

Tele dermatology in practice: Report of Mayo Clinic experience

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Abstract

Background: Delivery of dermatologic care through telemedicine was accelerated by the COVID-19 pandemic. We sought to analyze the tele dermatology experience across Mayo Clinic's health care system to identify strengths and limitations of tele dermatology.

Methods: Electronic health records of dermatology tele visits were reviewed from multiple U.S. Mayo Clinic sites from January 2020 through January 2021.

Results: A total of 13,181 dermatology tele visits were conducted in 6468 unique patients. Patients were primarily female (60.2%), and mean age of all patients was 34.1 years. Synchronous / live video conferencing visits were the most common (40.0%) telecare modality. Synchronous / live audio conferencing and asynchronous / store-and-forward visits comprised 33.0% and 27.0% of appointments. In total, 3944 tele visits (29.9%) were successfully concluded via a single appointment. An in-person appointment was needed for 1693 patients (26.2%) after their initial tele visit. For patients with a single tele visit, synchronous / live video conferencing was the most common virtual modality (58.0% vs 32.2% of patients with multiple visits, $p < 0.001$). Patients needing in-person follow-up visits were slightly older than those who did not (mean [SD], 38.8 [22.3] vs 35.0 [23.6] years; $p < 0.001$) but without any sex-based difference. Around one-third of patients needed an in-person follow-up visit after their initial asynchronous / store-and-forward visit which was higher when compared with synchronous / live audio and video conferencing.

Conclusion: Single dermatology tele visits effectively managed nearly one-third of patients who did not require in-person follow-up. An initial synchronous / live video conferencing was more likely to yield a single clinical encounter, whereas asynchronous / store-and-forward visits required more in-person follow-up. Future studies are required that focus on dermatology-specific cost, diagnoses, access, quality of care, and outcomes.

Keywords

Dermatology, telehealth, telemedicine

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Introduction

The delivery of healthcare through telemedicine has been an emerging field that was accelerated by the COVID-19 pandemic, as healthcare practitioners across the world were forced to seek creative solutions to curtail viral spread by minimizing face-to-face consultations. Dermatology is well positioned to adopt and become the paradigm of telehealth delivery given the visual nature of the specialty. Proponents

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of telehealth cite reduced healthcare costs and improved access, particularly for patients from disadvantaged backgrounds or rural areas who need subspecialty care.¹ At least two studies of teledermatology have found positive outcomes, including improved medication adherence for certain disorders such as acne and chronic inflammatory dermatoses.^{2,3} In a student population, factors that increased students' likelihood of adopting telehealth included convenience, improved access, and efficiency.⁴

Although teledermatology may be regarded with optimism, its widespread implementation may be hindered by various factors. For example, patients require technological skills, which can be difficult for some patients, particularly many older adults,⁵ and need access to devices with high-quality cameras and reliable internet connectivity. Some patients may also prefer in-person visits over telehealth for various reasons, including a possible perceived impersonal nature of telehealth, concerns regarding security and privacy, and the possibility of system errors.⁴ Practitioner limitations include the inability to perform a complete cutaneous examination with palpation of lesions and an array of in-office procedures, such as potassium hydroxide preparations, Wood lamp examinations, dermoscopy, or biopsy.⁶

Despite these barriers, dermatology organizations such as the American Academy of Dermatology support the use of teledermatology as a high-quality care option when medically appropriate provided that patients still have the option of an in-person consultation.⁷ It remains unclear which population of patients would benefit most from teledermatology such that their dermatologic concern is safely and effectively diagnosed and treated via teledermatology. The efficacy and appropriateness of different types of televisits (asynchronous / store-and-forward vs synchronous / live audio-video conferencing) continues to be explored. In this study, we sought to categorize, report, and analyze the teledermatology experience across Mayo Clinic sites over a 12-month period, with the goal of identifying strengths and limitations of the telehealth approach to dermatologic care.

