciences is developing a standardized protocol and data dictionary for documenting clinical telemedicine consultations.

o Military Health Services System regional lead agents reported methodologies designed to, among other benefits, improve sick call and return to duty rates; assess the suitability of high resolution imagery for clinical applications in pathology, dermatology, and plastic surgery; and overcome shortages in child psychiatry to reduce costs to the Civilian Health and Medical Program of the Uniformed Services.

Data Base Research. We included information on wartime and operations other than war (Appendix K), and peacetime medical conditions that are the most resource intensive for DoD (Appendix J). The data are provided to help reduce medical resource expenditures.

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Part I - Introduction

Background

Research Requested. The Medical Advanced Technology Office, U.S. Army Medical Research and Materiel Command, requested we conduct a research and data collection effort to identify and categorize clinical diagnoses from which the DoD Telemedicine Testbed Project office (Testbed office) can prioritize and develop a clinical telemedicine needs assessment. The Testbed office was established to manage rapidly advancing digital communication technologies that could be used to support and enhance the medical care provided by the Military Health Services System.

Telemedicine Defined. Telemedicine is a capability which allows electronic projection of the expertise of a health care professional over time and space to the location of a patient or other collaborating health care professional(s). The Assistant Secretary of Defense (Health Affairs) (ASD[HA]) defines telemedicine as "The investigation, monitoring, and management of patients and the education of patients and staff using systems which allow ready access to expert advice and patient information no matter where the patient or the relevant information is located. The three main dimensions of telemedicine are telecommunications, medical computer science, and health services." Other terms used in this report are defined in Appendix A.

Objectives

Our objectives were to:

o identify and assess clinical telemedicine needs assessments and benefits analyses conducted in the private sector, in other Government agencies, and within DoD itself, to provide the Testbed office with data useful for conducting a DoD-wide clinical telemedicine needs assessment and developing DoD-wide clinical telemedicine requirements.

o analyze DoD data bases for medical diagnoses that occur during war and operations other than war to identify medical conditions that could potentially benefit most from telemedicine applications. In addition, analyze resource intensive medical diagnoses within the peacetime Military Health Services System to identify medical conditions that could potentially benefit most from telemedicine applications.

Scope and Methodology

The breadth and depth of telemedicine required a very focused approach to our research and data collection efforts. At our client's request, we focused on the clinical applications of telemedicine. We modified the ASD(HA) definition of telemedicine to meet our research focus. Our research and telemedicine definition focus included those clinical telemedicine applications using interactive audio and video. Interactive audio includes two-way telecommunications, that is, a telephone conversation or the audio portion of a teleconference. Interactive video includes two-way visual interaction, that is, the video portion of a teleconference. Interactive audio and video also include "store and forward" applications, that is, multiple-media electronic-mail and time delayed high resolution still video image interactions.

We used DoD Manual 7920.2M, "Automated Information System Life-Cycle Management Manual," March 1990, its associated DoD acquisition system references, and its criteria for a mission need statement as a guide in determining the types of data needed for this research effort.

We reviewed over 300 telemedicine articles through on-line data base sources at the Joint Medical Library (which included the National Library of Medicine); attended some and obtained materials from other telemedicine conferences; and conducted interviews to identify private sector, other Government agencies, and DoD clinical telemedicine needs assessment, utility, and benefits analysis methodologies (Appendixes B and C). Because of the rapid changes occurring in telemedicine technology, we limited our clinical telemedicine literature search to relevant articles published from 1990 through 1995. We then analyzed the articles for clinical telemedicine utility determination and needs assessment approaches that met the Testbed office master planning goals.

We accessed DoD medical, logistical, and force management activity data bases and conducted interviews to obtain wartime and operations other than war data on wounded in action and disease nonbattle injury rates. We analyzed data bases that contained wartime casualty data for the capability of the data base to provide casualty predictions, by episodic frequency, supporting current and future combatant and non-combatant operations. We selected and are providing aggregate deployable medical systems patient condition or patient stream data developed by the Military Departments. The Defense Medical Standardization Board uses patient stream data to support the medical logistical planning requirements of the national military strategy (fighting and winning two almost simultaneous regional conflicts). Patient stream data are historical killed-in-action, wounded-in-action, and disease non-battle injury data modified by projections in tactics, weapons systems, and battlefield dispersions for future operations. We collected patient stream data and used a matrix designed to convert deployable medical systems patient conditions into international classification of disease - ninth revision code(s).

As a data collection source, we used the DoD Military Health Services System data bases for inpatient and outpatient diagnostic frequency and cost data, both within the direct care system (within military medical treatment facilities) and

for health care provided by the Civilian Health and Medical Program of the Uniformed Services. The DoD peacetime direct care system does not maintain patient level cost data.

We developed a telemedicine questionnaire and transmitted it to each surgeon general and each Military Health Services System regional lead agent within the Military Departments to collect data on ongoing, completed, and planned telemedicine projects; and any needs assessment, requirement determination, or benefit methodologies developed and used within the DoD.

Part II - Background and Analysis

Telemedicine Testbed Master Plan

On September 29, 1994, the U.S. Army Medical Research and Materiel Command published a draft Telemedicine Testbed Master Plan. In January 1995, it published a draft Telemedicine Strategic Plan. Both plans were being coordinated with the Navy and the Air Force, as of January 1996. Under the umbrella of the Telemedicine Testbed Master Plan, telemedicine validation initiatives, including Service specific and joint telemedicine demonstrations and projects are ongoing. A key component of the validation initiatives is prototyping new approaches and technologies for management of clinical data and processes within a common clinical, technical, and organizational control architecture. The Testbed office was researching and developing control architecture(s) that could be assessed and evaluated using objective, reproducible, and verifiable criteria and performance measures.

The Testbed office recognized the need to assess and prioritize the injuries and illnesses that would potentially benefit most from telemedicine applications. The intent of the Testbed office was to form a multi-Service, multi-disciplinary group to conduct a DoD clinical telemedicine needs assessment. That initiative could be the basis for focused prototyping, a business case for clinical telemedicine, and a DoD requirements determination. Our research results and data will support a Testbed project validation initiative to conduct a DoD clinical telemedicine needs assessment.

History of Telemedicine

Within the public and private sectors, telemedicine is at least a 35-year old technological medical tool that is going through a 1990s reengineering renaissance. The drivers behind telemedicine's new-found popularity are advancements in telecommunications and computer technologies, and a greater economic feasibility to use these technologies today than in the past. For example, according to an article in the February 1995 issue of the *Journal of the American Medical Association*, at least 40 states have telemedicine programs; 13 Federal agencies, including DoD, have begun telemedicine research and demonstration programs; the transmission cost for two-way interactive television today is one-tenth of comparable costs in 1959, and equipment costs are as low as $50,000 and decreasing. Like the changes in transmission and equipment cost, almost everything about telecommunications technology and telemedicine itself is constantly and rapidly changing. Questions abound, including telemedicine's utility, effectiveness, and even its definition. Additionally, there are few telemedicine policies, structures, and processes to examine in a traditional analytic program evaluation mode. DoD, like the States, private sector, and academia must define its own boundaries for the initial uses and future proliferation of telemedicine.

A Fundamental Challenge - Defining Telemedicine

Defining telemedicine is challenging because of its mixture of information technology and medical aspects. The spectrum of telemedicine use from an information technology standpoint includes approximately 80 percent audio (telephone), 15 percent still images (store and forward), and 5 percent interactive video and audio. (For our research we combined high resolution still image and interactive audio and video information technology as the focus of the definition of telemedicine.) Telemedicine from a medical standpoint includes administrative, clinical, and educational uses.

Our literature search revealed numerous definitions of telemedicine in the private and public sectors. Each definition had a consistent information technology and medical theme; however, a universally accepted definition is a continuing point of contention. We used a modified ASD(HA) definition of telemedicine and focused our research of telemedicine on those technological and clinical applications that were the primary objectives of the DoD Telemedicine Testbed Project office. The applications were:

o Patient focused - military medical applications for prevention, diagnosis, and treatment.

o Readiness orientation - supporting operational missions with difficult-to-serve, expensive-to-serve, and under-served patients.

o Advanced technology applications - using interactive audio and video.

Methodologies for Assessing Telemedicine

The term, utility, is most commonly used in the private sector and non-DoD public sector, and the term, needs assessment, is most commonly used within DoD. For the purposes of our research, we used the terms utility and needs assessment interchangeably to describe the methodology or process of determining the usefulness, intended use, best use, or singular usefulness of clinical telemedicine.

