



CALIFORNIA  
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# Store-and-Forward Teledermatology Applications

*Prepared for*

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*by*

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## About the Foundation

The **California HealthCare Foundation** is an independent philanthropy committed to improving the way health care is delivered and financed in California. By promoting innovations in care and broader access to information, our goal is to ensure that all Californians can get the care they need, when they need it, at a price they can afford. For more information, visit [www.chcf.org](http://www.chcf.org).

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# I. Executive Summary

TELEDERMATOLOGY IS THE PRACTICE OF dermatology using communication technology. In the United States, this method of facilitating dermatologic care has been used primarily to improve patient access in medically underserved and remote communities.<sup>1,2</sup>

Store-and-forward (S&F) teledermatology, the most common form of teledermatology, offers several potential advantages over traditional, in-office dermatologic care.<sup>3,4</sup> It has the ability to lower the cost of dermatologic care, increase patient access, and facilitate medical education and training.<sup>5-9</sup> But potential users can find it difficult to select an S&F application appropriate to their specific needs

Implementing an S&F teledermatology program is a sizeable undertaking for practitioners and health care organizations. Successful program implementation requires clear identification of goals, thorough understanding of an organization's care delivery and business models, and a well-articulated, strategic implementation plan.<sup>10</sup> There are several variables that can affect the selection of a particular S&F teledermatology application: characteristics of the practice, patient volume, the medical record filing system currently in use, and financial considerations.

This report summarizes the key criteria for evaluating S&F applications. With input from experts in teledermatology, dermatologists at the University of California, Davis (UCD) identified four major commercially available S&F applications in the United States. A multidisciplinary team then determined the key elements by which S&F teledermatology applications should be appraised. UCD dermatologists and information technologists then evaluated each S&F application according to these criteria. Experienced teledermatologists with high case volumes were also interviewed regarding their evaluation of the respective S&F applications.

## II. Introduction

TELEMEDICINE — THE USE OF TELECOMMUNICATIONS and information technologies to provide health care remotely — has the potential to improve health care by overcoming time and distance barriers and reducing costs. Given the near-universal use of the Internet, the increasing range of remote communication models, and the pressure to cut the cost of health care, the time may be ripe for telemedicine. Yet there are significant barriers to adopting telemedicine in health care systems of all sizes, including a lack of understanding about how to choose and implement available systems effectively.

The California HealthCare Foundation commissioned the Department of Dermatology at the University of California, Davis (UCD) to explore how providers select an S&F teledermatology application and to evaluate the major S&F applications in the United States.

A multi-disciplinary team of dermatologists, primary care providers, and information technologists was assembled to determine criteria for evaluating S&F teledermatology applications. Through a collaborative effort, the team identified evaluation criteria and performed an analysis of each application using the evaluation criteria and interviews with expert teledermatologists.

# III. Store-and-Forward Teledermatology

THERE ARE THREE MAJOR MODELS OF teledermatology delivery: S&F, live interactive, and the hybrid model. Among these models, S&F is the most commonly used; yet each model has advantages and drawbacks.<sup>1</sup> Selecting among these modalities depends on the specific needs, preferences, and objectives of referral and consultant sites.

The practice of S&F teledermatology entails the capture of still digital images and clinical information (e.g., history of present illness) and transmission of this information from referring providers to dermatologists for asynchronous review. This modality is similar to an email system in which users are not required to be simultaneously engaged at their computers.<sup>2</sup>

