

**TELEOPTOMETRY: INNOVATIONS AND REVOLUTIONIZATION OF INTEGRATING
TECHNOLOGY FOR FUTURE EYE CARE PRACTICE*****Dr Mahesh Chandra, Dr Jitendra Singh, Dr Vaishali Sharma, Imran Ahmad Ansari and Ayush Jha**¹Department of Optometry, Dr. Sushila Tewari Government Hospital & Medical College, Haldwani, Uttarakhand, India.²Clear Vision Eye Care Centre 1001, Sec-29, Faridabad, Haryana, India.³Vaidyashree Ayurveda and Panchkarma Centre, Indrapurum, Ghaziabad, UP, India.⁴Surajmal Agarwal, College of Paramedical and Health Eye Care, Kichha, US Nagar, Uttarakhand, India.⁵Jeewan Anmol Multi-Specialty Hospital, Champawat, Uttarakhand, India.***Corresponding Author: Dr Mahesh Chandra**

Department of Optometry, Dr. Sushila Tewari Government Hospital & Medical College, Haldwani, Uttarakhand, India.

Article Received on 15/04/2024

Article Revised on 25/05/2024

Article Accepted on 04/06/2024

ABSTRACT

India is a vast country with a significant part of its population residing in rural areas; therefore it is a challenge for governments to ensure access to top-tier healthcare services even in the most remote villages. This encompasses the crucial task of safeguarding the most invaluable assets of Tele-optometry (Telemedicine in Optometry), intended with telehealth to provide eye care services remotely. It can be used for a variety of services, including Triage, Screening, Consultation, and Remote supervision. Tele-optometry can be beneficial over the cost barriers or rely on public transportation and for patients who have mobility challenges. It can also be helpful for patients who are under quarantine, nervous to travel or have co-morbidities that require social distancing. Telemedicine in optometry offers synchronous care by connecting the patient and eye care professionals in real-time, therefore reliable internet access and hardware, such as a phone, tablet, computer, or smartphone inbuilt smart featured cameras and microphone are needed. By utilizing telemedicine technologies and fostering collaborative alliances, the optometry sector in India can tackle the country's eye care requirements and realize the objective of ensuring comprehensive eye health coverage for every individual. As anticipated, Tele-optometry has experienced significant growth recently with the government's aim to enhance healthcare accessibility for all and address preventable vision impairments, thus the future of Tele-optometry appears promising.

KEYWORD: telemedicine, telehealth, teleophthalmology, tele-optometry, eye care professional, low-vision telerehabilitation.

INTRODUCTION

Telemedicine in optometry refers to the use of telecommunications technologies, such as video conferencing, digital imaging, and remote monitoring devices, to provide eye care services at a distance.

Telehealth shows great promise as an embraced method to link healthcare providers with patients, facilitating healthcare delivery to those with limited access and resources. Telehealth is increasing widely with many applications and medical specialties in various fields including telepsychiatry, teleradiology, and telecardiology. Different reviews show the effectiveness of interactions between primary and secondary healthcare providers has been evaluated, alongside critiques regarding the sparse and inconsistent evidence regarding the effectiveness and cost-efficiency of telemedicine.^[1-3]

There are two primary forms of telehealth: synchronous and asynchronous. Real-time consultation has concerns with Synchronous telehealth and Asynchronous telehealth has concerns about the communication of health information not in real-time but with a store-and-forward approach. The example of Synchronous telehealth has concerns about the prescribing of medications, reassurance, an in-person appointment and the screening for retinopathies related to diabetes and prematurity are the example of Asynchronous telehealth.^[4-7]

Although the telehealth model has been utilized in various areas of healthcare. Teleophthalmology depends on tele-optometry which is well-researched and is highly regarded by practitioners. For a long while, extended quality of eye care services to the remote areas of India was a big challenge; especially considering the distance to reach the spot, of an eye care professional can be

significant. Telemedicine in optometry offers an easy solution to the problem.^[8-11]

It enables multifaceted role for optometrists, to diagnose, treat, and manage various ocular conditions without the need for in-person visits, allowing for greater accessibility, convenience, and efficiency in delivering eye care to patients, remote consultations, virtual eye exams, screening for ocular diseases, monitoring of treatment progress, and even low vision rehabilitation, along with the continuing education and training even second opinions, drive technological innovation, and inform policy and regulatory frameworks.

