

UC Davis

UC Davis Previously Published Works

Title

Access to Dermatological Care with an Innovative Online Model for Psoriasis Management: Results from a Randomized Controlled Trial

Permalink

<https://escholarship.org/uc/item/1k17q9pt>

Journal

Telemedicine Journal and e-Health, 25(7)

ISSN

1530-5627

Authors

Ford, Adam R
Gibbons, Caitlin M
Torres, Josefina
[et al.](#)

Publication Date

2019-07-01

DOI

10.1089/tmj.2018.0160

Peer reviewed



Published in final edited form as:

Telemed J E Health. 2019 July ; 25(7): 619–627. doi:10.1089/tmj.2018.0160.

Access to Dermatological Care with an Innovative Online Model for Psoriasis Management: Results from a Randomized Controlled Trial

Adam R. Ford, BS¹, Caitlin M. Gibbons, MSSW¹, Josefina Torres, MD¹, Heather A. Kornmehl, MD², Sanminder Singh, MD³, Paulina M. Young, BS¹, Cindy J. Chambers, MD, MAS, MPH³, Emanuel Maverakis, MD³, Cory A. Dunnick, MD⁴, and April W. Armstrong, MD, MPH¹

¹Department of Dermatology, Keck School of Medicine of the University of Southern California, Los Angeles, California.

²Department of Dermatology, Drexel University College of Medicine, Philadelphia, Pennsylvania.

³Department of Dermatology, University of California Davis School of Medicine, Sacramento, California.

⁴Department of Dermatology, University of Colorado School of Medicine, University of Colorado Denver, Aurora, Colorado.

Abstract

Background: Many patients with chronic skin diseases lack regular access to dermatologists in the United States and suffer poor clinical outcomes.

Introduction: We performed a 12-month randomized controlled trial to evaluate the impact of an online, collaborative connected health (CCH) model for psoriasis management on access to specialty care.

Materials and Methods: The 300 enrolled patients were randomized to online or in-person care. We compared distance traveled as well as transportation and in-office waiting time between the two groups and obtained patient and provider perspectives on CCH.

Results: At baseline, no differences existed between the groups in difficulties obtaining specialty care. Over 12 months, the mean (standard deviation [SD]) distance traveled to and from appointments was 174.8 (± 577.4) km/person for the in-person group and 2.2 (± 14.2) km/person for the online group ($p = 0.0003$). The mean (SD) time spent on transportation and in-office waiting for in-person appointments was 4.0 (± 4.5) h/person for the in-person group and 0.1 (± 0.4) h/person for the online group ($p = 0.0001$). Patients found CCH to be safe, accessible, equitable,

Address correspondence to: April W. Armstrong, MD, MPH, Department of Dermatology Keck School of Medicine of the University of Southern California, 1975 Zonal Avenue, KAM 510, Los Angeles, CA 90089, aprilarmstrong@post.harvard.edu.

Disclosure Statement

Dr. Armstrong has no relevant conflict of interests with this study; other disclosures include serving as an investigator, consultant, advisor, and/or speaker to AbbVie, Janssen, Lilly, Novartis, Sanofi, Regeneron, Leo, Science 37, Modmed, Pfizer, Ortho Dermatologics, and Modernizing Medicine. All other authors have no competing financial interests.

efficient, effective, and patient-centered. Providers found CCH to be useful for providing psoriasis care.

Discussion: The CCH model resulted in significantly less distance traveled as well as transportation and in-office waiting time compared to in-person care. Both patients and providers were highly satisfied with CCH.

Conclusions: The CCH model resulted in increased access to specialty care and enabled patient-centered, safe, and effective management of psoriasis patients.

Keywords

dermatology; teledermatology; telemedicine; telehealth

Introduction

Psoriasis is a chronic, inflammatory skin disease that affects 3.2% of U.S. adults.¹ Psoriasis is associated with comorbidities, and patients experience substantially reduced quality of life.²⁻⁵ For psoriasis patients in the United States, access to dermatologists is limited.⁶⁻¹¹ Patients experience long wait times and have difficulty maintaining access to dermatologists for follow-up care.^{6,7} Without regular access to specialty care, psoriasis patients experience increased medical and psychiatric comorbidities and reduced quality of life.³ Therefore, increased access to dermatologists is critical for improving patient outcomes.¹²

Providers have used teledermatology to manage skin diseases remotely.¹³ Studies have shown that accurate diagnoses are possible with current teledermatology technology in many practice settings.¹³⁻¹⁷ Furthermore, patients report being satisfied with remote care.^{13,17-20}

Currently, traditional *consultative* asynchronous teledermatology is the most practiced model of teledermatology. In this model, the primary care provider (PCP) photographs the patient's skin lesions and transmits these images and clinical history to the dermatologist. The dermatologist then evaluates these data and provides recommendations to the PCP. The PCP implements the recommendations and manages the patient. In this model, the dermatologist serves as a consultant and has no direct patient contact. This model has not been widely adopted,^{19,21} partly due to lack of direct contact between patients and dermatologists and increased PCP workload.¹⁸

Critical gaps in the teledermatology literature exist in three areas: (1) novel teledermatology models that focus on highly patient-centric collaborative care, (2) access outcomes associated with these novel teledermatology models, and (3) patient and provider perspectives on these novel teledermatology models.^{9,22} In this study, we addressed these gaps by evaluating an innovative, online, collaborative connected health (CCH) model for psoriasis management that fostered multidirectional communication among dermatologists, PCPs, and patients. Specifically, we examined access outcomes and patient and provider perspectives on this model.

