

**NON-SYSTEMATIC REVIEW****Dermatology****Teledermatology in the time of COVID-19**

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**Abstract**

**Aims:** The enormous spread of the novel Corona virus disease (COVID-19) represents a challenge to dermatological practice. Accumulating evidence has suggested a possible role of teledermatology in facing this challenge. In this article, we aimed to give a general overview of teledermatology in terms of models of practice, modes of delivery, advantages, limitations, ethical considerations and legislative challenges as well as discussing, using examples from literature, how dermatological practice can benefit from teledermatology during the time of the COVID-19 pandemic.

**Discussion and conclusion:** Teledermatology could be an accessible, accurate and cost-effective substitute for conventional face-to-face dermatological consultations during the COVID-19 pandemic. However, teledermatology practice needs updated legislation and guidelines. More efforts should be done to encourage dermatologists, especially in underserved communities, to provide teledermatology services. Ethical issues and data security related to teledermatology have to be considered.

**1 | INTRODUCTION**

The novel Corona virus disease (COVID-19) pandemic represents a challenge to healthcare systems and medical practice worldwide. Dermatology practice is amongst the most affected medical disciplines because dermatological examination requires close inspection that is currently advised to be avoided to prevent the spread of COVID-19.<sup>1</sup> Routine investigations, screenings, elective surgeries and follow-ups have been also discouraged as the hospitals and clinics could be sources of infection.<sup>2</sup> Besides, several dermatologists had to get home or hospital isolated for being infected or contacting patients with COVID-19.<sup>3</sup> These factors together have restricted access to dermatological care and reduced the capacity of dermatological practice.

Opposed to the limited access and capacity of dermatological practice in the time of COVID-19, there has been a concurrent

increase in the need for dermatological care for many reasons. First, the protective measures of COVID-19 including regular hand-washing, the repeated use of hand sanitisers and wearing personal protective equipment for a long time have resulted in a noticeable increase in dermatitis and worsening of other dermatological conditions.<sup>4</sup> Second, COVID-19, per se, has been shown to present with dermatological manifestations including erythematous rash, chilblain-like lesions, vesicular chickenpox-like exanthem and urticarial rash.<sup>5-7</sup> Third, several patients with chronic dermatological conditions had to consult their dermatologists regarding the use of immunosuppressive and immunomodulating systemic therapies for their possible interactions with COVID-19.<sup>8</sup> Fourth, relieving lockdown measurements in most countries is expected to be associated with a surge in elective dermatological consultations and surgeries.

To fill the gap between the limited access to dermatological care and the growing need for this care, digital approaches have been

considered. Of these approaches, teledermatology can be a timely solution for many of the challenges facing dermatological practice during the time of the COVID-19 pandemic. Teledermatology is the use of telecommunications technologies to allow the remote exchange of medical information related to dermatological conditions. The advances in audio, visual and data telecommunication technologies have made it easier for physicians to communicate with remotely situated patients.<sup>9</sup> This is particularly relevant to dermatology as visual cues are the keystone in identifying most dermatological pathologies. Images or videos of dermatological conditions can be remotely viewed by a dermatologist who can make a diagnosis and start a management plan for patients.

In this article, we aimed to give a general overview of teledermatology in terms of models of practice, modes of delivery, advantages, limitations, ethical considerations and legislative challenges as well as discussing, using examples from literature, how dermatological practice can benefit from teledermatology during the time of the COVID-19 pandemic.

## 2 | MODELS OF TELEDERMATOLOGY PRACTICE

There are four main models of teledermatology practice: (a) consultation: in which the referring physician consults the dermatologist regarding the patient's dermatological condition, (b) triage: in which dermatologists decide on the priority of management and referrals, (c) direct care: in which dermatologists consult their patients using video conference or patients directly send pictures of dermatological lesions to their dermatologists and (d) follow-up: in which dermatologists monitor the dermatological condition and its response to treatment.<sup>10</sup>

## 3 | MODELS OF TELEDERMATOLOGY DELIVERY

There are three types of technological models used for delivering teledermatology services: synchronous, asynchronous and hybrid.

### 3.1 | Synchronous (real-time)

In this model, there is real-time communication between the dermatologist and the patient or the referring physician. This is usually done via a live video conference. On the one hand, it allows dermatologists to provide patients with an experience that is more similar to face-to-face consultation on an interpersonal level. Dermatologists can ask patients about their manifestations and clinical history before receiving a quick response. This can make it more efficient for patients to be diagnosed and managed in a time-saving manner. On the other hand, this model requires previous coordination to decide on a time that is suitable for both parties which can be challenging

### Review criteria

- Using the terms (teledermatology OR online dermatology) AND (COVID-19), we searched PubMed for related articles.
- We summarised teledermatology models of practice and delivery, pros and cons and ethical and legislative challenges using examples from literature focusing on teledermatology during the COVID-19 pandemic.

