

Teleoncology in the Department of Defense: A Tale of Two Systems

DARRYL C. HUNTER, Maj., U.S.A.F., M.C., F.S.,¹ JENNIFER E. BRUSTROM, Ph.D.,²
BRIAN J. GOLDSMITH, M.D., Maj., M.C.,³ LAURIE J. DAVIS, Ph.D., Col., A.N.,⁴
MARK CARLOS, Maj., U.S.A.F., M.S.C.,¹ EILEEN ASHLEY, R.N.,¹
GILBERT GARDNER, M.A.,² and IMRE GAAL, Maj., U.S.A.F., M.C.²

ABSTRACT

Two telemedicine networks were developed for the purpose of conducting multidisciplinary oncology ("teleoncology") conferences. The infrastructure of each system differed: one system was Internet-based; the other was delivered via Integrated Services Digital Network (ISDN) lines. The purpose of this study was to describe the infrastructure and cost, consultative process, technical aspects, and conference format of the two teleoncology programs. The two systems' technical aspects, participant satisfaction with the systems, and conference participation were compared qualitatively. Assessment of the technical aspects of the systems suggested that each had distinct advantages. Survey results indicated that provider satisfaction with the technical and logistical aspects of each type of teleoncology conference was high. The present study may prove helpful for individuals who are considering implementing their own teleoncology programs.

TELEMEDICINE HAS BEEN DESCRIBED as the practice of medicine at a distance.¹ Telemedicine applications have been used in nearly every field of medicine, including radiology, psychiatry, dermatology, and cardiology. One aspect of telemedicine that has become increasingly common is teleoncology, the delivery of oncology services from a distance.¹ Teleoncology programs offer a variety of potential benefits, including enhancing primary care managers' access to referrals, expand opportunities for continuing medical educa-

tion (CME) credits, reduction of unnecessary referrals, and smooth coordination of patient care.

To date, only a handful of studies have examined the topic of teleoncology. Investigators have looked at the use of interactive video to provide psychosocial support,² the use of interactive video and proxy examiners to provide direct patient care,³ and the use of teleoncology to facilitate consultation by cancer specialists to geographically remote primary care providers.^{1,4}

¹Office of the Lead Agent, Travis Air Force Base, California; ²David Grant Medical Center, Travis AFB, California; ³Walter Reed Army Medical Center, Washington, D.C.; ⁴Tripler Army Medical Center, Oahu, Hawaii.

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Teleoncology in the Department of Defense

Two teleoncology programs in the Department of Defense—the Pacific Oncology Outreach Project and the Region 10 (Northern California area) Integrated Cancer Network—were implemented to provide consultative services for the purpose of providing care to cancer patients. There are differences between the two systems. The Pacific system consists of equipment supporting the transmission of images over the Internet; in contrast, the system in Region 10 utilizes Integrated Services Digital Network (ISDN) lines. Further, for the Pacific system, teleoncology conferences involve discussion of different types of cancer cases, whereas the focus of Region 10 teleoncology conferences is breast cancer. Background information and rationale for the establishment of each program is described below.

The Pacific Oncology Outreach Project was designed to facilitate the delivery of cancer care by Tripler Army Medical Center (TAMC), located in Honolulu, Hawaii, to the military beneficiaries encompassed by the Pacific Region. This region includes over 750,000 individuals eligible for medical care dispersed across 12 time zones and separated by vast bodies of water.

In Northern California, access to military cancer treatment facilities was challenged as a result of mandated downsizing and closure of military facilities. Since 1993, seven facilities closed, including two major medical centers that provided comprehensive care for cancer patients. The remaining medical center, David Grant Medical Center (DGMC) assumed increasing regional significance as the sole military cancer center in Health Services Region 10, a network of Northern California military treatment facilities. The primary objectives of the Region 10 Integrated Cancer Network were to promote collaboration and distance learning between two primary care-based facilities and DGMC.

