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ORIGINAL RESEARCH

Teledermatology May Benefit Marginalized Populations: National and Institutional Trends during the COVID-19 Pandemic

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ABSTRACT

Introduction: Limited data exist regarding demographic-specific teledermatology (TD) utilization during the coronavirus disease 2019 (COVID-19) pandemic. This study aimed to determine TD utilization trends during the pandemic.

Methods: A retrospective cohort study for national and institutional populations was conducted. Patient encounters in the American Academy of Dermatology's DataDerm registry (DataDerm) were analyzed from 1 April 2020 through 30 June 2021. All dermatological patients seen by Duke University Health Systems (DUHS) were analyzed from 1 March 2020 through 30 April 2021. In-person clinic visits versus TD encounters (national and institutional) and no-show rates (institutional only) were collected for visit type (i.e., TD versus in-person), sex, race, age/generation, and in- versus out-of-state location (national only). TD utilization is defined as the cohort of interest using TD (e.g., females, whites) within a demographic group (i.e., sex, race) as a percentage of total TD users. This was compared with in-person utilization during the identical timeframe.

Results: For US national data, 13,964,816 encounters were analyzed. Sex, race, age, and location each had a significant association with TD utilization (adjusted $p < 0.001$). For institutional data, 54,400 encounters were analyzed. Sex, race, and age had a significant association with TD utilization (adjusted $p < 0.001$). Both datasets revealed majority female populations for telehealth visits (DataDerm 66.0%; DUHS 61.7%). Non-white populations accounted for a higher percentage of TD utilizers (DataDerm 15.0%; DUHS 37.3%) when compared with in-person utilizers (DataDerm 11.7%; DUHS 22.3%). Younger patients utilized TD (DataDerm 63.6%; DUHS 62.6%) more than in-person services (DataDerm 26.3%; DUHS 43.8%). Institutional no-show rates between telehealth and in-person visits were lower for Black patients (11.8% versus 19.2%), other non-white races (10.6% versus 13.6%), and younger ages/generations (9.8% versus 12.8%), respectively. TD utilization decreased over time nationally as a percentage of total visits (2.9% versus 0.3%) in 2020 versus 2021, respectively.

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Conclusions and Relevance: During the COVID-19 pandemic, certain populations (females, younger patients, non-white races) showed higher TD utilization. Understanding TD utilization trends is critical in defining the role of virtual care for improving universal care access, optimizing resources, and informing future healthcare models for all patient populations.

Keywords: Teledermatology (TD); COVID-19; Population demographics; Healthcare delivery; Accessibility

Key Summary Points

Why carry out this study?

There are limited data available that highlight the current utilization of teledermatology (TD) across US demographics during the COVID-19 pandemic.

It is important to understand the utilization of TD during the pandemic for defining how virtual care delivery can improve and optimize both current and future healthcare models to meet the needs of all patient populations.

What was learned from the study?

During the pandemic, TD utilization was higher among female patients, non-white patients, younger patients, and out-of-state patients.

Differential trends in TD utilization were noted, consistent between institutional and national dermatology data, that can be useful for planning future healthcare delivery models.

INTRODUCTION

The COVID-19 pandemic led to a swift expansion of teledermatology (TD) services [1, 2]. Although nationwide adaptation was possible due to changes in licensure, billing, and infrastructure [3], TD is not a new concept. Unfortunately, regulatory barriers had previously prevented the widespread utilization of TD witnessed today. This is unsurprising, as TD may provide better, faster, and cheaper care to its users [4, 5]. Most importantly, TD provides improved access to often inaccessible dermatology services, particularly to underserved populations [6]. Our study aimed to report national and institutional TD service demographic-specific utilization and institutional no-show rates during the COVID-19 pandemic for the purpose of understanding the pandemic-specific trends in TD utilization.

METHODS

Data Collection

National-level data were retrieved from American Academy of Dermatology's DataDerm registry, which is a curated dataset for enrolled practices. Data included all national dermatological encounters reported in the aggregate from 1 April 2020 through 30 June 2021. This dataset included count data for telehealth utilization, stratified by the following patient factors: visit type (TD versus in-person), sex, race, age (> 40 or ≤ 40 years of age), and location (in- versus out-of-state).

Similar institutional data from Duke University Hospital System (DUHS) included all dermatological encounters from 1 March 2020 through 30 April 2021. These reports included telehealth utilization and no-show rates for all patients, stratified by the following patient factors: sex, race, and age grouped by generation [Greatest Generation (1901–1927), Silent Generation (1928–1945), Baby Boomer (1946–1964), Generation X (1965–1980), Millennial (1981–1995), Generation Z (1996–2010), and Generation Alpha (2010 or later)]. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or

comparable ethical standards. This study was granted an exemption by the Duke University Institutional Review Board due to the aggregate and non-identifying nature of the data.