### Message for the clinic

- Teledermatology can, to a great extent, fill the gap made by the COVID-19 pandemic between the limited access to dermatological care and the growing need for this care.
- Before engaging in teledermatology, dermatologists should be aware of the related legislations and seek technical support.

in instances where there is a significant difference in time zones. It can also be a problem for people who do not have access to high-speed internet as video conferences require significant bandwidth. Another issue is that video quality can be lower than that of still images. Also, some patients may not be comfortable with showing sensitive areas of their bodies through a webcam.<sup>11-13</sup>

### 3.2 | Asynchronous (store-and-forward)

In this model, the patient or the referring physician can take a still image of the skin condition. This image, along with relevant clinical history, is then stored and forwarded to the dermatologist. One of the main advantages of this model is the flexibility it gives to both dermatologists and patients. It removes the need for scheduling a time to communicate which is especially useful when they are in different time zones. This model allows dermatologists to review the image later without interrupting workflow. Having a still image can also help in two ways. First, dermatologists can receive a high-resolution image of the condition. Second, residents of rural areas with no access to high-speed internet can send their images. Yet, the main disadvantage of this model is the inability of dermatologists to clarify any ambiguous information in the clinical history. Instead, they have to communicate with the sender then wait for a response. This can be inefficient and cause delays in the diagnosis and management of patients.<sup>11-13</sup>

### 3.3 | Hybrid (mixed)

This model combines the use of synchronous and asynchronous teledermatology. The patient or the referring physician sends still

images with or without a text history to the dermatologist who makes a phone call with the sender to discuss the image and the case. Hybrid teledermatology can overcome the disadvantages of both models by providing dermatologists with a time-saving interview with the patient or the referring physician as well as a high-quality image of the dermatological condition.<sup>12</sup>

## 4 | FEATURES OF TELEDERMATOLOGY

### 4.1 | Accessibility

During the COVID-19 pandemic, dermatological patients, thanks to teledermatology, can be diagnosed and monitored at home; thus, they can avoid exposure to infection at medical facilities. Teledermatology can also offer broader coverage of dermatological care along with other advantages such as cutting travel time and reducing the time required to obtain a diagnosis and initiate treatment.<sup>14,15</sup>

Access to teledermatology services has been established in countries with developed healthcare systems that have allowed patients to obtain dermatological care during the COVID-19 pandemic. In two university hospitals in France, for example, teledermatology was able to act as a substitute for face-to-face visits in managing non-COVID-19 and COVID-19-related dermatological conditions.<sup>16</sup>

On the other hand, the access to dermatological care in low- and middle-income countries and rural areas is very limited because of the low ratio of dermatologists per capita and their skewed urban allocation in addition to the lack of established platforms for teledermatology. However, this pandemic can be a good opportunity to begin applying teledermatology in these countries. In Egypt, for example, many dermatologists started to provide synchronous and asynchronous teledermatology services during the COVID-19 pandemic. Most patients who received these services reported their usefulness, learnability and reliability whilst the dermatologists expressed their readiness to offer and expand their teledermatology services.<sup>17,18</sup> Also, previous teledermatology programmes have been able to complement dermatological care to residents of rural areas.<sup>19</sup> However, the lack of appropriate technology to access teledermatology remains a challenge that could exacerbate health disparities amongst underserved populations.<sup>20</sup>

Besides, elderly and illiterate patients may find teledermatology platforms difficult to use. In this regard, Simpson and Kovarik<sup>21</sup> have suggested some tips that can help people with limited knowledge of technology engage effectively in teledermatology such as reducing the steps to connect, providing simple instructions, offering a trial run and utilising multiparty encounters. We believe that such ideas side by side with other ideas that involve simplifying teledermatology delivery models should be prioritised to guarantee broader access.

### 4.2 | Accuracy

Teledermatology has nearly similar diagnostic and management accuracy compared with face-to-face consultations and has even more accuracy than general practice with insufficient dermatology training.<sup>14</sup> A study conducted in Switzerland to detect the diagnostic accuracy of teledermatology in 195 dermatological lesions showed that teledermatology alone was suitable to carry out skin cancer screening with 100% sensitivity and 76.6% specificity. When conventional teledermatology was combined with dermoscopic images, the specificity increased to 84.9%, allowing the reduction of unnecessary testing in a larger proportion of dermatological lesions.<sup>22</sup> Teledermatology aided by teledermoscopy was even more accurate in diagnosing cancer than direct referral amongst 59,279 primary care patients in Brazil.<sup>23</sup> In two randomised clinical trials, teledermatology was as effective as in-person management in improving clinical outcomes of patients with atopic dermatitis and psoriasis.<sup>24,25</sup> However, the accuracy of teledermatology in identifying dermatological conditions attributed to COVID-19 infection needs to be studied.

### 4.3 | Cost-effectiveness

Costs of teledermatology include direct costs for hardware and staff training and indirect costs for software services, internet connections and medical insurance.<sup>26</sup> However, compared with face-to-face consultation, teledermatology was found to be cost-effective through reducing inpatient visits and referral to secondary care, saving transportation time and expenses, minimising lost work productivity, sparing costs of companions in the case of children and disabled patients and avoiding drawbacks of a delayed diagnosis.<sup>27,28</sup> Moreover, during the COVID-19 pandemic, teledermatology has been shown to save the costs of protective equipment.<sup>15</sup> Also, preventing patients and dermatologists from getting infected with COVID-19 via teledermatology can minimise huge costs.