Methods

The study was exempt from review by the Mayo Clinic Institutional Review Board and patient consent was not required because no patient identifiers were retrieved or used during data analysis.

Through electronic health record search, we identified all outpatient dermatology appointments performed virtually at the departments of dermatology at Mayo Clinic in Rochester, Minnesota; Jacksonville, Florida; and Scottsdale, Arizona; and at Mayo Clinic Health System in Minnesota and Wisconsin from January 2020 through January 2021. All telehealth visits were coordinated by site-specific appointment offices including external and internal referrals. Appointments were scheduled on dedicated slots for each telehealth visit modality based on next immediate

availability. Outpatient dermatology televisits comprised asynchronous / store-and-forward (electronic visits), synchronous / live audio conferencing (phone visits), and synchronous / live video conferencing (video visits). Asynchronous / store-and-forward visits refer to an asynchronous appointment involving transmission of patient health information and clinical images via a store-and-forward method initiated by the patient or the referring health care practitioner (nurse practitioner, physician assistant, staff physician, resident, or fellow). All telehealth encounters were conducted within the electronic medical record (Epic MyChart™) using live audio-videoconferencing technology (Zoom) when indicated. Trainees (dermatology residents and fellows) were allowed to perform the televisits under direct supervision of staff dermatologist. Institution-wide, almost all televisits in dermatology require electronic submission of patient-provided photographs regardless of the virtual modality used (asynchronous / store-and-forward, synchronous / live audio conferencing, or synchronous / live video conferencing). When patients request a televisit (not in-person) appointment, they are provided with a link to an educational tool on how to obtain good-quality photos. New patients were only seen via synchronous / live video conferencing, whereas for the established patients, all televisits were offered. There were external referral (from outside institution providers), internal referral (consultation from institutional providers) as well as self-referrals by patients.

For each televisit, the following data were retrieved: age and sex of the patient, type and location of the appointment, and type of dermatologic practitioner. For each patient appointment, we recorded the number and type of subsequent follow-up appointments, if required (in-person vs televisit).

Statistical analysis

Categorical variables were presented as counts and percentages, and continuous variables were reported as median (IQR) or mean (SD) where appropriate. Comparisons between categorical variables were performed with a χ^2 test or with a Fisher exact test when cell counts were low; an analysis of variance or Kruskal-Wallis test was used to compare continuous variables. Statistical analyses were performed using R Version 4.0.3 in RStudio (RStudio, PBC). A p -value < 0.05 was considered significant.

Results

In total, 13,181 dermatology televisits from 6468 unique patients were conducted from January 2020 through January 2021. Most patients using teledermatology services were female (60.2%); all patients had a mean (SD) age of 34.1 (24.5) years. Synchronous / live video conferencing was the most common type of dermatology televisit

(40.0%), and synchronous / live audio conferencing and asynchronous / store-and-forward visits comprised 33.0% and 27.0% of virtual appointments, respectively. More than half of all dermatology televisits were completed at Mayo Clinic Rochester campus. Staff dermatologists were the most prevalent type of practitioners, accounting for 72.6% of televisits (Table 1).

New patient visits comprised 14.3% of all dermatology televisits. When televisits for new and established patients were compared, new patients were significantly older than established patients (mean age, 41.8 vs 32.8 years;

$p < 0.001$). New patients were more likely than established patients to be male, although the difference was small (43.4% vs 40.3%, $p = 0.01$). The majority of both new and established patients were evaluated in Mayo Clinic, Rochester, and by staff dermatologists (Table 2).

A total of 3944 dermatology televisits (29.9%) were successfully concluded via a single encounter with no additional follow-up required. For 610 patients, follow-up

Table 1. Unique patients (N = 6468) examined via dermatology televisits (N = 13,181) across Mayo Clinic, January 2020 through January 2021.

