



Original article

Analysis of telemedicine service delivery in Karachi, Pakistan: A cross-sectional survey examining practices and perspectives of healthcare providers

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ABSTRACT

Objective: This study aims to explore the healthcare sector's limited adoption of telemedicine platforms through the lens of clinician perspectives. It investigate the level of understanding and competence among medical practitioners regarding telemedicine in Karachi, Pakistan, with a specific focus on E-health clinics operated by Sehat Kahani physicians serving underserved communities.

Methods: An analytical cross-sectional study was undertaken between October 2022 and January 2023, in which 383 telemedicine consultants were invited to fill out a questionnaire designed to help the researcher better understand how these professionals felt about teleconsultations. This research was conducted at the Sehat Kahani E-Health Clinic with teleconsultation services in Karachi, Pakistan.

Results: The majority of clinicians had at least a basic understanding of telemedicine 64.8 %, including its medical applications 59.3 %. A significant percentage 25 % demonstrated extensive knowledge of telemedicine resources and standards. Continuous education in telemedicine is necessary approximately 68.4 % of doctors indicated a high level of satisfaction as their reaction. Regarding opinions, 98.7 % thought telemedicine is a viable care option, saving time, money, and effort 97.7 %, 93.7 %, respectively. 69.5 % had completed telemedicine training, and the vast majority 96.6 % agreed that it was helpful for patients.

Conclusions: The Clinicians at Sehat Kahani's telemedicine e-clinics were very knowledgeable about the technology and used it effectively. Underserved populations can gain access to high-quality healthcare through a combination of telemedicine, investments in infrastructure, and education. However, most medical professionals are curious about expanding their knowledge about telemedicine.

1. Introduction

The rapid transformation of our society by the field of information and communication technology (ICT) and its full potential in medicine and patient care remains unrealized. In contrast to other domains within the business world, the healthcare sector has not yet fully harnessed the potential benefits of utilizing ICT. Telemedicine refers to providing health care, keeping patient data, and delivering services to patients remotely through information and communication technologies. Telehealth is the delivery of healthcare services (including health

assessments, diagnoses, consultations, interventions, and supervision) to patients who are located in distant locales using telecommunications and information technologies.^{1,2} The concept of telemedicine has existed for a considerable duration, albeit in its recent emergence as a potential remedy for the challenges encountered by healthcare systems at large. One of the notable challenges encountered in the field is the inherent limitation in extending the reach of highly specialized medical interventions to a larger population residing in socioeconomically disadvantaged regions.^{3,4}

Telemedicine is particularly advantageous in low-income countries

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such as Pakistan, where approximately 63 % of the population resides in rural regions and only 37 % in urban areas.⁵ The growing popularity of telemedicine as a crucial component of delivering outpatient care can be driven by increased awareness and demand from the public, which has been accelerated by the global public health emergency triggered by the COVID-19 pandemic.⁶ Consequently, individuals residing in remote regions will now have the opportunity to access medical care at a more affordable cost.⁷ The economic livelihood of individuals residing in rural regions heavily depends on their agricultural activities or other self-sufficiency means. Consequently, the ability to access medical services without having to forgo a day's work assumes paramount importance.⁸ Due to these factors, individuals residing in rural regions exhibit a higher propensity to pursue medical care when necessary actively. In highly populated areas, the significance of telemedicine lies in its capacity to mitigate the strain on healthcare resources that are already under pressure. By enabling numerous patients to receive medical care without having to visit healthcare facilities physically, modern technology has the potential to alleviate this burden.⁵

