

Teledermatology in the US Military: A Historic Foundation for Current and Future Applications

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PRACTICE POINTS

- Teledermatology is increasing in its use and applications in both military and civilian medicine.
- The increased availability of high-quality digital photography as a result of smartphone technology lends itself well to store-and-forward (S&F) teledermatology applications.
- In the civilian community, new methods and platforms for teledermatology have been created based largely on those used by the military to maximize access to and efficiency of health care, including secure direct-to-consumer (DTC) mobile applications, live interactive methods, and integrated S&F platforms within electronic health record (EHR) systems.

Historically, the US military has utilized centralized store-and-forward (S&F) telemedicine programs for health care providers in remote locations worldwide. In the civilian community, new methods and platforms for teledermatology have been created based largely on those used by the military to maximize access to and the efficiency of health care, including secure direct-to-consumer (DTC) mobile applications for patients, live interactive methods, and integrated S&F platforms for dermatology services within electronic health record (EHR) systems. By incorporating similar innovative teledermatology methods and platforms, the US military health care system may benefit from increased accessibility and productivity.

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Telemedicine arose from the need to provide critical and timely advice directly to health care providers and patients in remote or resource-scarce settings. Whether by radio, telephone, or other means of telecommunication technology, the US military has long utilized telemedicine. What started as a way to expedite the delivery of emergency consultations and medical expertise to remote populations in need has since evolved into a billion-dollar innovation industry that is poised to improve health care efficiency and access to specialist care as well as to lower health care costs for all patients.

Teledermatology in the Military

A primary mission of military medicine is to keep service members anywhere in the world in good health on the job during training, combat, and humanitarian operations.¹ Telemedicine greatly supports this mission by bringing the expertise of medical specialists to service members in the field without the cost or risks of travel for physicians. Telemedicine also is effective in promoting timely triage of patients and administration of the most appropriate levels of care. With the advent and globalization of high-speed wireless networks, advancements in telemedicine continue to develop and are becoming increasingly useful in military medicine.

As a specialty, dermatology is heavily reliant on visual information and therefore is particularly amenable to telemedicine applications. The rising popularity of such services has led to the development of the term *teledermatology*. While early teledermatology services were provided using radio, telephone, fax, and videoconferencing,² three

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distinct visual methods typically are used today, including (1) store-and-forward (S&F), (2) live-interactive, and (3) a hybrid of the two.³ Military dermatology predominantly utilizes an S&F system, as still photographs of lesions generally are preferred over video for more focused visualization.

In 2004, the US Army Medical Department established a centralized telemedicine program using Army Knowledge Online,¹ an S&F system that allows providers in remote locations to store and forward information about a patient's clinical history along with digital photographs of the patient's condition to a military dermatologist to review and make a diagnosis or suggest a treatment from a different location at a later time. Using this platform to provide asynchronous teledermatology services avoids the logistics required to schedule appointments and promotes convenience and more efficient use of physicians' time and resources.

Given the ease of use of S&F systems among military practitioners, dermatology became one of the most heavily utilized teleconsultation specialties within the Army Knowledge Online system, accounting for 40% of the 10,817 consultations initiated from April 2004 to December 2012.⁵ It also is important to note that skin conditions historically account for 15% to 75% of outpatient visits during wartime; therefore, there is a need for dermatologic consultations, as primary care providers typically are responsible for providing dermatologic care to these patients.⁶ Because of the high demand for and low volume of US military dermatologists, the use of teledermatology (ie, Army Knowledge Online) in the US military became a helpful educational tool and specialist extender for many primary care providers in the military.

Teledermatology in the military has evolved to not only provide timely and efficient care but also to reduce health care costs. In a retrospective evaluation of the US Department of Defense's teledermatology consultation program from April 2004 to December 2012, as many as 98% of teledermatology consultations were answered within 24 hours of submission, 46 medical evacuations were avoided, and 41 medical evacuations were facilitated.⁴ In a study of teledermatology services used by deployed clinicians in Iraq from January 2005 to January 2009, it was estimated that teledermatology services would help save the military approximately \$30.4 million among 2157 dermatology patients.⁷

Advances in Teledermatology

While the military continues to use S&F teleconsultations—a model in which a deployed referring clinician sends information to a military dermatologist for diagnosis and/or management recommendations—a number of teledermatology programs have been developed for civilians that provide additional advantages over standard face-to-face dermatology care. The advantages of S&F teledermatology applications are many, including faster communication with dermatology providers, diagnostic concordance

comparable to face-to-face appointments, cost-effective care for patients, the ability to educate providers remotely,⁸ and similar outcomes to in-person care.⁹ However, as to be expected, in-person care remains the gold standard, especially when diagnostic accuracy depends on biopsy findings. A recent systematic review of teledermatology applications in the diagnosis and management of skin cancer showed that the diagnostic accuracy of in-person dermatology consultations remained higher than the accuracy provided by teledermatology consultations; however, as a result of additional technological advances in the quality of digital photography, some investigators have reported high accuracy when macroscopic and dermoscopic images were used in tandem.¹⁰

