



# Tele dermatology: current indications and considerations for future use

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## Abstract

Telemedicine is one of the most consequential technologies in modern healthcare. In certain situations, it allows for the delivery of care with high quality and minimal difficulty. This is particularly true in dermatology, in which many dermatological conditions can be treated remotely. The burden on dermatology patients has been greatly reduced for certain pathologies due to telemedicine. Health care providers also achieve improved job satisfaction following the convenience of meeting their patients. This paper details select dermatological conditions, and subsequently divides them into those treatable by telemedicine appointments, and those requiring face to face appointments.

**Keywords** Telemedicine · Tele dermatology

## Introduction

Telemedicine is among the recent pivotal advancements in modern medicine, allowing physicians to diagnose and administer treatments remotely, without having to be face to face with the patient. This practice involves electronic communication, where clinical services are provided without the patient having to visit the health care professional. The technology has been successfully incorporated into a number of clinical services: consultations, follow-ups visits, and medication prescriptions. Telemedicine has been observed to have ample benefits to both the health care provider and the patient, with one of the greatest being its improved access [1–4]. Perhaps the field most conducive to advances in telemedicine is dermatology, in which many diagnoses are made visually. While tele dermatology has been widely incorporated, it does not allow for appropriate care in all skin conditions [5, 6]. Certain dermatologic conditions may

necessitate in-person visits, since not all treatments could be done through videos, images or a phone call.

## Methods

This review was conducted by running keywords through PubMed and Google Scholar. Search terms included *tele dermatology*, *telemedicine*, *store-and-forward*, as well as cross-searches with the diseases of interest, including *atopic dermatitis*, *acne*, *psoriasis*, *skin cancer*, *surveillance*, *melanoma*, and *pigmented lesions*. Case reports, case series, systematic reviews, and original research articles spanning from January 2000 to August 2020 were thoroughly evaluated by 2 reviewers. Non-English studies were not included in this discussion.

## Literature review

Ample research has been conducted on the use of telemedicine to study its effectiveness and its successful implementation [7]. Traditionally, patient outcomes, satisfaction and feasibility have been metrics to measure its effectiveness [8–10]. The two main mechanisms that exist in tele dermatology are store-and-forward and synchronous platforms [11]. Store-and-forward refers to the practice of patients or primary care providers sending images of lesions of concern to dermatologists for evaluation. Synchronous

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tele dermatology refers to the practice of live-stream virtual appointments between patients and dermatologists. The adequacies of each platform relies on the condition involved, the image quality, and the experience of the provider [8]. Data imply that doctors using store-and-forward appointments in tele dermatology may attain more accurate results compared to face to face appointments in clinic because of the ease of second opinions [12]. Tele dermatology has also been shown to improve access, and work as an effective triaging tool [13, 14].

Tele dermatology has rapidly evolved in the United States ever, since it was introduced as a means of providing skincare to populations that could not access clinical centers [15]. A comprehensive study on tele dermatology was conducted in the United States in 2011, which delineated many of the potential uses and drawbacks [16]. Programs were introduced to curb the rapidly growing demand for specialized skincare, and have continued to increase as more innovative measures are continuing to change the effectiveness of telemedicine on dermatology [16]. There are, however, several challenges facing tele dermatology that could be a drawback to its success. Traditionally, one of the key barriers was the reimbursement visits relative to in-person visits [8]. However, in the era of COVID-19, this is less of a problem, as the Centers for Medicare and Medicaid Services have begun reimbursing virtual visits at the same rate as in-person visits [17]. Drawbacks to tele dermatology still exist outside of reimbursement. Network connectivity remains an issue in remote areas or in those with poor internet connectivity. Similarly, socioeconomic status and technology literacy play roles in accessing tele dermatology. Patients who do not have a smart phone, mobile device, or computer remain unable to have improved access. Communication between providers similarly remains problematic in certain cases [8]. While tele dermatology has the potential to be used as an effective triaging tool, many referring practitioners are not well versed in referring patients through this communication [8]. Despite these drawbacks, tele dermatology is largely considered successful at triaging and potentially managing many conditions. In general, these conditions can be considered based on the underlying etiology as well as the potential treatment used. In a recent study of the most common skin diseases in the United States, Lim et al. describe categories of prevalent diseases such as acne, atopic dermatitis, bullous diseases, cutaneous infections, connective tissue disorders, wounds, vitiligo, psoriasis and ulcers [18]. Of these, the conditions most heavily studied with respect to tele dermatology have been atopic dermatitis, acne, psoriasis, and skin cancers. Specifically, the store-and-forward modality of tele dermatology was evaluated in each of these conditions.