In Pakistan, healthcare funding comes from a variety of sources, including the public sector, private corporations, charitable organizations, and parastatal healthcare organizations. The doctor-to-patient ratio is 1:1300, which falls considerably short of the World Health Organization's recommended ratio of 1:1000.^{9,10} In the 2019 Global Health Security Index, Pakistan is positioned at the 167th rank in terms of healthcare capacity, specifically pertaining to the number of hospitals, clinics, and care centres accessible to individuals requiring medical assistance, compared to all 195 nations.¹¹ Various healthcare facilities, including rural health centres, basic health units, tehsil headquarters hospitals, district headquarters hospitals, and teaching hospitals, primarily support the healthcare system in Pakistan. In the aforementioned areas, there exists a significant limitation in terms of healthcare accessibility, with the existing provisions frequently falling short of meeting the required standards. There is a notable disparity in the number of hospital beds between rural and urban areas, with rural locations exhibiting an 18 % deficit compared to their urban counterparts. Approximately 22 % of medical professionals in the country are situated in non-metropolitan regions, accounting for slightly more than one-quarter of the total.¹² In addition, a study identified multiple obstacles doctors encounter in Pakistan when adopting telemedicine. These challenges comprise the absence of regulating bodies, evaluations, and recognition for service providers, as well as the risks of malpractice, misdiagnosis, prescription errors, and medico-legal issues.¹³ Disparities have widened over time due to urban populations experiencing fast development and facility expansion, while rural areas have remained relatively unchanged in terms of development. With 70 % of the population being treated by the privately owned health sector, questions arise about the government health sector's ability to keep up with the private sector's high service standards and patient satisfaction. In Pakistan, the current state of congested hospitals reflects the reality of the situation. The reliance on traditional methods will only exacerbate the issue in the future and increase the burden of treatment. Telemedicine can potentially reduce healthcare inequalities, particularly in rural regions.¹⁴

The utilization of telemedicine holds promise in overcoming various obstacles that impede the provision of healthcare services in geographically isolated and rural regions within the nation. Nevertheless, Pakistan has encountered obstacles in reaping substantial advantages from these advancements in e-Health,¹⁵ primarily due to socioeconomic, geographic, and political challenges,¹⁶ which impede the efficient implementation of the system. Several factors present a significant challenge to the progress and efficacy of telehealth in Pakistan. The low literacy rate of the population is a significant obstacle that hinders the daily functioning of telehealth services. This finding indicates that approximately 50 % of the population lacks basic literacy skills, highlighting the critical importance of providing appropriate education and training to individuals in order to address this issue.¹⁷ This study examines the perspectives, competencies, and level of familiarity

of doctors in Karachi, Pakistan, with the e-health system. Additionally, it aims to establish the extent to which doctors accept the system.

2. Materials and methods

2.1. Study design

The current study employed an analytical cross-sectional design. The sample size calculations were determined based on a telemedicine prevalence rate of 50 %. The study participants were general practitioners operating on the Sehat Kahani telemedicine system and mobile health application to provide teleconsultation services throughout Pakistan. The chosen sampling technique for this study is purposive sampling which falls under convenience sampling, which involves selecting participants based on specific criteria. The research was conducted at Sehat Kahani head office in Karachi, an organization that provides telehealth care, during the period spanning from October 2022 to January 2023.

2.2. Sampling method

The research that was chosen for our study sampling approach for data collection due to its pragmatic relevance.¹⁸ Data was collected from a sample of 422 clinicians. The OpenEpi software with a 95 % confidence interval and a 5 % margin of error calculated a sample size of 384. In consideration of possible uncertainties, a 10 % increase was made to the target sample size, which ultimately resulted in 422 participants, 39 incomplete responses were excluded and the final sample was comprised of 383 clinicians. The present study adhered to introduce and explain the consent procedure. The participants were assured that their anonymity would be safeguarded at all times. The study included telehealth clinicians who were certified physicians. These clinicians had completed their key performance indicators (KPIs) and provided quality health services through the Sehat Kahani platform for at least six months. To conduct a comprehensive study on telemedicine feasibility and challenges in Pakistan, we selected telehealth doctors based in Karachi, Pakistan. Their firsthand experience with the local context can provide valuable insights. It was also requested that the chosen physicians have sufficient technical accessibility, which includes a stable Internet connection and the ability to use personal computing devices like laptops, cellphones, or tablets. However, the study did not include clinicians who did not engage in telemedicine, were not based in Karachi, Pakistan, and had not finished their key performance indicators with Sehat Kahani platform.

