

# Factors influencing use and perceptions of tele dermatology: A mixed-methods study of 942 participants



Ellie Ci-En Choi, MBBS, MRCP,<sup>a</sup> Li Wei Heng, MBBS,<sup>a</sup> Sean Yilong Tan, MBBS, MRCP,<sup>a</sup>  
Phillip Phan, PhD,<sup>b,c</sup> and Nisha Suyien Chandran, MBBS, MRCP<sup>a</sup>  
*Singapore, Singapore and Baltimore, Maryland*

**Background:** The protracted COVID-19 pandemic highlights the need for a sustainable telemedicine practice.

**Objective:** To understand patient perceptions toward tele dermatology.

**Methods:** Convergent parallel mixed-methods study of 942 dermatology patients or their caregivers between June 2020 and April 2021.

**Results:** Multivariate regression found that youth, increased computer use, willingness to show body areas over photo/video, perceived quality of tele dermatology, demand for social distancing and to reduce commute were associated with willingness to use tele dermatology. The willingness to use tele dermatology declined with the easing of COVID-19 movement restrictions, and 48.5% reported a poorer experience with tele dermatology than with in-person consultations. Qualitative data from 26 interviews showed that willingness to use is influenced by pragmatic considerations, emotional factors, and data privacy concerns. These were moderated by the patient's perception of disease severity and need for an accurate diagnosis.

**Limitations:** Lack of data prior to the pandemic and during the initial lockdown period.

**Conclusion:** The willingness to use tele dermatology is influenced by circumstantial factors, technology literacy, views toward tele dermatology, and factors driving the purpose of consultation. The declining willingness to use tele dermatology with the easing pandemic, lower willingness to pay full in-clinic prices, and poorer experience compared with in-person consultations highlights the need to optimize this mode of delivery. (JAAD Int 2022;6:97-103.)

**Key words:** COVID-19; health services research; live video conferencing; mixed methods; tele dermatology.

## INTRODUCTION

During the COVID-19 pandemic, the practice of telemedicine greatly expanded around the developed world.<sup>1-4</sup> In the United States, telehealth consultations increased 2000%, peaking in April 2020 before declining.<sup>2</sup> With increasing viral transmissibility and as the virus becomes endemic, health

care providers can anticipate telemedicine to become a necessary mode of service delivery.<sup>5,6</sup> This highlights the importance of understanding the barriers toward adoption to ensure practice sustainability.

Studies of tele dermatology during the pandemic have been cross-sectional and quantitative, citing

From the Division of Dermatology, Department of Medicine, National University Healthcare System, Singapore<sup>a</sup>; Johns Hopkins Business School, Baltimore<sup>b</sup>; and Department of Medicine, Johns Hopkins Medicine, Baltimore.<sup>c</sup>

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Correspondence to: Ellie Ci-En Choi, MBBS, MRCP, Division of Dermatology, Department of Medicine, National University Healthcare System, 5 Lower Kent Ridge Road, Singapore 119074. E-mail: [ellie\\_choi@nuhs.edu.sg](mailto:ellie_choi@nuhs.edu.sg).

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benefits such as supporting social distancing while highlighting barriers, including poor-quality images and misdiagnoses.<sup>7-11</sup> Although useful, such studies are unable to uncover factors not preidentified by clinicians, providing an incomplete understanding of the phenomenon. Findings such as increased satisfaction among those with mild disease and increased acceptance among healthier patients have also not been fully explained.<sup>12,13</sup> Additionally, there are little data on patients' changing acceptances and behaviors as threat levels of the COVID-19 pandemic change, when tele dermatology becomes an option rather than a necessity.

This study seeks to answer 3 questions: (1) What influences the willingness of a patient to use tele dermatology, (2) how has the progression of the COVID-19 pandemic changed the perception and use of tele dermatology, and (3) what is the user's lived experience of tele dermatology, and how might it be improved.

## MATERIALS AND METHODS

A convergent parallel (simultaneous qualitative and quantitative) mixed-method study was conducted of patients or their caregivers (regardless of previous tele dermatology use) in an academic tertiary dermatologic center in Singapore. The center serves an average of 17,000 self-paying and government-funded patients who present with a spectrum of dermatologic diseases and severities. During the lockdown period of the pandemic, live video conferencing over Zoom (Zoom Video Communications Inc) was offered to outpatients who were due for in-person follow-up visits. Consultation by video conference became optional as movement restrictions were relaxed. Patients were encouraged but not required to share photos of their skin prior to or during the consultation (ie, hybrid tele dermatology).

