https://doi.org/10.48047/AFJBS.6.16.2024.82-92

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

Teleophthalmology: Insights from Ophthalmologists Practicing in Saudi Arabia

Mujeeb Ur Rehman Parrey*

Associate Professor Ophthalmology, Department of Surgery, Faculty of Medicine; Northern Border University, Arar; Kingdom of Saudi Arabia.

Corresponding author:

Dr. Mujeeb Ur Rehman Parrey; Ph.D.

ORCID: https://orcid.org/0000-0002-2731-5438

Associate Professor and Consultant Ophthalmology,

Department of Surgery, Faculty of Medicine; Northern Border University, Arar; KSA

Email: drparrey@gmail.com; Mujeeb.Parrey@nbu.edu.sa

Cell: 00966-504127126

Funding: None

Conflict of interest: None

Authors Contributions: Mujeeb Ur Rehman Parrey, contributed to research conception and design and data interpretation and manuscript writing and reviewing.

Volume 6, Issue 16, Nov 2024

Received: 15 Oct 2024

Accepted: 25 Nov 2024

Published: 2 Dec 2024

doi: 10.48047/AFJBS.6.16.2024.82-92

ABSTRACT

Background and Aim: Teleophthalmology (TO) is transforming eye care by overcoming geographic barriers and delivering services to underserved areas through digital innovation. Understanding ophthalmologists' perspectives is essential for the successful implementation of TO. This study examines their perceptions of TO, with a focus on factors that influence its adoption in clinical practice.

Materials and Methods: This cross-sectional study surveyed 120 practicing ophthalmologists in Saudi Arabia using a structured electronic questionnaire. Statistical analysis was conducted to explore associations between demographics and TO awareness.

Results: The study found high awareness of TO, with 65% of participants demonstrating strong understanding. Younger ophthalmologists (47.5% aged 20–29) and those with higher qualifications showed higher awareness. 73.33% considered TO more cost-effective than traditional care, and 86% expressed interest in additional training. 61% had attended over four TO sessions in the past year.

Conclusion: The study reveals strong awareness, perceived cost-effectiveness, and interest in TO training, particularly among early-career ophthalmologists in Saudi Arabia's urban, government healthcare sector. Education is key for TO adoption, with efforts needed to expand rural access, develop structured training, and implement competency assessments to improve TO's reach and quality of eye care.

Keywords: Awareness, Healthcare, Ophthalmology, Telemedicine, Teleophthalmology.

Introduction:

Teleophthalmology (TO) is revolutionizing eye care by bridging distances and breaking barriers, bringing critical services to underserved areas through digital innovation [1- 4]. TO models include store-and-forward, real-time, and hybrid approaches, allowing for flexible service delivery [5]. It is effective for early detection and management of conditions like retinopathy of prematurity (ROP), diabetic retinopathy (DR), and glaucoma, where timely screenings and interventions are crucial for optimal outcomes [6-8].

Research shows that TO achieves clinical results comparable to traditional methods, with strong patient satisfaction resulting from better accessibility and lower travel expenses [9-10]. Advances in technology, internet, and AI have transformed teleophthalmology from a research concept into a vital clinical service, providing efficient and cost-effective care [11-13]. Globally, TO is valued for its reliability, cost-effectiveness, and ability to provide care in areas lacking specialist access [14]. Challenges in teleophthalmology include limited internet access, high costs, low awareness, and resistance from some patients and providers. While patient satisfaction is high, providers often cite insufficient equipment and technical support as concerns [15-19].

In Saudi Arabia, uneven distribution of healthcare professionals, especially in rural areas, hinders timely care. Teleophthalmology offers a solution, exemplified by the national ROP telemedicine initiative and DR screening projects [20-21]. Realizing the potential of TO requires investments in infrastructure, education, and policies. Saudi Arabia's Vision 2030 prioritizes technology-driven solutions like teleophthalmology to improve healthcare access [22]. Future directions should focus on integrating AI, expanding remote monitoring, and increasing screening and follow-up programs for conditions such as cataracts and glaucoma.