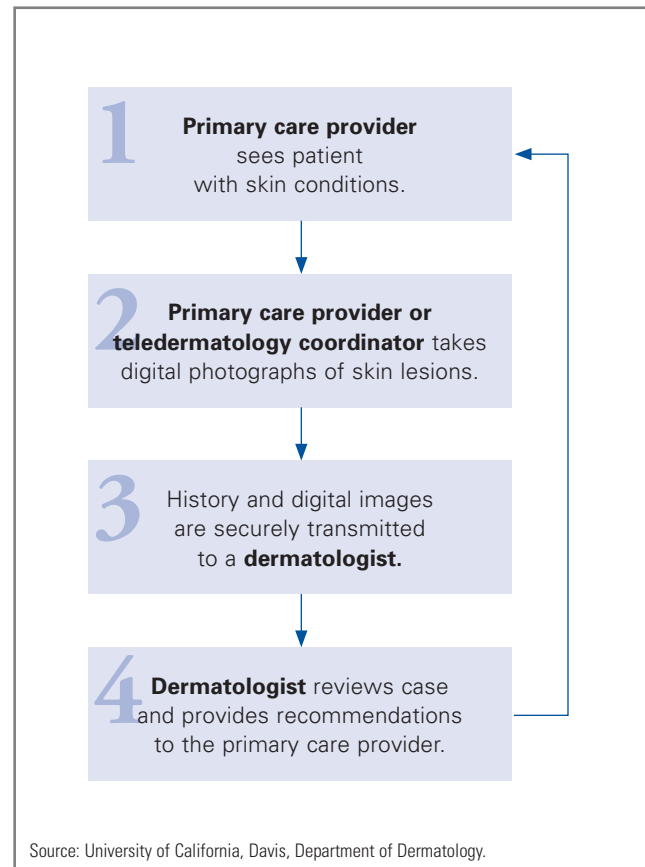
S&F teledermatology is an innovative, technology-enabled method of providing specialist care to patients who live in medically underserved or remote areas. Patients may benefit from decreased travel time and costs associated with visiting a dermatologist, as well as to improved access to dermatologic care.<sup>1</sup> Referring providers in remote areas benefit from S&F teledermatology because they gain access to specialists' opinions.<sup>2</sup>

Generally, an S&F teledermatology consult is conducted as shown in Figure 1.

S&F teledermatology differs in three major ways from live interactive teledermatology and the hybrid model. First, it is asynchronous, which saves the resources required to coordinate mutually agreeable appointments.<sup>2</sup> As a result, some teledermatologists contend that S&F teledermatology consultations may be more efficient than real-time consults.<sup>2</sup> In addition, the hardware required for S&F consultations is generally less expensive and more

readily available than that required for real-time teledermatology.<sup>2</sup> On the other hand, the lack of interaction between the dermatologist and the patient in the S&F modality is often perceived as a disadvantage.

Figure 1. S&F Teledermatology Consult Process



Source: University of California, Davis, Department of Dermatology.

## IV. Evaluation Criteria

IMPLEMENTING A TELEDERMATOLOGY PROGRAM is not easy. Despite the reported potential benefits of teledermatology, many programs have not flourished.<sup>9</sup> Researchers have cited several reasons why some programs are successful while others are not. For example, S&F teledermatology programs have been successful in government organizations, such as the Department of Defense, and in closed health care systems, where the organization has reasonable financial incentives to implement S&F teledermatology. In contrast, many other health care organizations have complex referral and authorization processes, which may impede implementation of an S&F program. Therefore, the initial steps in creating a program are to evaluate how a program may meet the patient demand for specialist care and how such a program integrates into the existing health care structure.<sup>1,9</sup> A thorough understanding of the organization's system of delivering care, its business model, legal and regulatory issues, and community needs are also important to implementing a successful program.<sup>1,9</sup>

Some programs have not been successful because the core purpose of teledermatology—increasing access to care—has been misunderstood. Teledermatology programs are generally embraced in medically underserved areas, where the community would otherwise lack access to specialty care. However, if there is sufficient access to local dermatologists, people usually have traditional face-to-face care.

It is important to calculate the resources required to implement an S&F program during the planning stages; failure to do so could result in a non-sustainable operation. Program directors need

to estimate patient volume, hours necessary for teledermatology coordinators, reimbursement rates, equipment costs, and specialist compensation before implementation. Among these factors, estimating patient volume and the number of hours necessary for a teledermatology coordinator are the most challenging. Due to the natural ebb and flow of patient volume, hiring a part-time teledermatology coordinator or sharing the cost of a medical staff member might be appropriate for clinics without constant, high patient volumes.

Finally, if the program does not have “buy in” from the organizational leaders and referring physicians, it likely will not flourish.<sup>10</sup> Many referring physicians resist changes in their practice patterns, and some may be especially skeptical of programs that require their additional involvement (such as communicating with patients regarding a specialist's recommendations.) Thus, it is critical to identify referring physicians who will help champion the S&F program within a referral clinic.