## Atopic dermatitis

Telemedicine has been consistently shown to be effective in managing atopic dermatitis. As technology has improved, increasing studies have demonstrated the utility of store-and-forward tele dermatology in atopic dermatitis. In 2015, researchers compared the effectiveness of telemedicine appointments to face to face appointments in a randomized clinical trial of 156 adults and children in hopes of understanding whether tele dermatology could improve access to care for patients with atopic dermatitis [19]. Each patient attended a face to face appointment as the initial visit. Thereafter, half attended follow ups face-to-face with a dermatologist every 2 months for a year. The other half regularly attended their appointments by sending pictures of their skin to remote dermatologists that prescribed treatments remotely. The researchers measured the severity of eczema among all the patients at the initial office visit and each follow up visit using two standardized scoring systems. Results showed uniform improvement of the patients' atopic dermatitis across both groups. In 2017, a similarly designed study demonstrated that when atopic dermatitis patients were seen via telemedicine appointments, their quality of life outcomes improved to the same extent as those seen in person [20]. These studies support the inference that telemedicine appointments are as effective as face to face appointments for the treatment of atopic dermatitis.

## Acne

Telemedicine has also been successful in effectively diagnosing and monitoring patients with acne. In a randomized controlled trial evaluating 69 patients diagnosed with severe acne that required isotretinoin therapy, patients received follow up care in the form of either outpatient face to face visits at 4-week intervals or telemedicine appointments every 2 weeks, each over a course of 24 weeks [21]. Telemedicine appointments utilized the store-and-forward modality, where patients captured three facial images and transmitted them over cellular networks to dermatologists for decision making. Using standardized scoring systems to assess treatment responsiveness, researchers found patients responded very positively to treatment regardless of whether the appointment was performed via telemedicine or as an in-person visit. In addition, patients who received the telemedicine modality reported high satisfaction with service throughout the study [21]. Further evidence of store-and-forward telemedicine as an effective diagnostic tool for acne was published in 2018 [22]. Researchers compared standardized scoring

metrics of acne severity provided by dermatologists that used photos delivered remotely from patients (who were guided by an assistive phone application) to those provided by a dermatologist after an in-person examination. The study found assessment scores measuring disease severity agreed despite the change in modality, thereby demonstrating that telemedicine is as effective at diagnosing acne remotely.

### Psoriasis

The treatment of psoriasis, which often requires extensive follow up, can also benefit from telemedicine. Early studies indicated the initial utility of teledermatology in the management of psoriasis, and these findings have been further validated by more recent findings. In 2010, a study consisting of ten patients was conducted over a 12-week period to identify whether store-and-forward teledermatology was as effective as face to face appointments in assessing the severity of psoriasis [23]. Teledermatology-treated patients used an assistive phone-based application to take pictures of areas of their affected skin. Two remote dermatologists then used those pictures to calculate the severity of each patient's disease at weeks 0, 1, 2, and every 2 weeks thereafter for a total of 12 weeks. A third dermatologist calculated severity scores of the same patients in face to face appointments at weeks 0, 1, 6, and 12. Severity scores were very similar between the two methods. A study conducted 2 years later added evidence that psoriasis patients experience high patient satisfaction and improved quality of life when monitored remotely [24]. However, each study was limited by its relatively small sample size. Later studies augmented these early findings. In 2018, a randomized controlled trial evaluated 296 patients to determine whether standardized severity score indices varied between online store-and-forward or in-person treatments. Patients received either online or in-person care for psoriasis over a period of 12 months [25]. Each patient in the online group, sometimes in consultation with an in-person primary care physician, contacted dermatologists asynchronously and assessments and treatments were provided by the dermatologist online. In contrast, patients in the in-person group received treatment from dermatologists directly in face to face appointments. Results showed the store-and-forward online model was as effective as in-person management for psoriasis patients.