This study evaluates the perceptions of ophthalmic professionals in Saudi Arabia to identify challenges and opportunities in integrating teleophthalmology. Their insights aim to guide strategies for improving healthcare access and outcomes in the region.

Materials and Methods:

Ethical Consideration: Ethical approval (No.105/24/H) was obtained from Northern Border University’s Bioethics Committee.

Location and structure of study: This cross-sectional study in Saudi Arabia assessed teleophthalmology perceptions using an electronic questionnaire shared via email, WhatsApp, and professional networks. It included study details, consent, demographics, 12 questions on TO awareness, and participants' personal experiences.

Sampling method and study sample: The study randomly sampled 2,273 ophthalmologists in Saudi Arabia [23], with a minimum sample size of 117 calculated using STATA/SE 11.2 based on a 50% hypothesized proportion, 35% observed proportion, 90% power, and 0.05 alpha level.

Statistical Analysis: Qualitative data were reported as frequencies and percentages, quantitative data as mean ± SD and range. Awareness was "adequate" (scores ≥9) or "inadequate" (scores <9). Chi-square and Fisher Exact tests analyzed associations, with significance at $P<0.05$. Analyses used STATA/SE 11.2 and MS Excel.

Inclusion and Exclusion Criteria: The study included male and female ophthalmologists from Saudi Arabia's public and private sectors, excluding those not in active practice.

Results:

Among the 120 participants, the largest group (47.5%) was aged 20 - 29 with a slight male majority (55.83%). A significant proportion (89.2%) were employed within the government sector and based in urban areas. More than half of the participants (57.5%) were resident ophthalmologists. Additionally, 31.7% of respondents had less than two years of experience in their field, and 56.7% had attained a bachelor's degree. A comprehensive demographic breakdown is provided in Table 1.

Table 1. Sociodemographic characteristics of the participants (n.=120)

Variable		No.	%
Age (years)	20-29	57	47.50
	30-39	24	20.00
	40-49	18	15.00
	≥50	21	17.50
Gender	Male	67	55.83
	Female	53	44.17
Nationality	Saudi	88	73.33
	Non-Saudi	32	26.67

Qualification	Bachelor	68	56.67
	Master	19	15.83
	PhD	33	27.50
Position	Resident	69	57.50
	Specialist	16	13.33
	Consultant	35	29.17
Work-place	Governmental	107	89.17
	Private	13	10.83
Work location	City	107	89.17
	Periphery	13	10.83
Total period of practice (years)	< 3	38	31.67
	3-5	37	30.83
	6-8	8	6.67
	9-11	7	5.83
	≥12	30	25.00

In terms of awareness about tele-ophthalmology (TO), 65% (78 participants) demonstrated an adequate level of awareness, while 35% had inadequate awareness. The mean awareness score was 08.25 (SD ± 3.70), with scores ranging from 0 to 12. Participants scored highest on questions related to the concept of TO as an imaging technology accessible via telecommunication channels, and as a tool for enhancing scientific knowledge through group discussions. Detailed responses to all awareness-related questions are available in Table 2.

Table 2. Awareness about teleophthalmology (TO) among the participants (n.=120)

Variable		No.	%
1. Are you aware that TO involves capturing images digitally and transmitting them through communication networks for diagnosis and consultation?	Yes	89	74.17
	No	1	0.83
	I don't know	30	25.00
2. Did you know that TO is also used for continuous medical education?	Yes	87	72.50
	No	4	3.33
	I don't know	29	24.17