The private and public sectors have been and are conducting a myriad of research and demonstration projects and programs designed to determine the utility of telemedicine. Our focus was on the methodologies developed and used to determine the utility of telemedicine, specifically patient-focused clinical telemedicine. A quote from "Telemedicine Technology and Clinical Applications," an article in the February 1995 edition of the *Journal of the American Medical Association*, summarizes the state of utility determination methodology and projects in the public and private sectors. It stated, "With the

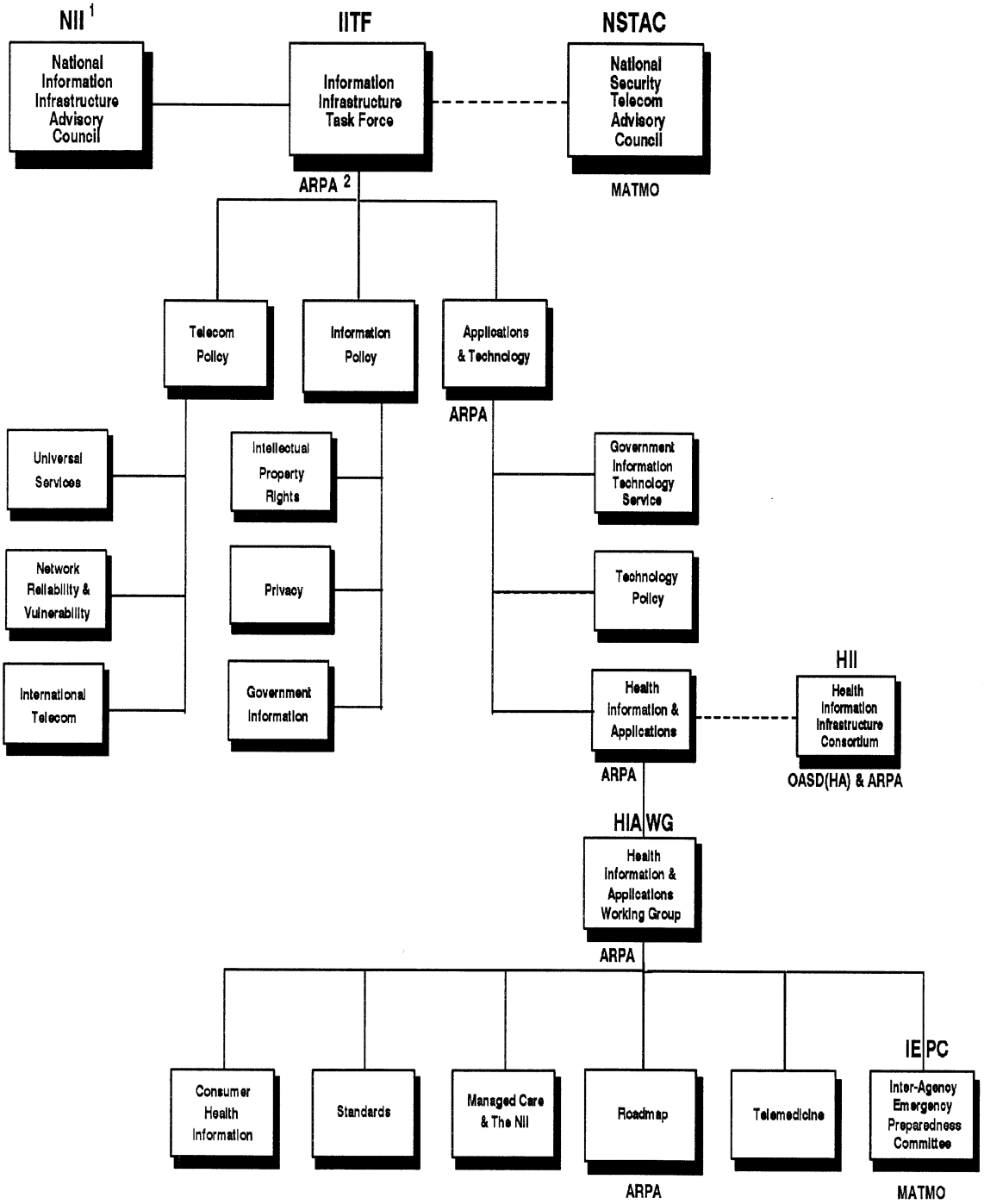
exception of image-oriented subspecialties, such as teleradiology and telepathology, few clinical studies have documented the accuracy, reliability, or clinical utility of most applications of telemedicine as a primary diagnostic or therapeutic modality."

As stated above, there is a paucity of retrospective data on the clinical utility of telemedicine. Most demonstration projects and programs have simply not individually generated enough telemedicine consultations by separate clinical procedure to conclude definitively much about the utility of telemedicine--other than as a medical tool, it works.

DoD Telemedicine Policy Formulation and Organizations and Initiatives

DoD is formulating and refining its telemedicine policy. It is also involved in national telemedicine policy and policy-related initiatives. Some leading DoD organizations involved in formulating national and DoD telemedicine policy initiatives are the DoD Advanced Research Projects Agency, the Office of the ASD(HA), and the U.S. Army Medical Research and Materiel Command. At the national level DoD is involved in the national information infrastructure initiatives (see Figure 1). Appendix D provides summary information on some of the groups in which DoD participates.

The ASD(HA) has established a DoD Telemedicine Testbed Board of Directors which supports national information infrastructure initiatives and is the steering group for DoD telemedicine development and utilization initiatives. DoD is contributing to the national leadership and is continually refining its organizational structure, processes, and policies to meet national and DoD telemedicine goals. Those goals include an integrated approach to policy determinations, and the development and use of telemedicine.



1 Activity acronyms appear above the appropriate box.
2 DoD participants in an activity are listed under the appropriate box.

Figure 1. DoD Participation in the National Information Infrastructure

Part III - Research Results

Research Results

We identified 20 needs assessment approaches and methodologies and 40 peacetime and wartime medical conditions for the Testbed office's consideration in conducting a DoD clinical telemedicine needs assessment. We also provide DoD data base information on those medical conditions that are the most resource intensive for the DoD in terms of peacetime aggregate medical costs and wartime frequency of occurrence.

Clinical Telemedicine Assessment Approaches and Methodologies in the Private Sector

Private Sector Approaches DoD Could Use. Of the numerous clinical telemedicine utility determination methodologies we reviewed, a combination of three methodologies and approaches provided promise in supporting the goals of the Testbed office. They include the general framework of Rural Health Futures, Inc.; the taxonomic scheme (the science, laws, or principles of classification) of the Center for Health Services Research; and the cooperative approach of the Telemedicine Research Center. Table 1 shows how each of those approaches meet specific Testbed office goals.

Table 1. Telemedicine Approaches and Methodologies From Private Sector Organizations That Support Testbed Office Goals

	Testbed Project Goals		
Private Sector Organization Approaches and Methodologies	Wide Spectrum of Clinical Procedures	Outcome Measurement Criteria	Large Data Collection Source
Rural Health Futures	X		X
Center for Health Services Research	X	X	
Clinical Telemedicine Cooperative Group	X	X	X

Rural Health Futures, Inc. (formerly Solutions Plus, Incorporated), acted as the principal researchers in the Kansas study (Volume 3, "Telemedicine - Assessing the Kansas Environment," November 1993) of telemedicine and the

opportunities presented by telemedicine applications. Of merit is the company's approach for a strategic information assessment specifically, application planning guidelines. The guidelines stress:

o clear definitions;

o defined goals, activities, and associations;

o feasibility assessments of pursuing a particular clinical telemedicine application;

o preparation of a plan for each telemedicine application to be pursued by a healthcare provider or system of providers; and

o a detailed definition of the minimum requirements that must be satisfied for the telemedicine application to meet the goals established.

The approach of Rural Health Futures offers a general framework for developing a needs assessment. The framework has the potential of covering a wide spectrum of clinical procedures because goals, activities, and associations can be developed to pursue a wide spectrum of clinical procedures by a group of clinical specialists or the entire Military Health Service System. Those same framework attributes, by definition, also have the potential of supporting a sufficiently large data collection source. Additionally, establishing minimum requirements that must be satisfied for assessing a wide spectrum of telemedicine applications could also meet the Testbed office's sample size goals.

The Center for Health Services Research (formerly the Center for Health Policy Research), a nonprofit organization of the University of Colorado, developed a clinical telemedicine taxonomic scheme designed to measure the effectiveness of a control group of telemedicine applications for use as a benchmark in assessing what research remains to be done and determining what processes of healthcare delivery cut across lines of clinical specialization. Because the Center for Health Services Research taxonomic scheme is designed to benchmark the effectiveness of telemedicine for all clinical specialties, the scheme potentially provides a verifiable, analytically sound means of addressing a wide spectrum of clinical procedures and establishing outcomes measurement criteria.

The Telemedicine Research Center is a not-for-profit organization with fiscal responsibility for the Clinical Telemedicine Cooperative Group, an alliance of telemedicine programs that are engaged in clinical telemedicine research studies. The goal of the Clinical Telemedicine Cooperative Group is to perform statistically valid clinical telemedicine research, across all clinical specialties, by using its cooperative of telemedicine demonstrations and projects. Because of the Clinical Telemedicine Cooperative Group goal, its approach to the evaluation of clinical telemedicine, and its potential for assisting DoD in developing a needs assessment that covers a wide spectrum of clinical procedures, contains outcomes measurement criteria, and contains a sufficiently large data collection source, it is an approach we independently concluded DoD

should consider. It is also an approach the Testbed office already agrees with, given the Testbed office became a member of the Clinical Telemedicine Cooperative Group in 1995.

Our literature search and research of private sector telemedicine assessment approaches and methodologies resulted in our identifying three approaches and methodologies that the Testbed office should consider. Other aspects of the utility of clinical telemedicine are discussed in Appendix E.

Clinical Telemedicine Assessment Approaches and Methodologies in Other Government Agencies

National Performance Review and Telemedicine. Telemedicine is a subject area within national performance review initiatives. Exploiting information technologies and the information superhighway are both initiatives resulting from the national performance review. The National Information Infrastructure Advisory Council, the Information Infrastructure Task Force, and the Health Information Infrastructure Consortium are all part of the National Performance Review support structure. The Information Infrastructure Task Force and Health Information Infrastructure Consortium have over 50 members from businesses, Federal agencies, national laboratories, and universities that design and manage demonstrations of information superhighway technologies. Two of the technologies are clinical information systems and telemedicine.

