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Characteristic Distinctions Between Pre-/Post-COVID-19 Teledermatology Adoptees: A Cross-Sectional United States-based Analysis and the Implications for Dermatologic Healthcare Equity

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ABSTRACT

Background: Studies suggest potential heterogeneity in telemedicine adoption with potential to exacerbate healthcare access inequity.
Methods: A pre-validated survey was electronically sent to a proprietary listserv of practicing US-based dermatologists. Results were stratified by when teledermatology was adopted. Chi-square and odds ratios (OR) with 95% confidence intervals (95%CI) were used to analyze categorical data while single-factor ANOVA with posthoc Tukey-Kramer was used for continuous data.
Results: 338 practicing US-based dermatologists completed the questionnaire. Academic/Government dermatologists were 4-times more likely (OR 4.08, 95%CI 2.37-7.03) to adopt teledermatology pre-COVID than private-practice dermatologists. Dermatologists with ≤10 years of experience were 1.8-times (OR 1.8, 95%CI 1.01-3.18) and 2.82-times more likely (OR 2.82, 95%CI 0.78-10.25) to adopt teledermatology pre-COVID-19 or at all, respectively, compared to dermatologists with ≥20 years of experience. Teledermatology adopters practiced more medical-dermatology ($P<.0001$) than non-adopters, who reported practicing more dermatologic surgery ($P=.003$; Tukey-Kramer $\alpha<.05$) and dermatopathology ($P<.0001$; Tukey-Kramer $\alpha<.05$). Pre-COVID-19 adopters were 4-times more likely (OR 4.69, 95%CI 1.46-15.07) to switch/incorporate live-interactive-only teledermatology (LI) post-COVID-19. Post-COVID-19 adopters were 6-times more likely (OR 6.09, 95%CI 3.36-11.06) to utilize LI than Pre-COVID-19 adopters. Pre-COVID-19 adopters use teledermatology for a larger proportion of patient visits than Post-COVID-19 adopters (19.6% v 10.4%, $P<.0001$), but also are 3.43-times more likely (OR 3.43, 95%CI 1.82-6.46) to report future decreases in usage.
Limitations: Cross-sectional retrospective survey and potential response bias.
Conclusion: Current teledermatology usage may be a suitable tool for medical-dermatology-focused practices. Material hurdles still exist for procedurally-oriented practices and future studies should investigate these barriers to maximize equitable access to dermatological care.

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INTRODUCTION

The COVID-19 pandemic prompted many dermatologists to adopt teledermatology to continue patient care.[1] Studies have since raised concerns regarding potential heterogeneity in telemedicine adoption and healthcare inequity exacerbation.[1-3] The purpose of this study was to identify factors associated with teledermatology adoption and their potential effect on (virtual) dermatologic access.

A pre-validated anonymous survey was emailed to a purchased proprietary listserv of actively-practicing US-based dermatologists. Completed results were stratified by teledermatology-adoption timepoint (TAT). Data analysis was performed using chi-square and odds ratios (OR) with 95% confidence intervals (95%CI) for categorical data and single-factor ANOVA with post-hoc Tukey-Kramer for continuous data.

TABLE 1.

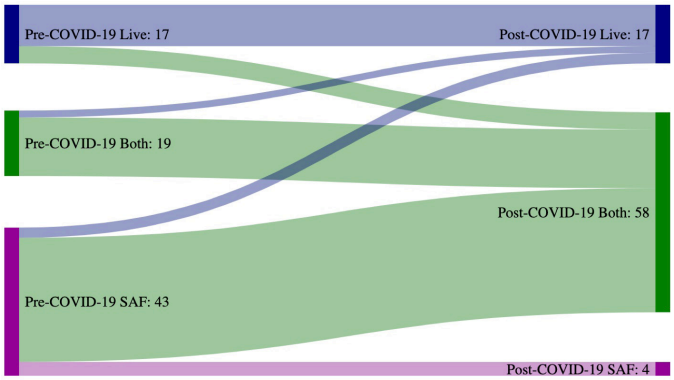
Respondent Demographics by Teledermatology-Adoption Timepoint. Demographics stratified by when teledermatology was adopted relative to COVID-19 pandemic (ie, "early" adopters (EAs) before 2020, "COVID" adopters (CAs) after 2020, "Not" adopters(NAs) have not implemented teledermatology). There was a significant relationship between when teledermatology was adopted and practice setting and years of experience with a greater proportion of dermatologists with over 20 years of experience in private groups adopting teledermatology only post-COVID-19. There were no significant findings when stratified by the US Census bureau location and urban (≥50,000 people/zip code) or rural (<50,000 people/zip code) population