3. Do you believe TO offers an advantage by providing real-time access to ophthalmic data through regular internet connections?	Yes	80	66.67
	No	10	8.33
	I don't know	30	25.00
4. Did you know that TO enables patients to consult with ophthalmologists in real-time through video conferencing?	Yes	62	51.67
	No	11	9.17
	I don't know	47	39.17
5. Are you aware that TO allows patients to transmit captured images later to specialists for subsequent diagnostic and treatment recommendations?	Yes	81	67.50
	No	9	7.50
	I don't know	30	25.00
6. Did you know that TO enables specialists to examine images sent from distant locations?	Yes	75	62.50
	No	12	10.00
	I don't know	33	27.50
7. Do you think TO can help reduce diagnostic errors by facilitating consultations with experts from across the country and around the world?	Yes	82	68.33
	No	16	13.33
	I don't know	22	18.33
8. Do you think TO has the potential to greatly improve patient care in near future?	Yes	91	75.83
	No	0	0.00
	I don't know	29	24.17
9. Do you believe that TO relies on images provided by referring healthcare professionals?	Yes	97	80.83
	No	0	0.00
	I don't know	23	19.17
10. Are you aware that TO can facilitate expert consultations during surgical procedures?	Yes	92	76.67
	No	6	5.00
	I don't know	22	18.33
11. Did you know that there are specialized software solutions designed for TO?	Yes	63	52.50
	No	5	4.17
	I don't know	52	43.33
12. Are you aware that TO enables group discussions on social media to promote the advancement of scientific knowledge in ophthalmology?	Yes	91	75.83
	No	6	5.00
	I don't know	23	19.17
Total score	Mean ±SD	8.25±3.70	
	Range	0-12	

	Inadequate	41	34.17
	Adequate	79	65.83

A significant association was observed between participants' qualification status and their level of awareness about teleophthalmology (p-value = 0.01). The relationship with other sociodemographic variables is shown in Table 3.

Table 1: Relationship between the TO awareness level and demographic variables of the participants (n.=120)

Variable		Inadequate (n.=41)		Adequate (n.=79)		X^2	P
		No.	%	No.	%		
Age (years)	20-29	25	60.98	32	40.51	6.40	0.09
	30-39	8	19.51	16	20.25		
	40-49	5	12.20	13	16.46		
	≥50	3	7.32	18	22.78		
Gender	Male	25	60.98	42	53.16	0.67	0.41
	Female	16	39.02	37	46.84		
Nationality	Saudi	29	70.73	59	74.68	0.21	0.64
	Non-Saudi	12	29.27	20	25.32		
Qualification	Bachelor	26	63.41	42	53.16	8.68	**0.01**
	Master	10	24.39	9	11.39		
	PhD	5	12.20	28	35.44		
Position	Resident	28	68.29	41	51.90	4.46	0.11
	Specialist	6	14.63	10	12.66		
	Consultant	7	17.07	28	35.44		
Work-place	Governmental	36	87.80	71	89.87	FET	0.76
	Private	5	12.20	8	10.13		
Work location	City	38	92.68	69	87.34	FET	0.54
	Periphery	3	7.32	10	12.66		
Total period of practice (years)	<2	18	43.90	20	25.32	FET	0.06
	3-5	12	29.27	25	31.65		
	6-9	1	2.44	7	8.86		

	9-11	4	9.76	3	3.80	
	≥12	6	14.63	24	30.38	

X2: Chi-square test; FET: Fisher Exact Test; Statistical significance was considered at P<0.05

For personal experiences with TO, 73.33% of participants found it more cost-effective than traditional hospital visits, 61% participants had attended more than four educational sessions on TO in the past one year and nearly 86% participants suggested that additional training sessions on TO would be beneficial for the ophthalmology professionals. (Figure 1).

