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Strategies for Teaching Store-and-Forward Teledermatology: A Survey of U.S. Dermatologists

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Abstract

Background

Teledermatology, a vital component of the COVID-19 pandemic, involves transmitting images of skin conditions to dermatologists from other providers or patients directly. The swift adoption of store-and-forward (SAF) teledermatology in residency programs highlighted the need for structured resident education amidst patient care priorities and logistical challenges. Since utilization of teledermatology has grown, we recognized the importance of identifying the strategies faculty use to teach future dermatologists SAF teledermatology.

Methods

The study employed a seven-step medical education questionnaire design process. A national survey was distributed in July 2024 to 127 teledermatology educators. The survey included questions about program characteristics and the use and effectiveness of ten educational strategies. The responses from the questionnaire were summarized with descriptive statistics through Microsoft Excel, and free-response questions were categorized with inductive coding.

Results

52 dermatologists (40.9% response rate) across all nine census bureau divisions of the US participated. The three strategies that teledermatology educators use most often include asking residents for differential diagnoses and leading diagnoses on images (n = 36 [92.3%]), reviewing relevant morphology (n = 36 [92.3%]), and describing systematic approaches to diagnosis and management (n = 31 [79.5%]). These three strategies were also rated as the most effective.

Conclusions

A systematic questionnaire development process identified critical educational strategies for teaching SAF teledermatology. These included soliciting diagnoses, reviewing morphology, and outlining diagnostic and management plans. Dermatology educators may consider utilizing these strategies to optimize teledermatology teaching to residents.

Background

The COVID-19 pandemic led to the widespread adoption of telemedicine.[1] Within the field of dermatology, store-and-forward (SAF) teledermatology, a platform that allows physicians to remotely diagnose and manage skin conditions in patients through image transmission, has rapidly expanded

care to underserved populations.[2–4] Despite this growth of SAF teledermatology, there is no clear consensus on how to train future dermatologists in this technology.

A 2020 survey showed that 96% of respondent dermatology residency programs incorporated teledermatology post-pandemic, compared to 30% pre-pandemic.[5] SAF teledermatology is widely used in dermatology residency programs and offers unique educational opportunities for trainees.[6] During the COVID-19 pandemic, training and clinic workflow disruptions threatened the quality of dermatology resident education.[7] Many programs developed creative solutions to maintain educational opportunities for dermatology residents, such as incorporating residents in multi-provider video visits[7] and allowing residents to review SAF teledermatology case lists with a consultant at regular sessions.[8] While these models sustained educational opportunities for residents, there is a lack of guidance about the specific educational strategies for teaching the skills and nuances of SAF teledermatology to residents.

Despite the growth of teledermatology, not all residency programs incorporate this practice into their curricula. While the American Academy of Dermatology has developed a Teledermatology tool kit and a one-hour online course “Making Teledermatology Work for You: Practice Integration, Training, and Coding” to address the educational gap for practicing dermatologists, there are no guidelines or standards for teaching teledermatology to residents.[9,10] This study aimed to identify the educational strategies dermatology faculty use to effectively teach SAF teledermatology to residents within SAF teledermatology case sign-outs, a process where a learner and educator review images, make a diagnosis, and create a management plan.

Methods

A 19-question survey and accompanying interview guide were developed specifically for this study through a seven-step medical education questionnaire design process.[11] A scoping review of methods for teaching telehealth, retrieving 466 articles and extracting data from 14 articles, was conducted to identify effective strategies for teaching asynchronous telehealth across multiple specialties.[12] Observations of SAF teledermatology sessions and interviews with residents and attendings were completed to characterize the process of teaching teledermatology. The findings from the scoping review and interviews were synthesized to develop survey items on Qualtrics. Expert validation, cognitive interviews, and pilot testing were conducted with four teledermatology educators and one medical education expert. Optional interviews, guided by a semi-structured interview guide developed for this study, were also offered to participants to gain additional feedback on improving teledermatology education. The full English-language survey instrument and interview guides are provided in the Supplementary Material.