2.3. Data collection

Questions for the questionnaire were selected after conducting an extensive literature search. Clinicians' socio-demographics, digital literacy, perspective, experience, and perceptions towards using the Sehat Kahani telemedicine solution are all evaluated via a 5-part, 33-question structured questionnaire. The questionnaire was developed through the inclusion of questions from different research papers that have been published.^{19–21} The developed survey was then piloted on a subset (10 %) of the total sample. The findings of the survey are going to enable any discrepancies in the questionnaire to be rectified and appropriate revisions to be made before the final version. The data collected from these individuals will not be made part of the final sample size.

The completed survey was distributed via Google Forms, and a short link was emailed to the official emails of qualified candidates with each respondent having a time period of 10 days to finish the survey. In order to reach participants who have not filled out the questionnaire, a follow-up email was also sent to eligible participants who have yet to finish the questionnaire.

2.4. Statistical analysis

Frequency and percentage were reported for categorical variables such as age groups, medical practice experience in years, how often a PC/Laptop is used, etc. Mean and standard deviation were reported for quantitative variables such as age, years of experience in the medical profession etc. Knowledge, perception and acceptance scores were generated by summing the responses of each component separately. Higher scores on the scale represented high-level knowledge, positive perception and high-level satisfaction. The assumption of normality of data was checked by the Shapiro-Wilk test. Mean scores were compared between the demographic information categories and clinicians' computer literacy using the Mann-Whitney test/Kruskal Wallis test. P-value <0.05 was considered statistically significant. Data analysis was done using a statistical package for social sciences (SPSS) version 24.

3. Results

A total of 383 clinicians were included in the study with mean ($\pm$ SD) age of 36.8 ($\pm$ 8.1) years. Mean ($\pm$ SD) year of experience as a medical professional was 9.2 ($\pm$ 7.2) and experience using telemedicine system was 1.9 ($\pm$ 1.6). One fourth of the clinicians always used PC/Laptop at their homes and half of the clinicians searched for information online. As a doctor, 154 (40.2 %) often interacted with patients via email or social media. Of all, 311 (81.2 %) clinicians showed their concern of possible legal issues around interacting with patient online (Table 1).

Knowledge levels were assessed of the clinicians where majority of them were familiar with telemedicine technology (n = 227, 59.3 %) and with medical applications of telemedicine technology (n = 248, 64.8 %) at average level. One fourth of the clinicians were familiar with telemedicine tools and guidelines, 262 (68.4 %) clinicians highly recommended continuous training for doctors in the use of telemedicine. Most

Table 1
Demographic Information, computer access and literacy of clinicians (n = 383).

	n	%
Age, years, Mean$\pm$SD, 36.8 $\pm$ 8.1		
< 35	168	43.9
35 - 45	158	41.3
> 45	57	14.9
Experience as a medical professional, years, Mean$\pm$SD, 9.2 $\pm$ 7.2		
$\leq$ 5	159	41.5
6 - 10	109	28.5
> 10	115	30.0
Experience using telemedicine system, years, Mean$\pm$SD, 1.9 $\pm$ 1.6		
$\leq$ 1	158	41.3
> 1	225	58.7
How often do you use PC/Laptop at home?		
Always	101	26.4
Often	178	46.5
Sometimes	74	19.3
Rarely	25	6.5
Never	5	1.3
How often do you search for information online?		
Always	205	53.5
Often	153	39.9
Sometimes	25	6.5
In your role as a doctor, how often do you interact with patients via e-mail or through social media?		
Always	50	13.1
Often	154	40.2
Sometimes	109	28.5
Rarely	55	14.4
Never	15	3.9
How many smart devices do you have?		
1-2	276	72.1
3 or more	107	27.9
Are you concerned of possible legal issues around interacting with patient online?		
No	72	18.8
Yes	311	81.2

clinicians rated the overall quality (n = 236, 61.6 %) and technical quality (n = 205, 53.5 %) of the telemedicine consultation as good, which showed their acceptance of telemedicine. During a telemedicine consultation, clinicians stayed somewhat to very comfortable (n = 362, 94.5 %) and reported that this service improved the health status of their patients (n = 322, 84.1 %). (Table 2).