### Medication monitoring

Telemedicine is effective in patients with three of the most common skin conditions diagnosed in dermatology: atopic dermatitis, acne, and psoriasis [18]. It has not only proven to be an effective diagnostic tool, but also has been shown to be effective for monitoring the treatment progression of

these diseases. These findings encourage further exploration of the value of telemedicine in relation to diagnosing and treating other skin conditions, and emphasizes the value of store-and-forward teledermatology as a potential standard for medication follow up and monitoring of all dermatology patients.

### Skin cancer surveillance

Despite its successful implementation in a series of dermatologic conditions, teledermatology has a more ambiguous use in melanocytic lesions, particularly with surveillance of skin cancers. With respect to patient satisfaction, teledermatology for use in skin cancer monitoring has been relatively successful [9]. This was found to be particularly true of younger patients, who have largely embraced teledermatology. In a recent literature review, Chuchu et al. note that in images of malignant lesions, the correct diagnosis was determined in the majority of cases [26]. However, they note several caveats, being the variable methodologies and types of malignancies among studies. Current recommendations detail that potentially malignant lesions require an in-person visit, citing a lack of systematic evidence detailing efficacy of teledermatology for this indication [27]. In recent studies, the use of teledermoscopy has been found to increase the accuracy of teledermatology with respect to diagnosing pigmented lesions [28]. This technology can be accessed through a smartphone or mobile device and highlights the potential for teledermatology with respect to surveillance for skin cancers. A relatively novel use is mole mapping, in which patients can take photographs of areas of concern to present to their dermatologist virtually [29]. While these methods have shown promise, many dermatologists are hesitant to adopt these technologies for monitoring potentially malignant processes, in part due to the lack of standardization across teledermatology practices as well as the legal implications.

### Discussion

Telemedicine is observed to be gradually taking a central place in the delivery of healthcare. Conditions that require minimal attention and treatment can easily be treated through telemedicine as prescriptions are done online. However, telemedicine is limited in its use as it depends on a stable network connection to operate. A stable network connection is important in the process of communication between the patient and the health care professional, which is a key aspect of telemedicine. There needs to be constant communication to enable the health care professional to obtain direct and timely information about the condition and also to enable the patient to obtain accurate prescriptions

in the right timings. Through such, telemedicine cannot be effective in areas that are lacking stable and secure internet connections, thereby limiting its use to a specific group of people.

In a bid to convert face to face appointments for health-care to telemedicine appointments, there needs to be more advanced technologies in terms of the methods used in the provision of the network. A reliable and secure source supply of network should be established to ensure that the system is utilized effectively. Health care professionals can be urged to convert their services for outpatient visits to telemedicine. Face to face appointments can be done until full treatment can be accomplished through telemedicine appointments, by dermatological conditions. Virtual visits can also be encouraged for conditions that do not necessarily require close monitoring during treatment. Prescriptions of conditions that can be examined through pictures can be done online to minimize travel time. Doing so will also enable patients to cut on unnecessary costs associated with in-person visits. The software can be customized to enable a clear recording of patient information, which could easily be transferred to other health care professionals or other health care facilities when required. Doing so would help improve telemedicine services, thereby recognizing its advantages over face to face care.

Telemedicine can improve by ensuring that the privacy of its patients is considered. Privacy can be reached by ensuring that login details and a consent enquiry are required before any information is presented to the health care professional about the patient. Information about the patient can also be encrypted through the use of more customized software. Through the Health Insurance Portability and Accountability Act of 1996 (HIPAA), patients' medical records and confidential health information are able to be protected [30]. Appropriate navigation of HIPAA is crucial to the successful implementation of telemedicine. Electronic billing is used in keeping records thereby minimizing the chances of fraud in health care delivery. Devices can ensure the security of information using passwords. These ensure that no unauthorized persons can access confidential information about a patient's condition. As telemedicine continues to be a great contribution to health care across the world, it is necessary to conduct further research on innovations, its success, and various solutions to the shifting from in-person treatment to telemedicine.

## Conclusion

While the COVID-19 pandemic has driven renewed interest in teledermatology, we anticipate improved access to healthcare and overall satisfaction from patients and providers will continue to propel its growth. Many studies

have verified teledermatology as a valid treatment for select chronic skin conditions such as atopic dermatitis, acne, and psoriasis. However, the practice still has opportunities to expand, including in the diagnosis, surveillance and treatment of skin cancer, where new technologies are being explored to provide remote monitoring capabilities for suspicious skin lesions.

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## Compliance with ethical standards

**Conflict of interest** The author(s) declare that they have no conflicts of interest.

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