The experts of ocular remedies and the affected individuals have a proportion of 1:100000 in India; and around the world, the highest number of blind people are found in India, although 88 per cent of blindness can be cured, lack of infrastructure, medical personnel and awareness are obstructive factor. The telemedicine service brings a change to the situation as it has proved itself at the time of the COVID-19 pandemic.^[12]

During the COVID-19 lockdown in March 2020, the Ministry of Health and Family Welfare (MoHFW), in conjunction with NITI Aayog, the Board of Governors (BoG) and the Medical Council of India (MCI) released Telemedicine Practice Guidelines to enable telemedicine to the healthcare personals for the safety of eye care personal and the patients as well.^[13]

This approach leverages advancements in digital health technologies to overcome geographical barriers, improve patient outcomes, and enhance collaboration between optometrists and other healthcare professionals.

In recent decades, prominent eye care institutions throughout India have embraced Tele-Ophthalmology and are serving their potential to deliver high-quality eye care services to remote and rural areas. Apollo TeleHealth, a renowned leader in Telemedicine Services, has played a significant role in transforming healthcare. Utilizing state-of-the-art digital tools and a skilled team has assisted nearly 2 million individuals and distributed eyeglasses at no cost.^[14]

The favour of tele-optometry can be understood through the twenty-seven pertinent studies of which 11 addressed the involvement of optometrists within telehealth services. Their scope of practice expanded beyond mere referral creation, and data collection during in-person services, to providing continued in-person care after consultation. Eight studies reported optometrists delivering primary eye care independently via telehealth, and commonly included with video conferencing.^[15]

BASIC REQUIREMENTS OF TELEMEDICINE^[16]

Telemedicine has benefits through reduced operational costs and less time for the procedure with the following important requirements.

1. INTERNET CONNECTION: The patients and optometrist connect via software of video conferencing, through a secure Internet connection. A basic broadband connection is ideal but some platforms require a 3G connection.

A fast and secure internet connection of a minimum of 10 Mbps for download speed and 5 Mbps for upload speed guarantees smooth video and audio transmission for a successful telehealth consultation. For the fast enough internet speed, an ethernet cable may be a good option to connect to the internet router.^[17]

2. TELEMEDICINE PLATFORM: The service providers need to locate the right platform according to the needs of the patient. So checkpoints are what capabilities are needed for the platform like scheduling, patient queuing and payments along with the customization and integration with Electronic Medical Records the digital data used to support telemedicine and e-health platforms.

Additionally, the service provider should sign a Business Associate Agreement (BAA) to protect healthcare organizations and specify to store patient information on the platform's servers.

Efficient document management is one of the primary requirements of telemedicine. The clinician directory is filled with appointment notes, consultation summaries, patient education, patient profiles, personalized care plans, prescriptions and image storage.^[18]

3. TECHNOLOGY SECURITY AND ITS COMPLIANCE:

Care should be taken to protect patient information even during telehealth virtual visits with a secure and sound-proof environment. Providers should also ensure the proper protection of patient health information through the Health Insurance Portability and Accountability Act (HIPAA)-1996 as it requires covered health plans and providers to comply with HIPAA rules for all telehealth services.

The use of security features has its value like end-to-end encryption the industry-standard SSL (secure sockets layer) and TLS (transport layer security) protocol are the communication rule that allows computer systems to talk to each other on the internet safely. Such certificates allow web browsers to identify and establish encrypted network connections and Advanced Encryption Standard (AES) 256 is the most secure encryption algorithm that works as a symmetric block cipher that uses a 256-bit key to encrypt and decrypt messages.