Despite these challenges, multiple programs have been sustainable and successful in the United States. A critical factor in that success is the selection of an appropriate S&F teledermatology application. But there are currently no established criteria or tested approaches for evaluating available S&F applications, and there are no studies that have compared the major S&F teledermatology applications.

The investigators in this study identified four major S&F applications available in the United States: AFHCAN, Medweb, TeleDerm Solutions, and Second Opinion. With input from teledermatologists from the American Telemedicine Association and the American Academy of

Dermatology, a multidisciplinary team consisting of dermatologists, primary care physicians, and information technologists worked to develop a set of evaluation criteria that can be used to assess an S&F teledermatology application (Table 1).

**Table 1. Evaluation Criteria for Store-and-Forward Teledermatology Applications**

EVALUATION CRITERIA	DESCRIPTION
System Requirements	Technical resources required to operate the program. Ability to run on a local computer versus web accessibility only.
HIPAA Compliance, Security, and Privacy	HIPAA compliance with secure storage, transmission, and access.
Information Sharing and Storage	Ability to store and transmit digital images, clinical history, and consultant recommendations in an organized and searchable fashion.
User Interface	User-friendliness and intuitiveness of the application. Upload speed for digital images.
Compatibility	Integration with existing EMR systems and applications. Ability to interface with standard imaging communication formats such as DICOM and PACS.
Scalability	Ability to fit into organizations of various types and sizes.
Billing	Ability to upload, capture, and/or process billing information directly to a third party payer.
Cost	License, server, and user costs.

DICOM: Digital Imaging and Communications in Medicine  
 EMR: Electronic Medical Records  
 HIPAA: Health Insurance Portability and Accountability Act  
 PACS: Picture Archiving and Communication System



# V. Comparison of Store-and-Forward Applications

EACH OF THE APPLICATIONS HAS UNIQUE technical and practical considerations:

## Alaska Federal Health Care Network (AFHCAN)

Since its inception in 1998, AFHCAN has facilitated telemedicine encounters at more than 273 sites spanning six states and three countries. Referrals are created using tConsult Cart, a locally-installed client application. Patient information is transmitted to consultants via a Web service, tConsult Web, which is Internet-accessible via Internet Explorer or Firefox and does not require software installation or plug-in downloads.

The tConsult Web interface is arranged similarly to commonly used email applications. All case activity is synchronized between users who have previously accessed the case. Comments from the referring and consulting physicians are organized and presented as a chronological dialogue.

Most options, such as “Add Comment,” “Attach Document,” and “View Activity,” are easily selected as hyperlinks. Files and images are simply uploaded from either the user’s hard drive or captured from peripheral devices. There are several other user-friendly functions, including detailed search options, a custom form creation tool, capability to print the case reports, and the ability to create quick lists of patients or providers.

Pictures are viewed within a separate “Image Viewer” window that provides various options including zoom, contrast and brightness, and save and/or print.

tConsult Web can be maintained either by the site’s own information technology department

or by AFHCAN. In the latter case, AMD Global Telemedicine, Inc. can host tConsult Server under a secure Application Service Provider (ASP) model starting at \$1,000 per month.

## Expert Teledermatologist Perspective

An expert teledermatologist has used AFHCAN for seven years and consults on at least 20 cases per day using tConsult Web. Approximately 60 percent of this teledermatologist’s referrals come from rural clinics, 30 percent from rural hospitals, and 10 percent from non-rural hospitals. This expert said:

- For a Web-based application with an intuitive interface, tConsult Web would appeal to new users who may not be technologically knowledgeable.
- tConsult Web’s strengths include large, color-coded icons, clearly labeled data entry fields, the simplicity of the search features, and its overall organization and layout.
- AFHCAN 4.9 could be improved by creating the ability to interface with electronic medical records and to submit billing information to third-party payers.
- tConsult Web is easy to use, provides an intuitive layout and is efficient at handling a high volume of consultations.

## Medweb

Medweb has been in operation for more than 20 years. It was originally designed for radiology but is now also used in a number of other medical specialties, including dermatology. Medweb 7.0.0

is entirely Web-based. The client software is an Internet Explorer plug-in that can be installed over the Internet and can be installed and used on any PC with a Windows 2000 or higher operating system and Internet access.

Referring providers create cases by entering information into either (1) a “highly structured” form containing multiple check boxes and radio buttons or (2) a “semi-structured” form with more free text-entry fields.