The survey was distributed to 127 teledermatology educators nationwide in July 2024. Dermatologists specializing in teledermatology education were identified through faculty profiles on program websites, research publications, and/or through confirmation from program directors. After available

teledermatology educator email addresses were collected, the survey was sent by personalized email, inviting participation via Qualtrics. All respondents indicated their consent to participate in the survey. Survey completion was optional. Participants were eligible to enter a drawing for a $50 gift card.

Survey data were exported from Qualtrics and analyzed through Microsoft Excel. Missing data were excluded from the analysis on an individual question basis. Quantitative data were analyzed with frequency counts, percentages, and mean and standard deviation calculations. Patterns in qualitative data from free-response questions and interviews were identified with inductive coding.

Participant privacy was protected with confidential survey responses and the discarding of direct identifiers. The study received exempt certification from the UCSF Institutional Review Board.

Results

The response rate was 40.9% (52 of 127 dermatologists); as not all survey questions were mandatory, the number of respondents to individual questions ranged from 36 to 52. The average number of years served as an educator within an academic department was 13.9 ± 10 years. Respondent dermatologist characteristics and the residency programs they teach at are summarized in Fig. 1. Dermatologists from all nine US ERAS geographic divisions participated, with most dermatologists from the East North Central (n = 9 of 37 [24.3%]), Pacific (n = 6 [16.2%]), and Mountain (n = 5 [13.5%]) regions. The types of teledermatology services offered at respondents' institutions include SAF (n = 36 of 37 [97.3%]), live interactive (n = 30 [81.1%]), and hybrid (n = 18 [48.6%]). The most common teledermatology practice settings were Veterans Health Administration Hospital outpatient (n = 19 of 37 [51.4%]), academic medical center inpatient (n = 18 [48.6%]), and academic medical center outpatient (n = 12 [32.4%]).

Dermatologists reported an average of 14.9 ± 5.2 residents in their program, with a minimum of 6 and a maximum of 25. Respondents reported a variety of teledermatology curriculum components in their programs, including in-person or virtual clinical experience (n = 31 of 36 [86.1%]), didactics (n = 18 [50.0%]), and reading textbooks and journal articles (n = 13 [36.1%]) (Fig. 1). Time that dermatology residents were exposed to SAF teledermatology ranged from less than 1 week to 52 weeks per year, with many programs integrating teledermatology into consult services rather than having a dedicated rotation. In an average week, respondents estimated that residents dedicate anywhere from less than 1 hour per week for programs without a dedicated rotation to 40 hours per week while on a dedicated month-long rotation.

Teledermatology educators' reported use and evaluation of the effectiveness of ten educational strategies during a SAF teledermatology case sign-out are summarized in Fig. 2. The three most used strategies were also the three most effective. Most respondents (n = 36 of 39 [92.3%]) often or almost always ask the trainee for a differential and leading diagnosis for imaging findings, and 90.9% of respondents (n = 30 of 33) rated this strategy as quite or extremely effective. An identical number of respondents (n = 36 of 39 [92.3%]) often or almost always review relevant morphology with trainees, and 78.8% (n = 26 of 33) rated this strategy as quite or extremely effective. For the third most used and

effective strategy, 79.5% of respondents (n = 31 of 39) often or almost always describe their diagnostic and management approaches with trainees, and 75.8% (n = 25 of 33) rated this strategy as quite or extremely effective. On the opposite end, the least used strategy was soliciting the trainee's goals for the session, with 71.8% (n = 28 of 39) of respondents reporting that they do this once in a while or almost never, and 41.9% (n = 13 of 31) evaluating the strategy as not at all or slightly effective.

A free-response question asked dermatologists about the techniques and/or content they incorporate into SAF teledermatology sign-out sessions to educate residents on inclusive care for patients from diverse backgrounds and across a spectrum of skin tones. These strategies included reviewing different manifestations of clinical findings in skin of color, discussing barriers to dermatologic care and cost-effective treatments for underserved patients, and using resources such as VisualDx, texts, and teaching archives to learn about a diagnosis in patients of color.

