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eMedicalDermatology Review

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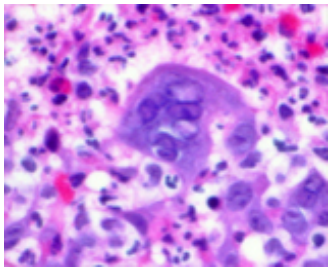

Thanks to everyone who responded to our survey. Your survey responses are valuable & everyone benefits from the results. Congratulations to the iPod winner, Michael Wirt of University of North Carolina, Chapel Hill.

[Editor's Note: The Editors of eMedicalDermatology Review thank you for your longstanding commitment to this publication.

We will be on a brief hiatus while we seek funding to continue to provide you with relevant and compelling topics every month.]

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Teledermatology

In this Issue...

Teledermatology involves the delivery of specialty care that is provided via information and communication technology wherever and whenever it is needed. There are 2 types of telemedicine systems: (1) real-time interactive (synchronous) teleconsultations using videoconferencing equipment and a patient presenter, usually a nurse; and (2) store-and-forward (asynchronous) teleconsultations, in which patient information and digital images are sent electronically to the specialist, who at a later time evaluates the data and submits his/her comments electronically to the referring physician. With the dearth and maldistribution of dermatologists in various geographic regions, teledermatology has evolved into a clinically effective economic alternative to in-person evaluations. A body of literature is available on the reliability and accuracy of diagnosis and management in teledermatology.

In this issue, we focus on store-and-forward teledermatology, reviewing the recent literature on the usefulness of teledermatology for pediatric referrals, cost savings for combat zone consults, the accuracy of teledermatology for pigmented and nonpigmented neoplasms, and the range of commercially available store-and-forward teledermatology applications.

LEARNING OBJECTIVES

After participating in this activity the participant will demonstrate the ability to:

- Evaluate the benefits and challenges associated with store-and-forward vs real-time interactive teledermatology consultations,
- Discuss the accuracy of teledermatology diagnoses,
- Describe the regulatory and reimbursement issues involved in incorporating teledermatology into clinical practice.

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Program Begins Below

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This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education through the joint sponsorship of The Johns Hopkins University School of Medicine and The Institute for Johns Hopkins Nursing. The Johns

- **Bernard A. Cohen, MD,** has indicated he has received grants for studies from Novartis Pharmaceuticals and Astellas Pharma Inc.
- **Susan Matra Rabizadeh, MD, MBA** has disclosed no relationship with commercial supporters.

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- THE ROLE AND COST SAVINGS ASSOCIATED WITH TELEDERMATOLOGY IN A COMBAT SETTING
- STORE-AND-FORWARD TELEDERMATOLOGY APPLICATIONS

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COMMENTARY

Teledermatology is an established tool for delivering dermatologic care, providing access to specialty care with good diagnostic agreement and accuracy,[1] along with high patient satisfaction, often with decreased waiting times for teleconsultations, and improved ability to triage cases, thus limiting unnecessary referrals. A review of the teledermatology literature reported that the agreement rate between clinic-based dermatologists and store-and-forward teledermatologists ranged from 57% to 95% when both the diagnosis and

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differential diagnoses were considered.[2] In their summary of the published literature, Levin and Warshaw, discuss the need for outcomes to be defined differently for studies of rashes vs studies of neoplasms.

[1] The studies by Warshaw and colleagues (reviewed in this issue) on the accuracy of diagnosis and management of nonpigmented and pigmented neoplasms using histopathology as the gold standard add to our current knowledge base. Warshaw's comparison study of teledermatology and in-person clinic dermatology revealed that although the diagnostic accuracy of teledermatology was inferior to that of clinic dermatology for nonpigmented neoplasms, the accuracy of the management plans was equivalent. In her study of the accuracy of pigmented neoplasms, in which teledermatology mismanaged 7 of 36 melanomas, the author advises caution when evaluating pigmented neoplasms by teledermatology.

