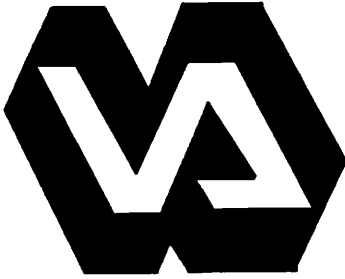


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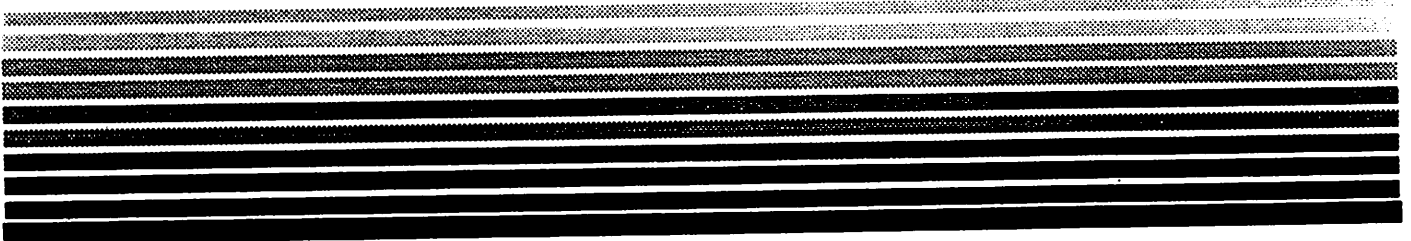


**DHCP INTEGRATED IMAGING PROJECT  
Report of the Evaluation Panel**

**June 8, 1990**

**Prepared by:**

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## **PREFACE**

This report contains the findings and recommendations of an Expert Evaluation Panel convened to report on the DHCP Integrated Imaging Project being implemented by the Washington Information Systems Center. The Panel met on May 14, 1990 and consisted of the following seven members:

Alden W. Dudley, Jr., M.D.  
H.K. Huang, D.Sc.  
Richard Johannes, M.D.  
Robert E. Miller, M.D.  
Helmuth Orthner, Ph.D.  
Clifford Patrick, Ph.D.  
Roger Shannon, M.D.

Booz, Allen & Hamilton supported the panel in the preparation of this report as part of the Digital Imaging Technology Evaluation that is currently underway for the Veterans Health Services and Research Administration's Information Technology Management Program.

## **EXECUTIVE SUMMARY**

## EXECUTIVE SUMMARY

Pursuant to the Department of Veterans Affairs (VA) Resource Allocation Committee directions, an Expert Evaluation Panel was convened to report on the DHCP Integrated Imaging Project. This panel was chosen from experts in medical imaging, hospital information systems, and health care services research from both the University environment and representative VA services. On May 14, 1990, the panel met with the Washington ISC development team and reviewed the results of their work. The panel unanimously reached the following conclusions:

1. *The Expert Evaluation Panel fully endorses the Washington ISC's Integrated DHCP Imaging Project, and recommends multi-year recurrent funding of the project;*
2. *This system is based on sound concepts which have been applied innovatively. It has significant potential benefits for the VA and the health care community at-large;*
3. *The project funding and staffing levels should be increased. This is based upon the long-range development plan and the need for continuity within the development team. The current year-to-year funding cycle absorbs excessive staff time, prevents long term planning, and makes it difficult to recruit personnel;*
4. *The project developers must continue to analyze emerging technologies that may become available in the near future to ensure continued evolution and enhancement of the DHCP Integrated Imaging System;*
5. *The Evaluation Panel concurs with the plan for phased deployment of DHCP Imaging applications to operational environments in other VAMCs following testing and verification of these individual applications;*
6. *The functions implicit in the development system should be expanded to remote VAMC sites to address the need for remote imaging consultations;*
7. *VA hospital information system development is recognized world-wide as conceptually and organizationally advanced. The DHCP Imaging Project exemplifies the type of development effort that has gained widespread respect in the general health care community;*
8. *The nature of this project lends itself to cooperative efforts with HSR & D to perform health services research, in addition to technology evaluations by independent third parties within and outside the VA;*
9. *At present, this is the only project in the VA health care environment clearly illustrating an understanding of how to integrate visual systems into a hospital information system (i.e., image and text integration). This expertise will allow commercial imaging systems to be integrated into the VA's DHCP development, while at the same time, allowing MIRM to accumulate the experience necessary for integration of commercially offered visual systems.*

The panel further notes that the development team has achieved extraordinary results considering the short development time, the difficulties of addressing the challenging and innovative nature of the task, and the relatively small amount of resources expended to date.

