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ARTICLE

Egyptian dermatologists attitude toward telemedicine amidst the COVID19 pandemic: a cross-sectional study

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ABSTRACT

Background: Telemedicine involves distant exchange of medical information between health providers and patients *via* a telecommunication device with/without the aid of an audiovisual interactive assistance. The current COVID 19 pandemic impact on health services mandated an utmost readiness to implement telemedicine which in part is dependent on health care providers willingness to adopt such platforms.

Aim: The aim of this cross sectional study was to assess knowledge and attitude toward telemedicine Egyptian dermatologists amidst the COVID 19 pandemic.

Patients and methods: A cross sectional study was designed and data were collected using structured self-administered online questionnaires.

Results: Dermatologists had a good knowledge about telemedicine (mean 4.17 ± 1.63; $p < .05$). Of those completing the questionnaire, 193 (68.9%) were familiar with the term 'telemedicine' and 164 (58.6%) were familiar with tools like teleconferencing. The majority of responding dermatologists 227 (81.1%) were confident that the COVID 19 pandemic is a good opportunity to start applying telemedicine protocols however the majority 234 (83.6%) preferred using it on trial basis at first before full implementation.

Conclusion: In conclusion an overall good attitude toward telemedicine was reported with a mean of 3.39 ($p < .05$). Further large scale studies are required to verify such findings.

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KEYWORDS
SARS-CoV-2; COVID19; telemedicine; teledermatology

Introduction

Telemedicine involves distant exchange of medical information between health providers and patients *via* a telecommunication device with/without the aid of an audiovisual interactive assistance. Teledermatology is an evolving branch of telemedicine that involves delivering of remote dermatology services to distant patients by using telemedicine and imaging (1). Owing to the visual diagnostic nature in dermatology; it had been one of the medical specialties subjected to extensive evaluation of telemedicine applications and a specialty where telemedicine has much potential to be implemented. More than 200 dermatology-related mobile applications are already available and are in use (2).

The COVID19 pandemic had impacted many dermatology practices worldwide, significantly reducing many face to face consultations and putting many practices on halt. Many urgent medical consultations and follow ups were maintained through mobile telemedicine platforms or through teledermatology telecommunications (3).

Technology is progressing at very rapid and sharp paces and the current pandemic's impact on health services mandated an utmost readiness to implement telemedicine which in part is dependent on health care providers willingness to adopt such platforms (4).

The aim of this cross sectional study was to assess Egyptian dermatologists' knowledge and attitudes toward telemedicine amidst the COVID 19 pandemic.

Patients and methods

This cross-sectional study was carried out among dermatologists in the public health sector in Egypt from May 15 2020 to June 15 2020. Data were collected using a self-designed well-structured questionnaire prepared by reviewing previous related studies (5–6) and was administered through an open access Google survey. The questionnaire consists of three main parts. Part 1 included sociodemographic information of the participants (5 items), part 2 was related to the dermatolgists professionals' knowledge of telemedicine (6 items), and part 3 investigated the dermatologists attitude toward telemedicine advantages (7 items), compatibility of telemedicine (four items), complexity of implementing telemedicine (5 items), and preference to try telemedicine systems (3 items). A 'Yes' or 'No'. format was used in assessment of the knowledge part. A score of '1' was given for 'Yes' and '0' for 'No'. One can score a minimum of 0 and a maximum of 6 in this section. An average score of 3 (50%) from the six questions was used as a cutoff point to determine the level of knowledge of telemedicine. The mean knowledge score of less than 3 (50%) was labeled as poor

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knowledge of telemedicine, and more than average score of 3 (50%) was labeled as good knowledge of telemedicine.

The perceived telemedicine attributes of relative advantage, compatibility, complexity, trial preference, were rated on a 5-point Likert scale that ranged from '1 = strongly disagree' to '5 = strongly agree,' except for complexity questions which were reversely scored (1 = strongly agree and 5 = strongly disagree). Mean scores were calculated and a mean of less than 2.5 (50%) was labeled as poor attitude, 2.6 (51%)–3.0 (60%) as moderate, and greater than 3.0 (60%) is labeled as good attitude.