Perception regarding telemedicine was investigated and it was noted that clinicians were agreed that telemedicine; is a viable approach for providing medical care services to patients (n = 378, 98.7 %), can save

Table 2
Knowledge and Acceptance of telemedicine among clinicians (n = 383).

Knowledge of Telemedicine	n	%
To what extent are you familiar with telemedicine technology?		
Low	26	6.8
Average	227	59.3
High	130	33.9
To what extent are you familiar with the medical applications of telemedicine technology?		
Low	36	9.4
Average	248	64.8
High	99	25.8
How often conferences, speeches or meetings held in your workplace regarding telemedicine technology?		
Low	114	29.8
Average	189	49.3
High	80	20.9
To what extent are you familiar with telemedicine tools?		
Low	60	15.7
Average	224	58.5
High	99	25.8
To what extent are you familiar with telemedicine guidelines?		
Low	56	14.6
Average	229	59.8
High	98	25.6
To what extent are you familiar with the use of telemedicine in other countries?		
Low	104	27.2
Average	211	55.1
High	68	17.8
To what extent is continuous training in the use of telemedicine necessary for doctors?		
Low	12	3.1
Average	109	28.5
High	262	68.4
Acceptance of Telemedicine	n	%
How do you rate the overall quality of the telemedicine consultation?		
Poor	3	0.8
Fair	54	14.1
Good	236	61.6
Excellent	90	23.5
How would you rate the technical quality of the telemedicine consultation?		
Poor	15	3.9
Fair	100	26.1
Good	205	53.5
Excellent	63	16.4
How do you rate the quality of care delivered by the telemedicine service when compared to the quality of traditional care?		
Not sure	21	5.5
Not as good	123	32.1
About the same	154	40.2
Better	85	22.2
Were you comfortable during the telemedicine consultation?		
No, very uncomfortable	3	0.8
No, somewhat uncomfortable	18	4.7
Yes, somewhat comfortable	182	47.5
Yes, very comfortable	180	47
Do you feel that the telemedicine consultation service may influence the health status of your patients?		
Negative effects on health	5	1.3
No change	56	14.6
Improved health	322	84.1
Would you continue to use the telemedicine service?		
No	3	0.8
Yes, but with improvements	265	69.2
Yes, in the same way as the service has been deployed	115	30

time and money (n = 374, 97.7 %) and efforts (n = 359, 93.7 %). There were 266 (69.5 %) clinicians who received training in telemedicine. Clinicians considered telemedicine a beneficial system for their patients (n = 370, 96.6 %), providing desirable patient diagnosis results (n = 321, 83.8 %) (Table 3).

Knowledge (range: 7–21), perception (range: 1–11) and acceptance of telemedicine (range: 7–22) had overall mean scores of 15.1 (± 3.0), 9.5 (± 1.6) and 17.2 (± 2.5), respectively. Clinicians who had more than one year experience using telemedicine system had significantly higher mean scores of knowledge (15.9 ± 2.8 vs. 13.9 ± 2.9 , p-value<0.001) and perception (9.7 ± 1.5 vs. 9.0 ± 1.6 , p-value<0.001) as compared to those who had one or less year experience. When scores were compared with computer literacy of clinicians it was found that those who always used PC/Laptop at home had higher mean scores of knowledge (16.2 ± 3.4 , mean difference = 4, p-value<0.001), perception (9.8 ± 1.4 , mean difference = 3.4, p-value = 0.004) and acceptance (18.1 ± 2.8 , mean difference = 4.5, p-value<0.001) as compared to other respective categories. Similarly, those who always interacted with patients via e-mail or through social media had higher mean scores of knowledge (16.9 ± 2.8 , mean difference = 2.8, p-value<0.001), perception (10.1 ± 1.2 , mean difference = 1, p-value = 0.003) and acceptance (18.9 ± 2.2 , mean difference = 2.3, p-value<0.001). (Table 4).