Both the Pacific Oncology Outreach Project and the Region 10 Integrated Cancer Network also sought to expand cancer patients' access to national clinical trials that were offered via medical center participation in national clinical cooperative groups. Both programs also uti-

lized the teleoncology conference opportunity as a convenient avenue for delivering CME.

Overview of Present Study

The purpose of this study is to describe the infrastructure and cost, consultative process, technical aspects, and conference format of two teleoncology programs: the Pacific Oncology Outreach Project (an Internet-based system) and the Region 10 Integrated Cancer Network (a system delivered via ISDN lines). Further, this study provides a qualitative comparison of the two systems' technical aspects, participant satisfaction with the systems, and conference participation. To our knowledge, this is the first study to describe two different ways of implementing teleoncology programs. The description presented in this article may be helpful for individuals at other medical facilities who are considering implementing their own teleoncology programs.

METHODS

Pacific Oncology Outreach Project

Materials. The Pacific Oncology Outreach Project was established to develop a low-cost Internet Tumor Board (ITB). The pilot site selected to link with TAMC was Guam Naval Hospital (GNH), a small Western Pacific facility located 3,800 miles away. Equipment included a film digitizer (Lumisys, Sunnyvale, CA), MDTV Telemedicine system (MMS, Charlottesville, VA), archive, Roche Telepathology system (Nikon Corporation, JA), a Web server for radiology images (MedWeb, San Francisco, CA), a PC workstation with Net Meeting desktop conferencing system (Freeware, Microsoft Corporation, Redmond, WA), conferencing telephone (Polycom Inc., San Jose, CA), and InFocus digital projectors (InFocus, Wilsonville, OR). Project cost information is presented in Appendix 1.

Consultative process. Two weeks prior to each ITB, the system manager at TAMC sends an e-mail message to the ITB mail group consisting of surgeons, oncologists, pathologists, radiologists, a geneticist, a psychologist,

nurses, and a tumor registrar. The message provides instruction and the due date for case submission. Presenting physicians access the Pacific Oncology web site and submit electronically a concise patient history, which includes specific questions and issues for tumor board discussion. All Web-based case history input forms are tied to a database located on a TAMC secure server. The TAMC systems manager can access the case history once the presenting site submits it. The presenting site is responsible for advance preparation and submission of radiology, pathology, and photographic images, as relevant to the case. All images are uploaded via the Pacific Oncology web page by the presenting site and are stored on a secure server at TAMC for retrieval by the systems manager.

Radiology image preparation. Images are printed on film at the presenting facility and the films are scanned utilizing a 75-film digitizer, creating high-resolution Digital Imaging and Communication in Medicine (DICOM) files. The DICOM files are transmitted over the Ethernet local area network (LAN) to the local MedWeb server. At GNH, the server automatically accepts and wavelet-compresses the DICOM image files before saving them to an integrated Web site database. Both Intranet and extranet users view the GNH MedWeb web site via Netscape Navigator or Communicator. Web site security authentication is mandatory before viewing the database. Working at a desktop PC, the presenting physician selects and displays the radiography on Netscape, and downloads them to Joint Photography Experts Group (JPEG) format. The physician removes identifying demographic data and crops the images in Lview, names them using a standardized code, and uploads them via the Pacific Oncology web site.

Pathology image preparation. Pathology slides at the remote facility are viewed with a Nikon (Garden City, NY) microscope and images are selected; the high-resolution digital video camera mounted on the microscope feeds video input via direct SCSI connection into a PC video board. The pathologist at the consulting facility captures still images using

WinCam software, saves them as bitmap files, crops them in Lview, names them using a standardized code, and uploads them via the Pacific Oncology web site.

Clinical photograph preparation. Clinical photographs are taken by the clinicians at the remote facility using a portable Kodak DC50 or DC120 (Rochester, NY) camera. The camera is later connected to a PC COM port where image files are downloaded using Kodak image transfer software. Conventional printed photographs can also be scanned into the PC using a flatbed scanner. All photography files are displayed with Lview, cropped, named using a standardized code, and uploaded via the Pacific Oncology web site. The systems manager posts the history along with the radiology, pathology, and clinical photo data to the ITB web site.