Both types of data-entry forms are comprehensive, and users do not have the option to create customized data-entry forms. Images can be uploaded from the user’s hard drive or captured from peripheral devices. Each image in Medweb 7.0.0 has an associated number, which can be dragged to a body diagram to illustrate the anatomic location involved in the consultation. This is a useful feature for matching a skin image with a body area.

The consultants’ interface provides a list of cases in queue with a color-coding system that indicates each case’s level of urgency. While the referring providers enter clinical information in discrete fields, the dermatology consultants receive the clinical information in a single, reformatted display that is easy to view. This useful feature provides consultants with a consolidated view of relevant clinical information. When responding to cases, the consultants can use the “patient education file” feature that allows them to attach a .doc, .xls, or .pdf file to the referring provider. These files can include detailed instructions for the referring provider or educational material for the patients.

Medweb 7.0.0 offers a robust image-viewing feature for consulting physicians. It provides numerous ways to annotate and manipulate image properties (e.g., zooming, labeling, rotating), and it has a virtual magnifying glass that can be dragged around the image for closer inspection.

## Expert Teledermatologist Perspective

An expert teledermatologist has used Medweb since January 2009 and has not previously used any other teledermatology applications. This teledermatologist consults on an average of 20 cases a month using Medweb. All the cases are from free-care clinic referrals. This expert said:

- Among Medweb’s (7.0.0) various features, the range of image viewer features and the concise display of the clinical data within a consult request are of particular value.
- Medweb 7.0.0 can run only on a Windows operating system. The lack of Mac platform compatibility is unfortunate but can be addressed by installing a Windows-based operating system onto a Mac computer.
- Medweb could be improved by using simpler user-interface functions to navigate and edit consultation reports. However, Medweb (7.0.0) has proven its ability to efficiently facilitate consultations.

## TeleDerm Solutions

First offered in 2001, TeleDerm Solutions is the only S&F application studied for this report that was specifically designed for dermatology. The current version is an entirely Web-based application. Users can securely create and access consults from a mainstream Internet browser.

Referring providers create consults by entering information into “Complaint” tabs. The relevant clinical information associated with each complaint is populated by using drop-down menus with an option to enter free text information. Images must be uploaded from the computer’s hard drive and cannot be directly imported into the program from external sources, such as a digital camera.

The consulting dermatologists' "Home Page" provides users with an overview of all consults, organized according to their status. For example, the consultants can view "Pending Consults" or "Answer New Consults," all sorted by date.

The Java-based image viewer in TeleDerm Solutions displays the image after several seconds. It contains basic functions for image manipulation, including magnification, inverting, zooming, flipping, and fit to window. Only one image can be loaded at a time.

As a teledermatology-specific application, TeleDerm Solutions 2.0 contains a large database of dermatology-specific templates in five categories: "Diagnosis," "Tests," "Procedures," "Medications," and "Patient Information." The use of these pre-written templates potentially could decrease the time required to answer a consult. For example, the user will find a 906-word "Patient Information" document on allergic contact dermatitis, which can be included in a consultant's response. Users cannot modify existing templates for future use or create their own templates. However, once the template is imported into the entry field for a patient, the teledermatologist can then edit the text to individualize the response for each patient.

### Expert Teledermatologist Perspective

Two teledermatologists with extensive experience using TeleDerm Solutions 2.0 were interviewed. One has used the application for eight years, responds to approximately 450 cases per month and has a payer mix entirely within the U.S. Department of Defense. The other has used the application for two years, consults on an average of 30 cases per month, and has a payer mix of around 75 percent private insurance, 10 percent self-pay, and 20 percent pro bono consultations. These experts indicated:

- TeleDerm Solutions 2.0 has a simple design and its ease of use would be attractive to many new users. It is also the only application that can incorporate dermatology trainees in the consultation workflow, allowing the attending dermatologists to engage and supervise trainees, such as dermatology residents, in the consultative process.
- The application could be improved by enabling faster image access and allowing more than one image to be viewed at a time in the image viewer. Like the other S&F applications evaluated in this report, TeleDerm Solutions 2.0 could also be enhanced by through integration with billing functions.

