Impact of teledermatology on the accessibility and efficiency of dermatology care in an urban safety-net hospital: A pre-post analysis

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Background: Teledermatology enables dermatologists to remotely triage and evaluate dermatology patients, but previous studies have questioned whether teledermatology is clinically efficient.

Objective: To determine whether implementation of a teledermatology system at the Zuckerberg San Francisco General Hospital and Trauma Center has improved the accessibility and efficiency of dermatology care delivery.

Methods: Retrospective, pre-post analysis of a pre-teledermatology cohort (June 2014-December 2014) compared with a post-teledermatology cohort (June 2017-December 2017).

Results: Our analysis captured 11,586 patients. After implementation of teledermatology, waiting times for new patients decreased significantly (84.6 days vs 6.7 days; $P < .001$), total cases evaluated per month increased significantly (754 vs 901; $P = .008$), and number of cases evaluated per dermatologist-hour increased significantly (2.27 vs 2.63; $P = .010$). In the post-teledermatology period, 61.8% of teledermatology consults were managed without a clinic visit.

Limitations: We were unable to control for changes in demand for dermatology evaluations between the 2 periods and did not have a control group with which to compare our results.

Conclusion: The dermatology service was more accessible and more efficient after implementation of teledermatology, suggesting that capitated health care settings can benefit from implementation of a teledermatology system. (J Am Acad Dermatol 2019;81:1446-52.)

Key words: access; appointments avoided; efficiency; store-and-forward; teledermatology; telehealth; telemedicine; underserved populations.

Teledermatology has become an increasingly used modality to deliver dermatology services. Analyses of teledermatology programs throughout different health care systems have demonstrated improved patient access, as measured through shorter waiting times,[1-5] with comparable diagnostic accuracy compared with in-person clinic appointments.[6-8] Teledermatology has also received positive reviews from patients[6,8-10] and providers.[9-11] However, whether teledermatology leads to greater efficiency within a health care system remains unclear. Many studies have claimed improved efficiency based on the percentage of dermatology clinic visits avoided,[3,4,8,12,13] but economic analyses of teledermatology systems have demonstrated mixed results in cost-effectiveness.[4,5,13-20] Furthermore, few studies have analyzed teledermatology systems within capitated health care

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systems, such as county and Veterans Administration hospitals, that would benefit most from improved efficiency.[1,2,5,11,12] We sought to address these gaps by analyzing the teledermatology system at Zuckerberg San Francisco General Hospital and Trauma Center (ZSFG).

METHODS

Study setting

The ZSFG Dermatology Clinic is the primary referral site for skin-related diseases for San Francisco Health Network. The San Francisco Health Network, including ZSFG, is owned and supported by the San Francisco Department of Public Health. ZSFG cares for a population of approximately 150,000 San Francisco residents per year, with most being publicly insured. Health care services are delivered primarily through a capitation payment arrangement.

CAPSULE SUMMARY

- Previous analyses of teledermatology have demonstrated improved access to care but inconsistent changes to the effectiveness of dermatology care delivery. We observed increased patient accessibility and improved clinical efficiency after implementation of teledermatology.
- Large, closed health care systems may benefit from using teledermatology to triage and manage patients.

Teledermatology program

The ZSFG teledermatology program was introduced through a 2-year phased implementation plan (January 2015 through December 2016). Before January 2015, all patients referred to the dermatology clinic were given appointments on a first-come, first-served basis without preclinic case review.

The teledermatology program was designed as a "triage" service for all nonemergent dermatology referrals. Referring clinic personnel were trained to use the teledermatology system through 2 group training sessions. Digital point-and-shoot cameras (Powershot ELPH 115 IS camera, Canon U.S.A, Melville, NY) were provided to each referring clinic. Referring providers upload images and consult questions through a web-based telemedicine platform (Medweb, version 7.0.11, San Francisco, CA).

During a dedicated weekly session, a team of 3 to 4 dermatology residents and an attending dermatologist meet to review teledermatology cases. Cases are first reviewed on the computer by a resident and then presented to the attending, who helps finalize the assessment and plan in the telemedicine platform. An electronic consult is generated for the referring provider with the expectation that the referring provider will implement the initial workup and treatment plan when necessary. The telemedicine platform also generates electronic communications to dermatology clinic staff to schedule patients approved for clinic visits.