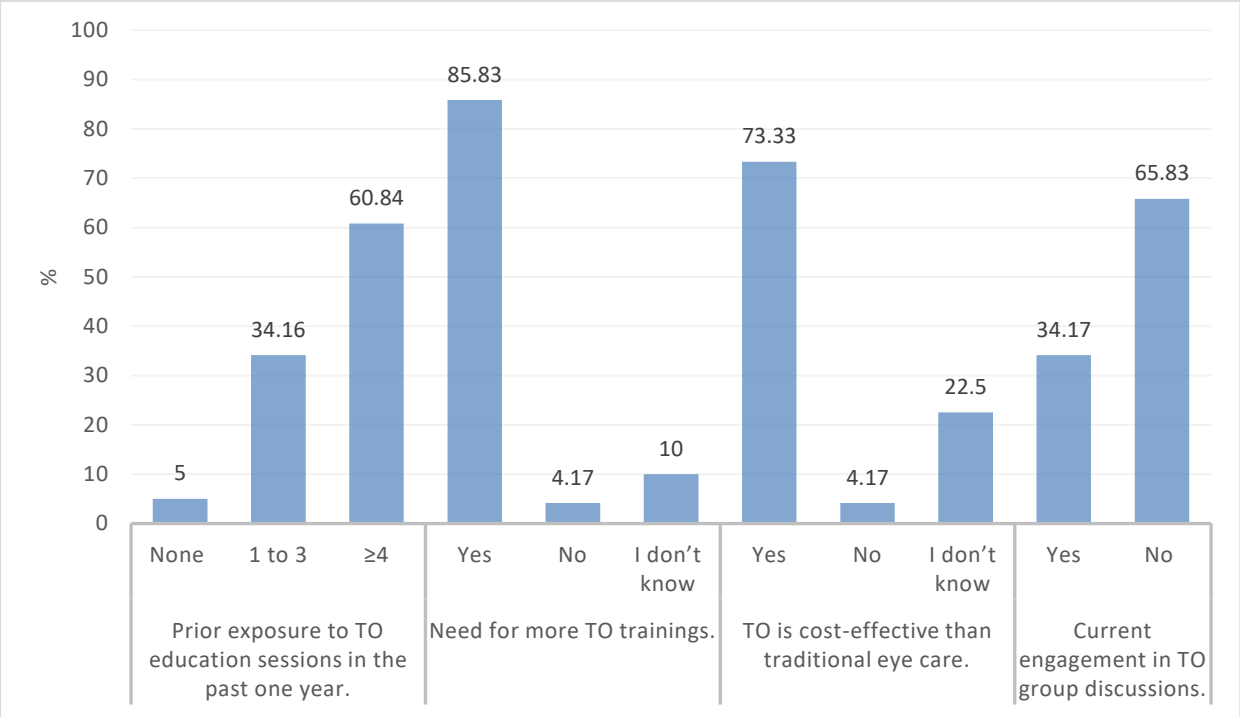

Figure 1: Participants' personal teleophthalmology (TO) experiences (n.=120)

Discussion:

This is, to the best of our knowledge, the first study to explore ophthalmologists' perspectives on teleophthalmology (TO) in Saudi Arabia, offering valuable insights into how Saudi ophthalmologists perceive and experience this digital healthcare tool. Involving 120 participants, primarily young, early-career professionals, the study reflects a generally positive attitude toward digital health integration in ophthalmology, which is particularly relevant in a nation with centralized healthcare.

Among participants, 47.5% were aged 20–29, with a male majority (55.83%), aligning with trends showing younger healthcare providers often more receptive to telemedicine and digital health innovations [24-25]. This younger demographic, already familiar with digital technology, holds promise for advancing TO in Saudi Arabia.

Most participants (89.2%) were affiliated with government healthcare institutions located in urban areas, suggesting TO's potential to expand access to underserved rural regions. Additionally, with 57.5% of participants in residency, the study reflects early-career perspectives that are likely to shape the future of TO in ophthalmology.

TO awareness was high, with 65% of participants demonstrating an adequate understanding, recognizing it as a tool for remote eye care and interdisciplinary collaboration. This aligns with research showing that telemedicine supports virtual case discussions and consultations [26]. The positive correlation between higher qualification levels and TO awareness further suggests that advanced training could drive TO adoption.

From an economic standpoint, 73.33% of participants perceived TO as more cost-effective than traditional eye care, consistent with global studies reporting reduced financial burdens on patients [27-28]. Notably, 86% expressed interest in additional TO training, indicating enthusiasm for structured education as digital health expands in Saudi Arabia. This is consistent with studies supporting the ongoing development of digital skills, not only for healthcare providers but also as an integral part of educational curricula [29-30]. With 61% having attended more than five TO-focused sessions, the study underscores a strong commitment to professional development in TO.