### Second Opinion

Second Opinion was introduced in 1994 and is installed at over 1,800 sites internationally. Second Opinion was designed to be installed locally by users and is not inherently Web-based. The application can be accessed via the Web using remote access technologies such as CITRIX and offers a Web Access module to allow data access through the Internet.

The current version, Second Opinion 7.07, typically uses local drives or servers to store the clinical information. However, it can be configured to store patient information in a centralized location to allow providers to access information about a large number of patients.

Referring providers create case content by using a combination of text documents, database forms, and image capture methods available in Second Opinion 7.07. The application has a set of standardized referral and consultation forms suitable for most medical specialties. It also offers a number of optional features at no additional cost to users interested

in customizing their own documents, such as the Developer's Tool Kit, Custom Form Designer, and Custom Report Writer. Completed referrals are sent as encrypted email attachments to consultants.

The consultants are required to install another program, Second Opinion Professional Expert Edition 7.0.4, to view and respond to consults, and every consultant must register with the vendor for tracking purposes. "Expert Edition" is free to consultants but must be purchased by the referring sites.

The consultant responds to a referral by typing free text into a basic form that contains three fields: "Consultation," "Recommended Treatment Plan," and "Recommended Follow Up/Additional Comment." Consultants also have the option of customizing documents. Completed forms can be saved as Word documents for printing, faxing, emailing, and postal mailing. Word documents sent by email are password-protected to ensure security.

All of a patient's clinical information is grouped into different levels of folders. A follow-up consultation request on a returning patient is automatically saved in that patient's file and sorted by date. This makes it possible for the referring provider and the consultant to easily view previous consultations on the same patient.

Second Opinion's image viewer is intuitive and versatile. It can play media clips and display still images, forms, and other documents. Multiple pictures can be viewed within a single window. Simply dragging a picture from the patient folder into the image viewer allows the user to compare several images side by side. Users can also annotate the images within the Image Viewer.

### **Expert Teledermatologist Perspective**

The teledermatologist experienced with Second Opinion has used the application for seven years and consults on an average of 26 cases per month. The expert said:

It is best to download referrals directly to the local hard drive. The patient file organization with subfolders within a patient's file, similar to the organization of a physical patient file, is good.

The image viewer, which displays multiple images at the same time, is versatile, efficient, and robust. The basic consultation fields, which allow text from other Word documents to be copied and pasted directly, are useful. As with other S&F applications reviewed here, Second Opinion 7.07 can be improved by creating integrated billing functions.

### **Evaluation Summary**

Table 2 on the following pages summarizes the evaluations of the major S&F applications according to the criteria.

**Table 2. Evaluation Summary of Major Store-and-Forward Teledermatology Applications**

EVALUATION CRITERIA	DESCRIPTION	AFHCAN	MEDWEB	TELEDERM SOLUTIONS	SECOND OPINION
<b>System Requirements</b>	Resources required to operate the program. Ability to run on a local computer versus Web accessibility.	Referral sites require installation of a local PC application. Consultants access cases via a Web-based application using Internet Explorer or Firefox.	PC with Microsoft Windows 2000 (or higher) and an Internet connection running Internet Explorer 5.5 Service Pack 2 or later.	Pentium class PC with 500MB RAM running Internet Explorer 5 or later.	PC with Microsoft Windows XP and Microsoft Office. Client software is currently compatible only with Microsoft Windows XP. Accessible via the Web using terminal services technology such as CITRIX. Second Opinion also has a WebAccess product not evaluated here.
<b>HIPAA Compliance, Security, and Privacy</b>	HIPAA compliance with secure storage, transmission, and access.	Data is encrypted with SSL. Cases can only be sent to recipients who are preconfigured within the AFHCAN system. Patient information record activity is tracked. All users can view detailed reports.	Data is encrypted with SSL. Patient information record activity is tracked and can be monitored by a network administrator. Once files are uploaded to a case, they cannot be removed or altered.	Data transfer encrypted via HTTPS and SSL. Hosted Service is from a Tier-1 data center approved by the VA. While creating a case, users must reconfirm login credentials at several stages.	Local client stores patient data in an encrypted (128-bit) file that is sent to the consultant as an email attachment. Password protection prevents unauthorized access. Information can also be sent in real-time by utilizing a network connection, thus eliminating need for file transfer via email.
<b>Information Sharing and Storage</b>	Ability to store and transmit digital images, clinical history, and consultant recommendations in an organized and searchable fashion.	Images can be uploaded from file or captured from medical peripherals. Patient data is stored in a central location where it is easily accessible.	Images can be uploaded from file or captured from medical peripherals. Patient data is stored in a central location where it is easily accessible.	Images can be uploaded from file or captured from medical peripherals. Patient data is stored in a central location where it is easily accessible.	Database is installed locally by default but can be configured for access from a centralized location. Images are uploaded from file.
<b>User Interface</b>	Degree to which the application is user-friendly and intuitive. Upload speed for digital images.	Features intuitive interface with large clickable buttons (suitable for touch screen). Web interface features email-like layout similar to Microsoft Outlook. Patient case data can be entered on user-customizable forms.	Patient data is entered in a tabbed form. Provides a library of customizable forms.	Intuitive workflow. A database of dermatology-specific templates enhances efficiency.	The user interface utilizes standard Microsoft icons. Patient information is organized in an intuitive fashion.