Whereas in-person dermatologic care may well provide better diagnostic and/or management accuracy compared with teleconsultation with a remote dermatologist, when no dermatologic care is compared with teledermatology care, the latter is always better. In the study by Chen and associates (reviewed in this issue) of a pediatric patient cohort who received store-and-forward teledermatology consults, 96% of the patients were diagnosed and treated by teledermatologists, with only 6% requiring an in-patient evaluation. Of note, there was a high discordance between the referring physician's provisional diagnoses and prior management, and the dermatologists' diagnoses and recommended therapies, demonstrating the effectiveness of specialty intervention via use of this technology tool.

Cost savings is a potential benefit of teledermatology. The report by Henning and coworkers, reviewed herein, found significant cost savings in a military combat zone with use of store-and-forward teledermatology. On the civilian side, Medicaid reimburses for telemedicine consultations in more than half of the states in this country, since it pays patients for their travel to receive medical care.[3] In addition, 12 states have mandated reimbursement for patient care via telemedicine.

The American Academy of Dermatology Association (AADA) "supports the use of telemedicine to deliver dermatologic expertise to populations who would not otherwise have access to dermatologists."[4] The AADA endorsed the American Telemedicine Association Practice Guidelines for Teledermatology, which describe recommended clinical, technical, and administrative aspects of delivering this form of remote evaluation.[5] For those interested in learning more about the practice aspects of teledermatology, a comparison of off-the-shelf store-and-forward teledermatology applications by Armstrong and collaborators is also presented in this issue.

Resident training in teledermatology has been incorporated into several military and civilian training programs, providing a unique way for faculty to supervise residents on the required core competencies for graduate medical education[6] as well as teaching the next generation of dermatologists about this method of delivery.

Commentary References

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6. Accreditation Council for Graduate Medical Education Accessed August 24, 2010.

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ANALYSIS OF STORE-AND-FORWARD PEDIATRIC TELEDERMATOLOGY CONSULTATIONS

Chen TS, Goldyne ME, Mathes EF, Frieden IJ, Gilliam AE. **Pediatric teledermatology: observations based on 429 consults.** *J.Am Acad Dermatol*. 2010; 62(1):61-66

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To understand the potential issues involved in the use of store-and-forward teledermatology for children referred from rural California primary care facilities to a private teledermatology practice using Second Opinion software, a retrospective study of 429 pediatric teleconsultations for patients ≤12 years of age was conducted from January 2002 to May 2006. Demographics, reason for consultation, diagnostic concordance, recommended management, and follow-up recommendations were all tabulated.

Two-thirds of the patients (mean age, 5.9 years; males and females equally represented) were referred to a teledermatologist for treatment and one-third for diagnosis plus treatment. The dermatologists agreed with the referring providers' diagnoses 48% of the time. The most common diagnoses were atopic dermatitis, nevi, verruca vulgaris, and molluscum contagiosum. When the referring diagnosis was "rash" or "dermatitis," 30% of these patients had atopic dermatitis or nummular eczema, and 14% had allergic contact, irritant contact, or unspecified dermatitis. An in-person evaluation was recommended in 6% of the patients, and a follow-up teledermatology evaluation was suggested in 1.4%. Recommended therapeutic management differed from the referring providers' protocol 72% of the time, with topical steroid use, in particular, an area of major discordance.

The teledermatology diagnoses paralleled those in a typical outpatient clinic. Diagnostic concordance between the referring provider and the teledermatologist was similar to that in other studies using store-and-forward teledermatology. Topical antifungal agents and systemic antibiotics were used often by referring providers to treat noninfectious dermatologic conditions.

In this study, nearly all of the skin disorders were addressed via teledermatology. As noted earlier, only 6% of patients studied were referred for in-person evaluation, demonstrating that store-and-forward teledermatology is effective in providing specialist intervention and perhaps education to referring providers with respect to the diagnosis and treatment of common skin disorders.

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ACCURACY OF STORE-AND-FORWARD TELEDERMATOLOGY FOR NONPIGMENTED NEOPLASMS

Warshaw EM, Lederle FA, Grill JP, et al, **Accuracy of teledermatology for nonpigmented neoplasms.** *J Am Acad Dermatol.* 2009;60(4):579-588.