### 4.4 | Informed consent

Obtaining informed consent before conducting the clinical assessment is essential. Alike, teledermatology necessitates informed consent in which the patient should understand the characteristics of teledermatology, policies regarding using webcams and saving or deleting photos and data security issues.<sup>29</sup> However, it is a matter of debate whether the patient should receive an online or video-recorded explanation of informed consent, or the patient reads his/her electronic informed consent. Another debate is rising about whether the patient has to sign a paper-based informed consent and upload the scan or could simply sign electronic informed consent by clicking agree or typing name.<sup>30-32</sup>

One point of view considers that when a patient sends an unsolicited consultation to the dermatologist including his/her photos and clinical history, this should be considered a conscious autonomous decision that can replace the need for written informed consent. Amongst underserved communities that have no access to established teledermatology services, patients use social networks to send photos of their lesions directly to their dermatologists in private messages. This approach is very common in developing countries and usually does not include signing informed consent, and dermatologists perceive receiving a phone call or messages of dermatological lesions from patients as consent.<sup>33</sup>

#### 4.5 | Data security

Social distancing measures imposed because of the COVID-19 pandemic including work from home have urged the need for tighter data protection regulations. Through teledermatology, patients may send photos of sensitive body parts and some of them are concerned that teledermatology carries the risk of privacy breach during data transmission, storage on a web server or involvement of other physicians.<sup>30</sup> Personal data leakage could be prevented by pseudo anonymisation (replacing patients' identifying data with codes), limiting access to authorised personnel, entity authentication, data encryption via usernames and passwords, virus scanning and filtering electronic feeds.<sup>34</sup> Dermatologists also should be educated on how to protect teledermatology patients' privacy by, for example, deleting photos and medical history saved on their devices immediately after updating their electronic medical records and also having enough technical skills to ensure the security of their devices and methods of communication with patients.<sup>35</sup>

### 5 | TELEDERMATOLOGY DURING THE COVID-19 PANDEMIC

To draft this section, we conducted a rapid systematic review of articles that investigated teledermatology practices during the COVID-19 pandemic. Using the terms (teledermatology OR online dermatology) AND (COVID-19), we searched PubMed for related articles published in English before 1 September 2021 ( $n = 285$ ). Then, we conducted a manual search of the reference lists of retrieved studies to obtain further studies. We considered full manuscripts, brief reports, editorials and letters. Eventually, we extracted and tabulated the following information from 26 selected studies: the last name of the first author, study location, subjects, study design, outcomes and significant findings (Table 1).

#### 5.1 | Teledermatology for outpatients

Whilst many dermatology clinics decided to close or reduce their capacity, others chose teledermatology. In Italy, Cinelli et al<sup>36</sup>

restricted the face-to-face consultation to urgent visits and surgical procedures and conducted the rest of the consultations via online video, telephone and e-mails. The authors showed that amongst 105 patients with dermatological complications under cancer therapy, 87 patients could be treated using teledermatology. Also, Brunasso and Massone,<sup>37</sup> in a tertiary centre in Italy, replaced all scheduled follow-up visits of patients with chronic dermatological disorders with phone calls and e-mailed photos when needed. Only 3% reported deterioration of their condition requiring in-person visits and teledermatology was effective in assurance, withdrawal and adding or switching drugs in the rest of the patients. In the United States, asynchronous teledermatology services were offered for suspected COVID-19 with dermatological conditions. These services were able to treat more than two-thirds of patients, avoid unnecessary personal and preserve protective equipment.<sup>38</sup> Still, it could be argued that whilst planned elective dermatological surgeries can be postponed, delaying surgery for skin malignancies can worsen the prognosis and eventually increase the treatment costs.<sup>39</sup> However, presurgery evaluation can be done through live video or phone calls whether at home or in a designed room in the hospital.<sup>40</sup>

#### 5.2 | Teledermatology for inpatients

Many hospitals had to withhold their dermatology inpatient services because of the high possibility of admitting patients with COVID-19. For example, 18% of the admitted patients in a tertiary hospital in Turkey who were presented to the inpatient dermatology clinic were COVID-19 suspects.<sup>41</sup> Thus, the utilisation of teledermatology for inpatients is crucial in terms of minimising the risk of COVID-19 exposure and reducing the consumption of protective equipment.<sup>42</sup> Taking pictures of skin lesions of the admitted COVID-19 patients and forwarding them to dermatologists allowed early diagnosis and treatment of their dermatological conditions.<sup>43</sup>

#### 5.3 | Teledermoscopy

Dermoscopy is a noninvasive tool that aids in the diagnosis of numerous dermatological disorders. However, dermoscopic lenses and buttons were found to be contaminated with microorganisms acquired through patient contact and were suggested to be sources of COVID-19 infection.<sup>44,45</sup> During the COVID-19 pandemic, teledermoscopy could be viewed as a better option compared to face-to-face examination as it reduces unnecessary referrals and waiting times; therefore, it could reduce the risk of cross-infection. Furthermore, it poses a good diagnostic accuracy compared with face-to-face consultation and histopathological diagnoses. Also, self-examination makes some patients feel more comfortable.<sup>11,46</sup> Teledermoscopy photos can be obtained through mobile equipped with dermoscopic attachment either by patients themselves or by their referring physicians whilst consulting dermatologists through asynchronous teledermatology. While the attachment can be sent

TABLE 1 Summary of studies that assessed teledermatology practices during the COVID-19 pandemic