4. Discussion

This study explored the perspectives and experiences of healthcare professionals regarding telemedicine communication. The research encompassed a sample of 383 healthcare professionals who employed telemedicine to deliver medical interventions and subsequent monitoring to patients who could not attend face-to-face consultations. The utilization of telemedicine has been determined to be a handy and

Table 3
Perception of telemedicine among clinicians (n = 383).

	n	%
Telemedicine is a viable approach for providing medical care services to patients		
Disagree	5	1.3
Agree	378	98.7
There is a potential role for ICT in the health care		
Disagree	9	2.3
Agree	374	97.7
Using of telemedicine system can save time and money		
Disagree	9	2.3
Agree	374	97.7
Telemedicine system can save efforts		
Disagree	24	6.3
Agree	359	93.7
The applications of ICT in healthcare is already available		
Disagree	77	20.1
Agree	306	79.9
Have you ever received any training in telemedicine?		
No	117	30.5
Yes	266	69.5
Is the system easy to use and navigate?		
No	46	12.0
Yes	337	88.0
Is the information presented clearly?		
No	31	8.1
Yes	352	91.9
Is telemedicine beneficial for your patient?		
No	13	3.4
Yes	370	96.6
Does telemedicine provide desirable results in patient diagnoses?		
No	62	16.2
Yes	321	83.8
How do you rate the comfort of using telemedicine equipment and procedures?		
Dissatisfied	16	4.2
Neutral	180	47.0
Satisfied	187	48.8

ICT=Information and Communication Technology.

efficacious mechanism for accessing patients and enhancing their health results. The study’s findings can be compared with prior research in the domain, offering significant insights into healthcare professionals’ attitudes and adoption of telemedicine. In general, the results indicate that telemedicine holds considerable potential as a means of healthcare provision, with the capacity to enhance healthcare accessibility and promote patient welfare.

The findings of demographic analysis conducted in this survey indicate that the age groups of physicians under 35 and between 35 and 45 were the most prevalent. Additionally, it was observed that 41.5 % of physicians had ≤ 5 years of work experience. The results align with the findings reported in the research paper, indicating that the majority of participants fell within the age range of 31–40 years, and approximately 30 % of them had < 5 years of work experience.²² The data revealed that a significant proportion of physicians, specifically 46.5 %, reported regular utilization of laptops within their homes. Furthermore, most physicians, accounting for 53.3 %, indicated frequent engagement in online information retrieval activities. The majority of physicians (72.1 %) utilized one to two devices in their professional practice, while a notable number (40.2 %) maintained regular communication with their patients via email or social media platforms. The results of this study align with prior research, which reported that 89 % of professionals possess two or more smart devices. Additionally, 72 % of professionals from diverse fields in this research consistently engage with patients through email or social media platforms.²³ Further, 42.4 % of professionals utilize the Internet as a means to search for information.²⁴

