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Comparing acne follow-up: teledermatology versus outpatient dermatology visits

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Abstract

The application of teledermatology for evaluating acne patients has yielded comparable therapeutic outcomes with traditional face-to-face evaluation, but follow-up compliance between these modalities is not well-studied. Our objective is to compare the rate and duration of follow-up between acne patients initially evaluated by teledermatology versus in-person outpatient consultation. Electronic medical review of acne patients, 18-35 years-old seen via teledermatology and face-to-face evaluation at the University of Pittsburgh Medical Center between 2010-2018 was performed. Teledermatology patients were less likely to follow-up in the first 90 days (13.0% versus 31.0%, $P < 0.001$) compared to patients seen face-to-face with overall follow-up rates of 22% among both modalities. The median time to follow-up was 45.5 days (IQR: 13/57) in the teledermatology group compared to 64 days (IQR: 56/77) in the face-to-face group ($P < 0.001$). Teledermatology patients were more likely to be treated with oral antibiotics (43.0% versus 28.5%) or oral spironolactone (18.5% versus 12.5%) compared to patients seen face-to-face ($P < 0.001$). Teledermatology poses a promising solution to extend dermatologic care with earlier access to follow-up. Our data demonstrates a need to improve teledermatology follow-up education to improve follow-up care.

Keywords: teledermatology, acne vulgaris, follow-up

Introduction

Teledermatology is increasingly being used in modern day medicine to provide care and diagnose

dermatologic conditions in such diverse settings as military combat zones, rural areas in the U.S., and many parts of the world with reduced access to healthcare [1-4]. To support the use of teledermatology, many studies have demonstrated a shortage of dermatologists with only 36 dermatologists per one million people, an average 36 calendar day wait time for new patient appointments, and 49% of practicing dermatologists feeling that they need more dermatologists in their communities [5, 6]. With the advent of teledermatology, we are now better equipped to address this shortage by increasing access to care as shown in one study, which used teledermatology to improve dermatologic access among Medicaid enrollees by at least 63.8% [7]. Currently, teledermatology is commonly employed through an asynchronous modality with store-and-forward technology, whereby clinical images are obtained and sent to the dermatologist who can review the images and clinical history [1]. Advantages of teledermatology include cost reduction, improvement in triaging care, reduction in time to biopsy or excision, and reduction of in-person referrals by 72% [1, 8, 9]. At the University of Pittsburgh Medical Center, one study found that the use of teledermatology could reduce consultation to outpatient dermatology clinics by 65% [1]. Accuracy has also been observed to be elevated with inter-observer agreement rates between teledermatology-based and clinic-based evaluation ranging between 70 and 90% [1].

Specifically, studies that focus on teledermatology applications in acne treatment have found comparable therapeutic outcomes between teleder-

Table 1. Teledermatology versus face-to-face acne evaluation demographics.

	eDermatology (200)		Face-to-Face Visit (200)		Both (400)	
Sex						
Male (%)	35	17.5%	35	17.5%	70	17.5%
Female (%)	165	82.5%	165	82.5%	330	82.5%
Age at Diagnosis						
Mean (SD)	25.7	±4.1	25.7	±4.1	25.7	±4.1
Ethnicity						
White (%)	152	76.0%	170	85.0%	322	80.5%
Black or African American (%)	17	8.5%	6	3.0%	23	5.8%
Hispanic/Latino (%)	1	0.5%	3	1.5%	4	1.0%
Asian (%)	13	6.5%	15	7.5%	28	7.0%
Native American (%)	0	0.0%	1	0.5%	1	0.3%
Not available/declined (%)	17	8.5%	5	2.5%	22	5.5%

matology consultation and outpatient consultation with fewer adverse reactions; furthermore, patients seen in a teledermatology setting were satisfied with mobile services and none requested further in-person consultation [10]. Another study comparing outcomes at four follow-up e-visits versus conventional office care demonstrated a similar decrease in total inflammatory lesion count along with comparable subject and dermatologist satisfaction with e-visit versus standard in-office evaluation [11]. However, follow-up after initial teledermatology evaluation for acne has not been compared to that of outpatient dermatology. This is an important part of establishing care after consultation and is even listed in the American Telemedicine Association Practice Guidelines for Teledermatology issued in 2016 [12]. To the author's knowledge, no articles have been published on this topic to date. The objective of this study was to analyze whether acne patients seen via teledermatology had different follow-up rates compared to those of outpatient, face-to-face dermatology visits within three months of the initial visit.