The development of the smartphone along with advances in digital photography and consumer-friendly mobile applications has allowed for the emergence of direct-to-consumer (DTC) teledermatology applications. Regardless of the user's ability, the quality of photographs taken with smartphones has improved, as standard features such as high-resolution cameras with image stabilization, automatic focus, and lighting have become commonplace. The popularity of smartphone technology also has increased, with nearly 75% of all adults and more than 90% of adults younger than 35 years of age owning a smartphone according to a 2016 survey.¹¹

In 2015, there were at least 29 DTC teledermatology applications available on various mobile platforms,¹² accounting for an estimated 1.25 million teleconsultations with providers.¹³ Teledermatology platforms such as DermatologistOnCall and Spruce Health have made accessing dermatologic care convenient, timely, and affordable for patients via patient-friendly mobile applications. Direct-to-consumer telemedicine allows patients to communicate directly with a specialist without the need for a referral from a primary care provider–gatekeeper.¹⁴

Regular access to dermatologic care is especially important for patients who have chronic skin conditions. Several unique practice models have emerged as innovative solutions to providing more convenient and timely care. For example, Curology (<https://curology.com>) is an online teledermatology practice specializing in acne treatment. The cost to the patient includes unlimited dermatology consultations via a web application and custom-made prescription topical medication sent by mail. Clarify Medical (www.clarifymed.com) makes phototherapy easy for patients and health care providers. Although narrowband UVB treatment traditionally is administered in a dermatologist's office 3 times weekly for several months until a skin condition has cleared, this smartphone application facilitates convenient, at-home phototherapy. An app-enabled light source allows patients to treat themselves in their own homes within the parameters of a physician's prescription.

Although DTC teledermatology practices are convenient for many patients and providers, some have been criticized for providing poor quality of care¹² or facilitating

fragmented care by not integrating with established electronic health record (EHR) systems.¹⁵ As a result, recommended practice guidelines for DTC teledermatology have been developed by the American Academy of Dermatology and some state medical boards.¹⁶ Moreover, several EHR systems, such as Epic (www.epic.com) and Modernizing Medicine's EMA (www.modmed.com), have developed fully integrated S&F teledermatology platforms to be incorporated with established brick-and-mortar care.¹⁷

The Future of Teledermatology in the Military

The Army Knowledge Online telemedicine platform used by the US military has continued to be useful, particularly when treating patients in remote locations, and shows promise for improving routine domestic dermatology care. It has reduced the number of medical evacuations and improved care for those who do not have access to a dermatologist.⁴ Furthermore, one study noted that most consultations submitted via teledermatology applications from a combat zone received a diagnosis and treatment recommendation from a military dermatologist faster than they would have stateside, where the wait often is 4 to 8 weeks. On average, a teledermatology consultation from Afghanistan was answered in less than 6 hours.⁴ Although this response time might not be realistic for all dermatology practices, there clearly is potential in certain situations and utilizing certain models of care to diagnose and treat more patients more efficiently utilizing teledermatology applications than in an in-person office visit. A review of 658 teledermatology consultations in the US military from January 2011 to December 2012 revealed that the leading diagnoses were eczematous dermatitis (14%), contact dermatitis (9%), nonmelanoma skin cancer (5%), psoriasis (4%), and urticaria (4%).⁴ Increased use of teledermatology evaluation of these conditions in routine US-based military practice could help expedite care, decrease patient travel time, and utilize in-clinic dermatologist time more efficiently. Teledermatology visits for postoperative concerns also have demonstrated utility and convenience for triage and management of patients in the civilian setting and may be an additional novel use of teledermatology in the military setting.¹⁸ With the use of an integrated S&F teledermatology platform within an existing EHR system that is paired with a secure patient mobile application that allows easy upload of photos, medical history, and messaging, it can be argued that quality of life could greatly be enhanced for both military patients and providers.