## **I. BACKGROUND**

## **I. BACKGROUND**

The Washington Information Systems Center (ISC) is implementing the Decentralized Hospital Computer Program (DHCP) Integrated Imaging System, at the Washington VA Medical Center (VAMC). This system integrates medical image data with the Department of Veterans Affairs' (VA's) existing DHCP hospital information system. The project received funding for FY90 which enabled continued development of the prototype system and field testing in an operational environment. As part of the funding approval, an evaluation of the current funding phase was directed. An Evaluation Panel which included experts in image management and communication systems, clinical image uses, automated medical information systems, and health services research, was convened at the Washington VAMC to review the progress of the system to-date, installation and further evaluation plans, and preliminary results. This meeting was conducted on May 14, 1990.

As part of the Evaluation Panel meeting, an assessment of the project was made by the panel participants. In addition, recommendations were made by the panel members to help the project development team in planning future directions. This report describes the DHCP Imaging System that is being developed by the Washington ISC, and its current status. The report also reflects the findings, assessment, and recommendations of the panel members relative to the DHCP Imaging Project.

### **1. A DHCP Integrated Imaging System is Being Field Tested at the Washington VAMC.**

Medical images such as x-rays, pathology slides, nuclear medicine scans, and angiogram films are currently stored in various locations throughout the hospital using alphanumeric, visual, and other modalities. This results in fragmented communication and record keeping. The DHCP Imaging Project attacks these problems by trying to pull together the fragmented medical record. Thus, the Washington ISC project team has a number of goals:

- To replace the currently fragmented patient record with a fully integrated, automated medical image and text system;
- To provide the patient's complete medical data, including images, to the treating physician on the ward, intensive care unit (ICU), operating room, emergency room, or ambulatory care areas of the medical center;
- To ensure the integrity of the original data file now frequently pillaged by residents and students;
- To eliminate repeat studies;
- To enhance communications among consulting physicians and primary care providers by making comprehensive patient data easily available to all;
- To determine the system's potential usefulness in the areas of medical education and research, and then to test this;

- To test the hypothesis that an imaging system will increase access to, and the availability of, images through a network model thereby providing active support to the practice of medicine.

To accomplish these goals, the Washington ISC has developed a unique integration concept that provides the basis for the management of images by the VA's DHCP hospital information system. **It has emphasized testing and using cutting-edge concepts on market-available equipment.** Data objects such as images are logically integrated directly into the VA's data base management system (DBMS). This DBMS is a utility used by all of the VA's DHCP software application packages. The image workstation network consists of numerous 80386-based workstations connected to the networked minicomputer-based DHCP system and image data servers. The workstations are relatively inexpensive and are based on currently available, off-the-shelf commercial hardware. They allow storage and display of a variety of high-resolution, true color or black-and-white images. Display resolutions vary and go up to 1024 x 768 32 bits/pixel for color and scrolled display of 2048 x 2048 x 8 bits/pixel for black and white images. These workstations will continue to support all existing DHCP programs which currently display alphanumeric data on ordinary terminals.

The DHCP Imaging System is currently installed in the department of Cardiology at the Washington, DC VAMC. Integration of catheterization and echocardiogram images with the DHCP Cardiology package has been the first focus of the project. The current workstation software includes full integration of images with the existing Cardiology package and a prototype Nuclear Medicine package. Images are automatically retrieved and displayed as the corresponding text data appears on the screen.

The Cardiology package allows users to record images and display them on the high-resolution monitor, while the patient's text report is simultaneously displayed. The images include echocardiograms, ventriculograms, coronary arteriograms, multigated nuclear ventriculogram (MUGA) scans, and thallium studies. When reviewing a procedure report, the images appear automatically as needed, and specific views can be enlarged. Clinicians can scan, store, and retrieve a number of images critical to the diagnosis, treatment, and prognosis of patients. A display of multiple small images has been designed for the patient summary option of the Medicine Package.

Over the next several months alpha development of the DHCP Imaging System based on tested concepts will expand to a hospital-wide network demonstration. A total of 15-20 workstations will be located throughout the Washington VAMC, making images available to virtually any clinician wishing to look at a comprehensive patient record. In addition to Cardiology, images relating to Radiology, Gastroenterology, Pathology, Surgery and Pulmonary medicine will be included. System functions to make the images accessible in a more useful fashion also will be added.