Integration enhancements were made with the telemedicine platform to allow for autopopulation of patient identifiers from the electronic health record and for distribution of report completion notifications to referring providers. Furthermore, integration with an enterprise imaging platform (Imaging Clinical Information System [ICIS], Agfa HealthCare, Mortsel, Belgium) allowed for images acquired through the telemedicine platform to be archived into our hospital picture archiving and communication system.

No other major changes were made to clinic personnel or clinic flow between the 2 study periods, and there were no significant differences in the total volume of patients served by the hospital system or specialty clinics between the 2 periods.

Study design

We conducted a retrospective, pre-post analysis of dermatology clinic services at ZSFG. Specialty service metrics were systematically measured at ZSFG starting in June 2014. Therefore, June 2014 through December 2014 was designated as the pre-teledermatology period. June 2017 through December 2017 was designated as the post-teledermatology period to assess a postimplementation steady state and to limit seasonal effects. The pre-teledermatology analysis included all new or established patients older than 18 years seen at the ZSFG Dermatology Clinic between June 1, 2014, and December 31, 2014. The post-teledermatology analysis captured all new or established patients older than 18 years who were evaluated at the dermatology clinic or via teledermatology between June 1, 2017, and December 31, 2017.

Patients seen in the dermatology clinic included both new and established patients. Waiting times were specifically for new patients being seen in the dermatology clinic and were measured by third-next available appointment (TNAA). In the post-teledermatology period, waiting times represented the time from completion of the teledermatology referral review to the TNAA.

Abbreviations used:	
CI:	confidence interval
TNAA:	third-next available appointment
ZSFG:	Zuckerberg San Francisco General Hospital and Trauma Center

Our study was reviewed by the University of California, San Francisco Human Research Protection Program Institutional Review Board and granted exempt certification on April 19, 2018 (Reference #215917).

Data

Clinic operational data (new patient waiting times, clinic volumes, and attendance) were independently generated by the ZSFG Specialty Care and Diagnostics Department. The number of dermatology clinics and the amount of time spent by dermatology attendings and residents seeing clinic patients were recorded by the dermatology department administration. We excluded the hours of nondermatologist providers (rotating medical students, internal medicine residents, and family medicine residents) because their clinic attendance was inconsistently recorded.

Measurements relevant only to the post-teledermatology period included number of teledermatology consults answered, number of teledermatology consults referred for a dermatology clinic visit, number of teledermatology patients referred for a clinic appointment who attended their appointment, and number of minutes spent by dermatology physicians answering teledermatology referrals. Medweb software automatically collects data on multiple parameters, and data reports can be generated for each of these parameters.

The percentage of dermatology clinic visits avoided per month was calculated by dividing the number of teledermatology cases not referred to clinic by the total number of teledermatology cases answered. To calculate the number of cases evaluated per dermatologist-hour, we divided the total number of dermatology patients evaluated by the total number of hours spent seeing patients in clinic or reviewing teledermatology cases. In the post-teledermatology period, the total number of dermatology patients evaluated was the sum of patients seen in dermatology clinic and patients managed exclusively through teledermatology without a dermatology clinic visit. We also calculated the number of clinic patients evaluated per dermatologist hour spent in clinic for the post-teledermatology period.

Table I. Demographic characteristics of the study populations

Variable	Pre-teledermatology sample (n = 5278)	Post-teledermatology sample (n = 6308)
Female, No. (%)	2660 (50.4)	2965 (47.0)
Race/ethnicity, No. (%)		
White non-Hispanic	1847 (35.0)	1937 (30.7)
White Hispanic	929 (17.6)	1646 (26.1)
Asian	1188 (22.5)	1451 (23.0)
Black or African American	596 (11.3)	637 (10.1)
Other	718 (13.6)	637 (10.1)
Age, mean (SD), y	51.34 (14.94)	52.55 (15.99)
Health care coverage, No. (%)		
Medi-Cal	2624 (49.7)	3261 (51.7)
Medicare	1099 (20.8)	1458 (23.1)
Healthy San Francisco	724 (13.7)	637 (10.1)
Other coverage	698 (13.2)	864 (13.7)
Uninsured	133 (2.5)	88 (1.4)
Primary language, No. (%)		
English	3621 (68.6)	4170 (66.1)
Spanish	939 (17.8)	1142 (18.1)
Cantonese	364 (6.9)	580 (9.2)
Other	354 (6.7)	416 (6.6)

Statistical analysis

No sample size calculation was performed given our pre-post study design. The percentage of dermatology clinic visits avoided is provided as a descriptive statistic for the post-teledermatology period only. Waiting times for new patients, total number of cases evaluated per month, total number of cases evaluated per dermatologist-hour per month, and number of clinic patients evaluated per dermatologist-hour in clinic per month were compared by 2-tailed t tests. No-show rates were compared by a 2-tailed, 2-proportion z test. A P value of $<.05$ was deemed significant. The statistical analysis was performed using Excel 14.2.0 software (Microsoft, Redmond, WA).