Conference format. The morning of the ITB, the TAMC systems manager establishes a NetMeeting internet protocol (IP) address-specific connection between the TAMC and GNRH desktop conferencing PCs. The participating outlying sites then access the whiteboard file. Through NetMeeting, two or more users can communicate and collaborate as a group in real time. The whiteboard responds to manipulation including pointing, highlighting, zooming, marking up, and page changes, on all PCs nearly instantaneously. Normally controlled by the presenting site. The whiteboard file of text and images is projected on large screens by InFocus (Wilsonville, OR) digital projectors. To support real-time audio, the system engineers either select audio transmission over the Internet via NetMeeting, or if network congestion is encountered, place a telephone call between the two conference rooms' speakerphones. Video is not supported by this system. At the commencement of the ITB, the presenting clinicians at GNH discuss cases and view clinical images. The systems manager controls the display of simultaneously viewed text and images. Pointer, highlighter, zoom, and markup tools are also used and simultaneously displayed in a shared teleconference environment. TAMC-ITB participating radiologists and pathologists may also comment on the clinical images viewed. TAMC surgeons and oncologists may offer treatment

recommendation or may defer recommendations pending collection of additional clinical data. Oncology nursing staff coordinate air evacuation, appointment scheduling, and social support issues. The TAMC tumor registrar documents ITB recommendations in the conference minutes. Minutes are signed by participant TAMC oncologists and transmitted to the GNH systems manager via fax for distribution to GNH clinicians.

Region 10 Integrated Cancer Network

Materials. Region 10 established a multidisciplinary telemedicine workgroup consisting of information systems officers and clinicians to design and establish an integrated and systemic approach in deploying its telemedicine applications. In contrast to the Pacific Initiative, Region 10 implemented its teleoncology network utilizing high bandwidth technology. This technology permitted real-time video interaction among participants in a teleconference format: participants and relevant medical studies are displayed simultaneously. The infrastructure of this network is comprised of equipment for video display of participants, mammograms, and pathology images and installation of ISDN lines to provide bandwidth of 384K. This ISDN line was selected to enhance provider acceptance of the broadcast images. Additional microphones and a high-quality tilt-pan-zoom camera were added to support multimedia requirements. Project implementation cost for central site and two peripheral sites was approximately \$400,000 (see Appendix 2). Participants at two geographically dispersed military facilities with only diagnostic and/or surgical capability were then able to participate remotely with an already existing weekly multidisciplinary breast conference at DGMC.

Consultative process. A cancer network coordinator (CNC) was hired to act as the liaison between the referring providers and the central tumor board, and also to facilitate the development of a breast care pathway for all breast cancer cases. This coordinator serves as liaison among the DGMC participants, including personnel from information systems, radiology,

pathology, surgery, hematology-oncology, radiation oncology, physical therapy, and the cancer survivors' support group. The coordinator provides the principal administrative support for the DGMC teleoncology conference. Specifically, the CNC interfaces with referring providers to insure that relevant clinical materials arrive in a timely fashion, are reviewed by conference clinicians in advance, and that the care for the breast cancer patient is coordinated in an efficient manner. When a provider at a remote facility wishes to present a case to DGMC provider via the conference, the provider contacts the CNC who takes a verbal history while filling out an intake form. The provider is then responsible for assembling the relevant materials for the conference, including a consultation request form, hard copies of relevant radiographs, pathology slides, and paraffin blocks. These materials are delivered via Federal Express to the CNC who delivers them to the breast conference radiologist and pathologist for advance review. Typically, materials must be received no later than the close of business 2 working days prior to the conference. The CNC electronically transmits a brief history of the patient to all tumor board participants in advance of the conference. The network bridge coordinator at Travis AFB, is apprised of the remote facility(ies) participating in the conference and is responsible for insuring that the bridge connection is made and maintained on the day of the conference.