	No. (%) ^a
Sex	(n = 6468)
Female	3896 (60.2)
Male	2572 (39.8)
Age, y	
Mean (SD)	34.1 (24.5)
Appointment type	(n = 12,038)
E-visit ^b	3256 (27.0)
Phone visit	3967 (33.0)
Video visit	4815 (40.0)
Mayo Clinic site	(n = 13,168)
Scottsdale, Arizona	2395 (18.2)
Jacksonville, Florida	1769 (13.4)
Mayo Clinic Health System	2104 (16.0)
Rochester, Minnesota	6900 (52.4)
Practitioner type	(n = 8180)
Nurse practitioner or physician assistant	849 (10.4)
Staff dermatologist	5938 (72.6)
Resident or fellow	1393 (17.0)

^aData are No. (%) unless otherwise indicated. Some data were unavailable for some patients and visits.

^bAsynchronous appointment involving transmission of patient health information and clinical images via a store-and-forward method. E-visit: electronic visit.

Table 2. Comparison of new and established patients examined via dermatology televisits.

	Televisit, No. (%) ^a		p-value
	New patients (n = 1884)	Established patients (n = 11,297)	
Sex			0.01
Female	1067 (56.6)	6741 (59.7)	
Male	817 (43.4)	4556 (40.3)	
Age, y			<0.001
Mean (SD)	41.8 (23.3)	32.8 (24.5)	
Appointment type	(n = 1782)	(n = 10,256)	
E-visit ^b	459 (25.8)	2797 (27.3)	0.73
Phone visit	346 (19.4)	3621 (35.3)	<0.001
Video visit	977 (54.8)	3838 (37.4)	<0.001
Mayo Clinic site		(n = 11,284)	<0.001
Scottsdale, Arizona	498 (26.4)	1897 (16.8)	
Jacksonville, Florida	447 (23.7)	1322 (11.7)	
Mayo Clinic Health System	143 (7.6)	1961 (17.4)	
Rochester, Minnesota	796 (42.3)	6104 (54.1)	
Practitioner type	(n = 895)	(n = 7355)	<0.001
Nurse practitioner or physician assistant	83 (9.3)	766 (10.4)	
Staff dermatologist	705 (78.8)	5233 (71.1)	
Resident or fellow	107 (11.9)	1356 (18.4)	

^aData are No. (%) unless otherwise indicated. Some data were unavailable for some patients and visits.

^bAsynchronous appointment involving transmission of patient health information and clinical images via a store-and-forward method. E-visit: electronic visit.

visit data was not available. We compared the single-televisit group with the group that had multiple or recurring televisits and found no significant sex-based difference between groups. Regarding age, patients examined via a single televisit were slightly older than those who had multiple visits: mean (SD) age, 37.4 (22.7) vs 32.6 (25.1) years ($p < 0.001$). For patients with a single televisit, synchronous / live video conferencing was the most common virtual modality (58.0%) vs the second most common modality for patients with multiple visits (32.2%, $p < 0.001$) (Table 3).

Of the overall 6468 unique dermatologic patients examined via telemedicine, 1693 (26.2%) eventually required an in-person examination. When we compared patients who required in-person visits with those who did not, we found no sex-based difference, but patients who required in-person follow-up were significantly older (mean [SD] age, 38.8 [22.3] vs 35.0 [23.6]; $p < 0.001$; Table 4). The proportion of patients who needed an in-person follow-up visit after their initial televisit was higher for asynchronous / store-and-forward visit when compared with synchronous / live audio and video conferencing (35.3% vs 19.3% and 23.4%, respectively; $p < 0.001$, Table 5). More than two-third of synchronous / live video conferencing were completed successfully via single televisit (70%; Table 5).