Study ID	Subjects	Outcomes	Findings
Mostafa & Hegazy <sup>17</sup> (Egypt)	Cross-sectional study including patients at public and private healthcare settings	Attitude towards teledermatology	90% were satisfied with teledermatology First visits were conducted at private healthcare settings and were not covered by health insurance
Cinelli et al <sup>36</sup> (Italy)	Descriptive analysis of 105 oncological patients contacted by e-mail or telephone	Response Follow-up	Response to teledermatology: 83% 14 patients reported worsening conditions
Brunasso & Massone <sup>37</sup> (Italy)	Descriptive analysis of 195 patients with chronic inflammatory dermatosis	Reaching diagnosis Follow-up	94% of patients were successfully diagnosed by teledermatology Five patients had worsening conditions and required face-to-face consultation Nine psoriatic patients required withdrawal of biological therapy
Cartron et al <sup>38</sup> (US)	Retrospective analysis of 16 patients who used asynchronous teledermatology	Reaching diagnosis	81% of patients were successfully diagnosed by asynchronous teledermatology
Fluhr et al <sup>57</sup> (France)	Interview of 82 patients and their four dermatologists	Attitude towards teledermatology	Patients were less satisfied with the duration of teleconsultation and technical errors than their dermatologists
Conforti et al <sup>58</sup> (Several countries)	Online surveying of 678 dermatologists from the International Dermoscopy Society	Use of teledermatology Frequent diagnoses	27% used teledermatology for the first time during the COVID-19 pandemic A noticeable decrease in skin cancer diagnosis was recorded
Kazi et al <sup>59</sup> (US)	Retrospective analysis of 1672 synchronous and 951 asynchronous teledermatology visits	Number and method of teledermatology visits Diagnoses and given treatments The relation between teledermatology type and diagnosis	Acne and acne treatments were the most common diagnoses and prescriptions, respectively Acne treatment was more common in asynchronous whilst biological therapy was more common in synchronous visits
Lee et al <sup>60</sup> (USA)	Retrospective analysis of outpatient dermatology and teledermatology visits 3 mo before and 3 mo after the COVID-19 pandemic	The difference in number and type of visits	Decreased outpatient and increased teledermatology visits Increased use of teledermatology amongst the elderly after the pandemic
Chiricozzi et al <sup>61</sup> (Italy)	A cross-sectional study on 183 patients with atopic dermatitis on immunity-lowering medications or phototherapy	Follow-up	Almost 15% stopped their systemic therapy because of physician decision or patient choice
Sendagort et al <sup>62</sup> (Spain)	Prospective observational study on 1497 patients with cancelled visits because of the COVID-19 pandemic	Reaching diagnosis	83% of patients were successfully diagnosed by teledermatology
Elsner <sup>63</sup> (Germany)	Online surveying of 480 dermatologists	Use of teledermatology Types of teledermatology	17.5% offered synchronous teledermatology 11.3% offered asynchronous teledermatology 10% offered both types
Gorrepati & Smith <sup>64</sup> (USA)	Descriptive analysis of websites of dermatological clinics	Availability of teledermatology	86.5% of websites provided teledermatology consultation
Sharma et al <sup>65</sup> (India)	Online surveying of 184 dermatologists	Use of teledermatology	88.6% used teledermatology Using teledermatology was more common in larger cities
Villani et al <sup>66</sup> (Italy)	Retrospective analysis of 72 acne patients	Readiness to use synchronous teledermatology	All patients accepted to participate

(Continues)

TABLE 1 (Continued)

Study ID	Subjects	Outcomes	Findings
Ruggiero et al <sup>67</sup> (Italy)	Descriptive analysis study of 52 acne patients	Satisfaction with synchronous teledermatology	92% of patients were satisfied with synchronous teledermatology
Perkins et al <sup>68</sup> (US)	Descriptive analysis of teledermatology visits at one department	Use of teledermatology	First week: 225 visits Second week: 500 visits Third week: 1148 visits
Altunisik et al <sup>69</sup> (Turkey)	Comparison between teledermatology use 2 mo before and 2 mo after the COVID-19 pandemic	Use of teledermatology	Video calls by mobile: 28% before and 39.3% after the COVID-19 pandemic Online video calls: 12.1% before and 24.3% after the COVID-19 pandemic
Moscarella et al <sup>70</sup> (several countries)	Online surveying of 434 physicians (87.1% certified board dermatologists) from 49 countries	Use of teledermatology Types of teledermatology	45.9% used teledermatology for the first time during the COVID-19 pandemic Telephone calls were the main mode
Yeroushalmi et al <sup>71</sup> (US)	Online surveying of 168 patients	Perceptions towards teledermatology	Time efficient (81.1%) No transportation (74.2%) Maintaining social distancing (73.6%)
Stadler et al <sup>72</sup> (Germany)	Descriptive analysis of 91 patients	Satisfaction with teledermatology	54% were very happy Men were more satisfied than women 23.1% would use teledermatology in the future
Bhargava et al <sup>73</sup> (Several countries)	Online surveying of 733 dermatologists	Use of teledermatology	26.1% before and 75.2% after the COVID-19 pandemic
Handa et al <sup>74</sup> (India)	7530 patients and 34 dermatologists	Use of teledermatology	81% of patients were successfully diagnosed by teledermatology 88.4% of dermatologists were satisfied
Low et al <sup>75</sup> (Australia)	Online surveying of 137 dermatologists	Satisfaction with teledermatology	Helpful in screening patients (15.8%) Assessing patients using biological therapy (49.9%) Assessing patients with inflammatory conditions (19.5%)
Su & Das <sup>76</sup> (US)	Analysis of 8085 visits before the COVID-19 pandemic and 2024 visits after the COVID-19 pandemic	Use of teledermatology	Virtual visits: 0.0% before the COVID-19 pandemic versus 77.3% after the COVID-19 pandemic
De Simone et al <sup>77</sup> (Italy)	Patients with suspected dermatological malignancies	Use of teledermatology	Outpatient selection
Flynn et al <sup>78</sup> (Ireland)	Descriptive analysis of 171 patients	Use of teledermatology	A photo-triage system was created to facilitate diagnosis and treatment

to consumers via mail, a clear policy is still lacking on how to provide mobile teledermoscopy and who will pay for them.<sup>47-50</sup>