Statistical Analysis

Patient demographics and encounter type are summarized with frequency counts and percentages of non-missing values. No-show rate was calculated as the percentage of no-show in total scheduled encounters. The association between encounter type and each demographic variable was examined using the chi-square test for each dataset. The significance of the tests was assessed at $\alpha = 0.05$, and adjusted *p*-values were reported to reduce the family-wise error rate using the Bonferroni method. All statistical analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC).

RESULTS

National DataDerm Results

Data from up to 13,964,816 encounters across the USA were analyzed. Utilization by out-of-state patients was proportionally higher for TD services ($n = 19{,}422$; 14.6%) compared with in-person services ($n = 580{,}358$; 4.2%; adjusted $p < 0.001$). Younger patients (age ≤ 40 years) contributed more to TD service utilization ($n = 62{,}695$; 63.6%) when compared with in-person services ($n = 1{,}329{,}218$; 26.3%; adjusted $p < 0.001$). The proportion of women who utilized services via TD ($n = 65{,}023$; 66.0%) was greater than those who utilized in-person services ($n = 2{,}940{,}122$; 58.3%; adjusted $p < 0.001$). Non-white patients made up a higher percentage of TD utilizers ($n = 8{,}920$; 15.0%) when compared with in-person utilizers ($n = 394{,}580$; 11.7%; adjusted $p < 0.001$) (Table 1).

The proportion of telehealth utilizers aged 40 years and younger trended upwards from 2020 Q2 ($n = 32{,}990$; 57.4%) to 2021 Q2 ($n = 4{,}250$; 77.2%). Telehealth utilization trended up for non-white populations from 2020 Q2 ($n = 4{,}890$; 13.3%) to 2021 Q2 ($n = 573$; 21.5%), while in-person utilization by non-white populations remained consistent ($n = 50{,}199$–
$103{,}487$; 10.0–13.0%) (Fig. 1). Telehealth utilization decreased throughout the pandemic with percentage of total visits that were telehealth encounters and absolute count of TD visits decreasing from 2020 Q2 ($n = 78{,}698$; 2.9%) to 2021 Q2 ($n = 7{,}002$; 0.3%).

Institutional Results

There were 54,402 dermatological encounters at DUHS between 1 March 2020 and 30 April 2021, of which 2851 (5.2%) were telehealth encounters. Telehealth utilization decreased from 8.2% ($n = 1{,}976$) in the first half (1 March 2020 to 30 September 2020) of the pandemic compared with 2.9% ($n = 875$) in the second half (1 October 2020 to 30 April 2021) of the pandemic (adjusted $p < 0.001$).

Compared with in-person encounters, telehealth encounters had a higher percentage of women ($n = 1{,}758$, 61.7% versus $n = 29{,}397$, 57.0%, adjusted $p < 0.001$, Table 1), non-white patients ($n = 1{,}062$, 37.4% versus $n = 11{,}504$, 22.3%; adjusted $p < 0.001$), and younger generations (Generation X, Millennial, Generation Z, and Generation Alpha) ($n = 1{,}782$, 62.6% versus $n = 22{,}602$, 43.8%, adjusted $p < 0.001$).

No-show rates were not different between in-person and telehealth for females (8.9% versus 8.3%, $p = 0.39$) and males (8.3% versus 8.1%, $p = 0.82$) (Table 2). Black patients (11.8% versus 19.2%, adjusted $p < 0.001$) had lower no-show rates for telehealth than in-person visits, while white patients (5.5% versus 6.1%, $p = 0.27$) and other races (10.6% versus 13.6%, $p = 0.08$) did not have this difference. Younger generations (Generation X, Millennial, Generation Z, and Generation Alpha) had lower no-show rates for telehealth compared with in-person (9.8% versus 12.8%, adjusted $p < 0.001$). Older generations (Greatest Generation, Silent Generation, and Baby Boomer) did not have this difference (5.1% versus 4.6%, $p = 0.41$).