Within the Federal Government, over 20 organizations are directly or indirectly involved in national information infrastructure initiatives, and at least 13 Federal organizations are involved in telemedicine demonstrations and projects. A list of Federal organizations involved in telemedicine is in Appendix F. A detailed discussion of other Government agency involvement in the national information infrastructure and telemedicine is in Appendix G.

Other Government Agency Approaches That DoD Should Consider. Based upon our research, the other Government agency approaches that DoD should consider are:

- o participation in telemedicine utility determination collaborative efforts and
- o the Heath Care Financing Administration economic costs model.

Public and Private Sector Partnerships. Grant programs are the primary means by which Government agencies are involved in telemedicine. Government agency grant programs for clinical telemedicine demonstrations and projects are open to State and local governments and private sector applicants. The methodologies and approaches used to evaluate clinical telemedicine utility by States, academia, and the private research sector are at least partially funded by Department of Health and Human Services and other Federal grant programs. That fact illustrates that determining the utility of telemedicine is a

public and private sector collaborative effort. An example of a telemedicine utility determination collaborative effort is the telemedicine research conducted by the Telemedicine Research Center, and the center's Clinical Telemedicine Cooperative Group. The center and group are private sector research activities. The center and group have requested and received Federal grant funds, and both research activities have government agencies (including DoD) as member organizations. The goals of the Clinical Telemedicine Cooperative Group are to:

o pool data from many telemedicine projects simultaneously;

o use common protocols for gathering data;

o achieve economies of scale in data management, data processing, and data analysis; and

o achieve statistically valid results on a wide series of clinical specialties in a short time.

Such collaborative efforts provide DoD access to methods and approaches for evaluating the utility of telemedicine.

Economic Cost Model. The Health Care Financing Administration has developed a methodology designed to estimate telemedicine utility by conducting cost and benefit effectiveness analysis. The Health Care Financing Administration is attempting to expand Medicare and Medicaid reimbursements for telemedicine consultations. The methodology:

o assesses three categories of costs (Provider, Medical, and Beneficiary) for their fixed, recurring, and aggregate costs.

o Provider - Accounting Costs, which is direct costs for clinical labor, supplies, and equipment and indirect costs for support labor, overhead, and technical support.

o Medical - (Medicare) Federal Budgetary Costs, which includes current payments for referrals, transfers, and telemedicine reimbursement.

o Beneficiary - Economic Costs, which is healthcare expenditures to public and private providers, and lost productivity expenditures and wages and opportunity costs in time and travel costs.

o uses diagnosis-related group-based cost data.

o establishes and uses telemedicine cost charges.

Clinical Telemedicine Assessment Approaches and Methodologies Within DoD

Within DoD, we identified initial telemedicine successes, national and DoD-unique research and development contributions of the Advanced Research Projects Agency, and the DoD acknowledgment that the successful proliferation of telemedicine as a medical tool will require an integrated approach from the research and development stage to its forward deployment and use in operations during peace and war.

Initial Telemedicine Successes. Within the context of the ASD(HA) definition of telemedicine, DoD has ongoing telemedicine prototypes, projects, and demonstrations that vary from administrative uses, such as digital transfer of patient records, to local and wide-area health care management information systems. The results of our clinical telemedicine questionnaire identified ongoing clinical telemedicine projects and demonstrations throughout the United States in 9 of the 12 DoD lead agent regions (see Figure 2). See Appendix H for examples and a detailed discussion of DoD telemedicine development successes. Information on telemedicine initiatives throughout DoD is contained in Inspector General, DoD, "DoD Telemedicine Demonstrations and Projects Directory," December 1995.

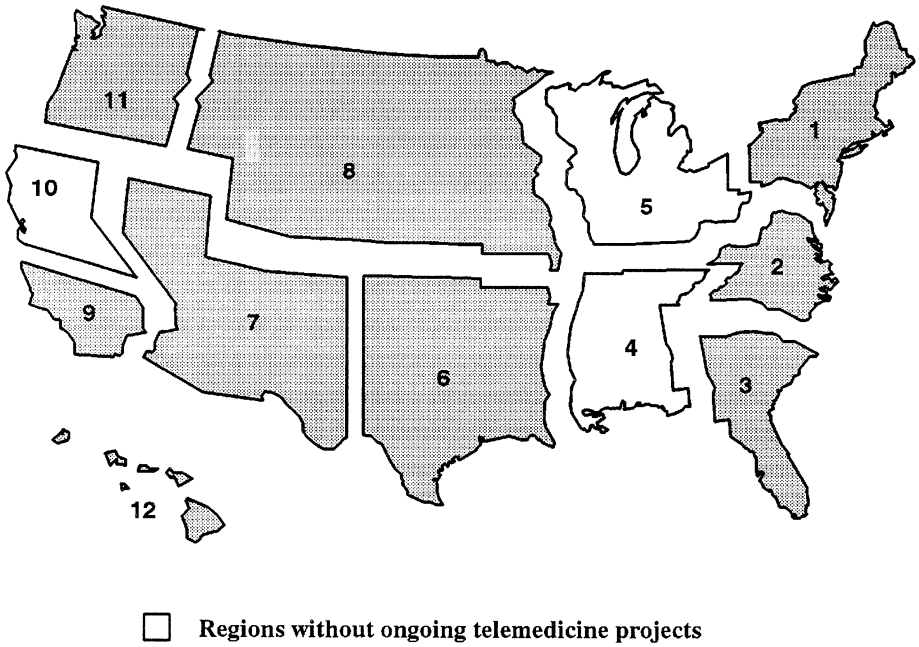


Figure 2. Telemedicine Within DoD Health Service Regions

Research and Development Leader. The DoD Advanced Research Projects Agency is an integral resource in both national information infrastructure initiatives and the research and development of telemedicine within DoD. The Advanced Research Projects Agency is conducting over 27 telemedicine related research and development projects. Some of those projects are three-dimensional ultrasound imaging for diagnosis of battlefield wounds, development of a portable micro-ventilator, development of a personnel status monitor, and real-time three-dimensional ultrasound for physiological monitoring. Another Advanced Research Projects Agency leading edge telemedicine research project involves telepresent surgery, that is, conducting a clinical operation via telemedicine using a doctor in a virtual environment operating through a robotic device performing surgery on a patient at a remote site within the local hospital or across the world.

The Advanced Research Projects Agency and Testbed office are partners in DoD telemedicine research and development, initial development, and operational development. Although the Advanced Research Projects Agency and DoD, and their public and private sector counterparts have proven that telemedicine is a useful medical tool, the operational development of clinical telemedicine within DoD will require the integrated efforts and participation of demonstration projects within DoD and throughout the public and private sectors.

Internal Initiatives That Support a DoD Clinical Telemedicine Needs Assessment. Several data sources and ongoing initiatives within the OASD(HA), the Joint Staff, the U.S. Transportation Command, and the Uniformed Services University of the Health Sciences, could assist the Testbed office in conducting a DoD telemedicine needs assessment.

DoD Strategic Planning Data. We identified two strategic planning initiatives the Testbed office should consider in answering the clinical telemedicine needs assessment question, "How will telemedicine support DoD Military Health Services System strategic goals and objectives as defined by ASD(HA), the Joint Staff, the commanders-in-chief of the Unified Commands, and the Military Departments"? The first strategic planning initiative is the Medical Readiness Strategic Plan 2001, March 1995. The ASD(HA) defined goals and objectives for the Military Health Services System in the Medical Readiness Strategic Plan 2001. The plan contains several objectives that have a direct impact on how and under what conditions the clinical use of telemedicine should be assessed and integrated within the Military Health Services System. Action items within the plan address problems with medical resources, the medical communications infrastructure, and management information systems. A discussion of specific Medical Readiness Strategic Plan 2001 action items effecting telemedicine is in Appendix H.

The second strategic planning initiative is the March 8, 1995, memorandum, "Medical Categories for Technology Emphasis," in which the Joint Staff requested priority funding for initiatives that support medical services that reduce the current in-theater medical footprint and its demand for airlift capability. The new doctrine supports health promotion and maintenance; prevention and treatment of diseases and nonbattle injuries; immediate life-

saving treatment; resuscitative care and stabilization of combat casualties; and smaller, lighter medical equipment sets. The Testbed office's DoD-wide needs assessment should address clinical telemedicine capabilities as an invaluable tool in support of ASD(HA) goals, Joint Staff doctrine, and joint operations.

Aeromedical Evacuation Data. The U.S. Transportation Command, has the capability to provide DoD aeromedical evacuation cost data for any location worldwide in support of clinical telemedicine benefits determinations. For example, in a December 19, 1994, memorandum to the Joint Staff, Directorate of Logistics, "Aeromedical Evacuation Reimbursement Rates for United Nations Forces in Haiti," the U.S. Transportation Command estimated the special assigned airlift mission costs of a C-130 cargo aircraft was $5,259 per hour for a flight from Port-au-Prince to Washington, DC. Inspector General, DoD, Report No. 95-225, "Aeromedical Evacuation System," June 9, 1995, estimated that in FY 1993, DoD spent about $72 million to transport 23,530 patients for healthcare within the continental United States. With the availability of cost data, the clinical telemedicine cost benefit could be quantified.