		EA (n=79)	CA (n=243)	NA (n=16)	*P*-value
Practice Setting, n (%)					
Private Solo		10 (12.7)	46 (18.9)	5 (31.3)	*P*<.001 $\mathcal{X}^2$(6,n=338)=30.55
Private Group		23 (29.1)	125 (51.4)	6 (37.5)	
Academic/Gov't		37 (46.8)	43 (17.7)	3 (18.8)	
Multispecialty Group		9 (11.4)	29 (11.9)	2 (12.5)	
Years in Practice, n (%)					
Resident/Fellow		12 (15.2)	18 (7.4)	1 (6.3)	*P*=.02 $\mathcal{X}^2$(8,n=338)=17.78
1-10		22 (27.8)	51 (21.0)	2 (12.5)	
11-20		14 (17.7)	59 (24.3)	1 (6.3)	
21-30		14 (17.7)	67 (27.6)	4 (25.0)	
31+		17 (21.5)	48 (19.8)	8 (50.0)	
Practice Location, n (%)					
Northeast	Urban	18 (22.8)	77 (31.7)	4 (25.0)	*P*=.70 $\mathcal{X}^2$(14,n=338)=10.87
	Rural	2 (2.5)	4 (1.6)	1 (6.3)	
South	Urban	23 (29.1)	51 (21.0)	5 (31.3)	
	Rural	4 (5.1)	18 (7.4)	0 (0.0)	
Midwest	Urban	9 (11.4)	34 (14.0)	1 (6.3)	
	Rural	4 (5.1)	7 (2.9)	0 (0.0)	
West	Urban	17 (21.5)	47 (19.3)	4 (25.0)	
	Rural	2 (2.5)	5 (2.1)	1 (6.3)	
Practice Type, mean %					
Medical		73.0*	73.6*	48.1	*P*<.0001, α<.05
Surgical		14.5*	14.2*	29.6	*P*=.003, α<.05
Cosmetic		7.8	10.5	8.6	*P*=.28
Dermatopathology		4.7*†	1.6*	13.7	*P*<.0001, α<.05

Data from 338 practicing US-based dermatologists were analyzed (Table 1). Academic/Government dermatologists were 4-times more likely (OR 4.08, 95%CI 2.37-7.03) to adopt teledermatology pre-COVID than private practice dermatologists. Dermatologists with ≤10 years of experience (YoE) were 1.8-times (OR 1.8, 95%CI 1.01-3.18) and 2.82-times more likely (OR 2.82, 95%CI 0.78-10.25) to adopt teledermatology pre-COVID-19 (ie, early-adopters (EAs)) or at all, respectively, compared to dermatologists with ≥20 YoE. No significant relationship existed between TAT and practice location ($\mathcal{X}^2$(14, n=338)=10.87, *P*=.70) even after stratification by US Census Bureau region, section codes (ie, first three digits in a given area code), or population density (ie, urban (≥50,000 persons/zip code) or rural (<50,000 person/zip code)).

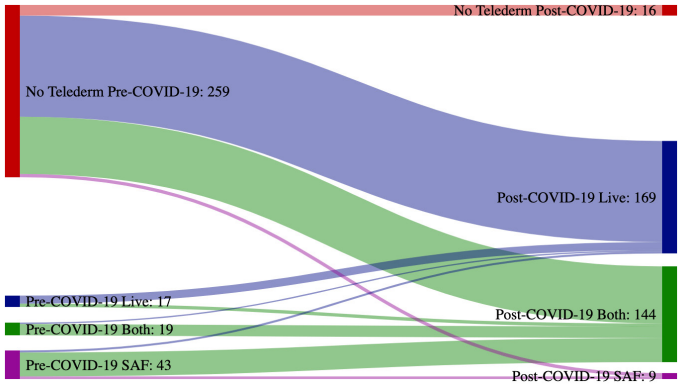
Teledermatology-adopters practiced proportionally more medical-dermatology (*P*<.0001; Tukey-Kramer α<.05) than non-adopters (NAs), who reported proportionally more dermatologic

FIGURE 1. Teledermatology modalities used by early adopters pre- and post-COVID-19. Weight of flows and height of nodes are proportional to sample size.



Live – live-interactive only teledermatology (Navy); SAF – store and forward only teledermatology (Pink); Both – hybrid live-interactive and store-and-forward teledermatology (Green)

FIGURE 2. Proportion of teledermatology modalities used by all adopters Pre- and Post-COVID-19. Weight of flows and height of nodes are proportional to sample size.