The current study’s findings unveiled that most physicians maintained a favourable opinion towards telemedicine. In the survey that was conducted, a significant majority of physicians (98.7 %) expressed agreement about the viability of telemedicine as an effective strategy for their patients. Furthermore, a substantial proportion (97.7 %) recognized the potential of telemedicine to assume a crucial role in the future of healthcare. In addition, it was seen by physicians that telemedicine resulted in time and cost savings, with most respondents (97.7 %) acknowledging this benefit. Additionally, a significant proportion (88.0 %) found telemedicine to be user-friendly, while a majority (93.7 %) believed that it had the potential to reduce their workload. The findings align with several studies, indicating that 52.8 % of healthcare professionals engage in telemedicine practices, and 70.5 % recommend the training and adoption of telemedicine.²⁴ Furthermore, 90 % of respondents believed telemedicine could save time, money, and effort, with professionals from various specialities concurring that telemedicine is feasible for delivering medical care to patients.²³ Additionally, 90 % of participants found telemedicine to be cost-effective, and 61 % of physicians reported an increase in patient volume beyond their regular practice.²⁵

Study participants showed high levels of familiarity with telemedicine technology, including the technology itself (59.3 %), its applications (64.8 %), and its tools (58.3 %). Nearly half of the doctors also reported using telemedicine in presentations, speeches, and meetings. Additionally, many medical professionals (68.4 %) emphasized the importance of ongoing telemedicine training. Compared with other research, the results of this one show that 46.9 % of professionals already have some familiarity with telemedicine tools; nevertheless, 77 % of those professionals think they need more training to use telemedicine effectively.²³

5. Conclusion

The implementation of telemedicine has initiated a significant technological advancement in medical knowledge globally. This is particularly visible in the E-health clinics of Sehat Kahani, where healthcare professionals demonstrate noteworthy awareness and utilization. The achievement of equitable healthcare in neglected places necessitates a significant allocation of resources towards the development of infrastructure and the provision of education to effectively

Table 4

Knowledge, perception and acceptance scores of telemedicine by demographic and computer literacy of clinicians (n = 383).

	Knowledge scores Mean $\pm$ SD	p-value*	Perception scores Mean $\pm$ SD	p-value*	Acceptance scores Mean $\pm$ SD	p-value*
Overall	15.1 $\pm$ 3.0		9.5 $\pm$ 1.6		17.2 $\pm$ 2.5	
Age, years						
< 35	15.3 $\pm$ 2.7	0.523	9.4 $\pm$ 1.5	0.520	17.4 $\pm$ 2.4	0.639
35 - 45	14.9 $\pm$ 2.9		9.5 $\pm$ 1.6		17.1 $\pm$ 2.5	
> 45	15.0 $\pm$ 3.8		9.3 $\pm$ 1.9		17.0 $\pm$ 2.9	
Experience as a medical professional, years						
$\leq$ 5	15.1 $\pm$ 2.8	0.974	9.5 $\pm$ 1.5	0.590	17.3 $\pm$ 2.3	0.977
6 - 10	15.2 $\pm$ 2.8		9.6 $\pm$ 1.4		17.3 $\pm$ 2.6	
> 10	15.0 $\pm$ 3.5		9.3 $\pm$ 1.9		17.1 $\pm$ 2.8	
Experience using telemedicine system, years						
$\leq$ 1	13.9 $\pm$ 2.9	<0.001	9.0 $\pm$ 1.6	<0.001	17.0 $\pm$ 2.5	0.101
> 1	15.9 $\pm$ 2.8		9.7 $\pm$ 1.5		17.4 $\pm$ 2.6	
How often do you use PC/Laptop at home?						
Always	16.2 $\pm$ 3.4	<0.001	9.8 $\pm$ 1.4	0.004	18.1 $\pm$ 2.8	<0.001
Often	15.3 $\pm$ 2.7		9.6 $\pm$ 1.4		17.1 $\pm$ 2.3	
Sometimes	13.8 $\pm$ 2.4		9.2 $\pm$ 1.6		16.9 $\pm$ 2.3	
Rarely	13.5 $\pm$ 2.9		8.8 $\pm$ 1.9		15.8 $\pm$ 1.9	
Never	12.2 $\pm$ 3.9		6.4 $\pm$ 3.8		13.6 $\pm$ 4.7	
In your role as a doctor, how often do you interact with patients via e-mail or through social media?						
Always	16.9 $\pm$ 2.8	<0.001	10.1 $\pm$ 1.2	0.003	18.9 $\pm$ 2.2	<0.001
Often	15.3 $\pm$ 2.8		9.6 $\pm$ 1.5		17.4 $\pm$ 2.4	
Sometimes	14.6 $\pm$ 2.6		9.2 $\pm$ 1.5		16.6 $\pm$ 2.5	
Rarely	14.1 $\pm$ 3.5		9.1 $\pm$ 1.8		16.7 $\pm$ 2.7	
Never	14.3 $\pm$ 3.7		9.3 $\pm$ 2.2		16.7 $\pm$ 2.4	
How many smart devices do you have?						
1-2	14.8 $\pm$ 3.0	0.001	9.4 $\pm$ 1.6	0.488	17.1 $\pm$ 2.6	0.330
3 or more	15.9 $\pm$ 2.8		9.6 $\pm$ 1.4		17.5 $\pm$ 2.3	