Data were coded and entered using the statistical package for the Social Sciences (SPSS) version 26 (IBM Corp., Armonk, NY, USA). Data was summarized using mean, standard deviation, minimum and maximum in quantitative data and using frequency (count) and relative frequency (percentage) for categorical data. For comparing categorical data, Chi square (χ^2) test was performed. Exact test was used when the expected frequency was less than 5. *p*-Values less than .05 were considered as statistically significant

Results

A total of 280 dermatologists completed the full questionnaire. Those with incomplete or partially answered responses were excluded. 213(76–1%) were females and 67(23.9%) were males. The majority of dermatologists completing the survey 148(52.9%) were between 30 and 40 years age group while those above 60 years of age represented a minority 12(4.3%). More than half of the included dermatologists were holding a master degree 152(54.3%) and 137(48.9%) were specialists. The majority of dermatologists responding to this survey were having 10 years of experience or more 125(44.6%) (Table 1).

Table 1. Sociodemographic characteristics of the participants.

	Count	%
1. What is your gender?		
Female	213	76.1
Male	67	23.9
2. What is your highest medical degree		
MBBCh	25	8.9
Diploma of Dermatology	50	17.9
Master in Dermatology (MSc)	152	54.3
Doctoral Degree (MD)/PhD	53	18.9
3. How old are you?		
20–30	45	16.1
30–40	148	52.9
40–50	44	15.7
50–60	31	11.1
60 and above	12	4.3
4. What is your current Title		
Resident	60	21.4
Specialist	137	48.9
Consultant	83	29.6
5. How many years of dermatological experience do you have?		
Less than 5 years	61	21.8
5–10 years	94	33.6
More than 10 years	125	44.6

Dermatologists had a good knowledge about telemedicine (mean 4.17 ± 1.63; $p < .05$). Of those completing the questionnaire, 193 (68.9%) were familiar with the term 'telemedicine' and 164 (58.6%) were familiar with tools like teleconferencing. The majority of respondents were confident about telemedicine reduction of transportation time and in saving physicians time (90% and 81.8% respectively). The majority of respondents 150 (53.6%) had never seen a telemedicine system before and 199 (71.1%) of responding dermatologists were knowledgeable of medical staff reduction that could be imposed by telemedicine (Table 2).

The current study indicated that dermatologists had an overall good attitude toward telemedicine with a mean of 3.39 ($p < .05$). The relative advantage attribute had a good attitude score with a mean of 3.38, compatibility of telemedicine systems had good attitude score with a mean of 3.49. A very good attitude was scored for the trial preference of telemedicine systems among dermatologists '3.98' while a moderate attitude toward complexity of using and applying telemedicine was observed '2.99'. Of all participating dermatologists, 194 (69.3%) had a good knowledge of telemedicine and 211 (75.4%) had a good attitude toward telemedicine, compared to 86 (30.7%) with poor knowledge of telemedicine and 55(19.6%) with moderate attitude toward telemedicine. Only 14 (5.0%) had a poor attitude toward telemedicine (Table 3).

216 (77.2%) of the respondents agreed that telemedicine shall increase and improve communication among health care providers and 222(79.3%) were confident that telemedicine shall decrease the number of visits to clinics and medical centers. 188 (67.2%) of the dermatologists surveyed appreciated telemedicine ability to accomplish tasks more quickly while 98(35%) were skeptical and disagreed about telemedicine ability to improve clinical decisions (Table 3).

The majority of respondents 112 (40%) agreed that telemedicine is compatible with most of the dermatology work aspects and 235 (83.9%) agreed that amid this corona pandemic telemedicine represents a totally compatible solution. Concerning fitting with a dermatologist's life style, 134 (47.9%) agreed that telemedicine would be a good fit (Table 3).

Regarding the complexity of utilizing telemedicine, 123 (44%) of the responding dermatologists agreed that information confidentiality represents an issue with protecting privacy. 165 (58.9%) were confident that telemedicine will add extra responsibilities for the dermatologist to take care of and consider. Furthermore, 162 (57.9%) of the respondents refuted the fact that telemedicine is a hard process to learn and expressed the relative ease they anticipate with using telemedicine systems (Table 3).

Table 2. Dermatologists knowledge level of telemedicine.