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An in-person dermatologist and a teledermatologist evaluated 728 patients with nonpigmented skin neoplasms, the majority of whom were Caucasian males. Both individuals generated a primary diagnosis, up to 2 differential diagnoses, and a management plan. The primary outcome was aggregated diagnostic accuracy, defined as the percent of correct matches of any chosen diagnosis with histopathology results. Management plan accuracy, a secondary outcome, was defined as the percent of correct matches with an expert panel management plan. The incremental effect of using polarized light dermatoscopy (PLD) in addition to macro images was also assessed.

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The aggregated diagnostic accuracy of teledermatology (macro images) was inferior to in-person dermatology for all lesions, as well as for the subgroups of benign and malignant lesions. However, management plan accuracy with store-and-forward teledermatology vs in-person dermatology was equivalent. Teledermatology aggregated diagnostic accuracy rates for teledermatology using PLD were significantly better than diagnostic accuracy using macro images alone (P=.0017), yielding equivalent diagnostic accuracy between teledermatologists and clinic dermatologists.

Whereas use of standard in-person clinic dermatology proved to be superior to teledermatology for diagnostic accuracy of both macro images alone and macro images plus PLD images, accuracy of the management plans was equivalent. For malignant lesions, macro plus PLD images improved teledermatology aggregated diagnostic accuracy rates, so the teledermatology and clinic dermatology rates were equivalent. Although the diagnostic accuracy of teledermatology was inferior to in-person dermatology, this study confirms the usefulness of teledermatology for the management of patients with nonpigmented lesions and emphasizes the important role of PLD images in the diagnosis of malignant nonpigmented lesions.

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ACCURACY OF STORE-AND-FORWARD TELEDERMATOLOGY FOR PIGMENTED NEOPLASMS

Warshaw EM, Lederle FA, Grill JP, et al. **Accuracy of teledermatology for pigmented neoplasms.** *J Am Acad Dermatol.* 2009;61(5):753-765

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The aim of this trial was to compare conventional in-person clinic dermatology with store-and-forward teledermatology for pigmented skin neoplasms, using the outcomes of diagnostic accuracy and appropriateness of management. The effect of using PLD or contact immersion dermatoscopy (CID) images on teledermatology accuracy rates was also studied, and the outcomes were examined with respect to both malignant and benign lesions.

Outcome measures included the following: (1) aggregated diagnostic accuracy, defined as agreement of the primary diagnosis or any of the differential diagnoses with histopathology results; (2) diagnostic accuracy of the primary diagnosis; and (3) appropriateness of the management plan, as determined by a dermatology expert panel based on histopathologic diagnoses. Patients included those referred to dermatology clinics by nondermatology health care providers for evaluation and biopsy of a pigmented skin neoplasm, as well as those undergoing removal/biopsy of a pigmented neoplasm.

For the in-person evaluation, 1 of 11 staff dermatologists completed a clinical assessment, which included the following: (1) a choice of 17 common diagnoses for 1 primary and up to 2 differential diagnoses; (2) a choice of 5 basic management plans (remove/biopsy/destroy, observe/reassure, antifungal treatment, antibiotic treatment, anti-inflammatory treatment); (3) pigmentation status; and (4) level of confidence in the chosen diagnosis and management plan. The in-person dermatologist also had a choice of “other” for the diagnosis or management plan that could be handwritten.

For the teledermatology encounter, 1 of 3 board-certified dermatologists with clinical expertise in dermatoscopy (defined as >5 years’ experience and a recognized pigmented lesion expert in the community) reviewed the digital photographs, as well as the standardized patient and lesion history that was collected by research assistants.

A panel of 3 board-certified dermatologists met in order to (1) group “other” diagnoses into diagnostic categories for analysis; (2) define the gold standard reference management plans for each lesion category; and (3) qualitatively rate the severity of differences in chosen management plans as “minor” (non–life-threatening, no delay in appropriate therapy), “moderate” (non–life-threatening, possible delay in appropriate therapy), or “major” (potentially life-threatening).