Uniformed Services University of the Health Sciences Data. The Uniformed Services University of the Health Sciences has three initiatives that could assist the Testbed office in developing and documenting a DoD telemedicine needs assessment. The first two capabilities include a telemedicine consultation treatment record and data dictionary. Both will be tested during demonstrations in the MYSTECH project. The MYSTECH clinical telemedicine project will demonstrate the use of clinical telemedicine in the specialty areas of dermatology, neurology, and orthopedics by using telemedicine to treat patients and record the results at sites including Walter Reed Army Medical Center, Washington, DC; Fort Detrick, Maryland; and Carlisle Barracks, Pennsylvania. The initiative could provide a method of collecting concurrent telemedicine data DoD-wide, and retrospective and outcomes data for clinical telemedicine benefit determinations. The MYSTECH project is sponsored by the Medical Advanced Technology Management Office.

The third Uniformed Services University of the Health Sciences initiative is in the Casualty Care Research Center. The Casualty Care Research Center is the archive for a combat casualty data collection methodology, based on the "Evaluation of Wound Data and Munitions Effectiveness Team - Vietnam and Cambodia," data bases. The system was used to document and analyze the wounds and disease non-battle injuries of more the 8,000 casualties during the Vietnam Conflict. The system could be used as a clinical telemedicine data collection means for DoD operations ranging from operations other than war to war.

DoD Lead Agent Needs Assessment and Benefits Determinations. Our clinical telemedicine questionnaire results provided information on the types of needs assessments and benefits determinations being developed and used in DoD clinical telemedicine demonstrations and projects. A total of 15 needs assessment methodologies and benefits determination approaches were identified within DoD (see Appendix H). Among the seven needs assessment methodologies were the use of information technology to overcome medical staff shortages, comparing the costs of conventional means of health care

delivery to the costs of providing the same health care services using telemedicine, and using surveys to assess the benefits of teledentistry. Among the eight benefits determination approaches identified were validation of the functional use and quality of performing teleradiology at sea, reducing aeromedical evacuation costs, and reducing lost time from readiness training.

DoD Clinical Telemedicine Needs Assessment Data Base Resources

We identified and assessed DoD medical, logistical, and force management data bases for wartime and operations other than war medical conditions, and the Military Health Services System data bases for peacetime medical conditions. The number of data base resources were limited, however, our research resulted in the identification of several viable sources of wartime casualty data and peacetime cost data.

Data Base Resources Summary. The wartime and operations other than war, and peacetime data base resources provided in Appendixes J and K can be used to identify specific clinical specialties, within the Military Health Services System, that are the most resource intensive for DoD. The 40 deployable medical system patient condition casualty predictions; the 14 Civilian Health and Medical Program of the Uniformed Services international classification of diseases - ninth revision diagnosis codes, which cost DoD an average of $235 million per year; and the 17 direct care system relative weighted products are information that the Testbed office can use in developing a DoD clinical telemedicine needs assessment. Additionally, the data could be used to prioritize ongoing and future clinical telemedicine demonstrations and projects by focusing research on those clinical specialty areas that are the most resource intensive. Adopting this research approach could, therefore, offer DoD the greatest opportunity for cost and resource savings resulting from the use of clinical telemedicine.

Conclusion

This research report provides the Testbed office information to aid in developing a DoD telemedicine needs assessment. The clinical telemedicine utility and needs assessment methodologies provided from the private and public sectors, and the clinical specialty information we have provided are starting points for the Testbed office, and its multi-Service, multi-disciplinary committee. The data provided can be used to consolidate, plan, and program the direction and focus of ongoing and future clinical telemedicine demonstrations and projects throughout DoD. The focused efforts of the DoD Telemedicine Board of Directors and Testbed office should ultimately result in the establishment of a DoD Clinical Telemedicine Program.

Part IV - Additional Information

Appendix A. Definitions

Ambulatory data system. An automated system that collects detailed ambulatory care data for all outpatient encounters (surgeries, procedures, and visits) and stores it in a data base that can be used by local and regional managers for comprehensive data analysis and trending. The system will ultimately be part of the Composite Health Care System.

Business case. An economic model designed to minimize resource expenditures and maximize profit.

Civilian Health and Medical Program of the Uniformed Services (CHAMPUS). The DoD health benefits program that is part of the Military Health Services System, for eligible beneficiaries when health care is not available or accessible in a military medical treatment facility.

Clinical. The actual observation and treatment of patients.

Composite Health Care System. An integrated hospital information system that supports the administration and delivery of health care in military medical treatment facilities. The core is an integrated automated patient data base. It supports patient appointments and scheduling, patient administration, dietetics, laboratory, pharmacy, radiology, and other inpatient and outpatient services.

Control architecture. The parameters established and used to conduct an evaluation.

Deployable medical systems. A medical facility capable of being located in a desired or required area of operations during a contingency, war, or national emergency.

Diagnosis related group. A statistical system of classifying an inpatient stay into groups for purposes of payment. This is the primary method of reimbursement to hospitals for care provided to CHAMPUS and Medicare beneficiaries.

Direct care system. The component of the Military Health Services System concerned with health care provided in the military medical treatment facility.

International classification of diseases - ninth revision (ICD-9). The classification of disease by diagnosis codified into 6-digit numbers.

Lead agent. The head of 1 of the 12 DoD Health Service regions within the United States. For 11 regions, the lead agent is the commander of a medical center in the region; in the national capital area, the lead agent is a tri-Service committee.

Major diagnosis category. A division of principal diagnoses into 25 mutually exclusive principal diagnosis areas. The diagnosis areas correspond to a single organ system or etiology and in general are associated with a particular medical specialty.

Medicare. The Medicare program, established under Title XVIII, "Health Insurance for the Aged," of the Social Security Act of 1965 is a Federal Government program that provides health care to the elderly and disabled. Medicare consists of two separate but coordinated programs.

o Part A, Hospital Insurance provides coverage for basic hospital inpatient services as well as limited post-hospital and home health services and hospice care.

o Part B, Supplementary Medical Insurance is optional and provides coverage for physicians' and surgeons' services, outpatient hospital, laboratory, and radiology services, as well as an array of other professional services and medical supplies.

Medicaid. The Medicaid program was established under Title XIX of the Social Security Act of 1965. Medicaid is operated by the States, which use both Federal and State funding to provide health services for the poor.

Military Health Services System. The combined resources of the direct care system and CHAMPUS.

Mission need statement. Defines and documents a mission need, justifies resource expenditures for the identification and exploration of solutions to satisfy the need.

Needs assessment. The management and technical considerations developed to justify resource expenditures for the identification and exploration of solutions to satisfy an improved effectiveness or efficiency opportunity.

Operations other than war. Military actions during peacetime and conflict that do not necessarily involve armed clashes between two organized forces.

Patient condition. A range of similar diagnoses that have been aggregated and described as one notional situation intended to be representative of the medical materiel required to treat the group.

Patient stream. An estimate of the number of patient conditions that will occur during military operations.

Appendix B. Organizations Visited or Contacted

Office of the Secretary of Defense

Assistant Secretary of Defense (Command, Control, Communications and Intelligence), Washington, DC
Assistant Secretary of Defense (Health Affairs), Washington, DC

Joint Staff

Director for Logistics (J-4), Arlington, VA

Department of the Army

Army Center for Strategy and Force Evaluation, San Antonio, TX
Surgeon General, Washington, DC

Department of the Navy

Naval Health Research Center, San Diego, CA
Surgeon General, Washington, DC

Department of the Air Force

Surgeon General, Washington, DC

Unified Command

Commander in Chief, U.S. Transportation Command, Scott Air Force Base, IL

Other Defense Organizations

Advanced Research Projects Agency, Arlington, VA
Civilian Health and Medical Program of the Uniformed Services, Aurora, CO
Combat Casualty Care Center, Uniformed Services University of the Health Sciences, Bethesda, MD
Defense Health Resources Study Center, Monterey, CA
Defense Medical Standardization Board, Frederick, MD
Defense Technical Information Center, Alexandria, VA
Defense Manpower Data Center, Arlington, VA

Other Defense Organizations (cont'd)

Regional Lead Agents of the Military Health Program
Uniformed Services University of the Health Sciences, Bethesda, MD

Non-Defense Federal Organizations

Department of Agriculture, Washington, DC
Department of Commerce, Washington, DC
Department of Health and Human Services, Washington, DC
Department of Veterans Affairs, Washington, DC

Other Non-Defense Organizations

American Hospital Association, Washington, DC
American Telemedicine Association, Austin, TX
Braddock, Dun and McDonald Incorporated (DoD Contractor), Vienna, VA
Center for Health Policy Research, Denver, CO
Center for the New West, Denver, CO
East Carolina School of Medicine, Greenville, NC
Kansas University Medical Center, Kansas City, KS
Mayo Clinic, Rochester, MN
Medical College of Georgia, Augusta, GA
Michigan State University, Kalamazoo, MI
Mountaineer Doctor Television, West Virginia University, Morgantown, WV
RAND Corporation (DoD Contractor), Santa Monica, CA
Rural Health Futures Inc, Fort Collins, CO
Telemedicine Research Center, Portland, OR
Texas Telemedicine Project, Austin, TX
University of Colorado, Boulder, CO
University of Iowa, Iowa City, IA
University of South Carolina, Columbia, SC
Vector Research Incorporated (DoD Contractor), Arlington, VA

Congress

Congressional Budget Office, Washington, DC
House Armed Services Committee Hearings, Subcommittee on Research and Technology - Telemedicine, Washington, DC

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Appendix D. DoD Participation in Telemedicine Initiatives and Groups

The following is a synopsis of DoD participation in telemedicine initiatives at the national and departmental levels.

o The DoD Advanced Research Projects Agency is a member of the Information Infrastructure Task Force, formed by the White House Office of Science and Technology Policy and the National Economic Council to support National information infrastructure (the information superhighway) initiatives. The Information Infrastructure Task Force has three committees:

- o Telecommunications Policy,
- o Information Policy, and
- o Applications and Technology.