	Yes		No	
Knowledge level survey questions	Count	%	Count	%
Are you familiar with the term 'telemedicine'	193	68.9	87	31.1
Have you seen a telemedicine system before	130	46.4	150	53.6
Are you familiar with tools like teleconference or teleconsultation	164	58.6	116	41.4
I know telemedicine will reduce medical staff needed	199	71.1	81	28.9
I know that telemedicine will reduce transportation costs	252	90.0	28	10.0
I know that telemedicine can save a dermatologists time	229	81.8	51	18.2

Table 3. Dermatologists attitude toward telemedicine.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean score
Advantages						
Telemedicine reduces medical error	29 10.4%	91 32.5%	91 32.5%	55 19.6%	14 5.0%	2.76
Telemedicine facilitates diagnosis	17 6.1%	70 25.0%	84 30.0%	89 31.8%	20 7.1%	3.09
Telemedicine increases communication.	3 1.1%	20 7.1%	41 14.6%	152 54.3%	64 22.9%	3.91
Telemedicine reduces visits to clinics	0 0.0%	14 5.0%	44 15.7%	164 58.6%	58 20.7%	3.95
Telemedicine accomplish tasks quickly	5 1.8%	33 11.8%	54 19.3%	152 54.3%	36 12.9%	3.65
Telemedicine improves clinical decision	11 3.9%	87 31.1%	81 28.9%	83 29.6%	18 6.4%	3.04
Provides comprehensive health care	6 2.1%	65 23.2%	75 26.8%	113 40.4%	21 7.5%	3.28
Relative advantages total mean score						3.38
Compatibility						
Telemedicine is compatible with work	4 1.4%	89 31.8%	75 26.8%	98 35.0%	14 5.0%	3.10
Telemedicine is compatible with work situation	3 1.1%	46 16.4%	74 26.4%	121 43.2%	36 12.9%	3.50
Telemedicine is compatible with COVID pandemic	0 0.0%	15 5.4%	30 10.7%	140 50.0%	95 33.9%	4.12
Telemedicine fits dermatology lifestyle	7 2.5%	78 27.9%	61 21.8%	108 38.6%	26 9.3%	3.24
Compatibility total mean score						3.49
Complexity						
Telemedicine requires more effort	5 1.8%	100 35.7%	66 23.6%	96 34.3%	13 4.6%	2.96
Telemedicine learning is hard process	15 5.4%	147 52.5%	68 24.3%	45 16.1%	5 1.8%	3.44
Telemedicine increases work load.	5 1.8%	128 45.7%	69 24.6%	68 24.3%	10 3.6%	3.18
Telemedicine adds extra responsibility	0 0.0%	63 22.5%	52 18.6%	135 48.2%	30 10.7%	2.53
Telemedicine threatens information privacy	6 2.1%	80 28.6%	71 25.4%	106 37.9%	17 6.1%	2.83
Complexity total mean score						2.99
Trial preference						
COVID is a good opportunity to try telemedicine	1 0.4%	14 5.0%	38 13.6%	156 55.7%	71 25.4%	4.01
I want to try a telemedicine application	1 0.4%	28 10.0%	36 12.9%	167 59.6%	48 117.1%	3.83
Trying is essential before implementation	2 0.7%	17 6.1%	27 9.6%	142 50.7%	92 32.9%	4.09
Trial preference total mean score						3.98
Overall attitude mean score						3.39

Table 4. Overall attitudes and knowledge of telemedicine scores.

		Count	%
Knowledge of telemedicine			
knowledge of telemedicine	Good knowledge	194	69.3
	Poor knowledge	86	30.7
Attitude toward telemedicine			
Overall attitude mean score	Poor attitude	14	5.0
	Moderate attitude	55	19.6
	Good attitude	211	75.4

The majority of responding dermatologists 227 (81.1%) were confident that the COVID 19 pandemic is a good opportunity to start applying telemedicine protocols however the majority 234 (83.6%) preferred using it on trial basis at first before full implementation. Moreover the majority of participating dermatologists 215 (76.7%) were willing to try a telemedicine system (Table 3).

Good knowledge of telemedicine was not related to most of the dermatologists qualities or demographics, however it was high significantly related to the age of respondents and was the highest at the 30–40 years age group ($p = .004$). On the contrary positive attitude toward telemedicine was not significantly related to any of the dermatologists qualities or demographics except for the highest medical degree obtained, among which master degree holders showed the most significant attitude toward telemedicine ($p = .40$) (Tables 4–6).

Discussion

This first report of attitudes and perceptions of Egyptian dermatologists toward telemedicine amid the COVID 19 pandemic suggested an increasing good knowledge and readiness of the majority for further apprehension and observation of this increasingly used platform.