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The majority of the 542 patients studied were male, elderly, and Caucasian; one-fourth of the participants had a history of nonmelanoma skin cancer and 6% had a personal history of melanoma. Histopathologic categories included the following: 23% benign keratoses, 21% dysplastic nevi, 15% benign nevi, and 12% pigmented basal cell carcinomas; 36 of the lesions were melanomas.

Aggregated diagnostic accuracy for clinic dermatology was superior to teledermatology accuracy for all image types. For primary diagnostic accuracy, teledermatology and clinic dermatology were equivalent when macro images and CID images were viewed by teledermatologists. Clinic dermatology was significantly more accurate for macro images only and for macro images plus PLD images. The rates of appropriate management were equivalent for macro images only and for macro images plus PLD images. Teledermatology was significantly better than clinic dermatology for all 3 image types. No significant differences in accuracy rates were reported between macro images alone and macro images plus PLD images. Adding CID images significantly enhanced primary diagnostic accuracy, but not aggregated diagnostic accuracy or management plan appropriateness.

Regarding the results for malignant lesions, aggregated diagnostic accuracy rates with clinic dermatology were superior to those with teledermatology. Moreover, clinic dermatology was superior with respect to management appropriateness (all image types) for malignant lesions.

Compared with clinic dermatology, using histology as the gold standard, the mismanagement of melanomas with teledermatology was significant. With clinic dermatology, 1 lentigo maligna was mismanaged; with teledermatology, 7 melanomas were mismanaged when macro images were viewed alone, 3 were mismanaged when macro and PLD images were viewed, and 5 were mismanaged when macro and CID images were viewed. The findings of the study are summarized below:

1. Teledermatology was not equivalent to clinic dermatology for aggregated diagnostic accuracy, regardless of the image type (macro images alone, macro plus PLD images, or macro plus CID images).

2. Clinic dermatology was inferior to teledermatology with respect to management appropriateness.

3. The severity of inappropriate management was worse with teledermatology than with clinic dermatology for all image types. In all, 7 of the 36 melanomas (19%) would have been mismanaged by teledermatology, compared with 1 of the 36 (3%) by clinic dermatology.

4. Although teledermatology diagnostic accuracy and management plan appropriateness rates improved with the addition of dermatoscopic images (PLD or CID images), only primary diagnostic accuracy (macro plus CID images vs macro images alone) was significantly better.

5. In all cases (the overall group, the benign lesion subgroup, and the malignant lesion subgroup), the addition of PLD or CID images improved the aggregated and primary diagnostic accuracy of teledermatology. However, the only statistically significant improvements were observed with primary diagnostic accuracy for all pigmented lesions, as well as for benign, but not malignant, lesions.

6. The rate of management plan appropriateness with teledermatology using macro images alone did not differ significantly with the addition of PLD or CID images.

7. It is important to note that the participating dermatologists were aware that this was a study that may have influenced their decisions and that the majority of mismanaged melanomas were evaluated by the same teledermatologist, and the authors attributed this to chance. Also, this study was not a functioning site-to-site teledermatology program as the authors state.

Compared with other studies of teledermatology accuracy for pigmented skin neoplasms using histopathology as the gold standard, the primary diagnostic accuracy rates of 59% with clinic dermatology and 50% to 57% with teledermatology using macro images alone were higher than a similar study with 144 pigmented lesions, including 4 melanomas and

rates of 43% for clinic dermatology and 47% for Teledermatology.[1] . For teledermatoscopy, the diagnostic accuracy rates of 50% to 67% in this study are lower than those from other studies, with rates of 75%, 86%, and 81% to 95% reported. [2,3,4]

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THE ROLE AND COST SAVINGS ASSOCIATED WITH TELEDERMATOLOGY IN A COMBAT SETTING

Henning JS, Wohltmann W, Hivnor C. **Teledermatology from a combat zone.** *Arch Dermatol.* 2010;146(6):676-677.