Discussion

In this study, we reported the tele dermatology experience comprising more than 13,000 televisits across Mayo Clinic in a 1-year span. Most patients were female, and the mean age of all patients was 34 years. Synchronous / live video conferencing occurred more often than synchronous / live audio conferencing and asynchronous / store-and-forward visits, which was expected given that video allows for visual examination, a more intimate patient–practitioner relationship, and a dynamic interaction.⁸ A minority of all tele dermatology appointments (14.3%) were new patient visits. This small percentage could be explained by several factors: the patient's or practitioner's preference for an initial in-person visit, lack of patient familiarity with telemedicine modalities, or possible inappropriateness of a televisit as the first encounter given the clinical context (e.g. anticipated need for a biopsy).⁹

In our experience, televisits provided an effective tool for dermatologic examination and management because approximately 30% of televisits did not require any additional follow-up, irrespective of patient sex. Furthermore, of all televisit types, synchronous / live video conferencing was significantly more common among patients who required only one visit vs patients who required follow-up (58.0% vs 32.2%). This difference may be related to the possibility of synchronous / live video conference allowing for more comprehensive examination and,

therefore, management vs other tele dermatology modalities. Alternatively, practitioners and/or patients may perceive that asynchronous / store-and-forward or synchronous / live audio conferencing would be better choices for patients with chronic conditions requiring frequent follow-up care (e.g. severe nodular acne being treated with isotretinoin). In addition, patients with more complex diagnoses requiring

Table 3. Comparison of single and multiple dermatology televisits.^a

	Multiple televisits ^b (n = 9237)	Single televisit (n = 3944)	p-value
Sex			0.08 ^c
Female	5426 (58.7)	2382 (60.4)	
Male	3811 (41.3)	1562 (39.6)	
Age, y			<0.001 ^d
Mean (SD)	32.6 (25.1)	37.4 (22.7)	
Appointment type	(n = 8410)	(n = 3628)	
E-visit ^e	2546 (30.3)	710 (19.6)	<0.001 ^f
Phone visit	3153 (37.5)	814 (22.4)	<0.001
Video visit	2711 (32.2)	2104 (58.0)	<0.001
Mayo Clinic site	(n = 9232)	(n = 3936)	<0.001 ^c
Scottsdale, Arizona	1800 (19.5)	595 (15.1)	
Jacksonville, Florida	975 (10.6)	794 (20.2)	
Mayo Clinic Health System	1340 (14.5)	764 (19.4)	
Rochester, Minnesota	5117 (55.4)	1783 (45.3)	
Practitioner type	(n = 6450)	(n = 1800)	<0.001 ^c
Nurse practitioner or physician assistant	694 (10.8)	155 (8.6)	
Staff dermatologist	4518 (70.0)	1420 (78.9)	
Resident or fellow	1238 (19.2)	225 (12.5)	

^aSome data were unavailable for some patients and visits.

^bRequired at least 1 additional follow-up visit.

^cPearson χ^2 test.

^dAnalysis of variance.

^eAsynchronous appointment involving transmission of patient health information and clinical images via a store-and-forward method.

^fKruskal-Wallis test.

E-visit: electronic visit.

Table 4. Comparison of patients examined via televisit only and patients requiring in-person follow-up after televisit.^a

	Televisit only (n = 4775), No. (%)	In-person follow-up (n = 1693), No. (%)	p-value
Sex			0.30
Female	2894 (60.6)	1002 (59.2)	
Male	1881 (39.4)	691 (40.8)	
Age, y			<0.001
Mean (SD)	35.0 (23.6)	38.8 (22.3)	
Mayo Clinic site	(n = 4765)		<0.001
Scottsdale, Arizona	818 (17.2)	223 (13.2)	
Jacksonville, Florida	776 (16.3)	354 (20.9)	
Mayo Clinic Health System	905 (19.0)	243 (14.4)	
Rochester, Minnesota	2266 (47.6)	873 (51.6)	
Provider type	(n = 2423)	(n = 972)	<0.001
Nurse practitioner or physician assistant	251 (10.4)	68 (7.0)	
Staff dermatologist	1808 (74.6)	788 (81.1)	
Resident or fellow	364 (15.0)	116 (11.9)	

^aSome data were unavailable for some patients and visits.

follow-up care could have been preferentially examined by staff physicians through synchronous / live video conferencing.