## 5.4 | Education

Because of the COVID-19 pandemic, most hospitals and medical schools cancelled or postponed their clinical educational classes, medical trainees were discouraged to attend outpatient clinics and ward rounds and many scientific meetings and conferences were cancelled. These disruptions did not just affect the academic process but the knowledge and experience of residents and trainees as well. Teledermatology, however, can offer platforms for training residents and exchanging knowledge between dermatologists worldwide.<sup>13,51</sup> In a pioneering experience, Harvard Medical School designed a teledermatology rotation for medical students including synchronous

and asynchronous visits and consultations. During this rotation, students were able to preview teleconsultations and develop a differential diagnosis and management plan for the most common dermatological conditions. They could also learn via online visits about monitoring chronic dermatological conditions.<sup>52</sup> Hence, we believe that including teledermatology in medical education and training medical students and residents on its use should be taken seriously.

## 5.5 | Dermatological surgery

Since the beginning of the COVID-19 pandemic, a dramatic decrease in elective surgeries was noted and at the heart of these cosmetic surgeries. One study surveyed 100 dermatologists working in private dermatocosmetology clinics who described how heavily COVID-19 hit their businesses.<sup>53</sup> Certain procedures carry a high

risk of COVID-19 transmission such as facial injections that necessitate close face-to-face contact.<sup>54</sup> Teledermatology can serve as a tool for preoperative assessment, discussion of the surgery decision with the patient and consent as it has the advantage of decreased waiting times and time to surgery.<sup>55</sup>

## 6 | TIME TO INVEST IN TELEDERMATOLOGY

The rising need for dermatological care that is faced with limited access to this care, especially during the COVID-19 pandemic time, makes the investment in teledermatology very promising. According to Pasquali et al,<sup>13</sup> teledermatology services could be provided directly or using a third party. In direct teledermatology, dermatologists themselves are the service providers and they are responsible for the technical arrangement side by side with the dermatological care service, and patients or their health insurance companies pay directly to the dermatologists. In third-party teledermatology, medical applications or hospitals provide the technical arrangement whilst a list of dermatologists assigned to the application or the hospital offers the dermatological care, and patients or their health insurance companies pay to the applications or hospitals that share part of their revenues with dermatologists. While direct teledermatology could be more flexible and faster than the third-party one, health insurance companies typically cover third-party teledermatology.<sup>56</sup>

Still, many teledermatology services, especially direct teledermatology, lack obvious reimbursement policies in the case of treating patients covered with health insurance.<sup>27</sup> This lack of these policies is accompanied by shortages in the legislations that regulate teledermatology because of the rapid progress of technologies that exceed the updates in legislations, and there is even a lack of teledermatology legislations in many areas of the world.

It should be noted that healthcare systems and their financing methods differ significantly across the world; therefore, we cannot claim that a certain healthcare system or a certain financing method is better than the other when it comes to teledermatology practices. Therefore, lawmakers, healthcare givers and health insurance companies have to work on new flexible legislations that guarantee the delivery of teledermatology care of quality to patients alongside funding start-ups in teledermatology applications and encouraging more dermatologists to offer teledermatology services by providing them with training, technical support and legal counselling. Besides, reliable mechanisms for reimbursement should be determined to encourage more dermatologists to invest in teledermatology.

## 7 | CONCLUSION

In conclusion, teledermatology can offer a convenient way of expanding access to dermatological care in cost-effective, accurate and efficient ways whilst minimising the risk of COVID-19 transmission.

More efforts should be exerted to provide dermatologists and patients with the technical support needed for teledermatology. Legislations and guidelines for putting teledermatology in practice whilst protecting patient privacy and data security are needed.

### CONFLICT OF INTEREST

The authors declare no conflict of interest.

### AUTHOR CONTRIBUTIONS

All authors contributed to writing, editing and revising this manuscript.

### DATA AVAILABILITY STATEMENT

Data sharing does not apply to this article as no datasets were generated or analysed during the current study.