Live – live-interactive only teledermatology (Navy); SAF – store and forward only teledermatology (Pink); Both – hybrid live-interactive and store-and-forward teledermatology (Green)

surgery (*P*=.003; Tukey-Kramer α<.05) and dermatopathology (*P*<.0001; Tukey-Kramer α<.05). EAs also practiced proportionally more dermatopathology than dermatologists that adopted teledermatology post-COVID-19 (CAs) (*P*<.0001; Tukey-Kramer α<.05).

Despite 78% originally using store-and-forward-only teledermatology platforms/modalities (SAF), post-COVID-19 EAs were 4-times more likely (OR 4.69, 95%CI 1.46-15.07) to report switching to live-interactive-only teledermatology platforms/modalities (LI) or to combine SAF and LI (Figure 1). CAs were 6-times more likely (OR 6.09, 95% CI 3.36-11.06) to utilize LI than EAs (Figure 2). While EAs currently used teledermatology for a larger proportion of patient visits (19.6% v 10.4%, *P*<.0001), they were 3.43-times more likely (OR 3.43, 95%CI 1.82-6.46) to report decreased future usage compared to CAs (Table 2). 81.3% of NAs reported no plans to implement teledermatology (Table 3).

95.2% of dermatologists surveyed currently use some sort of teledermatology (vs. 11% in 2014),[4] with 71.8% adopting teledermatology post-COVID-19. While EAs tended to be younger academic dermatologists, greater than 47% of CAs have at least 20 YoE and more than 70% are in some form of private practice, which represents ~80-90% of US dermatologists.[4] Furthermore, other studies have demonstrated increased interest in utilizing technology to augment existing practices and practice logistiscs.[5] Expansion of private-practice virtual technologies, most notably teledermatology, usage may facilitate access, especially to regions where it has been traditionally limited. Given CAs self-reported prediction for increased future usage, teleder-

TABLE 2.

Self-Reported Current and Future Teledermatology Usage. Percent of patients currently seen with teledermatology as of 1/2021 and self-reported future teledermatology usage stratified by timepoint when teledermatology was adopted. While Pre-COVID-19 Early Adopters (EAs) report currently seeing a significantly larger portion of their patient panel via teledermatology, there were also more likely to report decreased future usage than CAs

	Early Teledermatology Adopters (EAs)	COVID Teledermatology Adopters (CAs)	*P*-value
% Patients currently cared for with teledermatology, mean % (SD)	19.6 (22.9)	10.4 (15.2)	<.0001*
Future Use			
Stay the same, n (%)	32 (40.5)	114 (46.9)	*P*<.001 $\chi^2(2,n=322)=16.00$
Increase, n (%)	24 (30.4)	103 (42.4)	
Decrease, n (%)	23 (29.1)	26 (10.7)	

*2-sided t-test

χ^2– chi-square

TABLE 3.

Potential Usage by Current Non-Adopters. Future teledermatology usage by dermatologists who have not adopted the teledermatology (NAs). A majority of NAs report they are not likely to use teleder-matology in their practice going forward.

	Teledermatology non-adopters (NAs) n (%)
Yes	3 (18.8)
No	13 (81.3)

matology may account for up to 20% of post-COVID-19 patient visits. Although unclear why EAs expect decreased future teledermatology usage, this may be relative to expected in-person visit increases following further COVID-19 restriction easements.

Increased (LI) teledermatology usage denotes a significant shift in dermatology practice.[1,4] LI may provide a sustainable method of managing well-controlled/chronic inflammatory dermatoses (eg, patient visits that may only need prescription refills).[2,6] While teledermatology alone may be increasingly compatible with medical dermatology, it may not currently suffice for visits requiring procedures, even common ones such as dermoscopy or biopsy. High-risk skin cancer patients may be inordinately affected as COVID-19 already delayed the timely diagnosis/management of a significant proportion of melanoma and nonmelanoma skin cancers, highlighting the need to adapt and innovate cancer diagnosis and management tools to the virtual space.[1,6]

Limitations include the study's retrospective nature and response bias given limited NA/rural respondents, though data represented multiple geographic locations, YoE, and practice settings.

Future studies should seek to investigate how financial, logistic, and medical barriers including geographic constraints surrounding licensing requirements, triaging initial and return patient visits to in-person or virtual visits, and usage of complementary tools during teledermatology visits to augment and maximize appropriate use may affect equitable access to dermatological care.

DISCLOSURES

JWM is a 2021-2022 Telehealth Fellow with Doximity, Inc and has served as an advisory board member for Doximity, Inc. MA, GHL, DZ, SP, and DSR have no relevant disclosures or conflicts of interest.

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