In the quantitative component, a questionnaire assessed the reasons for the use or nonuse of tele dermatology and the user experience of patients or their primary caregivers (detailed methods in Supplementary File 1, available via Mendeley at <https://data.mendeley.com/datasets/zx3xjyg5hv/1>). The questionnaire was self-administered or administered by a caregiver or research assistant to the non-English-speaking respondents. The primary

outcome was "willingness to use tele dermatology," comprising the mean response to 6 questions: willingness to use tele dermatology before, during, and after the COVID-19 pandemic (hypothetically) and for a follow-up visit, new problem, and/or first visit. Responses to questions assessing similar constructs were aggregated based on clinical validity and

correlation coefficients and were used in the multivariable regression analysis.

Data collection spanned 11 months, starting in June 2020 after the peak in COVID-19 community cases in Singapore and paralleled the decreasing community spread and relaxing of movement restrictions over the subsequent year. Analysis was conducted using SPSS V26 (IBM Corp).

In the qualitative component, in-depth one-on-one semistructured interviews were conducted to explore patients' perceptions of tele dermatology. The participants were recruited through purposive sampling. After each round of 5 to 6 interviews, the research team coded the raw data into themes, and refinements to the interview guide were made to reflect initial learnings. This cycle continued in an iterative process until theoretical saturation was achieved, defined as the stage where no new themes were identified. Data were analyzed using analytic induction following grounded theory principles with ATLAS.ti 8.0 (ATLAS.ti Scientific Software Development GmbH).<sup>14</sup> This form of analysis allows researchers the flexibility to discover constructs not preidentified in the literature so as to enrich extant theory by grounding it in systematically acquired data. The study was designed and reported following Consolidated Criteria for Reporting Qualitative Studies guidelines. The study was approved by the hospital's institutional review board.

## RESULTS

A total of 942 participants were recruited from the outpatient dermatology clinic between June 2020 and April 2021. The poor-quality responses were excluded, leaving 913 responses for analysis. Of these, 26 patients (20 with prior experience with tele dermatology and 6 without) were recruited through purposive sampling for in-depth interviews (mean duration, 38 minutes) to gain qualitative insights. Descriptive data are reported in

### CAPSULE SUMMARY

- Satisfaction with tele dermatology was lower than that with in-person consultations.
- Patients' willingness to use tele dermatology declined with the easing of public infection-control measures, reflecting the need to address underlying psychosocial barriers to ensure practice sustainability.

**Table I.** Multivariable linear regression of factors associated with willingness to use teledermatology\*

Independent variables	Unstandardized coefficients (standard error)	Standardized coefficients	P value
Age	−0.004 (0.001)	−0.077	.012 <sup>†</sup>
Sex (female; reference group: males)	0.100 (0.044)	0.061	.025 <sup>†</sup>
Race (Chinese; reference group: other races)	0.059 (0.047)	0.032	.210
Education level	0.009 (0.024)	0.011	.710
Paying rate (self-paying; reference group: government subsidized)	−0.004 (0.062)	−0.002	.943
No. of comorbidities	0.030 (0.034)	0.024	.380
Time to travel to dermatologist	0.017 (0.024)	0.019	.472
Average daily phone use	0.025 (0.023)	0.031	.278
Average daily computer use	0.035 (0.018)	0.061	.046 <sup>†</sup>
Prior experience of telemedicine	0.007 (0.078)	0.002	.928
COVID-19 phase (phase 3 [relaxed restrictions]; reference group: phase 2 [heightened restrictions])	−0.053 (0.046)	−0.030	.248
Willingness to show body parts over photo/video	0.143 (0.023)	0.194	.000 <sup>†</sup>
Perceived quality/accuracy of teledermatology	0.454 (0.059)	0.237	.000 <sup>†</sup>
Usage for social distancing	0.284 (0.048)	0.173	.000 <sup>†</sup>
Usage if taught to set up	0.038 (0.063)	0.017	.552
Usage for faster appointment time	0.030 (0.048)	0.018	.525
Usage to reduce commuting time and cost	0.278 (0.055)	0.151	.000 <sup>†</sup>
Usage if financially incentivized	0.051 (0.059)	0.026	.390
Usage if reimbursable	−0.013 (0.073)	−0.005	.861
Nonuse because of poorer communication	−0.085 (0.047)	−0.052	.075
Nonuse because no confidence in setting up	−0.234 (0.071)	−0.099	.001 <sup>†</sup>
Nonuse as the existing delivery models are working	−0.401 (0.068)	−0.179	.000 <sup>†</sup>
Nonuse as concern about diagnostic accuracy of telemedicine	−0.278 (0.070)	−0.130	.000 <sup>†</sup>
Nonuse as concern about data privacy	0.133 (0.049)	0.078	.007 <sup>‡</sup>

\*Adjusted R square = 0.491.