Materials and Methods

STUDY DESIGN

This 12-month, multicenter, pragmatic randomized controlled trial evaluated the impact of an online CCH model for psoriasis management compared to in-person care. The aims of this study were to compare access-to-care measures between patients randomized to CCH and in-person care and to assess the utility of CCH for increasing specialty care access from patient and provider perspectives.

PARTICIPANTS

The 300 enrolled participants were recruited from outpatient clinics and general adult populations in California and Colorado. The inclusion criteria were 18 years of age, having physician-diagnosed plaque psoriasis, having access to internet and a digital or mobile phone camera, and having a PCP or the ability to establish primary care.

RANDOMIZATION AND BLINDING

We performed stratified randomization using computer-generated random block sizes. Patients were randomized 1:1 to online or in-person care, stratified by site and disease severity (1:1:2 stratification to mild, moderate, and severe psoriasis groups). An independent statistician generated and concealed the randomization sequence and assigned participants to the interventions. Blinding of patients and providers was not possible due to the nature of the interventions.

INTERVENTION AND CONTROL

Online care (intervention arm).—Patients randomized to the online group received specialist care for their psoriasis through a secure, Health Insurance Portability and Accountability Act (HIPAA)-compliant, web-based CCH platform.²³ The CCH model was designed such that specialist services that usually occur in person could be delivered online asynchronously. The model enabled prompt receipt of dermatologist expertise and sharing of visit information among patients, PCPs, and dermatologists.

PCPs could access dermatologists online for consultation or requesting dermatologists to assume care of patients' psoriasis. In the consultation setting, the PCP's office would send digital photos and clinical history online to the dermatologist. The dermatologist would then provide treatment recommendations and patient educational materials online to the PCP and, with the PCP's permission, to the patient. In settings where the dermatologist assumed care of a patient's psoriasis, after receiving photos and history from the PCP's office, the dermatologist would make recommendations, prescribe medications, and provide educational materials online directly to the patient.

Online patients could also access dermatologists online asynchronously by sending photos and history to the online dermatologist. The dermatologist would make recommendations, prescribe medications, and provide educational materials online directly to the patient.

Patients and clinicians determined visit frequency by medical necessity. In all cases, visit information was also shared with PCPs. Follow-up questions with dermatologists were handled online or via telephone. At any time during the study, dermatologists could request to see an online patient in person, as deemed necessary.

In-person care (control arm).—Patients randomized to the in-person group sought psoriasis care from PCPs or dermatologists in person. The visit frequency was determined by medical necessity.

OUTCOMES

Access to care.—We used the following access-to-specialty-care measures: transportation factors, and transportation and in-office waiting time. Transportation factors included the total distance traveled to see a provider (round-trip driving distance from patient's home to provider's office multiplied by the number of in-person visits during the study period) and transportation mode is categorized into driving, getting driven, walking, taking public transportation, or using some other method. Transportation and in-office waiting time was defined as roundtrip transportation time plus in-office waiting time multiplied by the number of in-person visits during the study period. Difficulties with obtaining specialty care were assessed at baseline using questions from the Medical Expenditure Panel Survey with response choices on an ordinal scale.^{24,25}

Qualitative data collection.—We conducted semistructured interviews using an interview guide that allowed for flexibility in exploring the emerging themes. The interviewer took field notes on a standard assessment sheet, and the interviews were audio-recorded for later review. A case summary incorporating key findings was completed within 24 h of the interview. This was reviewed by the principal investigator to identify areas of uncertainty about the interpretation of findings. Interviews were conducted at 6 months and repeated at 12 months with the same participants.

- Patient perspectives: we interviewed 17 psoriasis patients from the online group to seek their feedback regarding the utility of CCH for accessing dermatologic care, their experience with the online platform, and the perceived quality of healthcare with CCH.
- Provider perspectives (PCPs and dermatologists): we interviewed eight PCPs and four dermatologists to seek their perspectives on the utility of CCH for increasing access to specialty care.

STATISTICAL ANALYSIS

Access to care.—To test the hypothesis that the online model would provide superior access to care compared to the in-person model, we compared the mean distance traveled to see a specialist and the mean transportation and in-office waiting time between the two groups using independent *t* tests with $\alpha = 0.05$. We assessed for any differences in transportation mode or difficulties with obtaining specialty care between study groups at baseline using chi-square tests with $\alpha = 0.05$.

Qualitative data analysis.—We employed qualitative analytical techniques with investigator triangulation and member checking to enhance the validity of the conclusions drawn. Once the data were collected, a template style of analysis was used to organize the data for reflection and development of emerging themes.^{26,27}

Results

OVERVIEW

A total of 148 patients were randomized to the online or in-person groups. All randomized participants received the intended intervention, and each participant was followed for 12 months. The mean (standard deviation [SD]) age was 49 (± 14) years. Table 1 shows baseline participant characteristics.

ACCESS TO CARE

At baseline, there were no differences in difficulties with obtaining specialty care between the two groups (Fig. 2B–D). Overall, 21% of patients found it very or somewhat difficult to travel to their provider's office, 31% found it very or somewhat difficult to contact their provider's office, and 51% found it very or somewhat difficult to schedule an appointment with their provider on short notice.