It is not very long ago that many clinicians were reported to have less knowledge and interest toward telemedicine (5,7,8). In the current study the degree of knowledge about telemedicine

Table 5. Relation between sociodemographic information and knowledge of telemedicine.

	Knowledge of telemedicine					
	Good knowledge		Poor knowledge			
	Count	%	Count	%	X^2	*p*-value
1. What is your gender?						
Female	147	75.8	66	76.7	0.031	.861
Male	47	24.2	20	23.3		
2. What is your highest medical degree						
MBBCh	15	7.7	10	11.6	6.548	.088
Diploma of Dermatology	30	15.5	20	23.3		
Master in Dermatology (MSc)	106	54.6	46	53.5		
Doctoral Degree (MD)/PhD	43	22.2	10	11.6		
3. How old are you?						
20–30	28	14.4	17	19.8	16.332	.004
30–40	103	53.1	45	52.3		
40–50	36	18.6	8	9.3		
50–60	24	12.4	7	8.1		
60 and above	3	1.5	9	10.5		
4. What is your current Title						
Resident	40	20.6	20	23.3	3.411	.182
Specialist	90	46.4	47	54.7		
Consultant	64	33.0	19	22.1		
5. How many years of experience do you have?						
Less than 5 years	36	18.6	25	29.1	3.987	.136
5–10 years	69	35.6	25	29.1		
More than 10 years	89	45.9	36	41.9		

χ^2 is for chi square *p* value is significant if <.05.

Table 6. Relation between sociodemographic information and attitude toward telemedicine.

	Overall attitude mean score					
	Good attitude		poor or moderate attitude			
	Count	%	Count	%	X^2	*p*-value
1. What is your gender?						
Female	166	78.7	47	68.1	3.184	.074
Male	45	21.3	22	31.9		
2. What is your highest medical degree						
MBBCh	20	9.5	5	7.2	8.306	.040
Diploma of Dermatology	41	19.4	9	13.0		
Master in Dermatology (MSc)	118	55.9	34	49.3		
Doctoral Degree (MD)/PhD	32	15.2	21	30.4		
3. How old are you?						
20–30	35	16.6	10	14.5	1.416	.890
30–40	109	51.7	39	56.5		
40–50	32	15.2	12	17.4		
50–60	25	11.8	6	8.7		
60 and above	10	4.7	2	2.9		
4. What is your current Title						
Resident	46	21.8	14	20.3	1.171	.577
Specialist	106	50.2	31	44.9		
Consultant	59	28.0	24	34.8		
5. How many years of dermatological experience do you have?						
Less than 5 years	48	22.7	13	18.8	0.853	.653
5–10 years	68	32.2	26	37.7		
More than 10 years	95	45.0	30	43.5		

χ^2 is for chi square *p* value is significant if <.05.

was relatively high (mean 4.17 ± 1.63; $p < .05$). Majority of the respondents 193 (68.9%) were familiar with the term 'telemedicine' and 164 (58.6%) were familiar with tools like teleconferencing. This was relatively higher than other cross sectional studies from India, Ethiopia, Srilanka, and Saudi Arabia which showed different knowledge attitudes (41%, 37.6, 43% and 46.1% respectively) (6,9,10,11). Nevertheless this was lower than knowledge demonstrated in a cross sectional inter-European study (84%) (12).

A number of concerns were raised by the dermatologists in the current study. First and foremost 123 (44%) of the responding dermatologists agreed that information confidentiality represents an issue with jeopardizing privacy. This was in line with a number of previously published studies (13–15). Protection of confidentiality and establishing secure information technology networks were reported to be of utmost importance when considering telemedicine implementation (16). Another concern of the responding dermatologists in the current study was about the accuracy of clinical diagnosis. Of the 280 questionnaire responding dermatologists, 98(35%) were skeptical and disagreed about telemedicine ability to improve clinical decisions. Teledermatology had been increasingly used

worldwide due to the visual qualities applied in cutaneous disease making telemedicine more dermatology-compatible when compared to other specialities (17).

