TELEDERMATOLOGY

An Innovative Tool Piloted at Penn Medicine Lancaster General Health

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INTRODUCTION

Telemedicine is transforming the manner in which medical care is accessed and delivered, and is part of the U.S. health care system's innovative response to provider shortages. Connectivity technologies allow dispersed teams of specialists around the globe to work remotely and to treat patients anywhere.

Since dermatology is a field that depends on visual clues, and is experiencing high demand, it has been particularly suited to the introduction of teledermatology, in which images are captured by the evaluating provider and sent to a remote specialist for review and recommendations.

The first evolutionary step in teledermatology was the leap from a personal smartphone camera to a dedicated smartphone camera equipped with a dermatoscope.[1,2] The images captured by a digital dermatoscope have high definition and substantial magnification, thus capturing details, and revealing the power of polarized light.

While face-to-face (FTF) care remains the gold standard for diagnosis, teledermatology has proven so useful that it has been adopted nationwide,[3] and has generally been favorably accepted by patients and practitioners. The drawbacks of not using FTF care as the primary modality can be mitigated if teleconsultants defer to FTF care whenever there is uncertainty.

In 2011, there were approximately 37 teledermatology programs, of which 10 were in governmental settings and 27 were in non-governmental settings. (The former practice settings include the VA, active military services, and Indian health services. Nongovernmental practice settings include those associated with academic institutions, private practices, medical groups, and other practice settings.) By 2016 there were 102 programs – 62 governmental and 40 nongovernmental. While the median number of consultations (*by practice setting*) per year was similar in 2011 and 2016, the maximum number of consultations increased from 6,500 to 20,000 (*by practice setting*).

Teledermatology continues to be one of the most popular telemedicine specialties. The most common practice setting for its use are academic medical centers. Instead of a live telemedicine encounter, it is more common to store-and-forward the image for reasons of convenience and cost-effectiveness.[3]

BENEFITS OF TELEDERMATOLOGY

There is currently an undersupply and maldistribution of dermatologists, who mostly practice in or near big cities or large academic centers, thus limiting access and delaying care for many patients.[4] Teledermatology fills a critical gap in access to care, particularly for the remote or underserved patient. Additionally, dermatologists are able to minimize unnecessary in-office consultations, thus increasing their availability for higher risk patients. This process also maximizes utilization of the Primary Care Provider prior to involving the specialist. Further, there is a cost savings to the patient if a teledermatology consultation is all that is needed, as they are able to avoid the cost of an in-person consultation, travel, and missed work.

The prompt evaluation of worrisome lesions by a dermatologist may also decrease morbidity and mortality. Skin cancer is the most common cancer in the United States, and it is estimated that one in five Americans will develop skin cancer in their lifetime.[5,6] Annually, more than 3 million Americans develop nonmelanoma skin cancer, such as basal cell or squamous carcinoma.[7] Timely evaluation and management of precancerous and cancerous lesions is critical; with early detection, the five-year survival rate for melanoma is 99 percent.[8]

IMPLEMENTATION AT LANCASTER GENERAL HEALTH
Implementation Strategy

Penn Medicine Lancaster General Health is implementing teledermatology in two stages, TeleDerm I and TeleDerm II, with the primary difference being the use of clinician

smartphone cameras in TeleDerm I, and the addition of the dermatoscope in TeleDerm II. The implementation team began by constructing the technology workflow and providing appropriate training. Next, they developed billing and payment processes. TeleDerm I was then piloted at Lincoln Family Medicine, and this experience was used to improve workflow efficiency. (Fig. 1)

This pilot program was then expanded to all practices in the North region, and then to a primary site in each geographic region. Finally, the pilot was expanded to all remaining sites in all regions. Medicaid patients were excluded from this initial pilot while workflow was improved, and these patients were later included with waived fees. Non-medical assistance patients are charged $40 dollars for the teledermatology services.

TeleDerm II introduced the use of the dermatoscope. The Center for Health Care Innovation at Penn Medicine Lancaster General Health (CHCI-LGH) purchased 15 dermatoscopes, and provided training for Primary Care Providers (PCPs). Training protocols and implementation lessons from TeleDerm I were utilized. The dermatoscopes will be piloted at 15 Family Practices with the eventual goal of expanding their use to all Family Practice sites.