Over 12 months, the in-person group had 315 in-person visits; the online group had 161 online visits. Consistent with the pragmatic study design, patients in the online group could see a provider in person if deemed necessary by the provider. Over 12 months, at the request of the treating provider, the online group had eight in-person visits: three were for an in-office procedure, two were for evaluation of a comorbid condition, two were due to psoriasis exacerbation deemed best managed in person, and one was for drug-related evaluation.

Transportation factors.—Over 12 months, the in-person group traveled a total of 25,870 km (mean [SD] 174.8 [± 577.4] km/person) to get to and from their appointments. The online group traveled a total of 327 km (mean 2.2 [± 14.2] km/person) to get to and from their in-person appointments (Fig. 1A, $p = 0.0003$). This represents a total reduction of 25,544 km traveled for the online group.

Overall, the majority of patients drove to their visits (77%); patients also took public transportation (13%), got driven by someone else (7%), walked (2%), or used some other method (1%). At baseline, there were no differences between the two groups in the mode of transportation used to access specialty care (Fig. 2A, $p = 0.79$).

Transportation and in-office waiting time.—Over 12 months, the in-person group spent a total of 591.1 h (24 days, 15.1 h; mean [SD] 4.0 (± 4.5) h/person) on roundtrip transportation and in-office waiting time for their appointments; the online group spent a total 12.6 h (mean 0.1 [± 0.4] h/person) on roundtrip transportation and in-office waiting time for their in-person appointments (Fig. 1B, $p = 0.0001$). This equates to an elimination of ~4 h spent traveling and waiting for each online patient over 12 months.

PATIENT PERSPECTIVES

The following common themes were identified from analysis of patient interviews: safety, accessibility, equity, efficiency, effectiveness, and patient-centeredness. Table 2 shows patient quotes exemplifying these themes.

Safety.—Overall, patients trusted the online platform; they had few privacy or confidentiality concerns with submitting their photos and medical information online. Patients noted that there is a small risk with sharing personal information online, but they mentioned that they already share personal information for purposes such as shopping and banking. Because several patients had experience accessing their medical records online before the study, they felt comfortable transmitting medical information and receiving medical care online. Several patients noted that they considered their psoriasis to be a relatively less sensitive topic compared to other personal health information. However, some patients noted embarrassment sharing photos of psoriasis affecting sensitive areas. Several patients in the online group presented for in-person visits because their problems could not be addressed by online care alone. For example, some patients required intralesional corticosteroid injections, which could only be performed in person. One patient noted that online care is safer, in that there is no risk of acquiring communicable diseases from other patients during visits.

Accessibility.—Patients found online care to be intuitive, easy to use, and convenient. Patients, particularly those living in remote areas, appreciated not having to make a trip to the office for their chronic disease management. Patients most often completed their online visits from home using a computer or tablet. They found it simple to contact their online physician with questions, and they reported that their questions were answered clearly, effectively, and in a timely manner. Several patients noted that the process of taking and uploading photos could be made easier; some patients had problems uploading their photos from their smartphones and desired a more user-friendly interface for the mobile app. Some patients noted difficulty photographing hard to reach areas such as their back.

Equity.—Most patients reported that the quality of online care was similar to that of in-person care. Some patients felt that the quality of online care was superior to that received in person because the system asked a comprehensive set of questions, prompted them to take photos, and enabled them to thoroughly express their concerns. However, some patients found online visits to be less personal; they preferred in-person care because they liked spending time face to face with their physicians. Face-to-face interactions allowed patients and physicians to have a discussion and provided the opportunity for patients to receive emotional support from their physicians, which was not possible online. Several patients reported feeling that in-person care may be more suited for initial diagnosis, whereas online care would be more fitting for chronic disease management.

Efficiency.—Patients appreciated the flexibility of online care in allowing them to obtain care without missing time from work or altering their daily routine. Furthermore, patients liked being able to complete an appointment when they needed it rather than having to schedule an appointment in advance. Many patients reported wait times of 1 month or longer

to schedule in-person appointments with dermatologists. Patients appreciated saving time and money not having to drive to appointments, find parking, or wait in waiting rooms. For in-person visits, patients spent substantially more time traveling and waiting than actually seeing their provider. Patients found the online platform to be efficient and were able to complete their visits in a timely manner; most patients spent 10–20 min completing their visits. Patients were happy with the 48-h turnaround time.

Effectiveness.—CCH was considered effective and comparable to in-person care for psoriasis management. Patients generally reported improvement in their psoriasis disease severity, and they often attributed this to being able to submit photos of their psoriasis online and receiving timely, high-quality care. Several patients experienced substantial improvement in their psoriasis when their concerns were addressed immediately by the provider and they were recommended different treatment regimens. Multiple patients mentioned improvement in their ability to receive sufficient quantities of their prescribed topical medications after transitioning to online care.

Patient-centeredness.—Patients felt that their needs were addressed with quality communication from the providers. Patients were comforted knowing that they could contact their online dermatologist with follow-up questions if needed. Several patients felt that CCH was so responsive to their needs that they wanted to see it used in other medical specialties. However, some patients reported limited rapport with their online physician; they preferred to receive care in person because they felt their emotional needs were better addressed through face-to-face interactions. Some patients desired the platform to be available in languages other than English.