AFHCAN: Alaska Federal Health Care Access Network  
 HIPAA: Health Insurance Portability and Accountability Act  
 SSL: Secure Sockets Layer  
 HTTPS: Hypertext Transfer Protocol Secure

PC: Personal Computer  
 RAM: Random Access Memory  
 VA: Veterans Administration

EVALUATION CRITERIA	DESCRIPTION	AFHCAN	MEDWEB	TELEDERM SOLUTIONS	SECOND OPINION
Compatibility	Integration with existing EMR systems and applications. Ability to interface with standard imaging communication formats such as DICOM and PACS.	Limited support for PACS and DICOM. Integration with existing PACS and DICOM requires customization with additional fee. Does not currently support HL7. Version 5.0, released in 2009, offers limited HL7 support.	Supports PACS and DICOM. HL7 import/export is not supported. Integration with HL7 is available for an additional fee.	Incompatible with PACS and DICOM. HL7 compatibility requires customization. Compatible with Internet Explorer 5.0 or greater	Does not support "out of box" HL7 or PACS compatibility. Integration with existing EMR and PACS and DICOM support are available for additional fees. This application is standards-based and can be integrated with third-party reporting software (e.g., Crystal Reports, Microsoft Access, Visual Foxpro, etc.)
Scalability	Ability to work in organizations of various sizes and functions.	Scalable	Scalable	Scalable	Additional configuration and resources may be required for large deployments.
Billing	Ability to upload, capture, and/or process billing information directly to a third party payer.	Creates a billing report form that can be sent to any system.	Has embedded ICD-9 and CPT code libraries. The uploading process to another system has to be defined.	Billing integration requires customization.	Billing integration requires customization.
Cost	License, server, and user costs.	Distributed worldwide by AMD Global Telemedicine, Inc. <ul style="list-style-type: none"> <li>tConsult Server: Perpetual Use License ranges from \$2,500 to \$20,000 depending on size of deployment.</li> <li>tConsult PC Client: Each referral site pays \$3,700 for a Perpetual Use License.</li> <li>tConsult Web Client: This Internet Explorer-based application is free of charge for consulting physicians.</li> </ul>	\$17,500 for the server software and hardware including one practice application (dermatology). Mandatory \$3,000 installation fee and mandatory \$3,000 training fee. Mandatory two year and beyond service fee of \$3,000.	\$3,500 "start-up fee" per location, which pays for TeleDerm staff to provide on-site training. Thereafter, consulting dermatologists pay a \$4 transaction fee per consult. Referral sites pay an annual maintenance fee of \$500.	Referral sites pay an average of \$2,500 for the basic version/network node and \$5,000 per site for a full version of Second Opinion Professional. Expert Edition is free for consultants.

CPT: Current Procedural Terminology  
DICOM: Digital Imaging and Communications in Medicine  
EMR: Electronic Medical Records  
HL7: Health Level Seven  
ICD-9: International Classification of Diseases, Ninth Revision  
PACS: Picture Archiving and Communication System

## VI. Application of Research Findings

TELEDERMATOLOGY IS ONE OF THE MOST rapidly expanding areas of telemedicine in the United States.<sup>11,12</sup> Among the different teledermatology delivery modalities, S&F teledermatology has significant potential to provide timely and low-cost dermatologic care to medically underserved and remote communities.<sup>9,10,13–15</sup> One of the first steps in establishing an S&F teledermatology program is the selection of an intuitive, secure, and affordable application.