Methods

Study design

This retrospective chart review was approved by the institutional review board of University of Pittsburgh (STUDY18120157) and compares follow-up

compliance in teledermatology with that of face-to-face outpatient dermatology visits at an urban tertiary care center, UPMC, from 2010 to 2018. A list of eligible patient charts was generated using the UPMC Health Record Research Request service, and inclusion criteria consisted of patients aged 18-35 newly diagnosed with an ICD 9 (706.1) or 10 code (L70.0) of acne vulgaris through teledermatology or face-to-face visits. Patients currently receiving or requiring oral isotretinoin therapy were excluded. We first identified and reviewed 200 eligible patient charts seen via teledermatology and then selected 200 patients seen through face-to-face meetings, who matched the age and gender distribution in the teledermatology group. Electronic medical records were reviewed for gender, ethnicity, age of first visit, date of first visit, date of first follow-up visit, follow-up modality (teledermatology or face to face), acne type or severity, insurance status, and treatment type. Our primary outcome was defined as follow-up within three months of their initial visit as suggested by American Academy of Dermatology guidelines to minimize bacterial resistance [13]. Treatment was divided into four groups regardless of oral contraceptive (OCP) treatment: only topical therapy, oral antibiotics with or without topical therapy, oral spironolactone with or without topical therapies, and oral antibiotics and spironolactone with or without topical therapy. Of note, any patient without a recorded insurance provider in the electronic chart was documented as uninsured.

Table 2. Teledermatology versus face-to-face acne evaluation clinical characteristics.

	eDermatology (200)		Face-to-Face Visit (200)		Both (400)		P value
Acne type*							
Comedonal acne (%)	10	5.0%	46	23.0%	56	14.0%	
Inflammatory acne (%)	28	14.0%	64	32.0%	92	23.0%	
Hormonal acne (%)	30	15.0%	33	16.5%	63	15.8%	
Nodulocystic (%)	9	4.5%	10	5.0%	19	4.8%	
Scarring acne (%)	0	0.0%	7	3.5%	7	1.8%	
Steroid acne (%)	0	0.0%	2	1.0%	2	0.5%	
Acne nos (%)	138	69.0%	99	49.5%	237	59.3%	
Treatment modality							<0.001
Only topical treatment with or without ocp (%)	62	31.0%	106	53.0%	168	42.0%	
Oral antibiotics with or without topicals or ocp (%)	86	43.0%	57	28.5%	143	35.8%	
Oral spironolactone with or without topicals or ocp (%)	37	18.5%	25	12.5%	62	15.5%	
Both antibiotic and spironolactone treatment with or without topicals or ocp (%)	15	7.5%	12	6.0%	27	6.8%	
Median overall days to follow-up (p25/p75)	139	66, 342	92	70, 158	98	68, 213	
Number of patients that followed-up in 90 days (%)	26	13.0%	62	31.0%	88	22.0%	<0.001
Median days to follow-up among patients returning in 90 days (p25/75)	45.5	13, 57	64	56, 77	61.5	45.5, 75.5	<0.001
Modality of follow-up ⁺							
eDermatology follow-up	8	30.8%	0	0.0%	8	9.1%	
Face-to-face visit follow-up	18	69.2%	62	100%	80	90.9%	
Insurance status							0.8
Patients without documented insurance status (%)	33	16.5%	35	17.5%	68	17.0%	
Patients with documented insurance status (%)	167	83.5%	165	82.5%	332	83.0%	

*Patients may fall into more than one acne type based on chart review.

⁺Follow-up percentages were calculated based on a total of 32 eDermatology and 63 face-to-face patients having follow-up.

Abbreviations: OCP: Oral contraceptive; Acne not otherwise specified: Acne NOS

Statistical analysis

The primary analysis in this study focused on whether patients initially seen by teledermatology or face-to-face visit had follow-up within three months of their initial visit. Descriptive statistics were presented as mean and standard deviation or median with inter-quartile range for continuous variables; frequency with percent was used to describe categorical variables. Differences in patient characteristics between teledermatology and face-to-face visits were assessed using Pearson Chi-square tests for categorical variables and t-tests or Wilcoxon rank sum tests for continuous variables.

Results with $P < 0.05$ were considered statistically significant. All analyses were performed using Stata, version 15 (StataCorp. College Station, TX: StataCorp LLC).