PROVIDER PERSPECTIVES

We sought provider perspectives on using the online platform to deliver coordinated care for psoriasis patients along the following four domains:

Utility of CCH for accessing dermatologists.—PCPs expressed that CCH was convenient for accessing dermatologists online. Specifically, PCPs appreciated the available online support in both consultative and direct-care forms. This flexibility allowed them to adjust their needs based on the complexity of a patient's skin condition. For example, they could use the consultative form for a patient who has mild psoriasis but occasionally experiences flares needing specialist input. For another patient who has moderate-to-severe psoriasis, PCPs could have a dermatologist take over care directly, knowing that the patient would be evaluated promptly and cared for longitudinally by experts.

Utility of CCH for providing patient care.—In general, dermatologists deemed CCH to be highly effective for providing care online to patients with chronic skin diseases. All four dermatologists highlighted that this online model provided greater access to specialty care for patients with chronic diseases, and they expected the outcomes to be similar to those of in-person care. For this model to be sustainable in the long run, dermatologists commented on the importance of addressing issues of reimbursement and continued technological

advances. They noted that, at this time, reimbursement for direct-to-patient care can be variable across different states and payers.

Assessment of clinician effort using CCH.—Dermatologists and PCPs expressed that they were initially concerned about unrestricted online access by patients and the potential for a high volume of unnecessary contacts. The providers were surprised that most patients did not contact them unnecessarily online. Nevertheless, providers expressed that their efforts spent on online care need to be adequately accounted for through established reimbursement mechanisms.

Integration of CCH into existing workflow.—Dermatologists and PCPs expressed that continued technological innovations with telehealth delivery are essential for online care to be well integrated into the existing workflow. That is, the user interface has to be intuitive and adaptive, the visit note must not take more than 3 min to complete, and there needs to be an automated check for image quality such that patients can retake images immediately if the initial submission contains poor-quality images. Resolving interoperability issues between telehealth platforms and other electronic health record platforms is critical for scalability.

Discussion

There is high demand among patients with chronic skin diseases for dermatologic care in the United States. However, due to a workforce shortage, there is a lack of access to dermatology providers.¹¹ Given the potential for improved access to care,^{9,28,29} high patient satisfaction,^{18,19} and cost savings,^{11,30} the use of teledermatology is expected to increase.^{11,13,17,31} In this study, we demonstrated that an innovative online model for healthcare delivery can foster increased access to high-quality specialty care for psoriasis patients. We showed that patients, PCPs, and dermatologists were highly satisfied with online care. Patients were especially pleased with the efficiency and accessibility afforded by this model.

Studies show that certain models of teledermatology result in clinical outcomes and quality-of-life improvements that are comparable to those achieved with in-person care.^{17,32} Despite providers' concerns for a high volume of unnecessary contacts with online care, over the course of this 12-month study, patients in the online group had nearly half the number of provider contacts as those in the in-person group. Therefore, CCH may help further increase access to specialty care by decreasing the total number of specialty care visits for patients with chronic skin diseases, while preserving the same level of high-quality care.

Overall, patients were highly satisfied with the quality of online care in this trial. Similar to previous findings,¹⁸ the main concern that some patients had with online care was that it made for a less personal patient-physician relationship. In this study, providers expressed other important considerations regarding teledermatology, which include variable reimbursement policies for direct-to-patient care and the continued need for technological innovations with telehealth platforms. Addressing these limitations is critical for dissemination of teledermatology as well as increased use of telemedicine in other medical specialties.

In conclusion, compared to in-person care, CCH resulted in increased access to specialty care with significant reductions in the distance traveled and the transportation and in-office waiting time. Patients, PCPs, and dermatologists found CCH to be highly useful for increasing specialty care access and delivering high-quality, coordinated care for patients with chronic skin diseases such as psoriasis.

Acknowledgments

We thank the following people and organizations for their contributions to this project: Jason Kao, BS, and Soneet Dhillon, BS, from University of California Davis for patient recruitment (uncompensated), National Psoriasis Foundation, State Network of Colorado Ambulatory Practices and Partners, High Plains Research Network, California Association of Rural Health Clinics, Los Angeles Network, California Primary Care Association, Psoriasis Patient Advocacy Council, American Telemedicine Association, Group for Research and Assessment of Psoriasis and Psoriatic Arthritis, and American Academy of Dermatology. The work was supported through a Patient-Centered Outcomes Research Institute (PCORI) Award (IHS-071502-IC).