The Advanced Research Projects Agency chairs the Applications and Technology Committee. The Applications and Technology Committee's focus areas are Government information technology services, technology policy, and health information and applications.

o The ASD(HA), and the Advanced Research Projects Agency are members of a National-level public and private sector consortium, the Health Information Infrastructure Consortium. The consortium's goal is to foster use of the National information infrastructure to improve the health of all Americans and explore health policy and marketplace issues. Two of the seven health information infrastructure subsystem policy and marketplace focus areas are clinical information systems and telemedicine.

o In support of the National information infrastructure and in coordination with the Health Information Infrastructure Consortium, the Health Information and Applications Working Group, a governmental inter-agency working group, meets to attain the goals of the Information Infrastructure Task Force. The health information infrastructure consortium presents the private sector, and the health information and applications working group presents the public sector perspectives on information infrastructure task force initiatives. The Advanced Research Projects Agency chairs the Health Information and Applications Working Group, and in addition, the Advanced Research Projects Agency and the OASD(HA) are subgroup chairs within the working group. The health information and applications working group's activities include facilitating inter-agency collaboration, fostering interoperable health information standards, and establishing model research criteria and guidelines.

o One of the subcommittees within the Health Information and Applications Working Group is the Interagency Emergency Preparedness Committee. The Interagency Emergency Preparedness Committee is chaired by the Medical Advanced Technology Management Office, U.S. Army Medical

Research and Materiel Command. The Commander, U.S. Army Medical Research and Material Command, is the Chief Operations Officer, and the Medical Advanced Technology Management Office is the sponsoring activity for the DoD Telemedicine Testbed Project.

o In addition to the Medical Advanced Technology Management Office's leadership in the Interagency Emergency Preparedness Committee, the Medical Advanced Technology Management Office is also a Government liaison to the National Security Telecommunications Advisory Council to the President. The National Security Telecommunications Advisory Council is private industry's equivalent to the National Information Infrastructure.

o The ASD(HA) chairs the DoD Telemedicine Testbed Board of Directors, which is a DoD interservice telemedicine activity supporting the Information Infrastructure Task Force initiatives. The Board's mission is to attain a DoD "Joint Vision of Telemedicine."

Appendix E. Telemedicine in the Private Sector

As discussed in this appendix, the private sector uses multiple approaches to assess the utility of telemedicine. Further, the private sector has licensing and malpractice concerns.

State-level Programs, the Primary Proving Ground. The preponderance of private sector telemedicine projects and demonstrations are coordinated or run as part of a State-level demonstration project. Of the nine State programs and projects we reviewed, each had one or more academic participants. State-level projects are expanding in the breadth of telemedicine sites being established and in the depth of the telemedicine services offered. The focus of telemedicine projects differed depending upon the population of a given area within a State, that is, projecting medical services is usually the focus in rural areas, while specialty consultation is the focus in urban areas. More than 40 States have telemedicine projects or demonstrations. However, no State program resulted in a sustained, fully-funded telemedicine program budget.

Approaches Used to Assess Utility. The private sector uses four types of approaches to assess telemedicine utility. They are business case, analytic, cooperative, and technological. A technological approach emphasizes the information technology and other technologies being researched and developed that will affect the way healthcare is delivered now and in the future. An example is telepresent robotic surgery. Through mutual consent with our client, the information and other technology aspects of telemedicine are outside the scope of this research report. However, information technology is an area of consideration that the Testbed office is addressing. Specifically, the DoD Advanced Research Projects Agency is researching and developing other technologies which could enhance the use of telemedicine as a medical tool.

Three Key Approaches. We focused our private sector research on a business case, an analytic, and a cooperative approach to addressing telemedicine utility, and their ability to meet our research criteria. A business case approach entails determining whether, as a medical tool, clinical telemedicine is cost-effective. An analytic approach entails developing and using comparative measurements, which are both accurate and sufficiently numerous, to obtain statistically valid results. A cooperative approach entails pooling data from multiple projects using common data collection methodologies, instruments, and protocols.

Business Case Approach. From a business case standpoint, the administrative benefits (for example, digital patient records and their management and electronic claims processing) of the merger of telecommunications technology and medicine has greater utility (that is the level of use and documented cost-effectiveness) than telemedicine's clinical benefits. According to telemedicine system utilization data published by the Mayo Medical Centers in October 1993, its telemedicine systems are used 57 percent of the time for administrative purposes, 16 percent of the time for clinical practice purposes, 17 percent for educational purposes, and 10 percent of the time for research. In a 1995 survey conducted by the Healthcare Information and Management Systems Society (HIMSS), however, 33 percent of the respondents reported usage of their telemedicine systems for remote consultations with physicians, 30 percent for

teleimaging of patient records and films, 22 percent for performance of remote clinical diagnosis, 10 percent for education, and 5 percent for surgical support (see Figure E). The survey indicated that the usage trend for clinical telemedicine is increasing. The documented cost-effectiveness of telemedicine's administrative uses however, still exceeds that of clinical telmedicine.

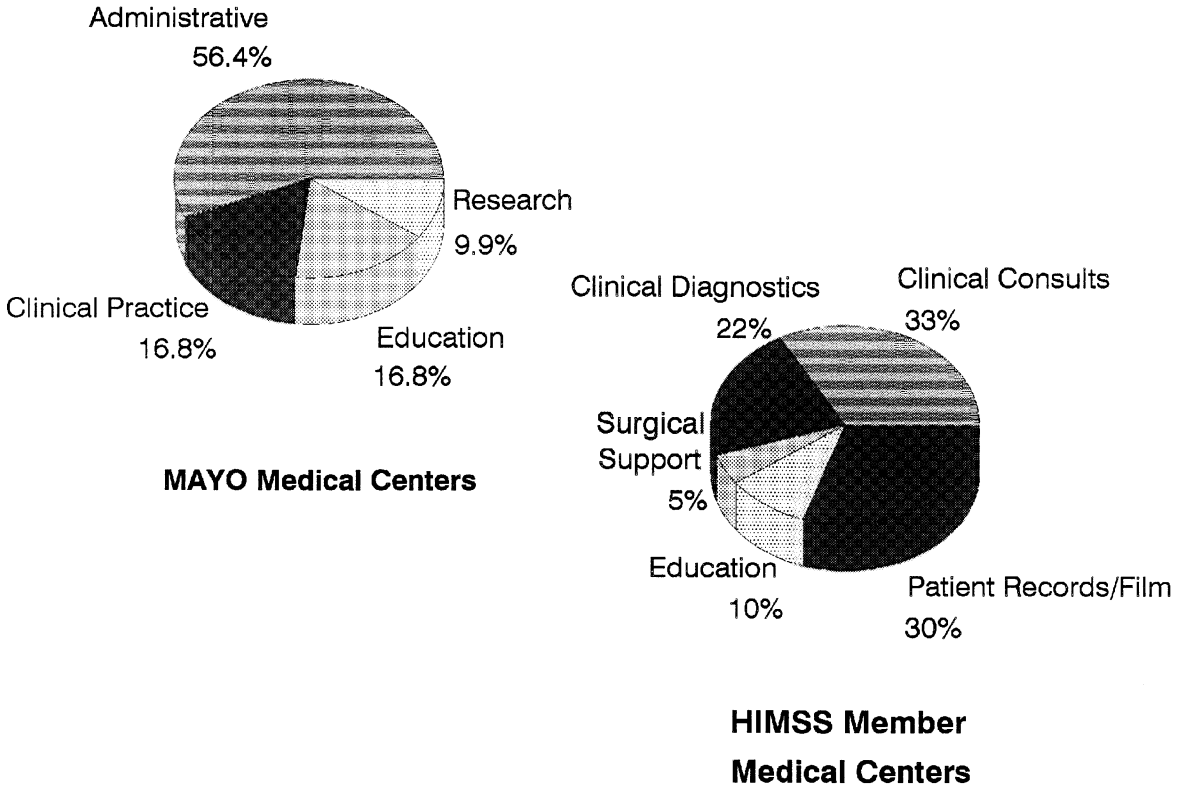

Figure E. Telemedicine System Utilization

Savings Attributed to Telemedicine. The 1992 Arthur D. Little Inc., study, "Telecommunications: Can It Help Solve America's Health Care Problems"? indicated that almost $30 billion in savings could be attributed to administrative uses of telemedicine and $200 million in savings could be attributed to educational and clinical applications. Savings were predictions that have not been verified. The savings support, however, the conclusion that the administrative benefits of telemedicine are greater than the clinical benefits.

Multiple Approach Methodologies are Common. Generally, most of the more than 300 plus articles we reviewed contained either a tenant or a combination of tenants of a business case, analytic, cooperative, or technological approach to assessing the utility of telemedicine. As we found with the business case example, none of the other approaches we reviewed met all the requirements of our research criteria. Each initiative, however, presents an approach or methodology that illustrates collaborative efforts of States, academia, and private enterprise. The methodologies also provide lessons

learned and innovative evaluation approaches DoD can participate in and adopt for DoD telemedicine needs assessment uses. Those observations notwithstanding:

o The paucity of retrospective and prospective data are the primary reason for limited clinical telemedicine utility determinations and benefits analysis.

o The majority of assessments were designed to meet the requirements of Federal and other grant programs, which typically were designed to simply prove telemedicine works versus proving telemedicines utility.

o The most consistently documented benefits of clinical telemedicine are lower indirect medical costs (for example, travel costs for providing or receiving medical treatment) and improved access to care.