## **2. FY90 Funding Approval of the DHCP Imaging Project by the RAC Directed an Evaluation of the Project Prior to Continued Funding.**

As part of the approval for FY90 funding for the DHCP Imaging Project, the Chief Medical Director's (CMD) Resource Allocation Committee (RAC) stated that continued funding would be contingent on an evaluation of the project. This evaluation is currently being conducted under the aegis of the VA's Information Technology Management Program (ITMP). ITMP, developed under the auspices of the Medical Information Resources Management Office (MIRMO) and conducted by the Center for the Evaluation of Health Care Information Systems Technology (CEHIST), is intended to permit VHS&RA



to proactively monitor, screen, and evaluate emerging information technologies for potential use in the VHS&RA platform. ITMP produces for VHS&RA managers and decision-makers guidance and evidence of the feasibility, implications and potential costs and benefits associated with the use of specific technologies in VAMC environments. This information will allow VHS&RA decision-makers to base their decisions on structured evaluations of discreet technologies, conducted in VAMC test bed environments.

**3. A Panel of Experts was Convened to Evaluate the Concepts, Features, Functions, and Methodology Employed by the DHCP Imaging Project Team. (See attachments for list of panel members and imaging project staff.)**

The evaluation panel members represented a group of experts in the fields of medical imaging systems, clinical information systems, and health services research. The panel members were thus able to provide a wide range of knowledge and experience with concepts and technologies related to the Washington ISC Imaging Project.

The DHCP Imaging Project team presented its methodology and approach to system development and its future plans. The system has been developed using a modular concept, which will enable modifications or upgrades to individual components without altering the whole system. In addition, strict adherence to industry standards has been followed whenever possible, producing a vendor-independent, transportable system. The project team also described the migration path envisioned for the system's hardware configuration, based on current technology trends.

As part of its future plans, the DHCP Imaging Project team is striving toward testing the portability of the system design. Portability, the ease with which a system can be duplicated at other sites, is an important indicator of the flexibility of a system. It will determine if the system can meet a fundamental requirement of DHCP, i.e., that it be operated with minimal expert intervention. It will also give some insight into the amount of customization that may be needed for specific hospitals, and it will provide the opportunity to further evaluate the effect that imaging will have on medical care.

The panel members were given a tour of the VA facility to observe the Imaging System installation, and to see a demonstration of an imaging workstation networked to the on-line DHCP hospital information system. The project team briefed the panel on the system installation plans, which included its current status, the work remaining to be completed at the demonstration VAMC, and future efforts. The structured evaluation process and preliminary results were presented.

The DHCP Imaging Project team suggested the development of remote medical consultation capabilities that would capitalize on the ability to transfer images from a remote VA facility to a VA facility where an expert consultant is located. This extension to the system would allow the VA to study the effectiveness of remote consultation by various clinical specialties.

**4. The Evaluation Panel Assessed the DHCP Integrated Imaging System, and Formulated a Series of Recommendations to the Development Group and VHS & RA for Future Development, Implementation, and Deployment of the System.**

Based on the presentations and discussions, panel members formed their assessment of the project. They provided insight into a number of aspects of the project,



including technical direction, staffing issues, resource requirements, and system functionality. From this discussion, the panel members provided a list of recommendations to the VA for proceeding with the project.

The discussions were broad-ranging and included such topics as:

- Funding for new or additional equipment and development tools ;
- Funding for additional staff;
- The need to collect data to measure user acceptance and effects on provider efficiency;
- Criteria for selecting images for inclusion in the integrated system.

The panel members were then asked for their views concerning the overall concept of the project and their evaluation of the progress made to date, in addition to their recommendations regarding future system development and deployment, and evaluation methodologies. Details of the panel's assessment and recommendations are contained in the remaining sections of this report.

## **II. ASSESSMENT**

## II. ASSESSMENT

The following is an overview of the panel's assessment of the DHCP Imaging Project.

### **1. The Ready Availability of Integrated Medical Image and Text Data within an Existing Hospital Information System is a Sound Concept with Significant Potential Benefits to both Patient and Clinician.**

The panel's initial assessment of the DHCP Imaging Project was that it is innovative and offers significant potential benefits for the VA. The concept underlying the system is sound, and the approach is unique within the United States. One of the panel members pointed out that the private sector and other government health care communities look to the VA for leadership in hospital information system development. The DHCP Imaging Project exemplifies the type of development effort that has gained widespread respect in the medical informatics and general health care community.