REFERENCES

- Rachakonda TD, Schupp CW, Armstrong AW. Psoriasis prevalence among adults in the United States. *J Am Acad Dermatol* 2014;70:512–516. [PubMed: 24388724]
- Takeshita J, Grewal S, Langan SM, et al. Psoriasis and comorbid diseases: Epidemiology. *J Am Acad Dermatol* 2017;76:377–390. [PubMed: 28212759]
- Van Voorhees AS, Fried R. Depression and quality of life in psoriasis. *Postgrad Med* 2009;121:154–161. [PubMed: 19641281]
- Blauvelt A, Armstrong AW, Krueger GG. Essential truths for the care and management of moderate-to-severe psoriasis. *J Drugs Dermatol* 2015;14: 805–812. [PubMed: 26267724]
- Fleischer AB Jr., Feldman SR, Rapp SR. Introduction. The magnitude of skin disease in the United States. *Dermatol Clin* 2000;18:xv–xxi. [PubMed: 10791144]
- Resneck J Jr., Kimball AB. The dermatology workforce shortage. *J Am Acad Dermatol* 2004;50:50–54. [PubMed: 14699364]
- Kimball AB, Resneck JS Jr. The US dermatology workforce: A specialty remains in shortage. *J Am Acad Dermatol* 2008;59:741–745. [PubMed: 18723242]
- Craiglow BG, Resneck JS Jr., Lucky AW, et al. Pediatric dermatology workforce shortage: Perspectives from academia. *J Am Acad Dermatol* 2008;59:986–989. [PubMed: 18835061]
- Uscher-Pines L, Malsberger R, Burgette L, Mulcahy A, Mehrotra A. Effect of teledermatology on access to dermatology care among Medicaid enrollees. *JAMA Dermatol* 2016;152:905–912. [PubMed: 27144986]
- Bystryn JC. Dermatology manpower needs. *Dermatol Clin* 2000;18:303–312, x. [PubMed: 10791157]
- Ehrlich A, Kostecki J, Olkaba H. Trends in dermatology practices and the implications for the workforce. *J Am Acad Dermatol* 2017;77:746–752. [PubMed: 28784330]
- Federman D, Hogan D, Taylor JR, Caralis P, Kirsner RS. A comparison of diagnosis, evaluation, and treatment of patients with dermatologic disorders. *J Am Acad Dermatol* 1995;32(Pt 1):726–729. [PubMed: 7722015]
- Whited JD. Teledermatology research review. *Int J Dermatol* 2006;45:220–229. [PubMed: 16533219]
- Sharma P, Kovarik CL, Lipoff JB. Teledermatology as a means to improve access to inpatient dermatology care. *J Telemed Telecare* 2016;22:304–310. [PubMed: 26377123]
- Eminovic N, de Keizer NF, Bindels PJ, Hasman A. Maturity of teledermatology evaluation research: A systematic literature review. *Br J Dermatol* 2007;156: 412–419. [PubMed: 17300227]
- O'Connor DM, Jew OS, Perman MJ, Castelo-Soccio LA, Winston FK, McMahan PJ. Diagnostic accuracy of pediatric teledermatology using parent-submitted photographs: A randomized clinical trial. *JAMA Dermatol* 2017;153:1243–1248. [PubMed: 29141082]

17. McKoy K, Antoniotti NM, Armstrong A, et al. Practice guidelines for teledermatology. *Telemed J E Health* 2016;22:981–990. [PubMed: 27690203]
18. Weinstock MA, Nguyen FQ, Risica PM. Patient and referring provider satisfaction with teledermatology. *J Am Acad Dermatol* 2002;47:68–72. [PubMed: 12077584]
19. Collins K, Walters S, Bowns I. Patient satisfaction with teledermatology: Quantitative and qualitative results from a randomized controlled trial. *J Telemed Telecare* 2004;10:29–33. [PubMed: 15006213]
20. Nelson CA, Takeshita J, Wanat KA, et al. Impact of store-and-forward (SAF) teledermatology on outpatient dermatologic care: A prospective study in an underserved urban primary care setting. *J Am Acad Dermatol* 2016;74: 484.e481–490.e481. [PubMed: 26679528]
21. Krupinski E, Barker G, Rodriguez G, et al. Telemedicine versus in-person dermatology referrals: An analysis of case complexity. *Telemed J E Health* 2002;8:143–147. [PubMed: 12079603]
22. Ekeland AG, Bowes A, Flottorp S. Effectiveness of telemedicine: A systematic review of reviews. *Int J Med Inf* 2010;79:736–771.
23. DirectDerm. 2018 Available at www.directderm.com (last accessed January 19, 2018).
24. Agency for Healthcare Research and Quality. Access to care measures. 2013 Available at www.ahrq.gov/research/findings/nhqrdr/nhdr02/premeasurea.html (last accessed December 27, 2013).
25. MEPS Access to Care Supplement—P15R5/P16R3/P17R1. 2013 Available at http://meps.ahrq.gov/survey_comp/hc_survey/2011/AC110311.pdf (last accessed December 27, 2013).
26. Crabtree BF, Miller WL. Doing qualitative research. Thousand Oaks, CA: Sage Publications, 1999.
27. Dillman DA, Smyth JD, Christian LM. Internet, mail, and mixed-mode surveys: The tailored design method, 3rd ed. Hoboken, NJ: Wiley, 2009.
28. Leavitt ER, Kessler S, Pun S, et al. Teledermatology as a tool to improve access to care for medically underserved populations: A retrospective descriptive study. *J Am Acad Dermatol* 2016;75:1259–1261. [PubMed: 27846951]
29. Madu PN, Chang AY, Kayembe MK, Kovarik CL. Teledermatology as a means to provide multispecialty care: A case of global specialty collaboration. *Pediatr Dermatol* 2017;34:e89–e92. [PubMed: 28297155]
30. Snoswell C, Finnane A, Janda M, Soyer HP, Whitty JA. Cost-effectiveness of store-and-forward teledermatology: A systematic review. *JAMA Dermatol* 2016;152:702–708. [PubMed: 27074289]
31. Patel J, Parr K, Buehler-Bota T, Hood AF. Integrating outpatient teledermatology education into the dermatology resident curriculum. *J Grad Med Educ* 2016;8:468–469. [PubMed: 27413472]
32. Kornmehl H, Singh S, Johnson MA, Armstrong AW. Direct-access online care for the management of atopic dermatitis: A randomized clinical trial examining patient quality of life. *Telemed J E Health* 2017;23:726–732. [PubMed: 28570163]