In establishing any S&F teledermatology program, the decisionmakers should analyze how a teledermatology program fits into the existing organizational structure operationally, financially, and culturally.<sup>10</sup> Specifically, it will be necessary to:

- Understand specific ways in which an S&F teledermatology program fulfills needs or demands within a particular health care organization, such as increasing patient access or reducing health care costs;
- Identify alternatives to telemedicine that could help fulfill the same needs or demands;
- Compare the telemedicine reimbursement structure with that of other health care delivery models;
- Define the current workflow and the cultural perception of telemedicine programs within the organization;
- Determine resources of the organization to support S&F teledermatology; and
- Identify potential teledermatology “champions” within the organization.

When decisionmakers are ready to acquire an S&F teledermatology application, they should perform an assessment of the existing information technology (IT) capabilities within their organization. For this assessment, they could use a tailored version of the criteria from Table 1. Important elements of the IT needs assessment include understanding existing system requirements, organizational policies regarding HIPAA compliance, secure storage, transmission, and access of medical records and clinical images, integration of telemedicine data with existing EMR, and existence of electronic billing mechanisms.

Once the capabilities of the existing IT structure have been assessed, the decisionmakers should compare their organizational IT capabilities with that of the existing S&F applications to determine optimal fit. The existing S&F applications should be evaluated against the criteria outlined in Table 1 (Evaluation Criteria for Store-and-Forward Teledermatology Applications). The decision will depend on the organization’s patient volume, reimbursement and financial system, and user preferences.

The four S&F teledermatology applications evaluated in this report are mature and well-developed products. Their organization and features differ widely. Each application can handle the basic necessities of teledermatology consultations, but all four applications lack good integration with existing electronic medical records systems and billing features. In summary:

- **AFHCAN 4.9** has a simple interface with large buttons and clearly labeled data entry fields. It facilitates consultations through an interface

that is similar to email, making learning the application easy for most users. Navigation within a consult is simple, supported by self-explanatory links. It requires both local installation (tConsult Cart) and use of a Web interface (tConsult Web) to facilitate consultations. Consultants have free access to tConsult Web. AFHCAN 4.9 could be improved by allowing users to remove uploaded documents prior to transmitting a consult.

- **Medweb 7.0.0** is entirely Web-based and requires plug-in download and installation. It has broad platform compatibility, as it can be used with Windows, Linux, or Apple operating systems. Medweb 7.0.0 has rich image display and editing features in its image viewer, allowing users to perform advanced image manipulation and annotation. Patient information is automatically reformatted into a concise display for consultants. The “Patient Education File” allows users to upload documents but could be improved by allowing users to create customized templates.
- **TeleDerm Solutions 2.0** was uniquely designed for facilitating S&F dermatology consultations. It is entirely Web-based. Some users may appreciate its pre-designed, dermatology-specific templates. TeleDerm Solutions 2.0 is the only application that allows trainee involvement in the consultative process with supervision from attending dermatologists. TeleDerm Solutions can be improved by updating some technology such as auto-fill of data entry fields and allowing more than one image to be viewed simultaneously.
- **Second Opinion** is not inherently Web-based; it uses local drives or servers to store clinical information. Some users may prefer downloading information locally because this would allow them to work offline. This application is highly structured, organizing patient information into

folders and subfolders. The program has the ability to recognize return patients and collates all visits belonging to the same patient into that patient’s file. Second Opinion’s organization scheme makes it particularly useful for sites that require follow-up S&F consultations on the same patients. The program also has a robust and versatile image viewer that allows multiple images to be seen simultaneously.



## VII. Conclusion

ALL FOUR APPLICATIONS EVALUATED are capable of facilitating S&F dermatological consultations. The development of S&F teledermatology applications in the future should be focused on: reducing the cost of the applications, simplifying user interface, increased compatibility and integration with electronic medical records systems, and development of fully integrated billing capability. With continuing advances in the field of S&F teledermatology, comparative analysis of the existing S&F applications is essential to inform potential users and encourage progress in the development of S&F teledermatology applications.

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