A number of studies evaluating diagnostic accuracy of teledermatology using submitted photographs showed a high rate of accurate diagnosis and significant patient satisfaction (18). Moreover a recent Brazilian study conducted on 6633 subjects who presented with 12,770 cutaneous lesions demonstrated that telemedicine increases primary care physicians' accurate diagnosis of skin conditions. Teledermatology managed 66.66% (8408/12,614) of dermatoses with the primary care physician without the need for an in-presence visit (19). Results of teledermatology consultations have been reported to be feasible, time saving, efficient and comparable to face to face visits (20).

A metanalysis of 21 studies assessed the accuracy of teledermatology in proper diagnoses of skin diseases in comparison to face to face visits and whether teledermatology saves patients and dermatologists time alike. The diagnostic accuracy (defined as agreement with histopathology for excised lesions or clinical diagnosis for nonexcised lesions) of face to face dermatology consultation remained higher than teledermatology (67–85% in comparison to 51–85%) (21). Despite this, some studies provided higher teledermatology accurate diagnosis rates compared to face to face visits (22–24).

A study conducted in a remote area in Egypt revealed 81.3% complete concordance and 97% partial/complete concordance rates, indicating that the cost-effective teleservice could enable educational programs and monitoring of practitioners (25). To note, Superior diagnosis decisions were dependent on the quality of the clinical images provided (26).

165 (58.9%) of respondents were confident that telemedicine will add extra responsibilities for the dermatologist to take care of and consider. This was in line with other studies where participants were concerned about administrative and legal responsibilities of telemedicine (27–28). Attitudes and behaviors of health care providers have significantly changed after than before using telemedicine systems. It was demonstrated that beforehand one might be cautious and unfamiliar about the nature of the platform used, however following the use telemedicine systems, physicians' opinions and concerns changed (29). In Egypt there exists no legal or administrative legislation to implement telemedicine which might be responsible for the disparity among the surveyed dermatologists as to what their responsibilities might be.

A recent study investigated the perception and satisfaction among Egyptian patients who received some form of teledermatology services (live interaction *via* What's app and Zoom) and asynchronous (What's app, emails) and an overall satisfaction of 91.0% was reported (30). Another cross sectional analysis reported positive patients' perception of teledermatology systems in saving time, travel expenses and reduced hospital waiting periods (31).

Teledermatology had been practiced inevitably even before telemedicine platforms were available. Ever since the revolutionary technological invent of mobile devices with high resolution cameras and computer visual soft wares, the informal practice of sending photos or using video interface programs to communicate was used by dermatologists and other health care providers to diagnose and prescribe treatments.

In the current study, the majority of respondents 112 (40%) agreed that telemedicine is compatible with most of the dermatology work aspects and 235 (83.9%) agreed that amid this corona pandemic telemedicine represents a totally compatible solution. Concerning fitting with a dermatologist's life style, 134 (47.9%) agreed that telemedicine would be a good fit. An advantage of dermatology is that it relies on visual diagnosis to a big extent which makes teledermatology and remote diagnosis compatible with the nature of the speciality. This does not eliminate the importance of face to face examination or procedural interventions that requires patients to be seen in person but can assist with triaging those who can be remotely consulted and those who require a face to face examination (32).

Delivery of medical services was reshaped worldwide amidst the COVID19 pandemic. Despite the mandated closure or limited-hour services of many health facilities and clinics, patients needed access for urgent skin consultations or follow ups which many dermatologists found themselves providing *via* a virtual telehealth platform for the first time (33).

Of the 280 respondents, 222(79.3%) were apprehensive of telemedicine advantages of cutting expenses, decreasing waiting periods and limiting the number of patients visits to clinics. A metanalsysis investigating 20 studies reported an average travel reduction of 43% when utilizing teledermatology platforms (34). Another report found waiting times for teledermatology referrals to be 2–50 days compared to 88–137 in conventional face to face examinations (35). One study reported a $76.36 per patient decrease in expenses among in Mongolian patients using a mobile phone teledermatology platform (36).

In the current study, the majority of responding dermatologists 227 (81.1%) were confident that the COVID 19 pandemic is a good opportunity to start applying telemedicine protocols however the majority 234 (83.6%) preferred using it on trial basis at first before full implementation. Moreover the majority of participating dermatologists 222 (79.3%) were confident that teledermatology will improve communication among health care providers and 215 (76.7%) were willing to try a telemedicine system. This comes in light of studies that confirmed better clinical collaboration between dermatologists in communicating for better diagnosis (37). Moreover, teledermatology permitted worldwide dermatologists to seek eachothers opinion for challenging or difficult cases (38).