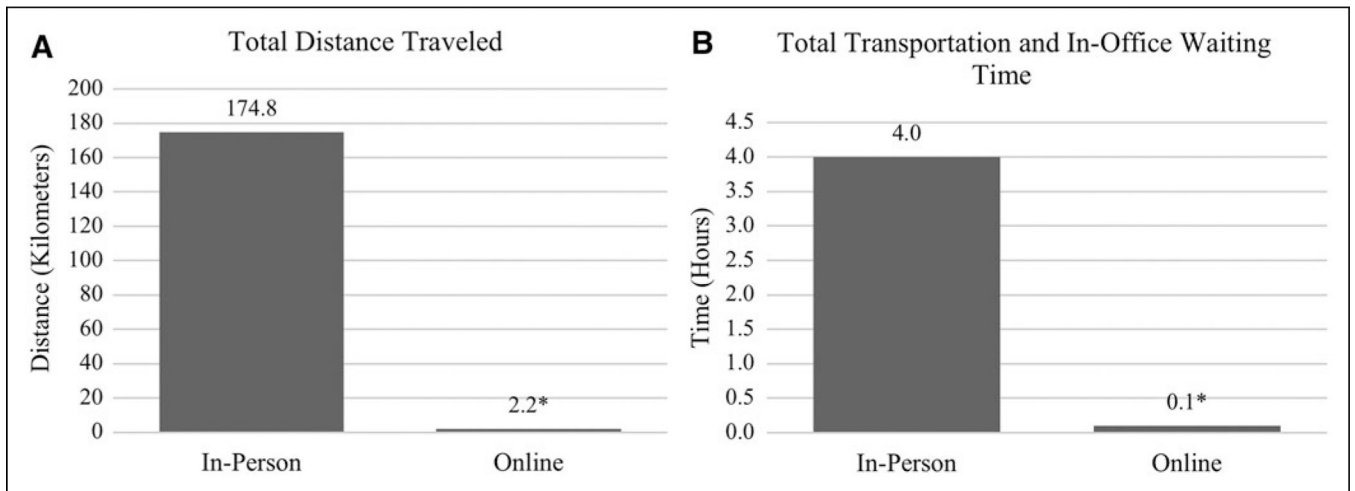


Fig. 1.

(A) Mean total distance traveled to and from in-person visits per patient over 12 months in each study group. Independent *t* test, * $p = 0.0003$. (B) Mean total transportation and in-office waiting time for in-person visits per patient over 12 months in each study group. Independent *t* test, * $p = 0.0001$.

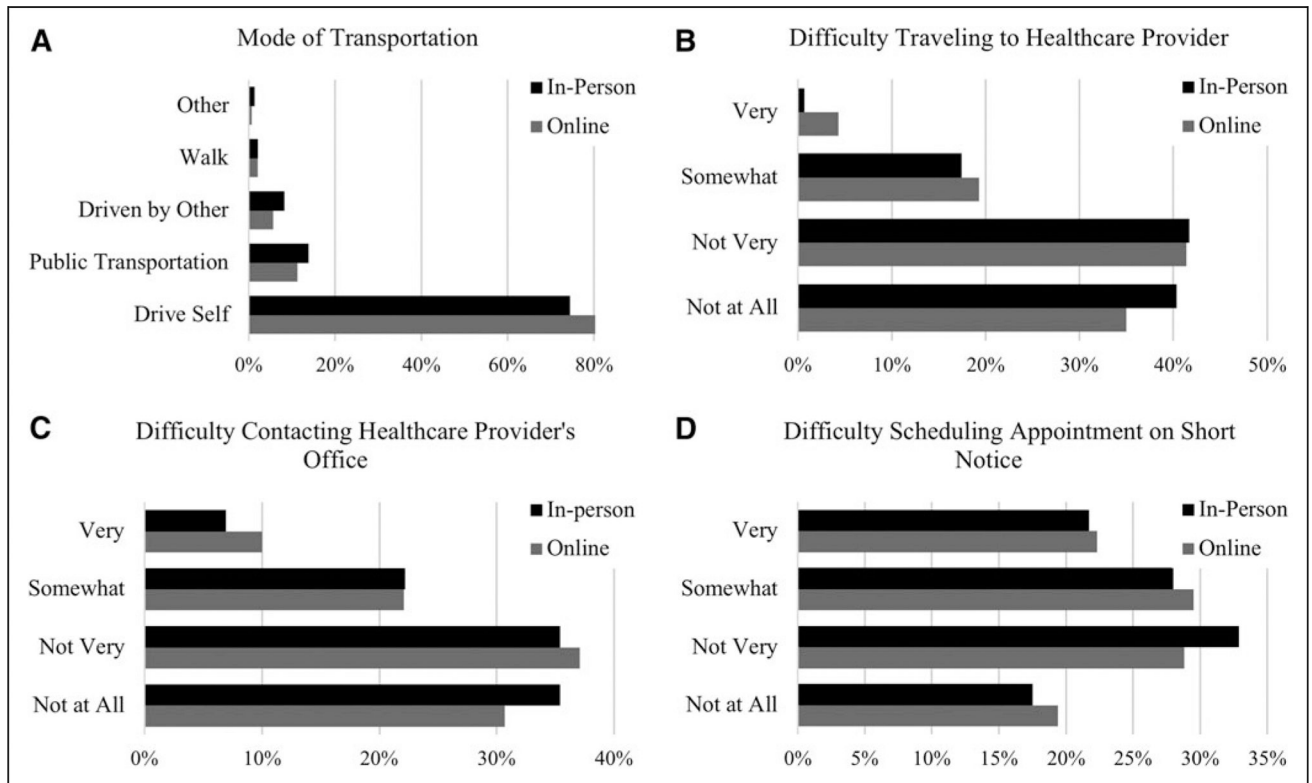


Fig. 2. Access to specialty care at baseline: **(A)** Mode of transportation used to get to appointments. Chi-square test, $p = 0.79$. **(B)** Difficulty traveling to healthcare provider's office. Chi-square test, $p = 0.22$. **(C)** Difficulty contacting healthcare provider's office. Chi-square test, $p = 0.73$. **(D)** Difficulty scheduling an appointment on short notice. Chi-square test, $p = 0.90$.