RESULTS

Patient population

Our analysis captured 5278 dermatology patients in the pre-teledermatology period and 6308 in the post-teledermatology period. Demographics of patients in the pre- and post-teledermatology periods were similar (Table I). Patients were ethnically and culturally diverse, with 45% identifying as nonwhite and 33% speaking a primary language other than English. Insurance coverage reflects the socioeconomic status of the patients, with 51% having Medi-

Table II. Access measures

Variable*	Pre-telederm	Post-telederm	Change (%)	*P* value
Patients seen in clinic per month, No.	754 (706.93-801.07)	681 (612.16-749.27)	−9.68	.110
Teledermatology referrals per month, No.	N/A	300 (259.85-339.58)	N/A	N/A
Dermatology patients evaluated per month (clinic + teledermatology only), total No.	754 + 0 = 754 (706.93-801.07)	681 + 221 = 902 (824.40-977.89)	+19.5	.008
Clinic waiting times (TNAA) for new patients, d	84.6 (69.66-99.49)	6.7 (2.78-10.65)	−92.08	<.001

N/A, Not applicable; *TNAA*, third-next available appointment.
*Data in parenthesis are the 95% confidence interval.

Cal, 22% having Medicare, 2% lacking insurance, and 25% having other coverage or being enrolled in Healthy San Francisco (a subsidized program for uninsured residents of San Francisco who are not eligible for Medicare or Medi-Cal).

Access

During the pre-teledermatology period, 754 dermatology patients were seen in the clinic per month (95% confidence interval [CI], 706.93-801.07 patients) (Table II). During the post-teledermatology period, 4765 patients were seen in clinic (average, 681 per month), and 1544 patients were evaluated entirely through teledermatology (average, 221 per month), with an average of 902 total patients being managed per month (95% CI, 824.40-977.89 patients). A 2-tailed *t* test demonstrated a nonstatistically significant difference between the average number of patients seen in the dermatology clinic per month ($P = .110$). A 2-tailed *t* test demonstrated a statistically significant difference between the total number of patient cases managed by dermatology per month ($P = .008$).

The mean TNAA for patients seen at the dermatology clinic was 84.6 days (95% CI, 69.66-99.49 days) in the pre-teledermatology period and 6.7 days (95% CI, 2.78-10.65 days) in the post-teledermatology period. A difference between these 2 periods was statistically significant ($P < .001$).

Efficiency

Weekly teledermatology sessions lasted an average of 100 minutes and led to 69.9 referrals being reviewed (Table III). During the post-teledermatology period, 801 of the 2098 teledermatology consults answered (38.2%) were recommended for a dermatology clinic visit. Of the 801 patients recommended for a clinic visit, 554 (69.2%) attended their appointment (Fig 1).

An average of 11.29 clinics was held per month during the pre-teledermatology period (95% CI, 10.47-12.11 clinics) compared with an average of 10.71 clinics held per month during the post-teledermatology period (95% CI, 9.52-11.90 clinics). The difference was not statistically significant ($P = .454$).

During the pre-teledermatology period, attendings and residents spent an average of 332 hours per month seeing patients in clinic (95% CI, 295.44-367.99 hours). During the post-teledermatology period, attendings and residents spent an average of 342 hours per month seeing patients in clinic and reviewing teledermatology cases (95% CI, 316.28-368.29 hours). The difference was not statistically significant ($P = .651$) and was maintained when specifically comparing time spent by attendings seeing patients in the clinic or reviewing teledermatology cases.

During the pre-teledermatology period, dermatologists logged 2322 hours at the clinic and were able to manage 5278 patient cases. Therefore, the number of cases evaluated per dermatologist-hour was 2.273 (95% CI, 2.10-2.45 cases). During the post-teledermatology period, dermatologists logged 2396 hours seeing patients or reviewing teledermatology cases and were able to manage 6308 patient cases. Therefore, the number of cases evaluated per dermatologist-hour was 2.633 (95% CI, 2.51-2.76 cases). A 2-tailed *t* test comparing these findings yielded a statistically significant result ($P = .010$).