### REFERENCES

- Gisondi P, Piaserico S, Conti A, Naldi L. Dermatologists and SARS-COV-2: the impact of the pandemic on daily practice. *J Eur Acad Dermatol Venereol*. 2020;34(6):1196-1201.
- Cengiz FP, Emiroglu N, Bahali AG, et al. Which dermatology patients attend to dermatology outpatient Clinics during the SARS-CoV -2 outbreak in Turkey and what happened to them? *Dermatol Ther*. 2020;33(4):e13470. 10.1111/dth.13470
- Damevska K, Neloska L, Simeonovski V, et al. Impact of covid -19 outbreak on dermatology services: Dermatology in isolation. *Dermatol Ther*. 2020:e13552. 10.1111/dth.13552
- Lan J, Song Z, Miao X, et al. Skin damage among health care workers managing coronavirus disease-2019. *J Am Acad Dermatol*. 2020; 82(5):1215-1216.
- Recalcati S. Cutaneous manifestations in COVID-19: a first perspective. *J Eur Acad Dermatol Venereol*. 2020;34(5):212-213.
- Freeman EE, McMahon DE, Lipoff JB, et al. Pernio-like skin lesions associated with covid-19: a case series of 318 patients from 8 countries. *J Am Acad Dermatol*. 2020;83(2):486-492.
- Genovese G, Colonna C, Marzano AV. Varicella-like exanthem associated with COVID-19 in an 8-year-old girl: a diagnostic clue? *Pediatr Dermatol*. 2020;37(3):435-436.
- Hayakawa J, Takakura H, Mizukawa Y, Shiohara T. Covid-19-related cutaneous manifestations associated with multiple drug sensitization as shown by lymphocyte transformation test. *J Eur Acad Dermatol Venereol*. 2020;34(12):779-781.
- Trettel A, Eissing L, Augustin M. Telemedicine in dermatology: Findings and experiences worldwide - a systematic literature review. *J Eur Acad Dermatol Venereol*. 2017;32(2):215-224.
- Pathipati AS, Lee L, Armstrong AW. Health-care delivery methods in teledermatology: Consultative, triage and direct-care models. *Journal of Telemedicine and Telecare*. 2011;17(4):214-216.
- Lee JJ, English JC. Teledermatology: A review and update. *Am J Clin Dermatol*. 2017;19(2):253-260.
- Coates SJ, Kvedar J, Granstein RD. Teledermatology: From historical perspective to emerging techniques of the modern era. *J Am Acad Dermatol*. 2015;72(4):563-574.
- Pasquali P, Sonthalia S, Moreno-Ramirez D, et al. Teledermatology and its current perspective. *Indian Dermatol Online J*. 2020;11(1): 12-20.
- Lee KJ, Finnane A, Soyer HP. Recent trends in teledermatology and teledermoscopy. *Dermatol Pract Concept*. 2018;8(3):214-223.
- Vidal-Alaball J, Acosta-Roja R, Pastor Hernández N, et al. Telemedicine in the face of the COVID-19 pandemic. *Aten Primaria*. 2020;52(6):418-422.