<sup>†</sup>P value < .05.

<sup>‡</sup>Univariable analysis did not show an association, and after discussion, this result was felt to be overall not significant.

Supplementary Table I (available via Mendeley at <https://data.mendeley.com/datasets/zx3xjyg5hv/1>).

### Quantitative analysis

The patients reported being more willing to use teledermatology during the pandemic (47%) compared with before the pandemic (26%). The willingness to use teledermatology was the highest for a routine follow-up visit (60.8%) and was lower for a first-time visit (21.9%) or a new problem (17.9%). Reducing the need for transportation and waiting time was the most common reason for using teledermatology, whereas concern about visual clarity was the most cited reason for nonuse (Supplementary Fig 1, available via Mendeley at <https://data.mendeley.com/datasets/zx3xjyg5hv/1>). We found that 47.3% of teledermatology patients were willing to pay only <50% and 37% were willing to pay 50% to 90% of the in-person consultation fee.

Multivariable linear regression showed that age (youth) and frequent computer use were independently associated with greater willingness to use teledermatology (Table I). The willingness to show sensitive body areas over photo/video, higher

perceived quality/accuracy of teledermatology, need for social distancing, and need to reduce commuting effort were positively associated with the willingness to use teledermatology. Conversely, the willingness to use teledermatology was negatively associated with the lack of confidence in using the technology, perceptions that in-person consultations are already working, and concerns with diagnostic accuracy. Data privacy concerns were not significant in this sample.

Univariable regression found a declining willingness to use teledermatology with the easing of COVID-19 movement restrictions (unstandardized B, −0.189; *P* = .001). This relationship was mediated by the reduced need for social distancing and increased nonuse because of the perception that existing delivery models are acceptable (Table II). A total of 68 participants had prior experience with teledermatology. Compared with in-person visits, approximately half of the patients believed that the experience was poorer (48.5%), whereas the rest of the patients were indifferent (39.1%) or considered teledermatology to be better (12.6%).

**Table II.** Multivariable logistic regression of changes in perception toward teledermatology during phase 3 (reduced community spread of COVID-19 and relaxed movement restrictions) compared with phase 2 (increased community spread of COVID-19 and stricter movement restrictions)\*

	Odds ratio (standard error)	P value
Willingness to show body parts over photo/video	0.000 (0.087)	.997
Perceived quality and accuracy	-0.180 (0.217)	.406
Usage for social distancing	-0.465 (0.183)	.011 <sup>†</sup>
Usage if taught to set up	-0.041 (0.242)	.864
Usage for faster appointment time	0.429 (0.183)	.019 <sup>†</sup>
Usage for convenience	0.008 (0.213)	.971
Usage if financially incentivized	-0.008 (0.226)	.972
Usage if claimable	-0.133 (0.283)	.639
Nonuse as poorer communication	0.076 (0.180)	.672
Nonuse as not confident setting up	0.163 (0.286)	.570
Nonuse as the existing physical consult system works well	0.550 (0.283)	.052
Nonuse as concern about the diagnostic accuracy of telemedicine	0.282 (0.262)	.282
Nonuse as concern about data privacy	0.361 (0.192)	.060

\*There was a reduction in use for social distancing, increase in use for faster appointment time, and increase in nonuse as the existing in-person system works well during phase 3 (period of relaxed restrictions). Model was adjusted for age, sex, race, education level, paying rate, number of comorbidities, time to travel to dermatologist, average daily phone use, average daily computer use, and prior experience of teledermatology.

<sup>†</sup>P value < .05.

We used 864 responses for the sensitivity analyses, which entailed re-estimating the model without the caregiver-completed surveys and treating the COVID-19 public health response as a continuous time variable. The results were similar.

### Qualitative analysis

**Willingness to use teledermatology.** The qualitative analysis showed that the drivers of willingness to use teledermatology could be categorized into 4 themes: pragmatic considerations, emotional considerations, concerns over data privacy, and the patient's purpose for the consultation that day (Table III in brief, Supplementary Table II [available via Mendeley at <https://data.mendeley.com/datasets/zx3xjyg5hv/1>] in detail).