Results

Demographics and acne type

In this study, 400 cases were evaluated including 200 teledermatology cases with initial visits between July 2015 and October 2018 and 200 face-to-face cases with initial visits between November 2010 and

October 2018. Although we attempted to match on one-year age stratum, there were slightly more 26-year-old males among the teledermatology cases who could not be perfectly matched in the face-to-face case group. Demographic characteristics for teledermatology, face-to-face, and overall visits are described in **Table 1**. A description of acne type among teledermatology and face-to-face initial visits is shown in **Table 2**. Notably, some patients were documented as having more than one type of acne. In our cohort of patients, 59.3% (237/400) of patients were diagnosed as acne not otherwise specified (Acne NOS), including 69.0% (138/200) and 49.5% (99/200) of teledermatology and face-to-face patients, respectively (**Table 2**).

Treatment modality and insurance type

Recorded treatment modalities for teledermatology and face-to-face cases are also demonstrated in **Table 2**. The greatest percentage of teledermatology cases were treated with oral antibiotics with or without topical therapy or OCPs at 43% (86/200). On the other hand, the highest percentage of face-to-face cases were treated with only topical therapy with or without OCPs at 53% (106/200). Importantly, antibiotics with concomitant spironolactone with or without topical therapy or OCPs represented the smallest percentage of cases in both teledermatology and face-to-face groups at 7.5% (15/200) and 6.0% (12/200), respectively. Differences in treatment modality were significant between the teledermatology and face-to-face cases ($P < 0.001$). Only 5.8% (3/52) of teledermatology and 2.7% (1/37) of face-to-face patients prescribed with spironolactone did not demonstrate oral contraception discussion.

In **Table 3**, the 160 patients with at least one documented acne type were categorized as follows: only comedonal-type acne, inflammatory or hormonal acne patients with or without comedonal acne, and nodulocystic acne patients with or without comedonal, inflammatory, or hormonal acne. All patients (13/13) with only comedonal-type acne were treated with topical therapy. Most inflammatory or hormonal acne patients with or without comedonal acne were treated with either topical agents at 33.6% (43/128) or oral antibiotics with or without topical agents at 39.06% (50/128). The majority of nodulocystic patients with or without comedonal, inflammatory, or hormonal acne were treated with oral antibiotics with or without topical agents (47.4%, 9/19) or both antibiotics and spironolactone with or without topical agents (21.1%, 4/19), demonstrating that treatment modality followed trends in recorded acne severity type. Treatment modality distribution was similar across specified versus unspecified acne types.

In addition, the percentage of patients with documented insurance was 83.5% (167/200) of teledermatology patients and 82.5% (165/200) of face-to-face patients (**Table 2**), ($P = 0.8$). No significant difference was noted between prescribed treatment modality and patient insurance status ($P = 0.8$).

Follow-up

Median duration to follow-up was 45.5 days (IQR: 13, 57) for teledermatology cases and 64 days (IQR: 56, 77) for face-to-face cases ($P < 0.001$), implying earlier access to care via electronic than in-person scheduling. Importantly, 13% (26/200) of teledermatology cases and 31% (62/200) of face-to-

Table 3. Acne treatment modality by acne type*.

	Comedonal Acne (13)		Inflammatory or Hormonal Acne (128)		Nodulocystic Acne (19)	
	n	%	n	%	n	%
Only topical treatment with or without OCP (%)	13	100%	43	33.6%	3	15.8%
Oral antibiotics with or without topicals or OCP (%)	0	0%	50	39.1%	9	47.4%
Oral spironolactone with or without topicals or OCP (%)	0	0%	27	21.1%	3	15.8%
Both antibiotic and spironolactone treatment with or without topicals or OCP (%)	0	0%	8	6.3%	4	21.1%

*Patients were categorized by recorded acne type as follows: only comedonal-type acne, inflammatory or hormonal acne patients with or without comedonal acne, and nodulocystic acne patients with or without comedonal, inflammatory, or hormonal acne. OCP, oral contraceptive.

face cases followed-up within the standard 90-day interval ($P < 0.001$). The overall follow-up rate for both modalities was only 22%; in addition, 8/26 (30.8%) teledermatology cases completed follow-up via teledermatology whereas 18/26 (69.2%) teledermatology cases completed follow-up via face-to-face. All face-to-face follow-ups (62/62) completed follow-up in-person (**Table 2**). Notably, no statistically significant differences in 90-day follow-up rates were noted based on gender ($P = 0.6$), age ($P = 0.08$), documented insurance status ($P = 0.2$), or treatment modality ($P = 0.5$).