16. Skayem C, Cassius C, Ben Kahla M, et al. Teledermatology for COVID-19 cutaneous lesions: substitute or supplement? *J Eur Acad Dermatol Venereol*. 2020;34(10):e532-e533.
17. Mostafa P, Hegazy AA. Dermatological consultations in the COVID-19 era: is teledermatology the key to social distancing? An Egyptian experience. *J Dermatol Treat*. 2020;1-6. 10.1080/09546634.2020.1789046
18. Elsaie ML, Shehata HA, Hanafi NS, Ibrahim SM, Ibrahim HS, Abdelmaksoud A. Egyptian dermatologists attitude toward telemedicine amidst the COVID19 pandemic: a cross-sectional study. *J Dermatol Treat*. 2020;1-7. 10.1080/09546634.2020.1800576
19. Peracca SB, Jackson GL, Lamkin RP, et al. Implementing teledermatology for rural veterans: an evaluation using the RE-AIM Framework. *Telemed J e-Health*. 2021;27(2):218-226.
20. Kassamali B, Haddadi NS, Rashighi M, Cavanaugh-Hussey M, LaChance A. Telemedicine and the battle for health equity: translating temporary regulatory orders into sustained policy change. *J Am Acad Dermatol*. 2020;83(6):e467-e468.
21. Simpson CL, Kovarik CL. Effectively engaging geriatric patients via teledermatology. *J Am Acad Dermatol*. 2020;83(6):e417-e418.
22. Markun S, Scherz N, Rosemann T, Tandjung R, Braun RP. Mobile teledermatology for skin cancer screening: a diagnostic accuracy study. *Medicine*. 2017;96(10):e6278.
23. Marwaha SS, Fevrier H, Alexeeff S, et al. Comparative effectiveness study of face-to-face and teledermatology workflows for diagnosing skin cancer. *J Am Acad Dermatol*. 2019;81(5):1099-1106.
24. Armstrong AW, Ford AR, Chambers CJ, et al. Online care versus in-person care for improving quality of life in psoriasis: a randomized controlled equivalency trial. *J Invest Dermatol*. 2019;139(5):1037-1044.
25. Armstrong AW, Johnson MA, Lin S, Maverakis E, Fazel N, Liu FT. Patient-centered, direct-access online care for management of atopic dermatitis: a randomized clinical trial. *JAMA Dermatol*. 2015;151(2):154-160.
26. Tensen E, van der Heijden JP, Jaspers MW, Witkamp L. Two decades of teledermatology: current status and integration in national healthcare systems. *Curr Dermatol Rep*. 2016;5:96-104.
27. Wang RH, Barbieri JS, Nguyen HP, et al., Group for Research of Policy Dynamics in Dermatology. Clinical effectiveness and cost-effectiveness of teledermatology: where are we now, and what are the barriers to adoption? *J Am Acad Dermatol*. 2020;83(1):299-307.
28. Sharma P, Nguyen BM, Yang FC. A patient-centric cost analysis of store-and-forward teledermatology. *Int J Dermatol*. 2020;59(2):e43-e45.
29. Nittari G, Khuman R, Baldoni S, et al. Telemedicine practice: review of the current ethical and legal challenges. *Telemed J e-health*. 2020;26(12):1427-1437.
30. Langarizadeh M, Moghbeli F, Aliabadi A. Application of ethics for providing telemedicine services and information technology. *Med Arch (Sarajevo, Bosnia and Herzegovina)*. 2017;71(5):351-355.
31. Kotsopoulou A, Melis A, Koutsompou V-I, Karasarlidou C. E-therapy: the ethics behind the process. *Procedia Computer Sci*. 2015;65:492-499.
32. Balestra M. Telehealth and legal implications for nurse practitioners. *J Nurse Practitioners*. 2018;14(1):33-39.
33. Tahir M, Yasmeen R, Khan RA. Exploring practices of dermatologists in ethical dilemmas in Pakistan: a narrative analysis. *Pakistan J Med Sci*. 2018;34(2):374-379.
34. Arafa AE, Anzengruber F, Mostafa AM, Navarini AA. Perspectives of online surveys in dermatology. *J Eur Acad Dermatol Venereol*. 2019;33(3):511-520.
35. Stevenson P, Finnane AR, Soyer HP. Teledermatology and clinical photography: safeguarding patient privacy and mitigating medico-legal risk. *Med J Australia*. 2016;204(5):198-200e1.
36. Cinelli E, Fabbrocini G, Fattore D, Marasca C, Damiani G, Annunziata MC. Safe distance, safe patients! Therapeutic management of oncological patients affected by cutaneous and mucosal adverse events during the COVID-19 pandemic: an Italian experience. *Support Care Cancer*. 2020;28(9):3991-3993.
37. Brunasso A, Massone C. Teledermatologic monitoring for chronic cutaneous autoimmune diseases with smartworking during COVID-19 emergency in a tertiary center in Italy. *Dermatol Ther*. 2020;33(4):e13495.
38. Cartron AM, Rismiller K, Trinidad J. Store-and-forward teledermatology in the era of COVID-19: a pilot study. *Dermatol Ther*. 2020;33(4):e13689.
39. Gomolin T, Cline A, Handler MZ. The danger of neglecting melanoma during the COVID-19 pandemic. *J Dermatol Treat*. 2020;31(5):444-445.
40. Gironi LC, Boggio P, Giorgione R, et al. The impact of COVID-19 pandemics on dermatologic surgery: real-life data from the Italian red-zone. *J Dermatol Treat*. 2020;1-7. 10.1080/09546634.2020.1789044
41. Temiz SA, Dursun R, Daye M, Ataseven A. Evaluation of dermatology consultations in the era of COVID-19. *Dermatol Ther*. 2020;33(5):e13642.
42. Rismiller K, Cartron AM, Trinidad J. Inpatient teledermatology during the COVID-19 pandemic. *J Dermatol Treat*. 2020;31(5):441-443.
43. Tao J, Song Z, Yang L, Huang C, Feng A, Man X. Emergency management for preventing and controlling nosocomial infection of the 2019 novel coronavirus: implications for the dermatology department. *Br J Dermatol*. 2020;182(6):1477-1478.
44. Mun JH, Park SM, Ko HC, Kim BS, Kim MB. Prevention of possible cross-infection among patients by dermoscopy: a brief review of the literature and our suggestion. *Dermatol Pract Concept*. 2013;3(4):33-34.
45. Jakhar D, Bhat YJ, Chatterjee M, et al. Dermoscopy practice during COVID-19 pandemic: recommendations by SIG Dermoscopy (IADVL Academy). *Indian Dermatol Online J*. 2020;11(3):343-344.
46. Bandic J, Kovacevic S, Karabeg R, Bandic M, Lazarov A, Opric D. Teledermoscopy for skin cancer prevention: A comparative study of clinical and teledermoscopic diagnosis. *Acta Informatica Medica*. 2020;28(1):37-41.
47. Kong F, Horsham C, Rayner J, et al. Consumer preferences for skin cancer screening using mobile teledermoscopy: a qualitative study. *Dermatology*. 2020;236(2):97-104.
48. Janda M, Horsham C, Vagenas D, et al. Accuracy of mobile digital teledermoscopy for skin self-examinations in adults at high risk of skin cancer: an open-label, randomised controlled trial. *Lancet Digital Health*. 2020;2(3):e129-e137.
49. Snoswell CL, Caffery LJ. Current economic evidence for teledermoscopy. *Curr Dermatol Rep*. 2020;9(2):131-135.
50. Marchetti A, Dalle S, Maucort Boulch D, et al. Diagnostic concordance in tertiary (dermatologists-to-experts) teledermoscopy: a final diagnosis-based study on 290 Cases. *Dermatol Pract Concept*. 2020;10(3):e2020071. 10.5826/dpc.1003a71
51. Cinelli E, Megna M, Di Guida A, Greco V, Annunziata MC, Fabbrocini G. Teledermatology for patient management, dermatology education and research during the COVID-19 pandemic. *Aust J Dermatol*. 2020;61(4):471-472.
52. Su MY, Lilly E, Yu J, Das S. Asynchronous teledermatology in medical education: lessons from the COVID-19 pandemic. *J Am Acad Dermatol*. 2020;83(3):e267-e268.
53. Esme P, Akoglu G, Erbil H. Medical and socioeconomic challenges of private dermatocosmetology clinics during COVID-19 pandemic: a survey from Turkey. *J Cosmet Dermatol*. 2020;19(12):3160-3165.
54. Goodman GJ, Liew S, Callan P, et al. Re facial aesthetic injections in clinical practice: Pretreatment and post-treatment consensus recommendations to minimise adverse outcome region-specific