Table 1.

Characteristics of Study Participants in Each Group at Baseline

CHARACTERISTICS	ONLINE, N (%)	IN PERSON, N (%)	TOTAL, N (%)
Sex			
Male	75 (50.7)	74 (50.0)	149 (50.3)
Female	73 (49.3)	74 (50.0)	147 (49.7)
Race ^{a,b}			
American Indian/Alaska Native	3 (2.0)	2 (1.4)	5 (1.7)
Asian	13 (8.8)	6 (4.1)	19 (6.4)
Black/African American	5 (3.4)	3 (2.0)	8 (2.7)
Pacific Islander	3 (2.0)	2 (1.4)	5 (1.7)
White	90 (60.8)	97 (65.5)	187 (63.2)
Other	36 (24.3)	36 (24.3)	72 (24.3)
Ethnicity			
Hispanic or Latino	46 (31.1)	54 (36.5)	100 (33.8)
Prior psoriasis treatment ^b			
Topical therapy	98 (66.2)	102 (68.9)	200 (67.6)
Light and laser therapy	52 (35.1)	53 (35.8)	105 (35.5)
Nonbiologic systemic therapy	54 (36.5)	60 (40.5)	114 (38.5)
Biologic therapy	32 (21.6)	27 (18.2)	59 (19.9)
Baseline psoriasis severity, mean (95% CI)			
PASI	4.68 (3.96–5.41)	4.40 (3.80–5.00)	
BSA, %	9.71 (7.35–12.07)	7.67 (6.14–9.21)	
PtGA	2.18 (2.00–2.35)	2.15 (1.98–2.32)	
Insurance type ^a			
Private	77 (52.0)	78 (52.7)	155 (52.4)
Medicaid	28 (18.9)	34 (23.0)	62 (20.9)
Medicare	27 (18.2)	26 (17.6)	53 (17.9)
No insurance	8 (5.4)	5 (3.4)	13 (4.4)
Tobacco use ^a			
Never	81 (54.7)	84 (56.8)	165 (55.7)
Former	36 (24.3)	42 (29.1)	78 (26.4)
Current	24 (16.2)	18 (12.2)	42 (14.2)
Chewing tobacco	2 (1.4)	1 (0.7)	3 (1.0)
Alcohol use ^a			
Never	36 (24.3)	33 (22.3)	69 (23.3)
Former	38 (25.7)	29 (19.6)	67 (22.6)
Current	69 (46.6)	83 (56.1)	152 (51.4)

CHARACTERISTICS	ONLINE, <i>N</i> (%)	IN PERSON, <i>N</i> (%)	TOTAL, <i>N</i> (%)
Comorbidities ^b			
Heart disease	5 (3.4)	7 (4.7)	12 (4.1)
Arthritis	32 (21.6)	45 (30.4)	77 (26.0)
Internal malignancies	4 (2.7)	8 (5.4)	12 (4.1)
Liver disease	4 (2.7)	8 (5.4)	12 (4.1)
Celiac disease	1 (0.7)	1 (0.7)	2 (0.7)
Stroke	2 (1.4)	3 (2.0)	5 (1.7)
Thyroid problems	12 (9.5)	12 (8.1)	24 (8.1)
Vision problems	22 (14.9)	24 (16.2)	46 (15.5)
Tuberculosis	6(4.1)	7 (4.7)	13 (4.4)
Inflammatory bowel disease	4 (2.7)	3 (2.0)	7 (2.4)
Basal cell carcinoma	4 (2.7)	5 (3.4)	9 (3.0)
Squamous cell carcinoma	1 (0.7)	2 (1.4)	3 (1.0)
Melanoma	0 (0.0)	2 (1.4)	2 (0.7)

^aSome participants declined to answer the questions regarding race (online 1; in person 4), insurance type (online 8; in person 5), tobacco use (online 3; in person 3), and alcohol use (online 5; in person 3).

^bResponses are not mutually exclusive.

BSA, body surface area; CI, confidence interval; PASI, Psoriasis Area and Severity Index; PtGA, patient global assessment.