Optional interviews with four participants yielded additional insights. Dermatologists discussed the importance of teaching residents to assess image quality and the value of describing diagnostic algorithms and categories (e.g., inflammatory vs. infectious vs. neoplastic). Further teaching recommendations included using a standardized template when discussing cases by having the resident describe the image, provide a differential diagnosis, provide a diagnostic and/or treatment plan based on the statistical likelihood of each diagnosis, and provide an appropriate backup plan for in-person evaluation.

Discussion

This national survey of US dermatologists is the first known study to systematically characterize instructional strategies used to teach store-and-forward (SAF) teledermatology to residents using a rigorous, seven-step medical education survey development process. Beyond describing curricular adoption, this study identifies specific, educator-endorsed teaching behaviors that may form the foundation of a structured teledermatology training. The strategies most frequently used and rated as most effective, eliciting differential diagnoses, reviewing morphology, and modeling diagnostic and management reasoning, center on active clinical reasoning and structured image analysis. These findings shift the focus from whether teledermatology is incorporated into residency training to how it is taught, providing preliminary guidance for programs seeking to develop competency-based teledermatology curricula. This study also highlights practical approaches to incorporate inclusive care for patients from diverse backgrounds into teledermatology education by exploring variations in clinical presentations on skin of color and discussing structural barriers to dermatologic care.

The study expands on prior scholarship on teaching strategies used in one-on-one interactions between educator and learner in a workstation setting. Many studies have come from radiology, which, like SAF teledermatology, involves thorough image analysis. Insights from radiology educators have highlighted similar effective strategies for image analysis, including reviewing a search pattern, reviewing radiology anatomy, and asking for a differential on an imaging finding,[13–15] which parallel the most used and

effective strategies in this study. Notably, the most effective strategies identified in our survey reflect elements of cognitive apprenticeship, including articulation of reasoning, modeling of expert thought processes, and structured scaffolding of diagnostic categories. By prompting learners to verbalize hypotheses and management plans, educators may facilitate the development of clinical reasoning skills specific to asynchronous image-based care. Interestingly, while these radiology educators have described the value of setting goals before a rotation or teaching session, our study found that soliciting a trainee's daily goals during a SAF teledermatology session was the least frequently used and least effective strategy. We suspect that educators and trainees may use existing objectives from teledermatology rotation syllabi to guide sessions, and/or the number of cases to review and limited time per session may hinder individual goal setting.

A previous survey of dermatology residents at the University of Ottawa found that 91% (n = 10 of 11) of resident respondents reported wanting to incorporate teledermatology-based learning into the dermatology curriculum.[16] Our survey demonstrated substantial variability in the duration and structure of SAF teledermatology exposure across residency programs, ranging from minimal weekly exposure integrated into consult services to dedicated full-time rotations lasting several weeks. The variation in SAF teledermatology exposure in the post-pandemic period underscores the need for more standardized approaches to prepare future dermatologists for a practice that almost certainly involves caring for patients remotely. The strategies identified in this study offer a preliminary instructional framework that programs can adopt to promote more standardized skill development.

To encourage effective teaching of SAF teledermatology to residents, especially among programs without a dedicated rotation, we recommend the following strategies during SAF case sign-out sessions:

- Engage residents in hypothesis-driven reasoning by eliciting differential diagnoses, reviewing morphology, and prompting explicit articulation of management plans.
- Deliberately incorporate image resources with diverse skin tones and discuss variations in presentation and access to care across patient populations.
- Incorporate structured templates into sessions to guide case discussion (e.g., resident describes image, diagnoses condition, provides a diagnostic/management plan, provides a back-up plan) and encourage residents to articulate their clinical reasoning.

These approaches operationalize the educator-endorsed strategies identified in this study and may facilitate more reproducible teaching across institutions. By utilizing these strategies evaluated and used by SAF teledermatology educators, dermatologists can help equip residents with the knowledge and skills they need to care for diverse patient populations in their future practice.