Implementation Challenges

Multiple challenges surfaced during both stages of implementation, the most significant being in-office workflow. The processes and procedures that providers are required to follow can be time-consuming. The consult order form is redundant; much of the information sought by the form is already documented in the progress note. Additionally, patients need to consent to an additional charge by signing a separate form, which cannot be printed until the consult order has been placed. The order also must be placed to generate a notification at checkout to collect the fee for non-medical assistance patients.

Overall, providers have found the response time by the dermatologists to be excellent, but timely follow-up with non-pilot dermatology groups is not guaranteed. Some providers have found challenges with communication when further information is needed after the initial consult request.
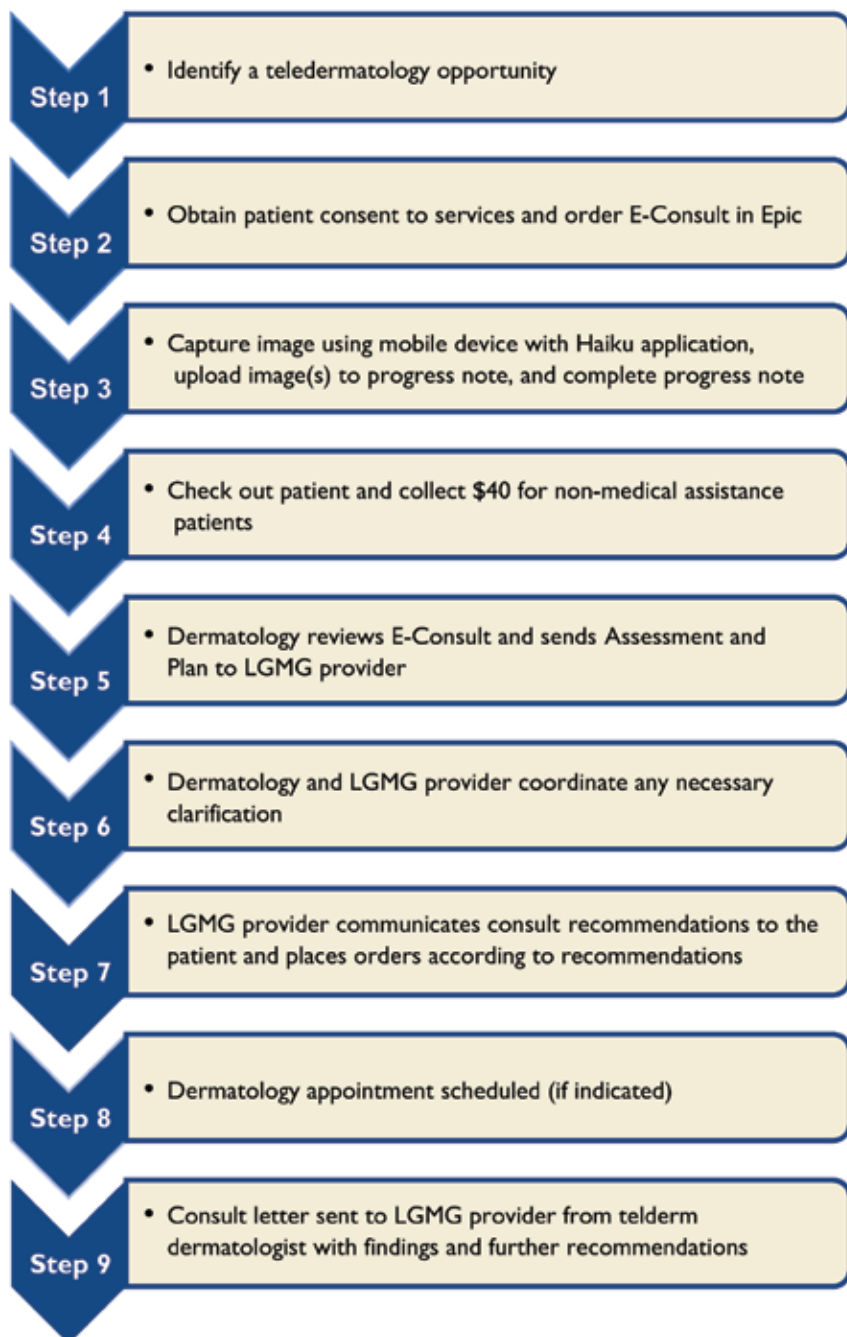