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Since 2004, the US Army has operated a store-and-forward teledermatology consult service for deployed medical providers. Between January 2005 and January 2009, a total of 2197 US Army teledermatology consults were sent by deployed health care providers to on-call consulting dermatologists via a store-and-forward system, transmitting digital photographs and a brief history by a single secure e-mail at a monitored server. More than 40 on-call dermatologists participated in a rotation system in which they answered the consults and provided comments to the responding dermatologist. The percent of total consultations and diagnostic agreement between the primary care physician and the dermatologist was calculated. Costs for patient transportation to an in-person dermatology consult within the combat zone and also for evacuation to the United States were also calculated.

A review of 2197 consultations revealed that 2157 patients could be managed in Iraq and 40 patients needed to be evacuated to the United States for evaluation. The most common diagnoses were eczema (13%), fungal infection (7%), and bacterial infection (7%). There was a 34% diagnostic agreement between the referring provider's provisional diagnosis and the teledermatology consultant's diagnosis. The diagnoses most often identified correctly by the referring provider were smallpox vaccination reactions (59%) and leishmaniasis (75%). The teledermatologist responded with a single definitive diagnosis in 75% of the consultations and with a differential diagnosis in 25% of the consults. In addition, the teledermatologist recommended evacuation to the United States for 2% (40) of the patients; evacuation for an in-person evaluation by the dermatologist in Iraq was recommended for 5% (104) of the patients. The cost associated with evacuation to the United States was estimated to be $562,380, and the cost associated with evacuation to the dermatologist in Iraq was estimated to be $416,000.

The authors noted that because of the high demand and low availability of dermatologists in the military, teledermatology is an excellent specialist extender, allowing primary health care providers worldwide to have access to dermatology consults. An additional benefit of teledermatology in the combat setting is "the incalculable savings of avoiding the risk of travel in a war zone." For incarcerated patient populations, transportation costs and risks are significant, with teledermatology an effective cost-saving and risk- avoidance method for delivering medical care to these patients. In the civilian sector, telemedicine can reduce patient costs associated with travel and time away from work and family.

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STORE-AND-FORWARD TELEDERMATOLOGY APPLICATIONS

Armstrong AW, Sanders C, Farbstein AD, et al. **Evaluation and comparison of store-and-forward teledermatology applications.** *Telemed J E Health.* 2010;16(4):424-438.

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The 4 major, commercially available store-and-forward (asynchronous, deferred) teledermatology applications were evaluated by 3 groups of individuals: (1) new users of teledermatology applications; (2) experienced, high-volume teledermatologists (defined as a dermatologist performing ≥20 store-and-forward consultations monthly with a particular application); and (3) information technologists. The 4 applications assessed were the Alaska Federal Health Care Access Network (AFHCAN), Medweb, TeleDerm Solutions, and Second Opinion. All of the applications were found to be mature and capable of handling store-and-forward teledermatology consultations.

Available since 1999, AFHCAN has been implemented in >340 Alaskan sites. AFHCAN is Web-based, and is reported to be easy to learn based on an intuitive interface, as well as the ability to customize patient information forms and to be efficient for a high volume of teleconsultations.

With >350 customers, Medweb has been available for 20 years and was created as a teleradiology application. Medweb is Web-based and has robust image viewer features, with zoom, rotate, annotate, and label capabilities.

TeleDerm Solutions, developed specifically for the field of dermatology, is also Web-based. Thumbnail images are visible when viewing written clinical information. With TeleDerm Solutions, it is not possible to customize forms and the image upload is slow—that is, 1 image at a time—because of the older Web interface. It has a security feature that requires confirmation of log-in credentials at several stages during the consultation process, as well as the capability of having a draft consultation created by a resident to be reviewed by an attending physician.

Established in 1994, Second Opinion is currently utilized in >18,000 locations. The software is self-installed and monitored by the user with no central location (ie, it is not Web-based). In addition, with Second Opinion, there is robust image viewing. The consultant version is free and the referring sites must purchase the software in order to create cases for submission. It has been reported that Second Opinion requires more instructions and practice to operate the application.

According to the authors, all of the applications evaluated need to increase their compatibility and integration with electronic medical records; develop an integrated billing capability; simplify their user interface; allow users to design templates for recommendations and patient education; and reduce their costs. The choice of a teledermatology application is a critical one for a clinician or organization, and this analysis offers a comprehensive review of the current commercially available options.

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