Panel members stated that the DHCP Imaging Project was significant and innovative in selecting the primary care providers as the principal targeted users of the system. This is a group which has great need for the services that this system offers and currently has little alternative other than manual labor for locating and reviewing images. The panel judged that the Imaging System would have a significant effect on the accessibility and availability of images, thereby facilitating the diagnosis and treatment of the veteran patient population.

The experience with the DHCP Imaging System thus far pertains predominantly to cardiac images. Members of the panel expressed great interest in the demonstration provided by Dr. Ross Fletcher (Chief of Cardiology) and noted his enthusiasm for the system. Dr. Fletcher stated that the automated summary display provides a new and valuable tool for Cardiology practice. The panel concurred that a newly developed image-based procedure synopsis is more useful than a text description and is faster and much more convenient than viewing the original film recording. While the Cardiology image set represents a somewhat limited set of images, it provides an excellent example of the system's potential. The panel members theorized that the system would achieve its greatest benefit upon the inclusion of radiology data and hospital-wide implementation.

### **2. The Current Level of Staffing and Resources is Inadequate to Meet the VA's Requirements for Future Image-Related Activities.**

The evaluation panel members recognized that the development team has made remarkable progress in a short period of time. The emergence of the Imaging Project has focused attention on the VA's changing imaging needs. These needs are shared by the hospital community at-large. Areas of concern include:

- Planned DHCP Imaging System development, implementation, training and support;
- Conformance of ancillary imaging systems to nationally accepted communications standards; and

- The ongoing need for the VA to provide consultative services and expert advice to others involved in the procurement of imaging systems and other related projects.

These needs will increase greatly when the system is implemented at other VA Medical Centers. Therefore, to successfully meet the project's objectives, the panel strongly recommends that additional staffing and resources be allocated to the project. In order to hire qualified individuals with expertise in these technologically sophisticated areas, multi-year recurrent funding including permanent positions is required.

### **3. Further Attention Needs to be Focused on Related Technology and Development Efforts by Other Groups.**

The panel commented on the technology being employed in the DHCP Imaging System. A number of considerations are involved in component selection including cost, ease of use, and performance. It was noted that emerging workstations are designed for graphics processing, and that future hardware platforms may be better suited for the VA's imaging applications. It was suggested that by incorporating more technologically advanced components into the current development environment, it may be easier to phase them into future enhancements of the operational Imaging System.

Panel members noted that there are other developers working on image-related technology efforts. The uniqueness of the VA's effort is the integration of images with a widely-installed integrated hospital information system. The panel members did not know of any other groups within the United States taking this approach, although two groups outside the U.S. are involved in similar projects. The panel recommended that the project team investigate other integration efforts and image technology developments to determine the relevance of these to the DHCP Imaging Project.

There was also mention of other technical aspects that the project team should consider with respect to concurrent efforts being undertaken. For example, efforts are underway to develop user interfaces that incorporate lexicons, or labels, that address the needs of specific medical specialties by incorporating vocabulary that pertains to a particular medical field. One example is the Uniform Medical Language System (UMLS) under development at the National Library of Medicine.

### **4. The Emphasis of the Project Has Been on Technology Integration Thus Far; Procedures for Users Will Be Addressed Later.**

The emphasis of the DHCP Imaging Project to-date has been on integration and installation of the system. Currently, this is not fully balanced by addressing the issues related to system functionality and procedures to be followed by users. The panel recognizes that as the demonstration system is implemented and used by clinicians, feedback will be obtained from the users and appropriate modifications can then be made to the system. The project team indicated that as system capabilities are added to existing DHCP applications, the design effort necessarily would include a thorough re-analysis of the needs of users.

Panel members inquired as to the procedures involved in image entry into the patient record:

- Who would scan and/or choose images to be stored and how would these decisions be made?
- What is the volume of images to be entered--all those provided versus selected images (by diagnosis, patient, clinician, specialty, etc.)?
- What are the issues surrounding image control/editing/retrieval?

All of these issues will be addressed by the development team, in conjunction with the Service Chiefs, clinicians, and technicians at the demonstration site during system installation.