Approximately one-fourth of the unique dermatology televisits in our cohort required an in-person follow-up appointment, with no sex-based differences noted between single-visit and multiple-visit groups. Follow-up visits occurred most frequently after asynchronous / store-and-forward than other appointment types. Several possible factors may explain these findings. One factor is a unidirectional delivery of information via asynchronous / store-and-forward compared with the interview nature of synchronous / live audio and video conferencing, which may contribute to more comprehensive information gathering, examination, and management for the video and audio groups. A selection bias is also possible if patients with more complex pathology were referred by other practitioners for primarily asynchronous / store-and-forward visit; in turn, patients seen in asynchronous / store-and-forward visits may necessitate a subsequent in-person visit or procedure, such as a biopsy. Furthermore, different reimbursement rates associated with each tele dermatology modality could affect the choice of preferred telemedicine method at an institution, and different patient costs or insurance plan co-payments could influence a patient's selection of virtual appointment type. Poor quality of submitted photographs also could have accounted for the need to proceed with in-person examinations.

The perceived monetary benefits for the patient that could be expected from an initial telemedicine visit should be carefully balanced against the potential for the need of subsequent follow-up visits and the financial strains for the practice including but not limited to provider availability, technology requirements, and telehealth reimbursement rates. In a study evaluating patients with acute respiratory tract infections, telemedicine visits were more likely to result in the need for follow-up care within 7

Table 5. Comparison of the follow-up outcome of patients initially evaluated by televisit based on the type.

Type of visit	Initial asynchronous/ store-and-forward visit (n = 1366) No. of patients (%)	Initial synchronous/ live audio conferencing (n = 1491) No. of patients (%)	Initial synchronous/ live video conferencing (n = 3001) No. of patients (%)
Concluded with single televisit	710 (51.9)	814 (54.5)	2104 (70.1)
Subsequent multiple televisits follow-up	173 (12.6)	388 (26)	193 (6.4)
Subsequent in-person follow-up	483 (35.3)	289 (19.3)	704 (23.4)

days vs in-person visits (10.3% vs 5.9%).¹⁰ In a large study of self-initiated primary care televisits, the rates of in-person follow-up visits were slightly higher, but no significant difference was found in rates of emergency visits or hospitalizations within 7 days of the initial visit.¹¹ Additionally, telehealth encounters were more likely to require in-person follow-up visits for patients with acute conditions than for those with chronic diseases in a large cohort study of privately insured patients during the COVID-19 pandemic.¹² Future studies on cost-effectiveness and outcomes specific to teledermatology are required to direct policy makers, payers, and practitioners.

Limitations

Although we have gleaned insights from this study, some limitations remain. First, this retrospective study was of a patient population at a single major integrated academic center, limiting generalization of our findings. Second, our study period ended in January 2021; as teledermatology and technology continue to evolve, so may patient preferences. Both telehealth visits and in-person visits were offered throughout the study period. However, since the study overlapped with the height of the COVID pandemic, this could have affected patients' choice. Another limitation is the lack of association between diagnosis and need for in person follow-up. Also, no restrictions were based on chief complaints for any of the visit modalities. The lack of follow-up for some of the patients initially evaluated by televisit is another limitation of the study. We only reported the final outcome on patients who pursued the recommended follow-up. Additionally, patient and provider satisfaction were not surveyed in this study. Last, we did not study the racial, geographic, or socioeconomic constructs of the patient population that used teledermatology services.

Conclusion

In this study, dermatology televisits, especially synchronous / live video conferencing, were an effective assessment modality. As teledermatology becomes increasingly more feasible, it is imperative for dermatology practitioners to understand the strengths and limitations of telemedicine. Understanding patient preferences for teledermatology can help practitioners more effectively deploy this technology into practice, with the hopes of improving access, convenience, and outcomes while reducing cost. By adding outcome measures and patient satisfaction insights into specific televisit types in future research, investigators can more effectively determine the most appropriate situations when teledermatology should be offered, what the appropriate teledermatology modality is, and when in the initial visit or follow-up timeframe these modalities should be used.

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