Conference format. The Region 10 teleoncology conference is multidisciplinary and held on a weekly basis. All breast biopsies performed during the previous week at DGMC are presented and discussed. Those cases diagnosed as cancer are discussed first and remote referrals are given preference. The remote presenting clinician provides a brief verbal history of the patient's presentation. The staff radiologist then displays relevant mammograms, ultrasounds, and any other relevant studies utilizing the film digitizer. Images are displayed on PictureTel (Andover, MA) monitors both at DGMC and LNH. Subsequently, the staff pathologist discusses the relevant pathologic findings with simultaneous image display via an image camera attached to the microscope on

the PictureTel monitor. Next, all conference participants at DGMC and LNH discuss management recommendations in a live conference format (interactive audio and video, displaying all participants). Definitive management recommendations are summarized and documented by the CNC and signed by the tumor board chair. If patient referral is to be made, the CNC coordinates the arrangement of necessary appointments in a streamlined manner and meets with the patient to insure that psychosocial, transportation, and housing needs are met.

Assessment

A qualitative assessment of each of the two teleoncology systems was conducted. The technical aspects of the systems, participants' satisfaction with the systems, and conference participation were appraised.

The qualitative assessment of the technical aspects of the two systems was conducted by comparing the pros and cons of systems' ease of implementation, visual display capabilities, administrative responsibility involved, and implementation costs.

Participant satisfaction was assessed with a survey. The survey consisted of a series of items asking participants to rate the technical, format, and logistical aspects of the conference. Ratings for the technical aspects of the conference (e.g., image quality, audio quality) were made on a 4-point scale ranging from 4 = "excellent" to 1 = "poor." Ratings for the format

aspects of the conference (e.g., radiologic description of the cases) were also made on a 4-point scale; the range for these items went from 4 = "major contribution to the conference" to 1 = "hindered conference." Finally, providers were asked to indicate whether they agreed or disagreed with a series of statements regarding the logistical aspects of the conference (e.g., suitability of day and time of the conference). Satisfaction with each of the two teleoncology systems was assessed following a single conference.

Conference participation was measured by counting the number of times individual facilities participated in conference sessions, the number of providers attending, and the number of cancer cases presented by each facility.

RESULTS

Technical Aspects

The technical, clinical, and administrative elements constituting the Pacific and Region 10 systems are summarized in Table 1.

Qualitative assessment of the technical aspects of each of the two systems indicate that each has distinctive advantages. The major advantage of the Pacific Internet-based system is that military treatment facilities have universal access to the Internet; thus the number of potential system users is maximized. Although the configuration chosen by the programs highlighted in this publication show costs to be

TABLE 1. SYSTEM COMPONENTS

	<i>Pacific</i>	<i>Region 10</i>
Technical	Medical center—systems network manager Remote facility—systems manager	Medical center—systems network manager Remote facility—surgeon, diagnostic radiologist, surgical nurse, systems manager
Clinical	Medical Center—surgeon, pathologist, diagnostic radiologist, radiation oncologist, medical oncologist, oncology nurse, psychologist, geneticist, project director Remote facility—pathologist, surgeon, diagnostic radiologist, surgical nurse	Medical Center—surgeon, pathologist, diagnostic radiologist, radiation oncologist, medical oncologist, oncology nurse, social worker, cancer network coordinator, mammography technologist
Administrative	Project director	Cancer network coordinator
No. of Sites	Guam, Okinawa, Korea, Yokota, Yokosuka, Misawa	McClellan, Lemoore
Distance of sites	>3,000 miles	500 mi

TABLE 2. PACIFIC (INTERNET-BASED CONFERENCE) SATISFACTION SURVEY

Following the conference on March 24, 1999, all 38 participants completed a satisfaction survey (100% response rate). Respondents were asked to rate how satisfied they were with technical, format, and logistical aspects of the conference.