During the post-teledermatology period, dermatologists logged 2164 hours in the dermatology clinic and evaluated 4765 patients in the clinic. Therefore, the number of clinic cases evaluated per dermatologist-hour was 2.20 (95% CI, 2.10-2.30 cases). A 2-tailed *t* test comparing this value against the number of cases evaluated per dermatologist-hour in the pre-teledermatology period yielded a nonstatistically significant result ($P = .360$).

Table III. Efficiency measures

Variable*	Pre-telederm	Post-telederm	Change (%)	*P* value
Clinics per month, average No.	11.29 (10.47-12.11)	10.71 (9.52-11.90)	−5.14	.454
Provider-hours per month (clinic + teledermatology), total hours	332 + 0 = 332 (295.44-367.99)	309 + 33 = 342 (316.28-368.29)	+3.01	.651
Cases evaluated per dermatologist-hour				
Overall	2.27 (2.10-2.45)	2.63 (2.51-2.76)	+15.86	.010
Clinic only	2.27 (2.10-2.45)	2.20 (2.10-2.30)	−3.08	.360
No-show rates for all clinic visits	0.302 (0.290-0.314)	0.304 (0.293-0.315)	+0.7	.810

*Data in parenthesis are the 95% confidence interval.

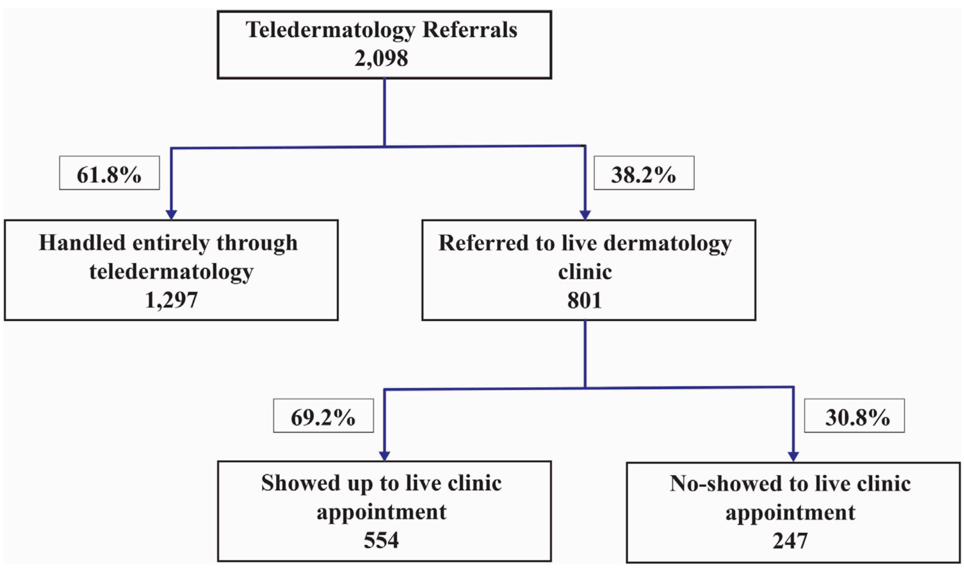

Fig 1. Flow diagram of teledermatology referrals in post-teledermatology period.

The no-show rate for dermatology clinic visits in the pre-teledermatology period was 0.302 (95% CI, 0.290-0.314) and for all clinic visits in the post-teledermatology period was 0.304 (95% CI, 0.293-0.315). A 2-tailed z test yielded a nonstatistically significant result (P = .810).

DISCUSSION

We conducted a retrospective, pre-post study to analyze the effects of teledermatology implementation on the accessibility and efficiency of dermatology care delivery within an urban safety-net hospital. Our findings demonstrate that implementation of a teledermatology triage system led to an increase in patient access to dermatology services by reducing new patient waiting times and increasing the total number of dermatology patient cases evaluated per month. In addition, teledermatology implementation led to an increase in the efficiency of dermatology care delivery by increasing the number of cases that could be managed per dermatologist-hour and by enabling nearly two-thirds of dermatology referrals to be evaluated without a dermatology clinic visit.