Licensing and Malpractice Concerns. The private sector faces several limitations in the use and expansion of telemedicine across State boundaries. Licensing and malpractice issues are keeping clinical telemedicine within a State's boundaries (the exceptions are international collaborations). The licensing and malpractice issues in using telemedicine rest with the questions:

o Who is providing medical services if two or more doctors are consulting on a given patient using telemedicine in different States?

o Who is licensed to practice medicine in which State and who is liable for telemedicine malpractice should it occur?

The answers to those questions, and their impact on the use of telemedicine, are still to be determined in the private sector. The questions are also telemedicine issues in the public sector and within DoD.

Summary. The private sector uses multiple approaches to assessing the utility of telemedicine. Although, from a business case standpoint, the telemedicine benefits have not been quantified, the use and growing importance of telemedicine as a clinical benefit has been demonstrated. Licensing and malpractice concerns need to be addressed to expedite expansion of the telemedicine clinical benefit.

Appendix F. Federal Organizations Involved in Telemedicine

Department of Agriculture

Rural Electrification Administration

Department of Commerce

National Institutes of Standards and Technology
National Telecommunications Information Administration

Department of Defense

Department of the Army
Department of the Navy
Department of the Air Force
Advanced Research Projects Agency
National Security Agency

Department of Health and Human Services

Agency for Health Care Policy and Research
Center for Disease Control
Health Care Financing Administration
Health Resource Services Administration
Indian Health Service
National Institutes of Health
National Library of Medicine
Office of Rural Health Policy
Public Health Service

Other Agencies

Department of Education
Department of Transportation
Department of Veterans Affairs
General Services Administration
National Aeronautics and Space Administration
Office of Management and Budget

Appendix G. Telemedicine in Other Government Agencies

Telemedicine demonstration initiatives of other Government agencies are an integral part of telemedicine development and use throughout the United States. Potentially, the greatest contribution of other Government agencies to determining the utility of telemedicine is the collaborations their funding has helped to form.

Government Agency Grants. A primary role of other Government agencies in telemedicine is providing grants to private sector companies, States, and universities to perform telemedicine demonstrations and projects.

o In FY 1994, the Rural Electrification Administration, a Department of Agriculture agency, awarded $10 million in education and medical grants through its Learning and Medical Link Program. The grants foster the development and deployment of advanced telecommunications services throughout rural America. Twenty-eight States participate in the Learning and Medical Link Program.

o The National Telecommunications Information Administration, a Department of Commerce agency, awarded $4.6 million in FY 1994 appropriations to support health related national information infrastructure initiatives in 11 States. Each grantee is required to conduct an evaluation of the effectiveness of its telemedicine demonstrations or projects, focusing on infrastructure effectiveness, health care access, and quality.

Government Agencies That Provide Health Care Services. In support of our research focus to identify clinical telemedicine utility determination methodologies and approaches, we placed special emphasis on those agencies that primarily provide healthcare services (for example, the Department of Veterans Affairs and the Department of Health and Human Services and its subordinate agencies).

Department of Veterans Affairs. A strength of the Department of Veterans Affairs telemedicine demonstrations and projects is its dedicated, compatible, and integrated healthcare information management system that reaches 100,000 users and connects all Veterans Hospital Administration medical facilities. The Department of Veterans Affairs has another advantage in implementing telemedicine technologies because, with its 171 medical centers and hundreds of clinics and nursing homes, the Department of Veterans Affairs is the largest healthcare network in the United States. Those attributes make the Department of Veterans Affairs a premier proving ground for telemedicine.

The Department of Veterans Affairs has two major clinical telemedicine testbeds in Augusta, Georgia, and Baltimore, Maryland. Both of those medical centers are conducting telemedicine demonstrations in conjunction with DoD and the private sector. The medical center in Augusta, for example, is conducting telemedicine demonstrations with the Center for Total Access, a telemedicine

consortium, that includes the Eisenhower Army Medical Center, the Medical College of Georgia, and over 50 other medical facilities and clinics throughout the State of Georgia. A primary focus of Veterans Hospital Administration telemedicine demonstrations and projects is to improve access and quality of care. Within the Department of Veterans Affairs, clinical telemedicine evaluation methodologies and approaches are still in the developmental stage.

Department of Health and Human Services. The Department of Health and Human Services is one of the most active Federal departments involved in the research, development, and demonstration of telemedicine as a healthcare tool. The Department of Health and Human Services and its subagencies represent 45 percent of the telemedicine participants we observed in the public sector. During FY 1994, the Department of Health and Human Services awarded over $20 million in grants for more than 40 telemedicine demonstrations and projects. Most telemedicine grants focus on the monumental task of improving healthcare access and quality in underserved areas throughout the United States. All Department of Health and Human Services clinical telemedicine grants have an evaluation component; however, the grants awarded by the Health Care Financing Administration are heavily focused on methodologies and approaches that assess the utility and cost-effectiveness of clinical telemedicine. The Health Care Financing Administration's management of the Medicare and Medicaid programs is the reason for its clinical telemedicine evaluation focus.

Telemedicine Payment Policy Within Medicare and Medicaid. Both the Medicare and Medicaid programs require Federal funding (approximately $162 billion for Medicare and $138 billion for Medicaid in FY 1994). The prospect of cost savings resulting from the use of telemedicine is an important issue to the Health Care Financing Administration and the States because reimbursement for the use of telemedicine is the key to making telemedicine a mainstream medical tool. Medicare does pay for teleradiology and other telemedicine services that do not involve direct interaction with a patient, because such payments are consistent with Federal policy. The decision to pay for telemedicine services through Medicaid is more dependent upon State policy, which varies from State to State. During FY 1994, the Health Care Financing Administration awarded over $4.6 million in clinical telemedicine demonstration project grants to the:

o Center for Health Policy Research - Analysis of Expansion of Access to Care Through the use of Telemedicine and Mobile Health Services.

o Iowa Methodist Health System - Evaluation of Clinical and Educational Services to Rural Hospitals via Optic Cable.

o Telemedicine Research Center, Clinical Telemedicine Cooperative Group - Sustainable Support System for Telemedicine Research and Evaluation.

o University of Michigan - Effects of Telemedicine on Accessibility, Quality, and Cost of Health Care.

o West Virginia University Research Corporation - Bundle Payment for Physician and Hospital Services Using Telemedicine Services.

The Health Care Financing Administration has awarded and is developing grants designed to assess and document the cost impacts of providing telemedicine. Proving that use of telemedicine is cost-effective or at a minimum neutral (using transportation cost savings data as one example) could provide Health Care Financing Administration the data needed to request a budget waiver from the Office of Management and Budget to reimburse more types of telemedicine consultations, such as those between medical hospitals, clinics, providers, and specialists.

Because of the Medicare and Medicaid historical precedence as a payer and third-party payer policy leader in the United States healthcare system, reimbursement precedence set by Medicare and Medicaid could lead to telemedicine reimbursement by other private and public sector payers. DoD uses many of the payment policy structures designed by the Department of Health and Human Services and the Health Care Financing Administration. An example is the use of diagnosis related groups.

Summary. The agencies' roles in telemedicine is evident in their national information infrastructure participation; the funding they provided to demonstration projects in over 28 States; and their involvement in every facet of telemedicine from access, quality, and cost determinations to developing the justification for Medicare and Medicaid reimbursement. The telemedicine utility determination initiatives and approaches funded (through grants) by other Government agencies should be considered by the Testbed office.

Appendix H. Telemedicine Within DoD

As discussed in this appendix, our research within DoD identified telemedicine development successes, strategic planning initiatives, and approaches and methodologies that are being tested and should be considered by the Testbed office.

DoD Telemedicine Development Successes. Examples of DoD telemedicine successes are:

o the Composite Health Care System, an administrative and clinical management information system within and between military medical treatment facilities,

o the Medical Digital Imaging Support System for computer radiography within and between medical treatment facilities worldwide. (Estimates showed that the Medical Digital Imaging Support System could increase productivity by 33 percent. Additionally, $30,000 per year potentially could be saved for each remote site receiving Medical Digital Imaging Support System radiology consultations),

o the Provider Workstation, a desktop management information system that interfaces with Composite Health Care System and provides cost and outcome data for specific diagnoses, and

o the Ultrahigh Resolution Display System, a support system for telepathology consultations.

Outside the continental United States DoD has proven that clinical telemedicine is a viable healthcare delivery tool on land during operations other than war in Haiti, Macedonia, Somalia, and Zagreb. In Somalia alone, clinical telemedicine saved DoD approximately $63,000 in aeromedical evacuation costs. DoD has also used telemedicine at sea aboard the *USNS Mercy*, the *USNS Comfort*, the *USS George Washington*, and the *USS Abraham Lincoln*. During project Challenge Athena, in which the *USS Abraham Lincoln* participated, the use of clinical telemedicine reduced aeromedical evacuations by approximately 41 percent.