utilize telemedicine. Significantly, there exists a noteworthy inclination among medical professionals to gain expertise on telemedicine. Promisingly, many participants exhibit positive attitudes towards telemedicine, indicating a readiness to incorporate technology into their professional healthcare activities. This highlights the capacity of telemedicine to improve the quality and availability of healthcare in various settings, indicating a positive step towards addressing healthcare disparities and embracing the transformative impact of telemedicine.

Limitations

- The study sample was restricted to professionals with prior telemedicine knowledge, possibly limiting the findings' generalizability to individuals who had not yet utilized this technology.
- The study include diverse degrees of technology knowledge and proficiency across doctors, which may potentially impact their perceptions and experiences about the utilization of telemedicine.

Recommendations

- Strengthen medical education with mandatory telemedicine training that covers ethical frameworks for advanced consultations, communication strategies, and technological proficiency.
- To further understand physicians' perspectives and experiences using telemedicine, we need a more prominent and representative sample of clinicians.
- Studies focusing on the effects of telemedicine care from the patient's perspective are needed to better comprehend the advantages and disadvantages of this treatment method.
- Legal constraints restricting the use of telemedicine should be studied in the future to determine their potential impact and possible solutions.

Ethical approval

Ethical approval was given by Dow University of Health Sciences, Karachi IRB reference number **IRB-2219/DUHS/2021**.

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Author's contribution

MK developed the study's framework and methodology. Data was gathered and organized by IA and MH. SH did the analysis and interpretation. The manuscript was initially drafted by MH and finished by MM. The manuscript was edited for clarity and accuracy by SK and KS. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

1. Ashfaq A, Memon SF, Zehra A, et al. Knowledge and attitude regarding telemedicine among doctors in Karachi. *Cureus*. 2020 Feb 9;12(2).
2. Wahezi SE, Kohan LR, Spektor B, et al. Telemedicine and current clinical practice trends in the COVID-19 pandemic. *Best Pract Res Clin Anaesthesiol*. 2021 Oct 1;35(3): 307–319.
3. Flumignan CD, Rocha AP, Pinto AC, et al. What do Cochrane systematic reviews say about telemedicine for healthcare? *Sao Paulo Med J*. 2019 Jul 15;137:184–192.
4. World Health Organization. *Telemedicine: Opportunities and Developments in Member States. Report on the Second Global Survey on eHealth*. World Health Organization; 2010.
5. Bilal W, Qamar K, Siddiqui A, Kumar P, Essar MY. Digital health and telemedicine in Pakistan: improving maternal healthcare. *Annals of Medicine and Surgery*. 2022 Sep 1;81, 104425.
6. Ali SA, Arif TB, Maab H, et al. Global interest in telehealth during COVID-19 pandemic: an analysis of Google Trends. *Cureus*. 2020 Sep 16;12(9).