The project team indicated that a major goal of the project is to develop a system that has wide applicability in the VA medical center settings. Once this goal is achieved, efforts to advance the technology employed and to perfect the user interface will be undertaken.

#### **5. Ongoing Structured Evaluations Are Necessary to Determine Both the Long-term Viability of the DHCP Imaging System and the Organizational Changes it Permits.**

Some evaluation panel members felt that, although they recognized the potential impact of the Imaging System, they could not estimate the extent to which the quality of health care would be improved. The panel stressed that a better definition of the predicted and realized benefits and impacts of the system was needed. This activity would help in ensuring that the implemented system complements and enhances the activities of the health care providers. Issues that the panel mentioned included:

- What impact will the Imaging System have on the practice patterns of physicians?
- How will the activities of clinicians and technicians be affected?
- What will be the impact of the system on patient care?
- Is it intended that the system act as a picture archiving and communication system (PACS), or that it provide selected medical images as part of a patient clinical record, or both?
- How might the Imaging System save on other expenses of patient care?

As part of the VA's ITMP technology evaluation, Booz, Allen has collected preliminary pre-implementation data, focusing on current manual image management procedures, potential system benefits, and user expectations. Because the system is in the early stages of installation and implementation, the impact of the DHCP Imaging System has not yet been seen and therefore cannot yet be measured. However, in addition to the potential for improved patient care due to immediate availability of archived images, it is expected that the Imaging System will provide a rapid (less than three years) return-on-investment by saving physician travel time to the primary source of the image and technician/technologist search time, in addition to eliminating duplication of histology slides or x-rays and the repeating of procedures for reconstruction of initial data.

The Panel discussed the need for health services research studies relating patient outcome to use of the Imaging System. Pre-implementation studies would be necessary to make comparisons. These might still be possible at the Washington VAMC, but should definitely be planned for subsequent sites. It was suggested that collaboration with the VA's Health Services Research and Development Service would be a productive arrangement. Several panel members expressed interest in helping to develop evaluation projects.

The Evaluation Panel responded very favorably to the overall concept of the system and progress of the project thus far. The Panel's recommendations both to the project team and VHS&RA management are delineated in the remaining section of the report.

### **III. RECOMMENDATIONS**



### **III. RECOMMENDATIONS**

The Evaluation Panel unanimously agreed that the DHCP Imaging Project team is pursuing a viable concept which is deserving of continued development and further deployment to other VA facilities. However, the panel members also felt that these efforts could not be accomplished without increased support in the form of additional staff and funding. The following recommendations reflect the outcome of the panel's discussions and assessment of the DHCP Imaging Project.

**1. In Order to Sustain the DHCP Imaging Project from an Organizational Perspective, Strong Upper Management Support Must Be Maintained Both at Central Office and in the Field.**

To date the DHCP Imaging Project has been developed by the ISC within the Washington VAMC. This was possible because of the tremendous support of both VHS & RA upper management and the medical center director. They have supported the project both conceptually and financially. For further development and deployment of the system, high-level support must continue for the next several years. The panel made the following comments and recommendations concerning the organizational aspects of the project:

- The development team must keep abreast of, and evaluate advanced technological platforms for the Imaging System as they become available and also keep up with changes in the marketplace, with an eye to maintaining compatibility between systems;
- As the DHCP Imaging System is deployed to additional VAMCs, central operational support related to the introduction of new technologies will be required;
- The developers should continue joint projects via interagency agreements, e.g., with the National Institute for Standards and Technology (NIST) to build the next-generation platform. This collaboration undoubtedly will increase and involve other agencies in the future;
- The development team does now and should continue to work with multiple commercial vendors, constructing interfaces to integrate imaging functionality with DHCP;
- The imaging project team should provide assistance for VA-wide medical imaging and hospital communications technology procurements, developing guidelines and specifications, and participating in facility activation planning.

**2. The Evaluation Panel Unanimously Endorsed the Need for Multi-Year Recurrent Funding of the Washington ISC DHCP Integrated Imaging Project.**

The Evaluation Panel emphasized and endorsed multi-year recurrent funding of the DHCP Imaging Project for a number of reasons.