In the face-to-face group, 26 patients had initial evaluation prior to that of the teledermatology cases. These 26 patients were significantly younger than other face-to-face patients ($P = 0.009$), but there were no significant differences in terms of gender, treatment modality, or follow-up rate ($P > 0.05$).

Discussion

We found that patients seen via teledermatology have lower overall follow-up rates than those seen in a face-to-face setting (13 versus 31%, $P < 0.001$). This result is consistent with patient and referring provider concerns of teledermatology with surveys demonstrating that 21% of patients and 26% of referring providers complained about inconsistencies in follow-ups. However, in our study, only 22% of the combined cohort had any follow-up, demonstrating room for improvement in both modalities [14]. Interestingly, teledermatology patients were also more likely to be treated with oral antibiotics with or without topical therapy or OCPs (43.0% versus 28.5%) or oral spironolactone with or without topical agents or OCPs (18.5% versus 12.5%). This can possibly indicate that acne patients seen via teledermatology are getting better control of their acne with stronger oral medications and are, therefore, less likely to follow-up. However, follow-up rates did not differ based on treatment modality overall ($P = 0.5$), suggesting that it was less likely to play a role.

The greater percentage of patients treated with spironolactone or oral antibiotics among teledermatology patients should also necessitate

closer follow-up to ensure that patients are not encountering complications of their treatment. Interestingly, our data showed that only 5.8% of teledermatology and 2.7% of face-to-face patients prescribed spironolactone did not document oral contraception discussion. This demonstrates that a majority of spironolactone cases mentioned OCP discussion among both teledermatology and face-to-face visits; the remaining cases may relate to lack of documentation, demonstrating the importance of documenting oral contraception with spironolactone if discussed. According to one review, although an effective medication for acne with demonstrated improvement in facial acne by 73.1%, spironolactone has been associated with such side effects as menstrual irregularities and lightheadedness in 46% of treated patients with 5% discontinuing the medication secondary to side effects [15]. Other notable documented adverse effects include diuresis, breast tenderness or enlargement, fatigue, hyperkalemia, headache, and teratogenicity [13,16]. The association of chronic oral tetracycline antibiotic use with increased risk of antibiotic resistance, upper respiratory tract infections, inflammatory bowel disease, pharyngitis, *C. difficile* infection, and *Candida* vulvovaginitis has been demonstrated [13, 17, 18]. In fact, owing to the risk of developing bacterial resistance, the American Academy of Dermatology guidelines currently recommend re-evaluation of systemic antibiotic use every 3-4 months [13]. This level of follow-up not only allows for monitoring for potential adverse effects, but it also allows for adjustment of therapy as well as assessment of compliance, response to treatment, patient satisfaction, and tolerability [19]. Furthermore, we do not notice a significant difference in the percentage of patients with documented insurance status among teledermatology and face-to-face patients seen for an initial diagnosis of acne. Thus, insurance status is unlikely to play a role in differences in the rate of follow-up between patients using teledermatology versus face-to-face visits.

In addition, it is important to note that all face-to-face visits completed follow-up in-person, and 30.8% (8/26) of teledermatology patients completed follow-up via teledermatology. This could relate to

patient preference, teledermatologist recommendation, or a possible lack of patient education on the ability to follow-up via teledermatology. The fact that teledermatology patients in our study had shorter median follow-up times compared to face-to-face patients may also show easier access to care via this modality. Further information and education on the ability to have teledermatology follow-ups could potentially maximize effective treatment and prevention of complications.

Study limitations include the retrospective nature of the study as it does not account for unmeasured confounders that could affect whether a patient chooses to use teledermatology, including the average distance from the treating provider. Furthermore, a significant percentage of patients, 59% (236/400), did not have a specified type of acne or level of acne severity as recorded by the evaluating dermatologist. However, we were able to use prescribed treatment as an approximate surrogate for acne severity based on the demonstrated correlation between acne severity type and treatment modality.

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Conclusion

In conclusion, this data demonstrates the increasing need to establish teledermatology follow-up education for acne to improve follow-up care for patients seen via this modality and make it comparable to that of in-person visits. However, our paper also demonstrates significantly shorter teledermatology follow-up times potentially indicating earlier access to care. Further information and education on the ability to have teledermatology follow-up could potentially maximize effective treatment and prevent complications. Future prospective studies can evaluate interventions to improve follow-up rates such as sending electronic follow-up reminders and limiting medication prescription duration to ensure follow-up compliance and to decrease risk for potential antibiotic resistance.

Potential conflicts of interest

The authors declare no conflicts of interests.

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