7. Dorsey ER, Topol EJ. Telemedicine 2020 and the next decade. *Lancet*. 2020 Mar 14; 395(10227):859.
8. Mahdi SS, Allana R, Battineni G, et al. The promise of telemedicine in Pakistan: a systematic review. *Health Science Reports*. 2022 Jan;5(1), e438.
9. Zahid N, Ali A, Gul B, et al. Perception and attitude of Pakistani doctors toward the use of telemedicine technology. *Cureus*. 2022 Nov 15;14(11).
10. Udaipurwala IH. Telemedicine in Pakistan—future of healthcare services. *Journal of Bahria University Medical and Dental College*. 2023;13(1):1–2.
11. Nadeem A. Implementation and usefulness of telemedicine services in the healthcare system of Pakistan. *Op Acc Jour of Med & Clini Sur*. 2022;4(2).
12. Ullah N, Khan P, Sultana N, Kwak KS. A telemedicine network model for health applications in Pakistan: current status and future prospects. *International Journal of Digital Content Technology and its Applications*. 2009 Sep;3(3):149–155.
13. Alam L, Alam M, Malik AM, Faraid V. Is Telemedicine our cup of tea? A nationwide cross-sectional survey regarding doctors' experience and perceptions. *Pakistan J Med Sci*. 2021 Sep;37(5):1319.
14. Achakzai A, Masood S, Khan J. Acceptance of telemedicine: a perspective from the doctors working in the tertiary care hospitals of quetta: acceptance of telemedicine. *Pakistan Journal of Health Sciences*. 2023 Jun;30:270–277.
15. Ahmed A, Ahmed M. The Telemedicine Landscape in Pakistan-Why are we falling behind? *JPMA. The Journal of the Pakistan Medical Association*. 2018 Dec 1;68(12): 1820–1822.
16. Khan UZ. Telemedicine in the COVID-19 Era: a chance to make a better tomorrow. *Pakistan J Med Sci*. 2020 Sep;36(6):1405.
17. Shoaib M, Noorani MM, Khaliq MF. Telemedicine: distance matters not now. *JPMA. The Journal of the Pakistan Medical Association*. 2012 Nov 1;62(11):1268–1269.
18. Kazmi S, Yasmin F, Shah M, Saeed U, Asghar MS. Nationwide assessment of knowledge and perception in reinforcing telemedicine in the age of COVID-19 among medical students from Pakistan. *Front Public Health*. 2022 Mar 31;10, 845415.
19. Field MJ, editor. *Telemedicine: A Guide to Assessing Telecommunications for Health Care*.
20. Acharya RV, Rai JJ. Evaluation of patient and doctor perception toward the use of telemedicine in Apollo Tele Health Services, India. *J Fam Med Prim Care*. 2016 Oct;5 (4):798.
21. Indria D, Alajlani M, Fraser HS. Clinicians perceptions of a telemedicine system: a mixed method study of Makassar City, Indonesia. *BMC Med Inf Decis Making*. 2020 Dec;20:1–8.
22. Ncube B, Mars M, Scott RE. Perceptions and attitudes of patients and healthcare workers towards the use of telemedicine in Botswana: an exploratory study. *PLoS One*. 2023 Feb 16;18(2), e0281754.
23. Albarrak AI, Mohammed R, Almarshoud N, et al. Assessment of physician's knowledge, perception and willingness of telemedicine in Riyadh region, Saudi Arabia. *Journal of infection and public health*. 2021 Jan 1;14(1):97–102.
24. Kumar G, Sharda HK, Tariq W, et al. Assessment of knowledge and attitude of healthcare professionals regarding the use of telemedicine: a cross-sectional study from rural areas of Sindh, Pakistan. *Front Public Health*. 2022 Oct 26;10, 967440.
25. Acharya RV, Rai JJ. Evaluation of patient and doctor perception toward the use of telemedicine in Apollo Tele Health Services, India. *J Fam Med Prim Care*. 2016 Oct;5 (4):798.