Items	Scale				
	Poor	Fair	Good	Excellent	N/A
Technical aspects of the conference					
Lighting quality of videoconference			50%	47%	
Audio quality of videoconference		21%	42%	37%	
Image quality of the participants					100%
Image quality of the mammograms			55%	34%	10%
Image quality of the pathology slides			42%	53%	3%
Amount of time allotted for the discussion of each case		5%	63%	32%	
Format aspects of the conference	Hindered conference	Did not contribute	Minor contribution	Major contribution	N/A
Radiologic description of the cases		8%	32%	46%	
Pathologic description of the cases			13%	87%	
Surgical oncologic discussion of the cases			16%	84%	
Medical oncologic discussion of the cases		2%	16%	82%	
Radiation oncologic discussion of the cases		13%	24%	63%	
Logistical aspects of the conference	Agree	Disagree			
The day of the week of the conference is suitable	100%				
Time of day for the conference is suitable	97%	3%			
Volume of cases presented was appropriate	100%				

higher with the Internet-based system, it does not account for costs incurred as a result of the lines which will vary geographically (Appendices 1 and 2). The distinct advantage of the ISDN-based system is that participants are displayed visually and it requires fewer administrative tasks at the remote site.

Participant Satisfaction

Thirty-eight participants from six facilities within the Pacific Oncology Outreach Project completed a satisfaction survey. The results of the survey appear in Table 2. Most of the technical aspects of the conference were rated "good" or "excellent" by 95% of the respondents. The only item which elicited a variation in response was audio quality; 21% of respondents assigned a rating of "fair" for this item.

Twenty-two participants from three different facilities within the Region 10 Integrated Cancer Network system completed a satisfaction survey. The results of the survey are presented in Table 3. Overall, 95% of all respondents indicated that the technical aspects of the conference were either "good" or "excellent." Satisfaction ratings for the format and logistical aspects were also quite high. For example, at

least 95% of respondents assigned high ratings to the radiologic, pathologic, surgical oncologic, and radiation oncologic discussion of the cases.

Conference Participation

A summary of participation in the Pacific Oncology Outreach Project is presented in Table 4. A total of 103 cases were presented over approximately one year. Table 5 provides an overview of participation in the Region 10 Integrated Cancer Network program. During the course of about one-year, 304 breast cancer cases were presented.

DISCUSSION

The Pacific Oncology Outreach Project and the Region 10 Integrated Cancer Network provide consultative services for the purpose of providing care to cancer patients. However, each program was established in order to meet different objectives. The Pacific Region's primary objective was to decrease unnecessary medical evacuations as well as streamline the referral process for those patients who were ul-

TABLE 3. REGION 10 (ISDN-BASED CONFERENCE) SATISFACTION SURVEY

Following the conference on March 4, 1998, 22 of the 25 conference participants completed a satisfaction survey (88% response rate). Respondents were asked to rate how satisfied they were with technical, format, and logistical aspects of the conference.

Items	Scale				
	Poor	Fair	Good	Excellent	N/A
Technical aspects of the conference					
Lighting quality of videoconference			4.8%	95.2%	
Audio quality of videoconference			13.6%	86.4%	
Image quality of the participants			27.3%	72.7%	
Image quality of the mammograms		5%	10%	85%	
Image quality of the pathology slides		5%	20%	75%	
Amount of time allotted for the discussion of each case		4.8%	42.9%	52.4%	
Format aspects of the conference	Hindered conference	Did not contribute	Minor contribution	Major contribution	N/A
Radiologic description of the cases				100%	
Pathologic description of the cases			4.5%	95.5%	
Surgical oncologic discussion of the cases			4.5%	95.5%	
Medical oncologic discussion of the cases		4.5%	4.5%	90.9%	
Radiation oncologic discussion of the cases			4.5%	95.5%	
Logistical aspects of the conference	Agree	Disagree			
The day of the week of the conference is suitable	95%	5%			
Time of day for the conference is suitable	85%	15%			
Volume of cases presented was appropriate	81%	19%			

timately evaluated. The Region 10 program was established to promote collaboration and distance learning among primary care-based sites with a central tertiary care facility.