Similar to the private and public sectors, the initial clinical telemedicine benefits documented most often within DoD were increased access, quality, and transportation cost savings (an example is reductions in aeromedical evacuations). A DoD project that resulted in large cost savings is the AKAMAI initiative clinical telemedicine demonstration with the remote Johnston Islands in the Pacific Ocean. The AKAMAI initiative, sponsored by the Tripler Army Medical Center, involved consultations with the Johnston Islands, which avoided about 50 aeromedical evacuations and saved approximately $132,000. That initiative as well as other initial DoD clinical telemedicine deployment

successes are a tribute to DoD innovative approaches to medical care and, in particular, clinical telemedical care, because no formal (life-cycle management) clinical telemedicine program or program funding exits within DoD.

DoD Strategic Planning Data That Affects Telemedicine. The following Medical Readiness Strategic Plan 2001 action items affect DoD capability to develop, implement, and deploy telemedicine capabilities.

o Action item 8 - develop a method of linking real world patient load data with modern patient condition codes enabling planners to forecast medical work load and resource requirements.

o Action item 10 - ensure the medical structure has a robust, seamless, and assured communications capability within the global communications architecture.

o Action item 13 - satisfy the validated requirement for a seamless medical information system serving contingency support and beneficiary care across all echelons.

DoD Telemedicine Approaches and Methodologies. Table H provides an overview of the types of approaches and methodologies the Military Health Services System lead agent regions are developing and testing. The information provided in the table was provided as a result of our lead agent telemedicine questionnaire.

Table H - DoD Telemedicine Needs Assessment Methodology and Benefit Approaches

Lead Agent Region	Needs Assess-ment	Methodology	Sponsoring Facility and Project Name	Benefits Evaluated	Criteria	Benefits
1	1	Performed; details not provided	Uniformed Services University of the Health Sciences **Army Advanced Technical Program**	* TBD		
			Walter Reed Army Medical Center, Washington, DC **Remote Clinical Communication Systems**	TBD		
			National Naval Medical Center (NNMC) Bethesda, MD and USS Washington **Challenge Athena II**	1		Validation of functional use and quality of performing teleradiology at sea
			NNMC and USNS Comfort **Restore Hope**	1		Image evaluation - poor at 56 kilobytes per second
			Naval Hospital, Naples, Italy **Telemedicine in EUCOM ****	TBD	Survey patients and providers	
			NNMC **NNMC and Annapolis Telemedicine**	TBD	Form procedures for conducting and installing telemedicine technology	
2	0	None performed	Naval Medical Center (NMC), Portsmouth **Digital Imaging Network - Picture Archiving and Communications System**	TBD	Efficiency	
			NMC Portsmouth Telemedicine Initiative	TBD	View patients prior to medevac ***	
			NMC Portsmouth Telepsychiatry	TBD	Remote psychiatry	
			Naval Hospital Camp Lejeune, NC Naval Hospital Cherry Point, NC **Expansion of Camp Lejeune Telemedicine Initiative to Cherry Point**	TBD	Evaluate system in terms of: process of care, patient outcomes professional outcomes, organizational processes and outcomes of interorgan-izational coordination, communications, implementation efficiency and conflict resolution, economic impacts of new services on consultations	
			Naval Hospital, Camp Lejeune, NC **North Carolina Telemedicine Infrastructure Agency**	TBD	Demonstrate utility of teleradiology by asynchronous transfer mode bandwidth transmission.	
3	4	Southeast dental services support area surveys	Tingay Dental Clinic **Teledentistry**	1	Standard survey instruments	Not listed
		Proof of concept of information technology	Eisenhower Army Medical Center (EAMC) Center for Total Access (CTA) **Picasso**	1	Standardized questionnaires	Cost savings
			EAMC and CTA Electronic House Call	TBD		
		Data collected from hospital staff	**EAMC Troop sick call**	TBD	Standard statistical measures	Return to duty time savings
		Reduce impact of staff shortages	**EAMC Child Telepsychiatry**	TBD		Cost/savings
			CTA and Georgia State Network Hub Site	TBD	Data collection	Cost/benefit
			Fleet Hospital 5 Naval Medical Center Fleet Hospital 6 Naval Medical Center Naval Medical Center Portsmouth **Provide Promise - Fleet Hospitals 5 and 6 Zagreb, Croatia**		Test transmission of teleradiology images from operational environment.	

*** TBD - To be determined** **** EUCOM - European Command** ***** Medevac - Air medical evacuation**

Table H - (Cont'd)

Lead Agent Region	Needs Assess-ment	Methodology	Sponsoring Facility and Project Name	Benefits Evaluated	Criteria	Benefits
4	0					
5	0					
6	1	Comparison of costs	Wiford Hall Medical Center **TRINET**	* TBD		
		TBD	TRICARE Southwest **TRINET**	TBD		
7	1	Cost-benefits study	William Beaumont Army Medical Center (AMC) **Disability Processing Beta Test**	TBD		Cost savings
8	0	None	Fitzsimons AMC **Telemedicine Demonstration**	1		Subspecialty consultation, improved communication, and reduce medevacs **
		None	Leonard Wood Army Community Hospital **Monthly tumor board conference**	1	In person consultations	Familiarity with patients and better continuity of care
9	0	None	Naval Hospital Camp Pendleton **Telemedicine Demonstration Project**	1	Cost/benefit analysis	Net benefit: $417,694
			USS Carl Vinson USS George Washington USS Belleau Wood Naval Medical Center San Diego **Challenge Athena III**	TBD	Test full motion video medical images from sea.	
			Naval Medical Center San Diego **Port Huemene and San Diego Telemedicine Initiative**	TBD	Radiographic images	
			Operation Deep Freeze	TBD	Enhance medical care to Antarctic	
10	0	TBD	USNS Mercy Naval Hospital Camp Pendleton **Kernel Blitz**	TBD	Test telemed tech in the field.	
			USS Abraham Lincoln USS Princeton USS John Paul Jones Naval Medical Center San Diego **FORCE 21**	TBD	Telemedicine from carrier at sea to escort ships in battle group	
			Naval Hospital Camp Pendleton **Expansion to Twentynine Palms**	TBD	Reduce lost time from readiness training	
			Camp Pendleton Telemedicine Initiative	TBD	Reduce patient visits to Naval Hospital	
11	0	TBD	Madigan Army Medical Center **Project Seahawk**	TBD		
12	0	No	Tripler Army Medical Center (TAMC) **AKAMAI Project**	1	Air medical evacuation	$2300 per evacuation, 15 medevacs avoided, and film retake rates lowered
			TAMC Joint Warrior Interoperability Demonstration '95	TBD	Developed by the Joint Crisis Action Test & Evaluation Program	
TOTAL	7			8		

*** TBD - To be determined** **** Medevac - Air medical evacuation**

Appendix I. Other Matters of Interest

Telemedicine Programming Documents. Both the Army and the Navy have developed program and budget documents for their individual department telemedicine initiatives. Because the Testbed office is developing a needs assessment (and ultimately a mission need statement as a precursor to a DoD-wide telemedicine program and budget document), the Testbed office could incorporate the program and budget documents developed by the two Military Departments into a DoD-wide Testbed requirements document.

Appendix J. DoD Medical Data Base Resources

The purpose of our collection of wartime and operations other than war and peacetime medical casualty and condition data is to support a clinical telemedicine needs assessment premise that the Testbed office will form a tri-Service committee to review and prioritize those clinical functions that have the greatest impact on force readiness.

DoD Medical Data Bases. The Medical Readiness Strategic Plan 2001 states in action item 13, "Satisfying the validated requirement for a seamless medical information system serving contingency support and beneficiary care across all echelons is a fundamental shortfall within the Military Health Services System." That shortfall adversely affects the capability and ability of the Military Health Services System to plan, train, and equip for, conduct, and evaluate its missions. Consistent with Medical Readiness Strategic Plan 2001 action item 13, we found few data base resources to meet our specific research needs. We found:

o no comprehensive source for DoD combat casualty data for the Korean and Vietnam Wars and for post-Vietnam operations other than war. The sources we did find were in the Uniformed Services University of the Health Sciences Wound Data and Munitions Effectiveness Team data base and the Navy Health Research Center.

o comprehensive sources of DoD patient stream data. Patient stream data were provided by medical and logistical planners from each of the Military Departments. That data, however, were being refined and integrated for Military Health Services System use by the Defense Medical Standardization Board.

o peacetime inpatient data were available but not by aggregate costs.

o no comprehensive source of DoD peacetime direct care outpatient data by aggregate costs.

o the most comprehensive data, collected to document DoD contracted aggregate peacetime inpatient care, outpatient care, and cost data, was maintained and provided for our use by the Office of the Civilian Health and Medical Program of the Unformed Services (OCHAMPUS).

Wartime Data Bases. We used rate of occurrence of combat related wounds and disease nonbattle injuries as our measurement in determining the greatest impact on force readiness. Those clinical functions identified could then be designated for telemedicine demonstrations that document the effectiveness of telemedicine in reducing the return to duty time for personnel with wounds and disease nonbattle injuries. Those types of casualties are documented and compiled by deployable medical systems patient code. That data could be used in a DoD mission need statement (DoD Manual 7920.2M, "Automated

Information System Life-Cycle Management Manual," March 1990) as the first step in establishing an operational readiness requirement within a DoD Clinical Telemedicine Program.

To support the development of a DoD clinical telemedicine needs assessment we obtained:

o deployable medical systems patient condition stream data from each of the Services,

o deployable medical systems patient condition descriptive narratives from the Defense Medical Standardization Board,

o international classification of diseases - ninth revision (ICD-9) descriptive narratives from Version 10.0, "St. Anthony's DRG [Diagnosis Related Group] Working Guidebook," and

o a draft matrix developed by the Army Medical Department Center and School to convert deployable medical systems patient condition codes to their equivalent ICD-9 codes.