- Panel members felt the project was an example of excellent work being done within the Federal government;
- They agreed that a highly productive project team has made tremendous progress in a short time, with limited resources;
- The concept of targeting the clinician end-users, rather than the radiology service alone is highly innovative, i.e., most imaging systems tend to focus on the needs of a single specialty such as the radiology service;
- The work being done by the DHCP Imaging Project team is now, and will continue to be, very important for both public and private sector health care providers, and has the potential to significantly impact the quality of health care delivery;

The Imaging Project requires a consistent core project staff in order to proliferate the system throughout VAMCs across the United States. The staff must be free to perform the actual project work, rather than spending blocks of time during each funding period requesting and obtaining the funds to continue the project. Recurrent funding of the project's FTEE would allow the team to recruit and hire knowledgeable, experienced and dynamic personnel.

Additionally, the VA would benefit from evaluations planned and carried out periodically throughout the life-cycle of the project to determine its effects over time -- e.g., benefits, areas needing improvement, or the effects of new/improved software modules. Evaluations should examine the viability of the current and future technology available, as well as look at the impact of the system on clinicians' practice patterns. As is obvious, continued development and deployment of the system will require a multi-year commitment of funding for staff and technical resources.

**3. In Order to Complete the Development of the Demonstration System in Washington, and to Deploy the Operational System to other VAMCs, Staff Resources Must be Increased.**

Because of their expertise and unique experience, the DHCP Imaging Project staff are receiving a growing number of requests for consultations and assistance. To fulfill their regular development duties and to meet these new demands, along with those that will be made as the Imaging System grows in complexity and number of deployed sites, the Evaluation Panel recommended additional staffing on a permanent basis. The areas where staff are needed include the following.

- An increase in technical staff is necessary for system development, operations and maintenance:
  - Completion of the demonstration site system at the Washington VAMC,

- Development of teleconsultation capabilities,
  - Installation, training, and operational assistance at 2-3 alpha, and subsequently beta, test sites,
  - Development of training sessions and manuals, and
  - Consultation for future installation sites.
- Additional technical staff would result in an opportunity to act as a liaison with, and participate in project evaluations (e.g., with HSR & D and the RMECs);
  - Administrative staff would allow the project team to provide imaging procurement guidance for VHS & RA and lend administrative support for the project;
  - A specialist in health services research could develop and oversee patient outcome and health care effectiveness research;
  - Field participants are needed to assist with development, field training, and evaluations (to include travel funds).

**4. Beta Testing and Further Deployment of the DHCP Imaging Project Should be Done on an Application by Application Basis, Rather than Awaiting the Completion of Alpha Testing of the Hospital-Wide Implementation.**

Having seen demonstrations of the Cardiology Service implementation and the future hospital-wide applications, the Evaluation Panel endorsed the concept of developing and implementing the DHCP Imaging System on an application by application basis. Panel members stated that this should be carried through to the beta site deployments and beyond. Recommendations were made as follows:

- Select at least two sites to eventually receive the entire DHCP Imaging System as the modules are tested and verified, and one or more remote sites with only one or two applications designed to test the effectiveness of teleconsultation;
- Maintain imaging applications in the alpha testing stage until the hardware and software can be utilized by other VAMCs to ensure that they can be operated with minimum developer support. This has a number of benefits:
  - As each application becomes functional it can be evaluated at beta test sites without waiting for the entire hospital-wide system to complete alpha testing, and
  - System enhancements may be attempted -- e.g., integration with PACS systems already in place, and selection and implementation of additional image improvement and manipulation capabilities (windowing and leveling for radiology, edge

enhancement, and off-the-shelf image processing package(s), among others).

- Additional evaluations would test the portability of the software by measuring:
  - The robustness of the system -- i.e., whether or not the system can run with a minimum of expert intervention (a basic premise of DHCP development), and
  - The software customization required for specific hospitals, including medical device interface software and DHCP interfaces,
- Develop remote teleconsultation capabilities. There are voiced and unvoiced needs within the VA for image communication between sites to support remote consultation. Using the DHCP Imaging System as a basis, this functionality could be developed as an integrated capability. This capability will allow image data transfer from a remote VA facility to a VA or non-VA facility where a medical specialist is located, and development of the functionality to support remote consultation. This approach will permit a controlled study of the effectiveness of teleconsultation by various medical specialties, and the selection of optimal telecommunications technology to support this capability.