Further, there are important distinctions in the infrastructure, consultative process, and conference format of the two systems. For example, the infrastructure of the Pacific system consists of equipment supporting the transmission of images over the Internet; in contrast, the system in Region 10 utilizes ISDN lines. Related to the differing infrastructures of the two

systems, it appears the Pacific Region had a higher initial cost based on 1996 complete costs (Appendixes 1 and 2). This figure does not include the cost of ISDN lines, which are regionally based and are incurred by the minute (\$1,500 per month).

The consultative team at each site has a similar composition. However, the administrative coordinator for the Pacific system is a tumor registrar, whereas a full-time cancer network coordinator performs the administrative functions in Region 10. Finally, the conference for-

TABLE 4. PACIFIC CONFERENCE PARTICIPATION, OCTOBER 1996–DECEMBER 27, 1998^a

Facility	No. of Sessions Attended	No. of Providers Attending (Average)	No. of Cases Presented (Total)
TAMC	54	10	0
Guam	45	9	36
Okinawa	34	7	28
Misawa	4	6	2
Korea	30	3	8
Camp Lejeune	2	6	0
Yokota	33	5	14
Yokosuka	29	4	15
Total ^b	54 ^b		103

^aProject Pilot was solely with Guam, October 1996–October 1997.

^bRepresents total number of Internet tumor board conferences held.

TABLE 5. REGION 10 CONFERENCE PARTICIPATION, FEBRUARY 11, 1998–JANUARY 27, 1999

<i>Facility</i>	<i>No. of Sessions Attended</i>	<i>No. of Providers Attending (Average)</i>	<i>No. of Cases Presented (Total)</i>
DGMC	38	13.3	292
McClellan AFB	2	4.5	3
Lemoore NAS	23	3.9	9
Total	63	21.7	304

mat of the Pacific system involves the transmission of synchronized clinical images via the Internet in conjunction with real-time audio. In contrast, the Region 10 network displays radiologic and pathologic findings via camera images; audio and video display of conference participants take place in real-time. Results of participant surveys suggest that satisfaction with the technical and logistical aspects of both the Internet-based system and the ISDN line-based system are very high.

A limitation of the present study is that the comparisons between the Internet-based and ISDN-based systems are qualitative rather than quantitative. However, these comparisons may be useful for others who are considering implementing their own teleoncology systems and who need information regarding the configuration of such systems. Another limitation of the study is that satisfaction data for both programs were collected following a single teleoncology conference.

Further, it is not possible to draw conclusions about the cost-effectiveness of Internet-based versus ISDN-based teleoncology programs based on the cost information provided in this article. Neither program described here was developed for the purpose of saving money, therefore, tracking cost-effectiveness data has not been a priority. In fact, the Region 10 program has a high fixed-cost structure and would not be expected to be cost-effective because it established a referral relationship between a distant primary care-based facility and a tertiary care facility where previously very little interaction existed.

Individuals interested in implementing similar programs at their facilities should be aware that they will probably encounter provider

skepticism. To counter these reservations, meticulous planning and cultivation of support by provider opinion leaders is key to gaining and sustaining provider acceptance. Additionally, individuals should anticipate the need for additional administrative support in order to implement their programs. Both Internet- and ISDN-based systems entail additional work in the way of technical support and handling of clinical materials at the central specialty site.

CONCLUSION

The Pacific Oncology Project was created to enable TAMC to carry out its mission in providing medical care for its beneficiaries throughout the Western Pacific. As of March 1999, 16 aeromedical evaluations were avoided as the result of the teleoncology conference. Further, the teleoncology system ensured that those patients who required MedEvacs were entered into clinical pathways without delay.

Region 10 was able to segue its program as a component of a global telemedicine initiative aimed at improving videoconferencing capability throughout the region. To date, there have been no physical referrals from the outlying facilities in Region 10 to the central cancer center. However, the conference has served as an excellent educational tool for surgeons and primary care providers at Lemoore NAS who do not have oncology specialists within the facility. This technology created a foundation that facilitated a collaborative relationship between the DGMC and Lemoore NAS in other telemedicine arenas, such as teledermatology and teleorthopedics.