- changes in line with the Covid-19 pandemic. *Australas J Dermatol*. 2020;61(4):362-366.
55. Patel P, Malik K, Khachemoune A. Patient education in Mohs surgery: a review and critical evaluation of techniques. *Arch Dermatol Res*. 2020;313(4):217-224.
  56. Mayer JE. Reimbursement for teledermatology in the United states: a review. *Health Technol*. 2015;5(2):67-71.
  57. Fluhr JW, Gueguen A, Legoupil D, et al. Teledermatology in times of COVID-19 confinement: comparing patients' and physicians' satisfaction by the standardized Brest teledermatology questionnaire. *Dermatology*. 2021;1-6.
  58. Conforti C, Lallas A, Argenziano G, et al. Impact of the Covid-19 pandemic on dermatology practice worldwide: results of a survey promoted by the International Dermoscopy Society (IDS). *Dermatol Pract Concept*. 2021;11(1):e2021153.
  59. Kazi R, Evankovich MR, Liu R, et al. Utilization of asynchronous and Synchronous teledermatology in a large health care system during the Covid-19 pandemic. *Telemed e-Health*. 2021;27(7):771-777.
  60. Lee MS, Guo LN, Wang W, Nambudiri VE. Differences in utilization of nonvideo telemedicine visits for dermatologic concerns in underserved populations during the Covid-19 pandemic. *Telemed e-Health*. 2021;27(8):827-834.
  61. Chiricozzi A, Talamonti M, Simone CD, Galluzzo M, Gori N, Fabbrocini G, Marzano A, Girolomoni G, Offidani AM, Rossi MT, Bianchi L, Cristaudo A, Fierro MT, Stingeni L, Pellacani G, Argenziano G, Patrizi A, Pigatto P, Romanelli M & Peris K. Management of patients with atopic Dermatitis undergoing systemic therapy during COVID-19 pandemic in Italy: data from the Da-covid-19 registry. 2021;76(6):1813-1824.
  62. Sendagorta E, Servera G, Nuño A, Gil R, Pérez-España L, Herranz P. Direct-to-patient teledermatology during COVID-19 lockdown in a health district in Madrid, Spain: the EVIDE-19 pilot study. *Actas Dermo-Sifiliográficas*. 2021;112(4):345-353.
  63. Elsner P. Teledermatology in the times of COVID-19 - a systematic review. *Journal Der Deutschen Dermatologischen Gesellschaft*. 2020;18(8):841-845.
  64. Gorrepati PL, Smith GP. Analysis of availability, types, and implementation of teledermatology services during COVID-19. *J Am Acad Dermatol*. 2020;83(3):958-959.
  65. Sharma A, Jindal V, Singla P, Goldust M, Mhatre M. Will teledermatology be the silver lining during and after COVID-19? *Dermatol Ther*. 2020;33(4):e13643.
  66. Villani A, Annunziata MC, Abategiovanni L, Fabbrocini G. Teledermatology for acne patients: how to reduce face-to-face visits during COVID-19 pandemic. *J Cosmet Dermatol*. 2020;19(8):1828.
  67. Ruggiero A, Megna M, Annunziata MC, et al. Teledermatology for acne during COVID-19: high patients' satisfaction in spite of the emergency. *J Eur Acad Dermatol Venereol*. 2020;34(11):e662-e663.
  68. Perkins S, Cohen JM, Nelson CA, Bunick CG. Teledermatology in the era of COVID-19: experience of an academic department of dermatology. *J Am Acad Dermatol*. 2020;83(1):e43-e44.
  69. Altunisik N, Turkmen D, Calikoglu E, Sener S. Views and experiences of dermatologists in Turkey about teledermatology during the COVID-19 pandemic. *J Cosmet Dermatol*. 2020;19(10):2460-2463.
  70. Moscarella E, Pasquali P, Cinotti E, Tognetti L, Argenziano G, Rubegni P. A survey on teledermatology use and doctors' perception in times of COVID-19. *J Eur Acad Dermatol Venereol*. 2020;34(12):e772-e773.
  71. Yeroushalmi S, Millan SH, Nelson K, Sparks A, Friedman AJ. Patient perceptions and satisfaction with teledermatology during the COVID-19 pandemic: a survey-based study. *J Drugs Dermatol*. 2021;20(2):178-183.
  72. Stadler P-C, Senner S, Frey S, et al. Teledermatology in times of COVID-19. *J Dermatol*. 2021;48(5):620-624.
  73. Bhargava S, McKeever C, Kroumpouzou G. Impact of COVID-19 pandemic on dermatology practices: results of a web-based, global survey. *Int J Women's Dermatol*. 2021;7(2):217-223.
  74. Handa S, Mehta H, Bishnoi A, et al. Teledermatology during the COVID-19 pandemic: experience at a tertiary care centre in North India. *Dermatol Ther*. 2021;34(4):e15022.
  75. Low ZM, Scardamaglia L, Morgan V, Kern JS. Australian Teledermatology experience during COVID-19. *Aust J Dermatol*. 2021. 10.1111/ajd.13681
  76. Su MY, Das S. Expansion of asynchronous teledermatology during the COVID-19 pandemic. *J Am Acad Dermatol*. 2020;83(6):e471-e472.
  77. De Simone P, Iorio A, Ardigò M, et al. Comment on "Rescheduling of clinical activities and teleconsulting for public dermatology. Two prompt answers to COVID-19 emergency". *Int J Dermatol*. 2020;59(10):1284.
  78. Flynn A, O'Connor C, Murphy M. Photo-triage of infantile hemangiomas: potential to reduce healthcare exposure in the COVID19 pandemic. *The Journal of Dermatological Treatment*. 2020:1-2. 10.1080/09546634.2020.1808153

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