Table 1 National and institutional data for dermatology utilization

	National (DataDerm) data			Institutional data		
	In-person, *n*(%)	**TD, *n*(%)**	**Total, *n*(%)**	**In-person, *n*(%)**	**TD, *n*(%)**	**Total, *n*(%)**
Sex	5,045,576	98,586	5,144,162	51,550	2850	54,400
Male	2,105,454 (41.7%)	33,563 (34.0%)	2,139,017 (41.6%)	22,153 (43.0%)	1092 (38.3%)	23,245 (42.7%)
Female	2,940,122 (58.3%)	65,023 (66.0%)	3,005,145 (58.4%)	29,397 (57.0%)	1758 (61.7%)	31,155 (57.3%)
Race	3,368,297	59,457	3,427,754	51,551	2843	54,394
White	2,973,717 (88.3%)	50,537 (85.0%)	3,024,254 (88.2%)	40,047 (77.7%)	1781 (62.7%)	41,828 (76.9%)
Black	123,482 (3.7%)	3748 (6.3%)	127,230 (3.7%)	6102 (11.8%)	658 (23.1%)	6760 (12.4%)
Other non-white	271,098 (8.0%)	5172 (8.7%)	276,270 (8.1%)	5402 (10.5%)	404 (14.2%)	5806 (10.7%)
Age	5,048,034	98,641	5,146,675	–	–	–
≤ 40	1,329,218 (26.3%)	62,695 (63.6%)	1,391,913 (27.0%)	–	–	–
> 40	3,718,816 (73.7%)	35,946 (36.4%)	3,754,762 (73.0%)	–	–	–
Generation	–	–	–	51,551	2849	54,400
Greatest Generation (1901–1927)	–	–	–	232 (0.5%)	8 (0.3%)	240 (0.4%)
Silent Generation (1928–1945)	–	–	–	9283 (18.0%)	265 (9.3%)	9548 (17.6%)
Baby Boomer (1946–1964)	–	–	–	19,434 (37.7%)	794 (27.9%)	20,228 (37.2%)
Generation X (1965–1980)	–	–	–	8537 (16.6%)	500 (17.6%)	9037 (16.6%)
Millennial (1981–1995)	–	–	–	6221 (12.1%)	422 (14.8%)	6643 (12.2%)
Generation Z (1996–2010)	–	–	–	4910 (9.5%)	480 (16.8%)	5390 (9.9%)
Generation Alpha (2010 or later)	–	–	–	2934 (5.7%)	380 (13.3%)	3314 (6.1%)
Location	13,831,400	133,416	13,964,816	–	–	–

Table 1 continued

	National (DataDerm) data			Institutional data		
	In-person, *n*(%)	TD, *n*(%)	Total, *n*(%)	In-person, *n*(%)	TD, *n*(%)	Total, *n*(%)
In-state	13,251,042 (96.0%)	113,994 (85.0%)	13,365,036 (96.0%)	–	–	–
Out-of-state	580,358 (4.0%)	19,422 (15.0%)	599,780 (4.0%)	–	–	–

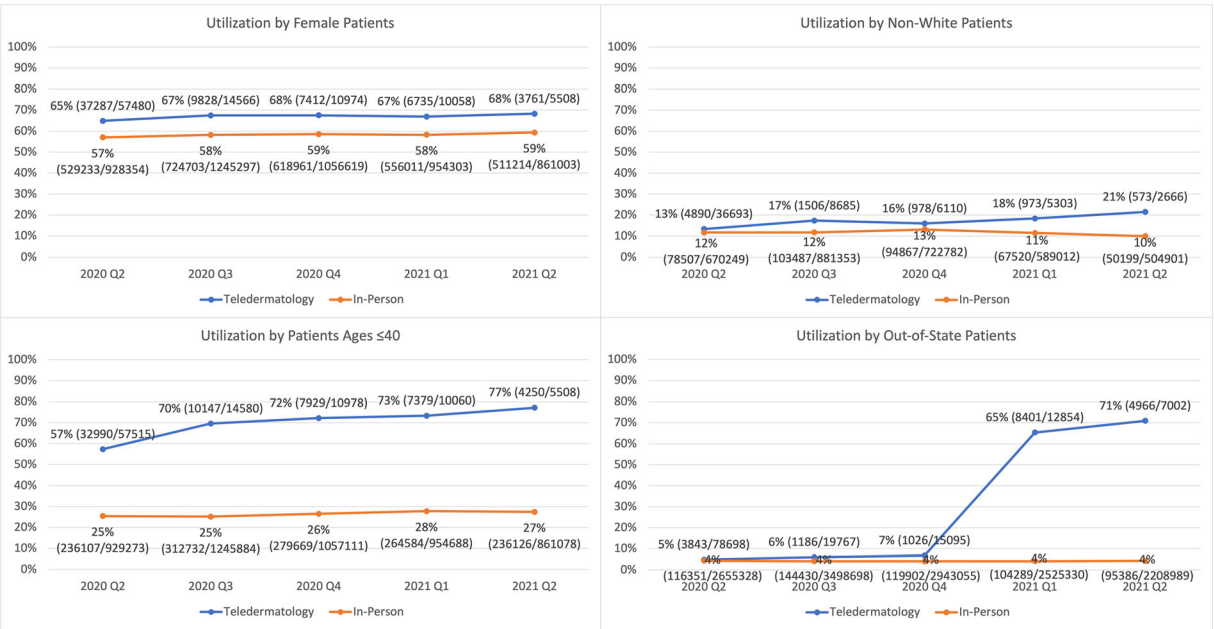

Fig. 1 Trends for utilization of encounter modality for demographic groups of interest (female, non-white, age $\leq$ 40 years, and out-of-state)

DISCUSSION

This study characterizes national and a single-institution TD use during the COVID-19 pandemic. With TD, dermatologists may better care for patients who typically encounter challenges with in-person visits, though data for this hypothesis are lacking and there is evidence to suggest the contrary as variability in internet access may create a digital divide and healthcare disparities [6, 7] .