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Address reprint requests to:

Maj. Darryl C. Hunter

P.O. Box 1312

Travis AFB, CA 94535

APPENDIX 1. INTERNET-BASED SYSTEM IMPLEMENTATION COSTS (1996 COSTS)

<i>Item</i>	<i>Cost/Unit</i>
Multimedia medical systems (MMS)	
Replace entire MMS with:	
Pathcom	\$26,690
Nikon microscope	7,170
Software-accepting video input	1,000
HC-150 Housecall Telemedicine	47,701
Video Packages	5,715
Pictoretal Concord Base Codec	27,550
Communication Interface Device	2,865
Telemedicine SILO	2,755
Microscope-Nikon Labophot	7,163
Path Cam-Ultra Digital Camera	29,698
Equipment shipping cost	963
DICOM Web Server	59,278
Lumisys 85LF	24,420
Lumisys Digitizer Workstation	13,500
Server 10 Gig. Storage	25,000
30 Gig. RAID array	25,000
UPS	350
Installation support	5,000
Dell Multimedia Workstations	3,670
InFocus Projector-Lite Pro 580	5,851
Kodak Digital Camera	900
Conference Telephone	500
Total	\$322,739

Peripheral Site (GUAM)

<i>Item</i>	<i>Cost/Unit</i>
MMS System Upgrade	\$47,701
Pathology System	45,130
MedWeb Server	56,978
Lumisys 85 LF	59,237
UPS	787
PC Workstation	2,538
InFocus Projector	4,755
Digital Camera	900
Speaker Phone	500
Flat Bed Scanner	700
Total	219,226
Total	\$541,965

APPENDIX 2. ISDN-BASED SYSTEM COSTS (1997 PRICES)

<i>Equipment Item</i>	<i>Central Site (DGMC)</i>		<i>Total Cost</i>
	<i>Quantity</i>	<i>Cost (Each)</i>	
Video Bridge	1	\$118,000	\$118,000
Bridge support/software, etc.	1	24,000	24,000
Bridge IMUX'g S/W (384Kbps)	1	7,934	7,934
Bridge Training-1 week in Boston	2	1,800	3,600
Bridge Audio card enhancement	1	11,885	11,885
Roll Around Vid Sys	1	38,800	38,800
VTC Group software	1	284	284
3-chip camera with remote pan/tilt/zoom	1	18,200	18,200
NT-1 ISDN Network Interface	1	200	200
BRI IMUX	1	3,050	3,050
Video scan converter	1	1,656	1,656
Audio package, power microphone	1	2,667	2,667
Multi-modem II	1	168	168
Dialing and data Y-cable to IMUX	1	388	388
ISDN BRI lines	3	200	600
Pathology scope	1	11,000	11,000
Microscope camer and light source	1	13,376	13,376
Pathology scope pointer	1	500	500
Document camera	2	3,500	7,000
Video Junction box w/multi-connections	1	1,500	1,500
Miscellaneous cables	1	300	300
Total			\$265,108
<i>Peripheral Site (Lemoore NAS)</i>			
<i>Equipment Item</i>	<i>Quantity</i>	<i>Cost (Each)</i>	<i>Total Cost</i>
Roll Around Vid Sys	1	\$38,800	\$38,800
VTC Group software	1	3,556	3,556
3-chip camera with remote pan/tilt/zoom	1	18,200	18,200
NT-1 ISDN Network Interface	1	200	200
BRI IMUX	1	3,050	3,050
Video Scan Converter	1	1,656	1,656
Multi-modem II	1	168	168
Dialing and data Y-cable to IMUX	1	388	388
ISDN BRI lines	3	200	600
Document Camera	1	3,500	3,500
Miscellaneous cables	1	300	300
Total			\$70,418
Total of both systems			335,526