This study's limitations include its 40.9% response rate, which may compromise the generalizability of the study. Some institutions had several teledermatology educators invited to participate in the survey. Also, the method of identifying teledermatology educators did not capture all potential participants; likely, many eligible dermatologists did not receive an invitation to the study. Thus, study results may

capture institutional practices rather than accurately reflect the entire target population's experiences. The reduced sample size of this study increases the risk of sampling error and lowers statistical power. Last, missing survey data, possibly from the optional survey completion and a relatively large number of open-ended questions, may bias estimates. Additionally, the study relied on educator self-report of strategy use and perceived effectiveness rather than objective measures of resident learning outcomes. As such, reported effectiveness reflects faculty perception and may not directly correlate with measurable improvements in resident competency. Response bias and nonresponse bias may also limit generalizability, as educators with greater interest in teledermatology education may have been more likely to participate.

From these results, future directions include gaining dermatology residents' perspectives on the most effective educational strategies for their learning. Prospective studies examining the frequency of use of the ten specific educational strategies in this study, as well as pre- and post-test scores of residents learning SAF teledermatology, may uncover how exposure to these strategies directly influences clinical knowledge and skill-building. Moreover, given the rising use of SAF teledermatology in both consultative and direct-to-consumer settings, another next step is to incorporate resident training on the nuances of communicating recommendations in clear and appropriate language to primary care providers and patients. Finally, as part of a long-term effort to standardize SAF teledermatology teaching, further work is needed to formally map the Dermatology Milestones from the Accreditation Council for Graduate Medical Education (ACGME)[17] onto teledermatology rotation objectives, which could provide a structured pathway for integrating teledermatology into competency-based training.

Conclusions:

Teledermatology has evolved from a pandemic-driven adaptation to a core component of contemporary dermatologic practice. This national survey of US teledermatology educators found that the most used and effective educational strategies for teaching SAF teledermatology to residents include asking trainees for differential diagnoses on imaging findings, reviewing relevant morphology, and describing systematic diagnostic and management approaches. Critical strategies for incorporating principles of inclusive care into teledermatology training include examining diverse presentations of clinical findings in skin of color and discussing barriers to care. The substantial variability in curricular exposure across programs underscores the need for more standardized approaches to teledermatology training. Given the increasing use of SAF teledermatology in consultative, direct-to-consumer, and population-based care models, formal instruction in asynchronous communication and documentation for primary care providers and patients represents an important next step in resident education.

Abbreviations

SAF
store-and-forward
UCSF

University of California, San Francisco

Declarations

Declarations

Ethics approval and consent to participate

This survey study was approved by the Institutional Review Board (IRB) at the University of California, San Francisco (approval/exemption number: 24-41326**)** and received exempt certification. All methods were performed in accordance with the relevant guidelines and regulations, including the Declaration of Helsinki. All respondents provided informed consent to participate prior to enrollment.

Consent for publication

Not applicable

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Author Contribution

KE and AT conceptualized the study. KE, AT, and GM screened articles for the scoping review. KE and AT and designed and distributed the survey. KE collected and analyzed the survey data. KE was a major contributor in writing the manuscript. All authors read, edited, and approved the final manuscript. AT made the decision to publish.

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Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Figures

Variable	Dermatologists, No. (%)
Geographic Region (n = 37)	
New England	3 (8.1%)
Middle Atlantic	4 (10.8%)
East North Central	9 (24.3%)
West North Central	3 (8.1%)
South Atlantic	3 (8.1%)
East South Central	2 (5.4%)
West South Central	2 (5.4%)
Mountain	5 (13.5%)
Pacific	6 (16.2%)
Teledermatology Practice Settings (n = 37)	
Academic medical center (inpatient)	18 (48.6%)
Academic medical center (outpatient)	12 (32.4%)
Veterans Health Administration Hospital (inpatient)	5 (13.5%)
Veterans Health Administration Hospital (outpatient)	19 (51.4%)
County hospital (inpatient)	7 (18.9%)
County hospital (outpatient)	11 (29.7%)
Community hospital (inpatient)	4 (10.8%)
Community hospital (outpatient)	6 (16.2%)
Other: Rural private practice	1 (2.7%)
Types of Teledermatology Practiced (n = 37)	
Store-and-forward	36 (97.3%)
Live interactive	30 (81.1%)
Hybrid	18 (48.6%)
Curriculum Components (n = 36)	
Synchronous didactic curriculum (live lectures)	10 (27.8%)
Asynchronous didactic curriculum (self-paced modules)	8 (22.2%)
Readings (texts, journal articles, etc.)	13 (36.1%)
In-person or virtual clinical experience	31 (86.1%)
Industry sponsored courses	0 (0.0%)
Society offered courses	3 (8.3%)
Conferences	5 (13.9%)
Panels	0 (0.0%)
Small group learning	11 (30.6%)