Despite representing a good number of dermatologists from across Egypt and from different geographic locations, the study was limited with the relative small sample size.

In conclusion, dermatologists included in the study showed a good knowledge and perception of telemedicine and were willing to adopt it in their practices following an initial trial period. An overall good attitude toward telemedicine was reported with a mean of 3.39 ($p < .05$). Concerns were raised about jeopardizing data privacy and about any legal or administrative responsibilities that might exist with adopting such systems. Policymakers should acknowledge the importance of technology in enhancing and improving health services and shall enact legislations to protect data privacy of patients and preserve rights of treating providers.

Author contributions

All authors contributed equally in the production of this work.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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References

1. Şenel E, Demir E. A global productivity and bibliometric analysis of telemedicine and teledermatology publication trends during 1980–2013. Dermatol Sin. 2015;33(1):12–16.
2. Brewer AC, Endly DC, Henley J, et al. Mobile applications in dermatology. JAMA Dermatol. 2013;149(11):1300–1304.
3. Coustasse A, Sarkar R, Abodunde B, et al. Use of teledermatology to improve dermatological access in rural areas. Telemed J E Health. 2019;25(11):1022–1032.
4. Gupta R, Ibraheim MK, Doan HQ. Teledermatology in the wake of COVID-19: Advantages and challenges to continued care in a time of disarray. J Am Acad Dermatol. 2020; 83(1):168–169.
5. Ayatollahi H, Sarabi FZ, Langarizadeh M. Clinicians' knowledge and perception of telemedicine technology. Perspect Health Inf Manag. 2015;12(Fall):1c.
6. Biruk K, Abetu E. Knowledge and attitude of health professionals toward telemedicine in resource-limited settings: a cross-sectional study in North West Ethiopia. J Healthc Eng. 2018;2018:1–7.
7. Woodward A, Fyfe M, Handuleh J, et al. Diffusion of e-health innovations in 'post-conflict' settings: a qualitative study on the personal experiences of health workers. Hum Resour Health. 2014;12:22.
8. Shahpori R, Hebert M, Kushniruk A, et al. Telemedicine in the intensive care unit environment—a survey of the attitudes and perspectives of critical care clinicians. J Crit Care. 2011;26(3):328.e9–328.e15.
9. Zayapragassarazan ZS, Kumar S. Awareness, knowledge, attitude and skills of telemedicine among health professional faculty working in teaching hospitals. J Clin Diagn Res. 2016;10(3):1–4.
10. Edirippulige S, Marasinghe RB, Smith AC, Fujisawa Y, et al. Medical students' knowledge and perceptions of e-health: results of a study in Sri Lanka. Stud Health Technol Inform. 2007;129(Pt 2):1406–1409.
11. Albarrak AI, Mohammed R, Almarshoud N, et al. Assessment of physician's knowledge, perception and willingness of telemedicine in Riyadh region, Saudi Arabia. J Infect Public Health. 2019;3:30139.
12. Mairinger T, Gabl C, Derwan P, et al. What do physicians think of telemedicine? A survey in different European regions. J Telemed Telecare. 1996;2(1):50–56.
13. Alaboudi A, Atkins A, Sharp B, et al. Barriers and challenges in adopting Saudi telemedicine network: The perceptions of decision makers of healthcare facilities in Saudi Arabia. J Infect Public Health. 2016;9(6):725–733.
14. Isabalija M, Kituyi A, Rwashana VW. Mbarika Factors affecting adoption, implementation and sustainability of telemedicine information systems in Uganda. J Health Inform Dev Ctries. 2011;5:300–316.
15. Broens TH, Huis in't Veld RM, Vollenbroek-Hutten MM, et al. Determinants of successful telemedicine implementations: a literature study. J Telemed Telecare. 2007;13(6): 303–309.
16. Judi HM, Razak AA, Sha'Ari N, et al. Feasibility and critical success factors in implementing telemedicine. Inform Technol J. 2009;8(3):326–332.
17. Resneck JS, Jr, Abrouk M, Steuer M, et al. Choice, transparency, coordination, and quality among direct-to-consumer telemedicine websites and apps treating skin disease. JAMA Dermatol. 2016 ;152(7):768–775.
18. O'Connor DM, Jew OS, Perman MJ, Castelo-Soccio LA, et al. Diagnostic accuracy of pediatric teledermatology using parent-submitted photographs: a randomized clinical trial. JAMA Dermatol. 2017 ;153(12):1243–1248.
19. G Bianchi M, Santos A, Cordioli E. Benefits of teledermatology for geriatric patients: population-based cross-sectional study. J Med Internet Res. 2020;22(4):e16700.
20. Lee JJ, English JC. 3rd. Teledermatology: a review and update. Am J Clin Dermatol. 2018;19(2):253–260.
21. Finnane A, Dallest K, Janda M, et al. Teledermatology for the diagnosis and management of skin cancer: a systematic review. JAMA Dermatol. 2017;153(3):319–327.
22. Congalton AT, Oakley AM, Rademaker M, et al. Successful melanoma triage by a virtual lesion clinic (teledermatoscopy). J Eur Acad Dermatol Venereol. 2015;29(12): 2423–2428.
23. Massone C, Maak D, Hofmann-Wellenhof R, et al. Teledermatology for skin cancer prevention: an experience on 690 Austrian patients. J Eur Acad Dermatol Venereol. 2014;28(8):1103–1108.
24. Şenel E, Sabancılar E, Mansuroğlu C, et al. A preliminary study of the contribution of telemicroscopy to the diagnosis and management of skin tumours in teledermatology. J Telemed Telecare. 2014;20(4):178–183.
25. Saleh N, Abdel Hay R, Hegazy R, et al. Can teledermatology be a useful diagnostic tool in dermatology practice in remote areas? An Egyptian experience with 600 patients. J Telemed Telecare. 2017;23(2):233–238.
26. Snoswell C, Finnane A, Janda M, et al. Cost-effectiveness of store-and-forward teledermatology: a systematic review. JAMA Dermatol. 2016;152(6):702–708.
27. Joseph L, Olamide A, Mathew C, et al. Knowledge and perception of health workers towards tele-medicine application in a new teaching hospital in Lagos. Sci Res Essays. 2007;2(1):016–019.
28. Sheikhtaheri A, Sarbaz M, Kimiafar K, et al. Awareness, attitude and readiness of clinical staff towards telemedicine: a study in Mashhad, Iran. Stud Health Technol Inform. 2016;228:142–146.
29. Hanson D, Calhoun J, Smith D. Changes in provider attitudes toward telemedicine. Telemed J E Health. 2009; 15(1):39–43.
30. Mostafa P, Hegazy A. Dermatological consultations in the COVID-19 era: Is teledermatology the key to social distancing? An Egyptian experience. J Dermatol Treat. 2020:1–6.
31. Al Quran HA, Khader YS, Ellauzi ZM, et al. Effect of real-time teledermatology on diagnosis, treatment, and clinical improvement. J Telemed Telecare. 2015;21(2): 93–99.
32. Wurm EM, Hofmann-Wellenhof R, Wurm R, et al. Telemedicine and teledermatology: past, present and future. J Dtsch Dermatol Ges. 2008;6(2):106–112.