**Pragmatic considerations.** This theme comprised the dimensions of "diagnostic and treatment capability," "strength of recommendation by physician," "infection risk," "cost," "convenience," "logistical and physical means," and "familiarity with technology."

Diagnostic and treatment capability was frequently mentioned, with concerns of "the quality of camera" and "lighting" resulting in reduced diagnostic accuracy. Cost considerations, including the opportunity costs, featured strongly in the interviews (eg, "In the end I waited for 30 mins, but I'm at home so I can fix myself a sandwich, scroll through my email").

**Emotional considerations.** This theme included the intangible aspects of a consultation, namely "affective communication" and "willingness to try."

Affective communication describes the emotional satisfaction and connection arising from an in-person consultation that would be attenuated with teleconsultation. One participant noted, "It is not the same...going on a date online and going on a date physically will be two different things." The willingness to try a new mode of delivery (ie, novelty seeking) also influenced the adoption, with 1 patient noting, "This is the first time I had to do consultation using a screen, so I feel a bit excited."

**Concerns over data privacy.** Data security was cited as a barrier to use, with concerns about unintended "recordings," "leakage of digital information," and "breach of data."

**Patient's purpose for consultation that day.** The perceived adequacy of teledermatology is moderated by the patients' priorities with respect to the purpose of consultation. For instance, the desire for accuracy was lower among patients who perceived their disease to be mild or stable. Conversely, patients with "an acute flare" or "a first-time consultation" were more concerned with reduced diagnostic accuracy. Some participants valued the relational experience of physically seeing a doctor; as noted by one patient, "[Teledermatology] was not something that I liked because I liked talking with that doctor, when I see him...my stress will be going down." Other interactions were more transactional, needing "to resupply medication" or address a problem.

**Triangulation of results.** Quantitative and qualitative results were compared in a convergence

**Table III.** Qualitative themes of factors influencing the uptake of teledermatology, derived from the interviews and content analyzed using grounded theory\*

Theme	Representative quote
Pragmatic considerations—framework/set up	
Diagnostic and treatment capability	“Sometimes [the] doctor will need to do some sample tests, they will need to...cut my nails or look at my skin through magnifying glasses... I’m not sure whether it can be done through Zoom.”
Strength of recommendation by physician	“I would explain my situation and I would leave it to him to decide what is good for me.” [When asked how he would respond if offered a teledermatology visit instead of FTF]
Infection risk	“There is the fear that if you are in contact or close proximity with these people with COVID-19, you have a chance of getting infected, and number two, the risk is also of getting quarantined again!”
Costs	“From the travel, I can save time, save money.”
Convenience	“With elderly parents, if we can minimize the physical traveling in and out of cars, and then transferring to wheelchairs and things like that, that’s also another convenience.”
Logistical and physical means	“Because you already have the laptop and everything so you don’t have to scramble to get one.”
Familiarity with technology	“Some people have some hesitancy because some people are not very good with the IT, they don’t know how to set up.”
Emotional/relational considerations	
Affective communication	“Physically, it’s probably more, you know, kind of, it feels like a better experience like, oh, you’re really listening to me.” “[With tele] I’m missing the verbal language. I’m not seeing half the body, I’m not seeing what they are doing, their gestures...the eye contact.”
Willingness to try (Novelty seeking)	“I’ve never heard of Zoom with a doctor before. But now that I’ve tried it, I think it’s okay.”
Data privacy	
Data privacy	“[With telemedicine] It’s easy for you to record what I say...If I see you in person...I know there’s no like physical, digital evidence of this floating around.”
Patient’s purpose for the consult that day	
Perception of disease severity	“As a patient, maybe I tend to minimize my symptoms, I would say it’s ok...I think it’s fine, you know, we don’t have to come in.” “Because honestly I don’t think that my symptoms are urgent that i will have to come down.”
Need for a diagnosis	“[If] this is the first time I’m trying to identify what’s wrong with myself, then I would feel better if the doctor has seen me and you examined it herself [FTF].”

\*A comprehensive table of quotes is presented in Supplementary Table II.

coding matrix, showing agreement for most themes (Supplementary Table III).<sup>15,16</sup> Findings were dissonant for the themes regarding data privacy, satisfaction with teledermatology, and the role of financial incentives.