Figure 1

Characteristics of Respondent Dermatologists and Residency Programs

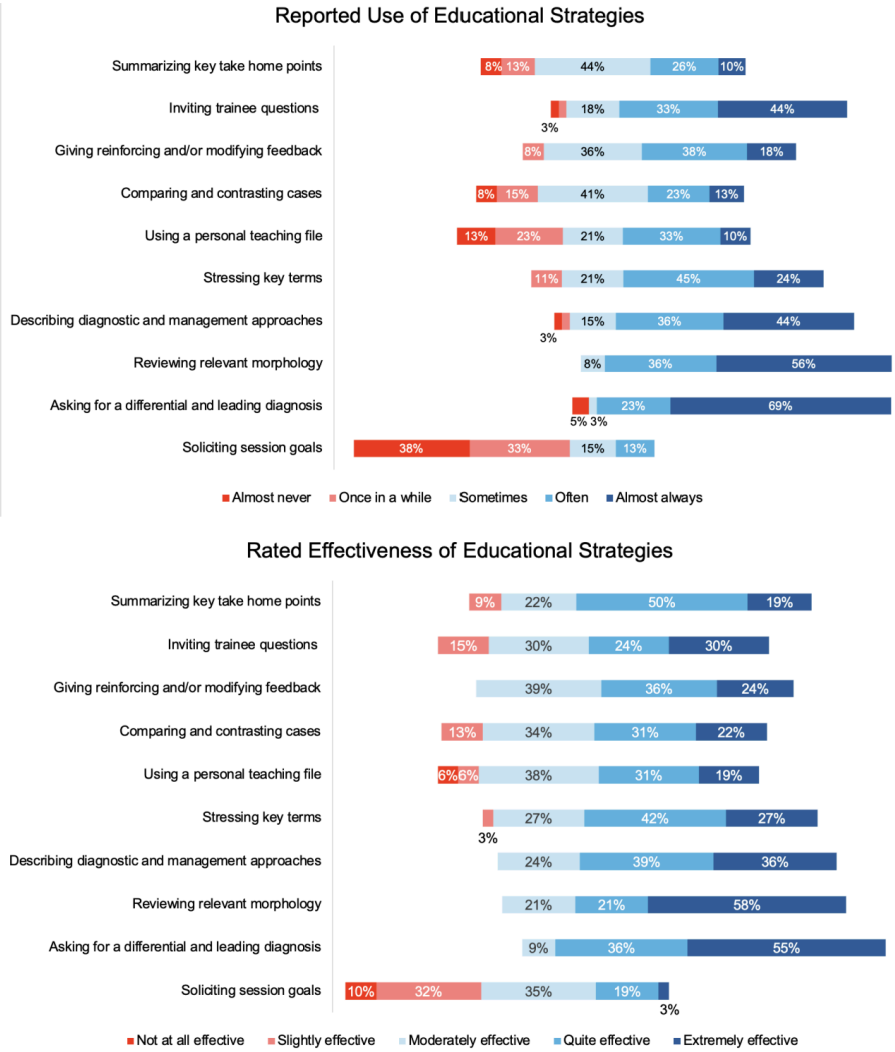


Figure 2

Dermatologists' reported use and evaluation of the effectiveness of educational strategies for SAF teledermatology

Supplementary Files

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- Supplementalmaterial11SEP2026.docx