33. Villani A, Scalvenzi M, Fabbrocini G. Teledermatology: a useful tool to fight COVID-19. J Dermatolog Treat. 2020; 31(4):325.
34. Wootton R, Bahaadinbeigy K, Hailey D. Estimating travel reduction associated with the use of telemedicine by patients and healthcare professionals: proposal for quantitative synthesis in a systematic review. BMC Health Serv Res. 2011;11(1):1–10.
35. Moreno-Ramírez D, Ferrándiz L, Nieto-García A, et al. Store-and-forward teledermatology in skin cancer triage: experience and evaluation of 2009 teleconsultations. Arch Dermatol. 2007;143(4):479–484.
36. Byamba K, Syed-Abdul S, García-Romero M, et al. Mobile teledermatology for a prompter and more efficient dermatological care in rural Mongolia. Br J Dermatol. 2015; 173(1):265–267.
37. Armstrong AW, Wu J, Kovarik CL, et al. State of teledermatology programs in the United States. J Am Acad Dermatol. 2012;67(5):939–944.
38. Greisman L, Nguyen TM, Mann RE, et al. Feasibility and cost of a medical student proxy-based mobile teledermatology consult service with Kisoro, Uganda, and Lake Atitlán, Guatemala. Int J Dermatol. 2015;54(6): 685–692.