Limitations: The reliance on self-reported data could lead to response bias, as participants' perceptions of awareness and experience may not align with objective measures. Expanding future samples to diverse practice settings could offer a more comprehensive view of TO perspectives across Saudi Arabia.

Conclusion:

This study highlights the generally positive perception and growing awareness of tele-ophthalmology (TO) among Saudi ophthalmologists, particularly among early-career professionals working in government healthcare settings in urban areas. A substantial portion of participants demonstrated adequate awareness of TO, recognizing its potential to enhance accessibility to eye care and facilitate professional knowledge sharing. The association between higher qualification levels and TO awareness underscores the importance of

advanced training in promoting digital health adoption. Additionally, the cost-effectiveness and the high demand for further TO training underscore the readiness of ophthalmology professionals to integrate digital health solutions into their practice. Future research encompassing a more diverse range of healthcare environments and using objective measures could provide a more comprehensive understanding of TO's adoption and impact across Saudi Arabia.

References:

1. Chen N, Wang J-H, Chiu C-J. Satisfaction with Teleophthalmology Services: Insights from Remote Areas of Taiwan. Healthcare. 2024; 12(8):818.
2. Li JO, Liu H, Ting DSJ, Jeon S, Chan RVP, Kim JE, et al. Digital technology, tele-medicine and artificial intelligence in ophthalmology: A global perspective. Prog Retin Eye Res. 2021;82:100900.
3. Jeganathan VS, Hall HN, Sanders R. Electronic Referrals and Digital Imaging Systems in Ophthalmology: A Global Perspective. Asia Pac J Ophthalmol (Phila). 2017;6(1):3-7.
4. Prathiba V, Rema M. Teleophthalmology: a model for eye care delivery in rural and underserved areas of India. Int J Family Med. 2011;2011:683267.
5. Areaux RG Jr, de Alba Campomanes AG, Indaram M, Shah AS; Pediatric Tele-Ophthalmology Consortium. Your eye doctor will virtually see you now: synchronous patient-to-provider virtual visits in pediatric tele-ophthalmology. J AAPOS. 2020 Aug;24(4):197-203.
6. Land MR, Patel PA, Bui T, Jiao C, Ali A, Ibnamasud S, et al. Examining the Role of Telemedicine in Diabetic Retinopathy. Journal of Clinical Medicine. 2023; 12(10):3537.
7. Brady CJ, D'Amico S, Campbell JP. Telemedicine for Retinopathy of Prematurity. Telemed J E Health. 2020 Apr;26(4):556-564.
8. Bisorca-Gassendorf L, Murovski S, Julich-Härtel H, Rickmann A, Szabo JE, Erokhina M, Wenzel M, Januschowski K. Asynchronous Teleophthalmology for Monitoring Glaucoma Patients in a Rural German Region: A Retrospective Observational Pilot Study. Cureus. 2022 Apr 17;14(4):e24210.
9. Sreelatha OK, Ramesh SV. Teleophthalmology: improving patient outcomes? Clin Ophthalmol. 2016;10:285-95.