Step 1 • Identify a teledermatology opportunity

Step 2 • Obtain patient consent to services and order E-Consult in Epic

Step 3 • Capture image using mobile device with Haiku application, upload image(s) to progress note, and complete progress note

Step 4 • Check out patient and collect $40 for non-medical assistance patients

Step 5 • Dermatology reviews E-Consult and sends Assessment and Plan to LGMG provider

Step 6 • Dermatology and LGMG provider coordinate any necessary clarification

Step 7 • LGMG provider communicates consult recommendations to the patient and places orders according to recommendations

Step 8 • Dermatology appointment scheduled (if indicated)

Step 9 • Consult letter sent to LGMG provider from telderm dermatologist with findings and further recommendations

Fig. 1. **TeleDerm Workflow.**

Finally, it has been a challenge to schedule patients for an in-office evaluation if the dermatologist does not take the patient's insurance. If the patient is able to get an in-office appointment with the dermatologist, some have expressed concern that they are required to pay a separate co-pay in addition to the $40 paid for the teledermatology consult.

From a technology standpoint, not all providers are willing to use their private cell phones. It has been a challenge for offices to ensure that both the dermatoscope and

a charged, dedicated phone are available. This particular issue was addressed in Telederm II with the implementation of a dedicated downtime phone. Additionally, providers report varying degrees of Epic training and comfort navigating Haiku and Canto. Moreover, not all clinicians are comfortable using the dermatoscope. It can be challenging to obtain quality images with the dermatoscope, which impacts the dermatologist's ability to provide an accurate diagnosis. Of note, CHCI-LGH developed an online training course (KnowledgeLink) to train providers on appropriate use of the dermatoscope.

Current Status

Currently, TeleDerm I has been rolled out to all 34 LGHP family practices. TeleDerm II, which uses dermatoscopes, is being piloted at four practices: Buck, County Line, Leola, and Quentin. CHCI-LGH is currently working on increasing awareness and training at these four practices. Before expanding the use of the dermatoscope to other practices, CHCI-LGH is addressing concerns regarding dermatoscope image quality. (When the dermatoscopic images were viewed in Epic initially, the dermatologist could not zoom in without degrading image quality. This problem is being addressed by having the PCP zoom in using the phone before taking the picture, while keeping it focused.)

Four of the 15 dermatoscopes are currently in use, one at each pilot site, along with a downtime phone. Eventually, the pilot program will expand to 15 family practices, each with its own dermatoscope. CHCI-LGH will then review the data and, if it is financially feasible, will propose that the organization invest in more dermatoscopes and expand Telederm II to all other practices.

RESULTS OF THE PILOT PROGRAMS

The following data from both TeleDerm I and TeleDerm II, were collected from April 5, 2018 through June 18, 2019, and will be referred to collectively as "the TeleDerm pilot." The metrics gathered include:

a) *Response time by the teledermatologist:* the time between the initial TeleDerm consult by the provider and the teledermatologist's response;

b) *Time from teledermatologist response to patient notification:* the time between the teledermatologist's response and followup with the patient by the initial referring provider;

c) *Time to FTF dermatologist appointment:* time between the initial TeleDerm consult and a FTF office visit with the dermatologist, if such a visit has been recommended;

d) *Time to biopsy:* time between the initial TeleDerm consult and biopsy of the patient's skin lesion.