**5. In Order to Facilitate Deployment and Further Development of the System, Additional Equipment and Effort Will be Needed.**

The Evaluation Panel recommended continued and increased funding of the DHCP Imaging Project not only for staffing, but also to take advantage of technological advances and changes in the marketplace. This would include the following items:

- Separate development and operational systems should be maintained in order to facilitate implementation in a live environment, while pursuing continued Imaging System development;
- Additional hardware and software, as well as network facilities, are needed at the alpha site so that there is at least one workstation per ward or ICU;
- Other interfaces should be developed, i.e., the Cardiology Siemens Bior interface, EKG, bronchoscopy interfaces, radiology PACS system interfaces;
- Further DHCP application integration should be performed as needed/requested;
- "Seed" equipment should be exported to the other ISCs around the country to facilitate software validation and verification and to assist with the integration of the Imaging System with the other clinical packages in DHCP;
- Additional hardware is needed for deployment of the system to the beta test sites and beyond. The type and number depend upon the size of the VAMCs and the extent to which the system is deployed at each site;

- The development of remote medical consultation (teleconsultation) capabilities will require installation of small, relatively inexpensive remote units in isolated VAMCs:
  - Optimal telecommunications technology should be selected to support teleconsultation involving images, and
  - The effectiveness of use of the technology in several medical specialties should be studied.

**6. There Must Be Detailed Structured Evaluations of Both the Technical Aspects of the DHCP Imaging System and the Impact of the System on Health Care Effectiveness.**

The panel members recommended both qualitative and quantitative evaluations to study imaging technology and its impact on the practice of health care. These would include technology (current and potential) assessments, cost-benefit analyses, and health services research. Rather than studying the impact of this technology at any one particular point in time, the Evaluation Panel recommended an ongoing evaluation process. Thus, if the system configuration falls short of the developers goals, plans can be made to replace all or part of it. At a minimum, evaluations would entail the following activities:

- Quantitative measurements should include:
  - Efficacy of the system -- can it perform as intended in an "ideal" setting,
  - Effectiveness -- does it perform as intended under field conditions, and
  - Efficiency -- does it perform as intended at a reasonable cost,

These measurements would be used to determine the cost-benefit impact of the system as it grows and is deployed. They also would define the progression to that end (cost-benefit impact) with hard data, rather than projections;

- Qualitative technology evaluations would assess existing hardware and software as well as what will be available in the future:
  - This would provide the ability to look ahead so that when advanced technology is more affordable it could be readily implemented,
  - This would highlight an advantage of the modular approach, i.e., that it allows updating and replacing of components of the system without changing the entire system, and
  - This would permit image quality and communication evaluation and enhancement as it becomes feasible. Some of this is being done via the aforementioned collaborative project with NIST, an attempt to determine the next-generation platform for the system;

- The portability of the software to at least one other imaging hardware platform (workstation) should be tested;
- Teleconsultation developments made by the project team would be evaluated to determine their effect at remote sites in the areas of utilization and efficiency, and the impact on patient care;
- Health Services Research studies would focus on the effect of the system on patient outcomes, costs, and on the current heavy users (orderers) of images -- i.e. the impact of the Imaging System on the medical care given to patients and on the administrative requirements to provide that care:
  - The impact on the behavior of ordering physicians,
  - The impact on the frequency with which consultations outside the facility are required,
  - Time spent on each patient visit, by both the patient and the physician,
  - Changes in staffing patterns,
  - Image-filing and work space requirements, and
  - The presence, types and frequency of negative impacts on patient care resulting from delays in the reporting of the results of procedures or from delays in the viewing of images;
- The benefits to clinicians/users would be measured, e.g., actual time savings attributable to the Imaging System, the frequency of missing or incomplete information, changes in the way clinicians practice health care and conduct conferencing/educational and research activities, any improvements in the quality assurance process, the effects on consultation services, and a definition of the benefits to the practice of medicine;
- Evaluations also are necessary in order to examine what is available in other countries, because, as panel members noted, several European and Asian efforts are ahead of many of the imaging projects here in the United States.

The assessments and recommendations of the Imaging Evaluation Panel substantiate the significant progress the project team has made in a short span of time, with a limited set of resources. In order to complete the demonstration at the Washington VAMC, continue system development, progress to VA-wide deployment of the Imaging System, and perform ongoing assessment of the program, recurrent multi-year funding is a definite requirement. Supplementing the development team staff, equipment, and funding sources is not only desired, but necessary. The panel of experts in imaging, information systems, and health services research fully endorses the Washington ISC integrated DHCP Imaging Project, and recommends that:

- The project be continued;
- The project be fully funded;
- The funding be on a recurrent, multi-year basis.

**ATTACHMENTS**



## **Digitized Imaging Evaluation Panel**

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