Our finding that teledermatology leads to shorter waiting times for new patients is consistent with previous studies analyzing other teledermatology systems.[1-5] However, many of these studies analyzed pilot programs or global health programs and may not have accurately represented the effects of teledermatology when fully implemented. One study analyzing teledermatology implementation within a large, closed health care system found statistically significant reductions in patient waiting time,[1] whereas another found reductions that were not statistically significant.[11] Our findings support the idea that teledermatology implementation can significantly reduce waiting times for new patients in large, closed health care settings.

The percentage of dermatology clinic visits avoided with teledermatology varies widely across health care systems. Among other studies analyzing teledermatology systems in large health care settings, the proportion ranges from 31%[12] to 84.4%.[6] Our finding of 61.8% lies in the middle of this range. We believe the key factor enabling us to achieve a low clinic referral rate is that dermatologists, rather than primary care physicians, designate whether a patient needs to be seen in the clinic. The key factor preventing us from reaching the upper threshold of this range may be the increased complexity of dermatology cases seen at ZSFG given its role as a secondary and tertiary referral hospital.

Our direct measure for efficiency demonstrating that teledermatology led to a higher number of patient cases evaluated per dermatologist-hour is novel. The significance of this finding is that the teledermatology system enabled the dermatology department to manage an increased number of patient cases for the same amount of human resources, thus suggesting that teledermatology may be an effective means of improving the efficiency of dermatology care delivery within large health care settings.

Several teledermatology systems previously reported within large, closed health care settings gave referring physicians the choice to submit their patient's case to teledermatology or to send it directly to the dermatology clinic.[1,11] In contrast, we required all referring primary care physicians to submit a teledermatology consult. Funneling all patients through teledermatology has multiple upsides. First, it shifts the triaging responsibility from primary care physicians to dermatologists, who may be more experienced at determining which patients warrant specialist care. Second, it enables more equitable distribution of dermatology resources to patients in the health care system because the amount of dermatology care a patient receives is based primarily on the severity of their presenting condition rather than other factors such as the ability of the referring physician or patient to obtain an appointment.

Telemedicine triage systems such as ours probably lead to increased average complexity of clinic patients, because straightforward cases are more often managed exclusively through teledermatology. In a closed or capitated health care model, reserving specialist visits for patients with complex medical needs may be more efficient, and such patients may require longer average clinic visits. We lacked sufficient tools to directly measure complexity, but found a downward, albeit nonstatistically significant, trend in the average number of clinic patients evaluated per dermatologist-hour in clinic from 2.27 in the pre-teledermatology period to 2.20 in the post-teledermatology period. This observed downward trend toward fewer patients managed hourly is perhaps explained by increased average patient complexity.

Strengths

We believe our results can be generalizable to both academic and nonacademic health care settings. Although residents were largely responsible for reviewing and responding to teledermatology consults at ZSFG, we counted an hour spent by a dermatology resident reviewing cases as being equivalent to an hour spent by an attending dermatologist. Therefore, an argument could be made that teledermatology may be even more efficient if implemented in a health care setting in which attending dermatologists manage teledermatology referrals without the added responsibility of teaching residents. Our results are also generalizable to health care settings serving vulnerable populations. We found that the teledermatology system led to increased efficiency and patient accessibility while serving a patient population with lower relative health literacy and socioeconomic status.

Limitations

Our study is limited by several factors. First, we focused solely on efficiency costs to the dermatology department without factoring in the time burden teledermatology may impose on other systems, most notably, referring physicians and clinics. Another study suggested that the rapid management of patients being triaged through teledermatology leads to fewer patient visits to their primary care physicians,[2] but this may not necessarily be true for our teledermatology system.

Second, we could not control for differences in demand for dermatology care between the 2 periods because we lacked records on the number of referrals for dermatology care at ZSFG in the pre-teledermatology period.

Third, we did not have a comparator clinic to act as a control group. Therefore, we are unable to control for confounding factors such as a system-wide push for shorter clinic waiting times.

Fourth, we were unable to measure the true waiting times for new patients being seen in dermatology clinic and used TNAA as an estimate. Although a true measurement of waiting times would be preferable, the use of TNAA is well established in the literature as a reliable approximation for nonurgent clinic appointments.[21]

Finally, the telemedicine software used in this study allows providers to efficiently view referrals, submit responses, and generate lists of patients for clinic appointments. Similar software may not be compatible with all electronic medical record systems.

CONCLUSION AND FUTURE DIRECTIONS

Implementation of teledermatology in closed health care systems can improve patient access and clinical efficiency. Teledermatology therefore has the potential to enhance dermatology care delivery both from the perspective of the patient and from the perspective of the health care system. Areas of future investigation include analyzing the financial costs of teledermatology implementation, measuring dermatology-specific outcomes, and examining the effects of teledermatology on resident teaching.