Limitations of Teledermatology

Certainly, there are and will always be limitations to teledermatology. Even as digital photography improves, the quality and context of clinical images are user dependent, and key associated skin findings in other locations of the body can be missed. The ability to palpate the skin also is lacking in virtual encounters. Therefore, teledermatology might be considered most appropriate for specific diseases

and conditions (eg, acne, psoriasis, eczema). Embracing teledermatology does not mean replacing in-person care; rather, it should be seen as an adjunct used to manage the high demand for dermatology expertise in military and civilian practice. For the US military, the promise and potential to embrace innovation in providing dermatologic care is there, as long as there are leaders to continue to champion it. In the current state of health care, many of the perceived barriers of teledermatology applications have already been overcome, including lack of training, lack of reimbursement, and perceived medicolegal risks.¹⁹

The US Federal Government is a large entity, and it will undoubtedly take time and effort to implement new and innovative programs such as the ones described here in the military. The first step in implementation is awareness that the possibilities exist; then, with the cooperation of dermatologists and support from the chain of command, it will be possible to incorporate advances in teledermatology and cultivate new ones.

Final Thoughts

The S&F teledermatology method used in the military setting has become commonplace in both military and civilian settings alike. Newer innovations in telemedicine, particularly in teledermatology, will continue to shape the future of military and civilian medicine for years to come.

REFERENCES

1. Vidmar DA. The history of teledermatology in the Department of Defense. *Dermatol Clin*. 1999;17:113-124.
2. McManus J, Salinas J, Morton M, et al. Teleconsultation program for deployed soldiers and healthcare professionals in remote and austere environments. *Prehosp Disaster Med*. 2008; 23:210-216.
3. Tensen E, Van Der Heijden JP, Jaspers MW, et al. Two decades of teledermatology: current status and integration in national healthcare systems. *Curr Dermatol Rep*. 2016;5:96-104.
4. Hwang JS, Lappan CM, Sperling LC, et al. Utilization of telemedicine in the U.S. military in a deployed setting. *Mil Med*. 2014;179:1347-1353.
5. McGraw TA, Norton SA. Military aeromedical evacuations from central and southwest Asia for ill-defined dermatologic diseases. *Arch Dermatol*. 2009;145:165-170.
6. Shissel DJ, Wilde J. Operational dermatology. *Mil Med*. 2004; 169:444-447.
7. Henning JS, Wohltmann W, Hivnor C. Teledermatology from a combat zone. *Arch Dermatol*. 2010;146:676-677.
8. Whited JD, Hall RP, Simel DL, et al. Reliability and accuracy of dermatologists' clinic-based and digital image consultations. *J Am Acad Dermatol*. 1999;41:693-702.
9. Pak H, Triplett CA, Lindquist JH, et al. Store-and-forward teledermatology results in similar clinical outcomes to conventional clinic-based care. *J Telemed Telecare*. 2007;13:26-30.
10. Finnane A, Dallest K, Janda M, et al. Teledermatology for the diagnosis and management of skin cancer: a systematic review. *JAMA Dermatol*. 2017;153:319-327.
11. Poushter J. Smartphone ownership and internet usage continues to climb in emerging economies. Washington, DC: Pew Research Center. www.pewglobal.org/2016/02/22/smartphone-ownership-and-internet-usage-continues-to-climb-in-emerging-economies/. Published February 22, 2016. Accessed February 2, 2018.
12. Peart JM, Kovarik C. Direct-to-patient teledermatology practices. *J Am Acad Dermatol*. 2015;72:907-909.

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13. Huff C. Medical diagnosis by webcam? Washington, DC: American Association of Retired Persons. www.aarp.org/health/conditions-treatments/info-2015/telemedicine-health-symptoms-diagnosis.html. Published December 2015. Accessed February 2, 2018.
14. Mehrotra A. The convenience revolution for the treatment of low-acuity conditions. *JAMA*. 2013;310:35-36.
15. Resneck JS Jr, Abrouk M, Steuer M, et al. Choice, transparency, coordination, and quality among direct-to-consumer telemedicine websites and apps treating skin disease. *JAMA Dermatol*. 2016;152:768-775.
16. Tele dermatology toolkit. American Academy of Dermatology website. <https://www.aad.org/practicecenter/managing-a-practice/tele dermatology>. Accessed April 24, 2018.
17. Carter ZA, Goldman S, Anderson K, et al. Creation of an internal tele dermatology store-and-forward system in an existing electronic health record: a pilot study in a safety-net public health and hospital system. *JAMA Dermatol*. 2017;153:644-650.
18. Jeyamohan SR, Moye MS, Srivastava D, et al. Patient-acquired photographs for the management of postoperative concerns. *JAMA Dermatol*. 2017;153:226-227.
19. Edison KE, Dyer JA, Whited JD, et al. Practice gaps, the barriers and the promise of tele dermatology. *Arch Dermatol*. 2012;148:650-651.