Our results and analysis show that non-white utilization was higher for TD, a trend that nationally increased over the course of the pandemic with our institutional data showing lower no-show rates for this group. Jointly, this suggests that TD may be especially appealing to minority patients and their families. Historically speaking, minority groups have had difficulty accessing dermatologic care, with technological gaps, a shortage of dermatologists, long wait times, and high costs each contributing to healthcare disparities [8, 9]. Demographics such as race/ethnicity, socioeconomic status, and county of residence are associated with decreased access to

Table 2 Institutional data for dermatology no-show rates

	In-person no-show rates (%)	TD no-show rates (%)	Total no-show rates (%)
Total	8.6	8.2	8.6
Sex			
Female	8.9	8.3	8.9
Male	8.3	8.1	8.3
Race			
Black/African American	19.2	11.8	18.5
White	5.5	6.1	5.5
Other	13.6	10.6	13.4
Generation			
Greatest Generation (1901–1927)	3.3	11.1	3.6
Silent Generation (1928–1945)	3.5	4.7	3.5
Baby Boomer (1946–1964)	5.0	5.1	5.1
Generation X (1965–1980)	10.0	8.9	10.0
Millennial (1981–1995)	11.7	6.4	11.4
Generation Z (1996–2010)	16.4	12.2	16.1
Generation Alpha (2010 or later)	16.2	11.2	15.7

dermatologists as well as broadband services [7–9]. While these trends are encouraging for the future of TD, we noted a significant drop in TD utilization including the number of actual telehealth visits, despite initial widespread adoption. We speculate that, besides 2020 Q2 numbers being inflated, challenging technology experiences, limited diagnosis and biopsy abilities, and poor resolution of video/images may be considered as reasons for the initial peak of inflated expectations having led to an "expected" trough of disillusionment [10]. This finding does not preclude the possibility of improved dermatology access for minority populations via telehealth options, including phone visits that require no internet access. Importantly, this study demonstrates trends of TD utilization that may represent demographic-based preference of care modality. While internet deserts and geospatial location may create barriers to entry for video visits, it should be noted that telehealth options including telephone visits have a much lower barrier to entry. These are included in the current study within TD encounters. The future of TD is largely uncertain, but our findings demonstrate the importance of maintaining TD as an accessible avenue for dermatologic care.

Our data found that younger individuals and females were more likely to utilize TD services, which is consistent with previously published Medicaid TD usage demographics (58.7% < 17 years of age; 58.2% females) [11]. While this study did not stratify diagnosis at the time of the encounter, these findings may be explained by patients attempting to establish care or having difficulties in access to care [11] .

Limitations include a single-institution report for no-show data that may not be representative of the overall national and other non-academic centers' experience. National data are also limited to the groups that participate with AAD's DataDerm. A decline in TD utilization as the pandemic progressed could have been artificially inflated due to the shutdown of in-person dermatology services during the first few months of the pandemic. Our data sources presented information in the aggregate, preventing more individual-level analyses (particularly temporal). Future national or multicenter studies with individual long-term data and diagnosis stratification are needed to build on these findings. Another caveat that we recognize is that there are likely geographic differences in TD utilization during the pandemic, perhaps related to factors such as access to internet and access to compatible technology. However, the DataDerm registry did not

provide the zip codes for the encounter data that would enable this analysis.

CONCLUSION

Our work provides evidence for TD utilization and perhaps preferences among various demographic groups, demonstrating disproportionate impact on improving access for and engagement of medically marginalized groups such as non-white races, females, and patients living farther away or out-of-state from their dermatologist, provided that access to broadband internet and technology literacy are not significant barriers [2, 6, 7, 12]. TD is preferred by younger patients, who are the next generation of healthcare consumers. Understanding TD trends can assist institutions in optimizing resource utilization and inform current and future healthcare delivery models for universal care access.

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Compliance with Ethics Guidelines. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. This study was granted an exemption by the Duke University Institutional Review Board due to the aggregate and non-identifying nature of the data.

Data Availability. The aggregate datasets analyzed during the current study are available from the corresponding author upon request.

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