10. Than J, Sim PY, Muttuvelu D, Ferraz D, Koh V, Kang S, Huemer J. Teleophthalmology and retina: a review of current tools, pathways and services. Int J Retina Vitreous. 2023 Dec 5;9(1):76.
11. Chokshi T, Cruz MJ, Ross J, Yiu G. Advances in teleophthalmology and artificial intelligence for diabetic retinopathy screening: a narrative review. Ann Eye Sci 2024;9:9.
12. Bajwa J, Munir U, Nori A, Williams B. Artificial intelligence in healthcare: transforming the practice of medicine. Future Healthc J. 2021;8(2):e188-e194.
13. Li JO, Liu H, Ting DSJ, Jeon S, Chan RVP, Kim JE, et al. Digital technology, tele-medicine and artificial intelligence in ophthalmology: A global perspective. Prog Retin Eye Res. 2021;82:100900.
14. Dolar-Szczasny J, Barańska A, Rejdak R. Evaluating the Efficacy of Teleophthalmology in Delivering Ophthalmic Care to Underserved Populations: A Literature Review. J Clin Med. 2023 Apr 27;12(9):3161
15. Khan IA, Bashar MA, Tripathi A, Priyanka N. The Benefits and Challenges of Implementing Teleophthalmology in Low-Resource Settings: A Systematic Review. Cureus. 2024 Sep 30;16(9):e70565.
16. Vazirani J. Commentary: Teleophthalmology: Opportunities and challenges. Indian J Ophthalmol. 2020 Jul;68(7):1379-1380.
17. Mazzuca D, Borselli M, Gratteri S, Zampogna G, Feola A, Della Corte M, et al. Applications and Current Medico-Legal Challenges of Telemedicine in Ophthalmology. International Journal of Environmental Research and Public Health. 2022; 19(9):5614.
18. Woodward MA, Ple-Plakon P, Blachley T, Musch DC, Newman-Casey PA, De Lott LB, et al. Eye care providers' attitudes towards tele-ophthalmology. Telemed J E Health. 2015 Apr;21(4):271-3.
19. Sharma M, Jain N, Ranganathan S, Sharma N, Honavar SG, Sharma N, et al. Tele-ophthalmology: Need of the hour. Indian J Ophthalmol. 2020 Jul;68(7):1328-1338.
20. Kalantan HA. Teleophthalmology in Saudi Arabia. Saudi J Ophthalmol. 2023 Mar 9;37(1):55-59.
21. Tan Z, Isaacs M, Zhu Z, Simkin S, He M, Dai S. Retinopathy of prematurity screening: A narrative review of current programs, teleophthalmology, and diagnostic support systems. Saudi J Ophthalmol. 2022;36(3):283-295.

22. Mani ZA, Goniewicz K. Transforming Healthcare in Saudi Arabia: A Comprehensive Evaluation of Vision 2030's Impact. *Sustainability*. 2024; 16(8):3277.
23. Ministry of Health Statistical Yearbook 2021. Ministry of Health. 2021. Retrieved from:https://www.moh.gov.sa/en/Ministry/Statistics/book/Documents/Statistical-Yearbook-2021.pdf .
24. Alzahrani, S. A., Khouja, J. H., GhamdI, S. A., Alotaybi, M., Bargawi, A., Alghamdi, A. A., & Fayraq, A. (2023). Telemedicine Acceptability Among Patients of Primary Health Care Clinics in the Western Region, Saudi Arabia. Cureus, 15(6), e40857.
25. Ferretti, A., Hubbs, S. & Vayena, E. Global youth perspectives on digital health promotion: a scoping review. BMC Digit Health 1, 25 (2023).
26. AlShareef, S. M., & AlWabel, A. A. Patient Opinions about Virtual Consultations in Saudi Arabia: A Nationwide Cross-Sectional Study. Healthcare 2024; 12(10), 1001.
27. Faleh AlMutairi M, Tourkmani AM, Alrasheedy AA, et al. Cost-effectiveness of telemedicine care for patients with uncontrolled type 2 diabetes mellitus during the COVID-19 pandemic in Saudi Arabia. Therapeutic Advances in Chronic Disease. 2021;12.
28. Patel KB, Turner K, Alishahi Tabriz A, Gonzalez BD, Oswald LB, Nguyen OT, et al. Estimated Indirect Cost Savings of Using Telehealth Among Nonelderly Patients With Cancer. JAMA Netw Open. 2023;6(1):e2250211.
29. Kaihlanen AM, Virtanen L, Kainiemi E, Sulosaari V, Heponiemi T. Continuing Education in Digital Skills for Healthcare Professionals - Mapping of the Current Situation in EU Member States. Int J Health Policy Manag. 2024;13:8309.
30. Holland Brown, T. M., & Bewick, M. (2023). Digital health education: the need for a digitally ready workforce. Archives of disease in childhood. Education and practice edition, 108(3), 214–217.