Notably, the baseline wait-times for a new patient FTF dermatology appointment in Lancaster County, PA, is a mean of 93 days, with a range of 61 days to 128 days. (This information was collected by contacting local area Dermatology offices directly.)

a) The goal of the TeleDerm pilot for response time by the teledermatologist was a mean of 24 hours after the TeleDerm consult. At the end of the TeleDerm pilot, the mean response time was 16 hours, with a median of 10 hours, and a range of 0.01 - 6.38 days.

b) The goal for time from the teledermatologist's response to patient notification was a mean of between 4 and 7 days. The pilot program's time was a mean of 4.6 days.

c) The goal for time to FTF dermatologist appointment was a mean of 10 days for a non-urgent referral and 3 days for an urgent referral. The TeleDerm pilot time for non-urgent referrals was a mean of 30.6 days, with a median of 35 days; the time for urgent referrals was a mean of 15 days, with a median of 11 days. The TeleDerm pilot fell short of its goal for time to FTF dermatologist appointment. Despite this outcome, a mean of 30.6 days for non-urgent referrals and a mean of 15 days for urgent referrals is still much faster than the average wait time in Lancaster County, PA, for Dermatology appointments (93 days).

d) The total number of patients who were diagnosed with skin cancer was 11. Of these, 2 had malignant melanoma, 1 had melanoma in situ, 2 had Basal Cell Carcinoma, and 6 had Squamous Cell Carcinoma. Average time to biopsy for melanoma was 14.67 days (range 9-21); for Basal Cell Carcinoma 34.5 days (range 28-41); and for Squamous Cell Carcinoma 8.6 days (range 6-16).

Discussion

The TeleDerm pilot had one teledermatologist responding to 78 PCPs; 200 TeleDerm consults were completed, or a mean of 14 per month. Eighty-seven percent of the TeleDerm consults did not recommend a FTF office visit with the dermatologist.

Of the 200 TeleDerm consults, 178 patients (80.5%) had follow-up with a PCP for further management, and 39 (19.5%) had an appointment with a specialist. Follow-up varied from none, to follow up with a PCP, a specialist, or both, and some TeleDerm consults resulted in follow-up with a dermatologist even though it was not recommended.

Considering that 80.5% of TeleDerm consults did not result in a FTF specialist visit, these results suggest that teledermatology could result in a significant reduction in unnecessary dermatology referrals and office visits, thereby increasing patient access to timely care. Currently, there is only one teledermatology provider at LGH fielding these TeleDerm consults. Additional teledermatology providers

could reduce the time to FTF dermatologist appointments.

THE FUTURE OF TELEDERMATOLOGY

Telemedicine has grown significantly during the Covid-19 pandemic,[9] which has given impetus to innovation and accelerated the transition to virtual medicine. There is no better time than the present to embrace the future and invest in the expanding possibilities of telemedicine. The surcharge was initially seen as a deterrent, but the Covid-19 pandemic has already done away with most payer's reticence to cover telemedicine, and coverage is now mainstream.

Entities like nursing homes or cruise ships can now stay connected with specialists across state lines and even oceans.

TeleDerm in Medical Education

Teledermatology has shown substantial value in medical education of both residents and medical students. Integration with a dermatology residency program could provide efficient, high quality patient care and simultaneously lower costs.[10]

Inpatient TeleDermatology

Teledermatology also has potential to expand in the inpatient setting. One study showed that about 55% of institutions using teledermatology had both inpatient and outpatient consultations. Inpatient teledermatology is used for remotely staffing inpatient consultations, triage consultations, and answering curbside questions from primary teams.[11]

Artificial Intelligence in TeleDermatology

The future of teledermatology at Penn Medicine Lancaster General Health includes plans not only to expand site locations of TeleDerm II, but also to explore advanced technology, such as artificial intelligence, to aid in the expedited diagnosis of worrisome skin lesions.

Artificial intelligence is increasingly being utilized in various medical specialties, especially dermatology, where algorithms allow a computer to analyze images of a skin lesion and determine the probability that it is malignant. A recent meta-analysis compared an artificial intelligence algorithm with the ability of primary care providers and dermatologists to diagnose malignant melanoma by observation. Diagnoses were confirmed histologically. The artificial intelligence algorithm was more accurate than primary care physicians and comparable to the dermatologists.[12]

As technology advances, the accuracy of artificial intelligence will likely rise, leading to increased adoption. In the future, artificial intelligence may become a standard tool in Dermatology offices as well as a screening tool in Primary Care offices.[13]

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