Unlike a major diagnostic category, a diagnosis related group, or an ICD-9 code, a deployable medical systems patient condition is not a medical diagnosis. A deployable medical systems patient condition comprises a range of similar diagnoses that have been aggregated and described as one notional situation intended to be representative of the medical materiel required to treat the group. The Defense Medical Standardization Board is leading an effort to establish a relationship between deployable medical systems patient conditions and ICD-9 codes. There are over 20 major diagnosis categories, hundreds of diagnosis related groups, thousands of ICD-9 codes, and over 350 deployable medical systems patient conditions. Initial work accomplished by the Army Medical Department Center and School identified as many as 11 related ICD-9 codes for one deployable medical systems patient condition. We used the Army Medical Department Center and School conversion matrix in this report. The deployable medical systems patient condition data we collected support the national military objective of two almost simultaneous operations in different theaters.

We collected and used nontheater specific deployable medical systems patient condition data representing the top 20 percent of total casualty projections. The data are rank ordered by deployable medical systems patient condition with the highest to lowest expected rate of occurrence. Examples of frequently occurring wounded-in-action deployable medical systems patient conditions and the corresponding ICD-9 code(s) projected for the Marine Corps are provided in Table J-1.

Table J-1. Data on Wounded-In-Action Rates Within the Marine Corps

Patient Condition	Rank Order	ICD-9 Code	Description
048	01	8121	Fracture Upper Humerus Open
186	02	9198	Superficial Injury
054	06	81390	Fracture Forearm Open

Charts providing data on the top 20 percent of deployable medical systems patient conditions by Service, their rank order of expected frequency, their associated ICD-9 code, and a narrative description are provided in Appendix K. Note: Appendix K is published under separate cover "For Official Use Only" and is provided upon request.

Peacetime Data Bases. We used aggregate costs and frequency rates as our measurement in determining the greatest impact on medical resources. The associated clinical functions could then be considered for DoD-wide clinical telemedicine demonstrations to document the effectiveness of telemedicine in reducing Military Health Services System costs. That data could then be used in a DoD mission need statement in establishing a formal DoD Clinical Telemedicine Program.

CHAMPUS Inpatient and Outpatient Data. We obtained 3 years of Military Health Services System peacetime medical care data paid for by CHAMPUS for both inpatient and outpatient care. The OCHAMPUS, Statistics Branch, provided the private sector healthcare data using the CHAMPUS Medical Information Systems and the CHAMPUS Diagnosis Code Reporting System. The CHAMPUS Diagnosis Code Reporting System contains summary level (aggregate totals DoD-wide) costs and workload data for all care by ICD-9, and diagnosis related group. We collected data on those ICD-9 episodes of care that accounted for the top 20 percent of total CHAMPUS healthcare expenditures.

Tables J-2 and J-3 provide inpatient and outpatient data by ICD-9 episodes of care and their costs relative to total CHAMPUS costs for fiscal years 1992, 1993, and 1994.

Table J-2. CHAMPUS Peacetime Inpatient Data
(Top 20 Percent - based on Government cost)

Diagnosis Code	Description	FY 1992		FY 1993		FY 1994	
		Cost of Diag (million)	Percent of Total Cost	Cost of Diag (million)	Percent of Total Cost	Cost of Diag (million)	Percent of Total Cost
296	Affective Psychoses	$170.0	12.5	$148.3	9.9	$137.8	14.0
V30	Single Liveborn	75.4	5.5	68.5	4.6	62.0	6.3
650	Normal Delivery	49.6	3.6	46.4	3.1		
414	Other Chronic Ischemic Heart Disease			42.9	2.9		
Subtotal [1]		$295.0	21.6	$306.1	20.5	$199.8	20.3
FY Total [2]		$1,360.76		$1,504.57		$984.0	

[1] ***Variations may occur due to rounding.***
[2] ***Total costs for all episodes of care by fiscal year.***

Table J-3. CHAMPUS Peacetime Outpatient Data
(Top 20 Percent - based on Government cost)

Diagnosis Code	Description	FY 1992		FY 1993		FY 1994	
		Cost of Diagnosis (million)	Percent of Total Cost	Cost of Diagnosis (million)	Percent of Total Cost	Cost of Diagnosis (million)	Percent of Total Cost
309	Adjustment Reaction	$38.4	4.3	$38.9	3.4	$35.8	4.4
300	Neurotic Disorders	37.3	4.2	37.5	3.3	33.8	4.1
786	Respiratory Chest Symptoms	27.8	3.1	30.9	2.7	35.2	4.3
296	Affective Psychoses	27.4	3.1	30.5	2.7	30.1	3.7
789	Other Abdominal or Pelvis Symptoms	22.1	2.5	22.6	2.0	25.6	3.1
780	General Symptoms	17.9	2.0	19.6	1.7	22.9	2.8
381	Otitis Media Nonsuppurative	16.0	1.8	14.5	1.3		
174	Malignant Neoplasm of Female Breast			15.6	1.4		
382	Otitis Media, Suppurative			14.8	1.3		
724	Back Disorder			14.0	1.2		
Subtotal [1]		$186.9	21.0	$238.9	21.0	$183.4	22.4
FY Total [2]		$885.44		$1,134.40		$819.96	

[1] ***Variations may occur due to rounding.***
[2] ***Total costs for all episodes of care by fiscal year.***

Military Health Services System Direct Care Patient Data. We obtained 3 years (FYs 1992 through 1994) of peacetime data for Military Health Services System inpatient care provided by the direct care system within DoD owned and operated military medical treatment facilities. The OASD(HA), through its contract with Vector Research Incorporated, provided direct care data using the Retrospective Case-Mix Analysis System. The Retrospective Case-Mix Analysis System contains summary level (aggregate totals DoD-wide) relative weighted product data by diagnosis related group. The relative weighted product is an aggregate work load and resource allocation measure for all direct care inpatient discharge records for a diagnosis related group. That type of data for outpatient care in the direct care system is not available. However, outpatient costs data are being developed in conjunction with ASD(HA) capitation budgeting initiatives. One such initiative is the development of an ambulatory (outpatient) data system within the Composite Health Care System. According to Vector Research Incorporated, an ambulatory data system may be on-line in 1997. We collected data on those diagnosis related group codes with relative weighted products that accounted for the top 20 percent of inpatient direct care (see Table J-4).

Table J-4. Direct Care Peacetime Inpatient Data
(Top 20 Percent - based on relative weighted product)

DRG[1] Code	DRG Description	FY 1992		FY 1993		FY 1994	
		RWP of DRG (thousand)	Percent of Total DRGs	RWP of DRG (thousand)	Percent of Total DRGs	RWP of DRG (thousand)	Percent of Total DRGs
373	Vaginal Delivery without Complications	24.4	3.5	22.3	3.5	18.9	3.4
222	Knee Procedures without Complications	15.2	2.2	15.2	2.4	12.8	2.3
187	Dental Extractions and Restorations	13.0	1.9	7.3	1.2	8.7	1.5
183	Esophagitis, Gastroent and Other Digest Disorders Age>17	10.8	1.6	10.2	1.6	7.7	1.4
468	Extensive Operating Room Procedure Unrelated to Principal Diagnosis	10.3	1.5	8.1	1.3	7.0	1.2
483	Tracheostomy, Except Mouth, Larnyx, or Pharnyx	10.1	1.5	10.6	1.7	11.7	2.1
359	Uterus and Adenexa Procedure for Non-malignancy	10.0	1.4	9.0	1.4	7.9	1.4
371	Cesarean Section without Complications	9.5	1.4	8.3	1.3	6.8	1.2
231	Local Excision and Removal of Internal Fixed Devises Except Hip and Femur	8.6	1.2	8.6	1.4	8.2	1.5
430	Psychoses	7.7	1.1	6.5	1.0	6.7	1.2
901	Alcohol or Drug Abuse or Dependence Over Age 21 without Complications	6.9	1.0				
391	Normal Newborns	6.9	1.0				
198	Total Cholecystectomy without Complications	6.5	.9	6.7	1.1		
162	Inguinal and Femoral Hernia Procedure Over Age 17 without Complications			6.9	1.1	5.3	.9
148	Major Small and Large Bowel Procedure with Complications			6.0	.9	5.5	1.0
062	Myringotomy with Tube Insertion Under Age 17			5.9	.9		
494	Laparoscopic Cholecystectomy without Complications					5.4	1.0
Subtotal[1]		139.9	20.2	131.6	20.8	112.6	20.1
FY Total[2]		690.6		632.6		562.6	

NOTE: The Relative Weighted Product (RWP) is a workload and resource allocation measure that quantifies the relative resource consumption.

[1] ***Diagnosis Related Group (DRG).***

[2] ***Variations may occur due to rounding.***

[3] ***Total RWP for all episodes of care by fiscal year.***

Summary. The medical conditions data collected and presented in this report should provide the Testbed office with reference material with which it could develop a DoD clinical telemedicine needs assessment and prioritize those clinical functions that have the greatest resource impact.

Appendix K. Wartime Medical Data

Appendix K is "For Official Use Only" and will be distributed under separate cover. Please contact Lieutenant Colonel Dean Calcagni, Medical Advanced Technology Management Office, at (301) 619-2468 for further information.

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