**Other findings.** Changes in perception during COVID-19 included increased awareness and availability of teledermatology and preference for in-person consultation after the pandemic (Supplementary Table IV [available via Mendeley at <https://data.mendeley.com/datasets/zx3xjyg5hv/1>]). Fourteen of 15 participants who shared their experiences reported a good experience with a prior teledermatology consultation. Nevertheless,

interviewees were quick to share suggestions for improving teledermatology, including optimizing the consultation setup (eg, connection stability), formalizing a periconsult process (eg, being updated on wait time), and providing financial incentives (Supplementary Table V [available via Mendeley at <https://data.mendeley.com/datasets/zx3xjyg5hv/1>]).

## DISCUSSION

Our quantitative results highlight the importance of age, education, and technological literacy as enablers of teledermatology use. The qualitative interviews suggested additional factors, such as patients’ perceived disease severity and purpose

for the consultation that day, which influenced the trade-offs between convenience and perceived diagnostic accuracy. This finding also explains previous reports of increased acceptance and satisfaction with teledermatology among healthier individuals with mild disease.<sup>12,13</sup>

The quantitative results reported an association between the easing of COVID-19 pandemic restrictions and a declining willingness to use teledermatology. This was mirrored in the qualitative findings. This phenomenon is not isolated to our setting and has been reported elsewhere.<sup>2,17</sup> It highlights the dynamic and changing nature of willingness to use, based on situational factors such as the threat from COVID-19 and the ease and availability of dermatologic access.

In the quantitative results, the teledermatology experience was graded to be poorer than in-person visits, which was dissonant to our qualitative interviews that reported mainly good experiences and was contrary to other studies reporting high satisfaction.<sup>7,8,18-23</sup> There are a few possible reasons for this discrepancy. First, our survey respondents graded their experience relative to an in-person visit.<sup>8,18-23</sup> Satisfaction scores of teledermatology without a conjoint analysis (ie, comparison with standard care) can lead to over-estimations of high satisfaction and can be misinterpreted as equivalent to in-person visits. Critically, studies conducted during pandemic lockdowns where teledermatology was the only option may have been anchored to a “no consultation” comparator, overestimating the attractiveness of telemedicine.<sup>18,21</sup> Finally, variations in service delivery, such as the lack of routine acquisition of clinical photos and the absence of a specialized telemedicine platform, may have caused the low satisfaction scores in our quantitative results.

This study raises potential implications for clinical practice. First, given the lower value and satisfaction reported with teledermatology, there is a need to optimize the service to ensure sustainability. Respondents’ ideas for improving the telemedicine experience included protocolizing the preconsult process and technology optimization point to the benefit of utilizing a specialized teledermatology platform such as the telehealth module in Epic Systems Corporation, rather than general platforms such as Zoom.<sup>24</sup> Additionally, the tradeoff between benefits of teledermatology with the reduced diagnostic accuracy highlights the role of appropriate triaging of suitable patients and supplementation with high quality photos prior to the consultation.<sup>25,26</sup> Second, there was a common expectation among patients that telemedicine should be priced less than an in-person consultation. However, in

reality, this is not always the case.<sup>27,28</sup> Health care institutions may need to accept and absorb a certain degree of financial loss if they wish to encourage the adoption of telemedicine by initially lowering the price. Finally, our results suggest that satisfaction with telemedicine needs to be compared with the standard in-person visit to avoid inflating the perceived value of the service.

The strengths of this mixed-methods study include a large, well-powered sample for hypothesis testing. The complementary qualitative interviews allowed us to better explain the findings and identify the gaps in the quantitative data. Conducting the study over a relatively long time also allowed us to observe changes in perceptions of teledermatology as COVID-19 progressed. Concurrently, we used multiple coders, reflexivity, and an audit trail to ensure the trustworthiness of the qualitative results. To our knowledge, this is the first longitudinal study of its kind combining quantitative and qualitative data.

A major limitation is the lack of comparable data prior to COVID-19 or during the initial heightened lockdown period when research activities were prohibited. The COVID-19 situation and approach to containment are constantly changing with emerging variants like Delta and Omicron, and the results would need to be interpreted in context. Finally, we did not seek the insights and perspectives from health care providers; hence, we were not able to observe the full spectrum of attitudes toward the technology and care delivery model.

## CONCLUSIONS

A patient’s personal assessment of the disease state is an important but easily missed factor contributing to the willingness to use teledermatology. As the pandemic eases, patients’ willingness to use teledermatology wanes. This, coupled with the lower satisfaction with teledermatology than with in-person visits, highlights the importance and difficulty in ensuring sustainability when building a teledermatology practice. The value and satisfaction with teledermatology also needs to be assessed compared with an in-person consultation for a reliable analysis of effectiveness.

## Conflicts of interest

None disclosed.

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