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REFERENCES

1. Bezalel S, Fabri P, Park HS. Implementation of store-and-forward teledermatology and its associated effect on patient access in a Veterans Affairs dermatology clinic. *JAMA Dermatol*. 2015;151(5):556-557.
2. Carter ZA, Goldman S, Anderson K, et al. Creation of an internal teledermatology store-and-forward system in an existing electronic health record. *JAMA Dermatol*. 2017;153(7):644-650.
3. Chansky P, Simpson C, Lipoff J. Implementation of a teletriage system improves access to dermatologic care in an underserved clinic: a retrospective review. *J Invest Dermatol*. 2017;137(5). https://doi.org/10.1016/j.jid.2017.02.359.
4. Mcgoey ST, Oakley A, Rademaker M. Waikato Teledermatology: a pilot project for improving access in New Zealand. *J Telemed Telecare*. 2015;21(7):414-419.
5. Whited JD, Hall RP, Foy ME, et al. Teledermatology's impact on time to intervention among referrals to a dermatology consult service. *Telemed J E Health*. 2002;8(3):313-321.
6. Campagna M, Naka F, Lu J. Teledermatology: an updated overview of clinical applications and reimbursement policies. *Int J Womens Dermatol*. 2017;3(3):176-179.
7. Osei-Tutu A, Shih T, Rosen A, et al. Mobile teledermatology in Ghana: sending and answering consults via mobile platform. *J Am Acad Dermatol*. 2013;69(2):e90-e91.
8. Whited JD. Teledermatology. *Med Clin North Am*. 2015;99(6):1365-1379.
9. Ford JA, Pereira A. Does teledermatology reduces secondary care referrals and is it acceptable to patients and doctors?: a service evaluation. *J Eval Clin Pract*. 2015;21(4):710-716.
10. Weinstock MA, Nguyen FQ, Risica PM. Patient and referring provider satisfaction with teledermatology. *J Am Acad Dermatol*. 2002;47(1):68-72.
11. Naka F, Lu J, Porto A, Villagra J, Wu ZH, Anderson D. Impact of dermatology eConsults on access to care and skin cancer screening in underserved populations: a model for teledermatology services in community health centers. *J Am Acad Dermatol*. 2018;78(2):293-302.
12. Kessler S, Leavitt E, Pun S, et al. Teledermatology as a tool to improve access to care for medically underserved populations: a retrospective descriptive study. *J Invest Dermatol*. 2016;136(5):1259-1261.
13. Landow SM, Mateus A, Korgavkar K, Nightingale D, Weinstock MA. Teledermatology: key factors associated with reducing face-to-face dermatology visits. *J Am Acad Dermatol*. 2014;71(3):570-576.
14. Armstrong AW, Dorer DJ, Lugn NE, Kvedar JC. Economic evaluation of interactive teledermatology compared with conventional care. *Telemed J E Health*. 2007;13(2):91-99.
15. Eminović N, Dijkgraaf MG, Berghout RM, Prins AH, Bindels PJ, Keizer NFD. A cost minimisation analysis in teledermatology: model-based approach. *BMC Health Serv Res*. 2010;10:251.
16. Pak HS, Datta SK, Triplett CA, Lindquist JH, Grambow SC, Whited JD. Cost minimization analysis of a store-and-forward teledermatology consult system. *Telemed J E Health*. 2009;15(2):160-165.
17. Reid DS, Weaver LE, Sargeant JM, et al. Telemedicine in Nova Scotia: report of a pilot study. *Telemed J*. 1998;4(3):249-258.
18. Snoswell C, Finnane A, Janda M, Soyer HP, Whitty JA. Cost-effectiveness of store-and-forward teledermatology. *JAMA Dermatol*. 2016;152(6):702-708.
19. Yang X, Barbieri JS, Kovarik CL. Cost analysis of a store-and-forward teledermatology consult system in Philadelphia. *J Am Acad Dermatol*. 2019;81(3):758-764.
20. Whited JD, Datta S, Hall RP, et al. An economic analysis of a store and forward teledermatology consult system. *Telemed J E Health*. 2003;9(4):351-360.
21. Jones W, Elwyn G, Edwards P, et al. Measuring access to primary care appointments: a review of methods. *BMC Fam Pract*. 2003;4:8.