Table 2. Patient Quotes on the Utility of the Collaborative Connected Health Model for Increasing Specialty Care Access

THEME	PATIENT QUOTE
Safety	<p>"It's not that important [of] information. I buy stuff online, and there's a lot more damage that could come from that than talking about my psoriasis."</p> <p>"As far as online goes, I feel really confident in it. I mean, the website seems secure, and I doubt any of my info is getting out there."</p> <p>"I'm not worried that I'm on an unsecure site. I'm not worried about my information getting out. My psoriasis is not a secret. You can see it, so it's not a secret."</p> <p>"I don't have to be in the waiting room with god knows what diseases."</p> <p>"I don't care if people have my psoriasis information. I'm more worried to have my banking information [online]. So, as long as it's not a venereal disease—I mean, it's my psoriasis—I don't really have a problem doing it online. I don't feel like my privacy is being invaded."</p> <p>"The computer—the one that is in the hospital—I imagine that they do everything possible so that one's privacy will not be compromised. But you never know about other parties that want to invade one's privacy."</p>
Accessibility	<p>"[The accessibility] is very good. It's better than making an appointment and going to the dermatologist, which is pretty hard because they have high volume. It's hard to get [an appointment]."</p> <p>"It's accessible enough. The only business is taking the photos. I'm quite capable of taking pictures with a digital camera, but it's the ability or disability to get the photos of remote places. It has nothing to do with the configuration of the website and only with my ability to record images of myself. I can hold a camera up, but I would probably need multiple mirrors. My arms just don't go that far."</p> <p>"That was, for me, very easy. I'm very comfortable being online, and it was well designed—so easy to use. I think it was fairly intuitive."</p> <p>"It is more convenient because if I were to be doing this study in the hospital, I would have to take time off my work to go to these visits. I have kids that I have to drop off at school in the morning, so it's not easy for me going to the hospital. It's convenient to do it from my computer. I can do it on my own time and at my own place."</p> <p>"The interface was decent. I think once you get on, it's straightforward."</p>
Equity	<p>"I say [the quality of online care is] good, good, like 100% good. I feel good because I feel they helped me with the treatment. I feel they had more persistence. I feel good about both ways, but when I go online they speak more with me, they ask me more things, and I feel well also."</p> <p>"I'd say the quality [of online care] is really good."</p> <p>"If I have a problem, I will probably want to be seen face-to-face. I don't need face-to-face as long as I'm stable and doing well."</p> <p>"How I felt about the platform was always influenced by the severity of my psoriasis at that time. In other words, if I felt overwhelmed by the disease and in need of reassurance and a pep talk, then the platform made me mad because the platform is not set up to do that. It's set up to give information to the provider. However, when the disease subsided, then I thought—no problem; this is great; I can just check in. It had to do with an emotional component of a relationship with the doctor that wasn't there."</p> <p>"It was almost no difference, particularly with these skin conditions. If the physician is capable of making an assessment online, the treatment is going to be the same regardless. I don't see a problem with it."</p> <p>"Face-to-face I feel like we know each other a little more. You have a closer contact. However, I feel like for certain things—specifically for psoriasis—it works. I don't feel the quality is any worse or any different because you are not face-to-face."</p>
Efficiency	<p>"I guess if I was working more and I really couldn't get to the doctor appointment as easily as I can, it would be nice that I could have the option to take a picture of it instead of just coming in."</p> <p>"The convenience is probably the biggest thing that pops out to me. Just because it's obviously super convenient to hop online and get it done and not have to go in person to an office visit and everything that goes with that. The convenience is probably my favorite thing about it. It's actually really time efficient. It only takes me a few minutes."</p>

THEME	PATIENT QUOTE
	<p>"It's convenient being able to do it on my own schedule, and also not having to travel because I live about four hours from the clinic, so it is more convenient to do it at home. Not having to go to the clinic. Parking. There is construction going on on the highway, so transportation makes things more difficult."</p> <p>"Yes [online visits] are efficient because they are on the spot. They are there when one most needs them. For me this is what matters. The service is fast and accessible. When one needs them, they are there fast."</p> <p>"I think the plus [of online care] is that if I choose to go off the grid and live two or three hours away from a city, this would be perfect. This would be great. This would be fabulous. But it's better than having to sit in a waiting room for half an hour waiting on them. I will say that."</p> <p>"The [in-person] visit lasts 15 minutes, and I wait one hour until they see me."</p> <p>"It's really short, like 15–20 minutes to do all the things—all the questions and everything. They answered in two days—very quick. My doctor only comes in on Fridays, so I think I would have to wait like three weeks. And then driving takes about half an hour, and then the wait is 15–20 minutes to a half an hour sometimes. I feel it's efficient if I just need to show them what's going on and have their advice."</p>
Effectiveness	<p>"[Online care] has actually helped me out a lot, so it's kind of cool. I'm glad I found your study. It's been working really well. I notice significant improvement. It's awesome."</p> <p>"What worked for me, I think, was the change of the medication on which I first started. They switched my medication, and now I feel like I have an improvement on my skin. The way things have been for me is that my treatment or care is better; my skin is better."</p> <p>"After I sent that information to the [online] doctor, I have had no problems with getting my quantities that I need for the Dovonex, so that's really a big thing for me, actually. Marked improvement, definitely."</p> <p>"They treated me well, and they helped me a lot with the treatment, which they changed for me, and now I feel better. The treatment worked for me."</p> <p>"I just know that by me sending pictures and getting the treatment that I got from it, it worked."</p>
Patient-centeredness	<p>"They care about you. First, by the medicine that they give us. Then, because they look at how you are progressing or if it has gone away. They reach out every two or three months to see if it's better or worse."</p> <p>"I was so comfortable with it online I thought, 'Oh, I wish I had this [for pediatrics] when I was a new mom.'"</p> <p>"[Online care] is good for a stable disease like with my psoriasis. I was at a pretty stable place, but if I was at a point where I needed to initiate a new med or new modality i.e., biologic, that would be different because you can't necessarily have that back and forth with the physician. But for maintenance it's excellent. Combining that with in-person may be the best combination."</p> <p>"I didn't have enough of a relationship with specific staff members to be able to feel fully confident that someone was there for me."</p>