The core principle of telemedicine is communication and its properties include comments or bi-directional text messaging broadcast messages, file transfer, group calls, group chat etc. The importance of such properties helps if the eye care personnel cannot attend to the patient due to any technical reason, then text messages are sent to the

concerned eye care personnel with queries and upcoming meetings.^[18]

A good documentation system in a telemedicine setting is very important, after the appointment, efficient delivery of invoices to the patient and receiving online payments should be faster with the properties of selection of the eligibility verification, reimbursement eligibility and insurance provider management.^[18]

4. TELEMEDICINE HARDWARE, SOFTWARE AND DEVICES: Healthcare organizations come in contact with patients through telehealth platforms which should be able to connect to any device that has an internet connection, a microphone, and a camera. The service providers can choose from a wide range of telemedicine carts and kiosks make enable quick assessment and data transfer to evaluate or diagnose a patient by the wide range of diagnostic tools discreetly and conveniently for patients to access care. The most common devices are blood pressure monitors, digital thermometers, and ultrasound devices. The online scheduling system supports booking online appointments via laptops, tablets and mobile phones. The key points of such software are appointment reminders, patient consultation requests, patient check-in, patient scheduling, specialist referral services, electronic referrals, and telemedicine triage.

The minimum hardware required for telemedicine is a laptop or mobile should be able to perform video calling and connect with the clinic. Therefore some of the necessities are mobile cart systems, wall-mounted access point of care systems (APS), remote monitoring devices, webcams, wearable devices and on-site kiosks.^[16]

A digital camera and microphones are essential tools in telehealth to allow successive virtual meetings to give a feel of a healthcare setting to minimize medical mishaps and treatment errors for both eye care professionals and the patient.^[17]

FaceTime and Zoom have a possibility for video conferencing, but the additional telehealth software features include electronic health record (EHR) integration, online appointment booking, encryption security, and reimbursement documentation. Curogram is a HIPAA-compliant patient-engagement solution that ensures all communication between eye care professionals and patients. Popular video conferencing tools such as FaceTime and Zoom are not HIPAA-compliant by default but Apple's FaceTime is a covered entity of HIPAA and is considered a healthcare provider's business associate (BA).^[17]

TELEMEDICINE ADOPTION FOR OPTOMETRY^[19-21]

The timeline highlighting the transformative impact and potential of telemedicine on optometric practice is as follows.

- 1. 1970s-1980s** - Researchers and clinicians are starting to investigate the feasibility of transmitting basic eye examination data like retinal images and visual field tests, through telecommunication networks with store and forward mechanisms.
- 2. The 1990s** -Teleophthalmology programs emerge for diabetic retinopathy screening, glaucoma management, and remote consultation services, in the rural and underserved regions with limited access to eye care services.
- 3. The early 2000s** - the quality and accessibility of diagnostic imaging by the advancements in digital imaging technology, including retinal cameras and optical coherence tomography devices. The web-based telemedicine platforms were introduced to facilitate secure communication and data sharing between eye care personnel and other healthcare providers.
- 4. 2002** - American Telemedicine Association publishes guidelines for teleophthalmology with recommendations for clinical practice, technology standards, and reimbursement policies for eye care.
- 5. The 2010s** – The expand of tele-optometry service includes consultations for a broader range of specialities and subspecialties like pediatric optometry, low vision rehabilitation, and contact lenses. The additional feature of the Integration of telemedicine was electronic health record (EHR) systems, facilitating streamlined workflow to enhance care coordination between telemedicine service providers and primary eye care practitioners.
- 6. The 2016** - Centers for Medicare & Medicaid Services expands reimbursement against telemedicine services in optometry to bill for remote consultations and virtual check-ups etc. This way policy increases financial incentives for optometrists and adaptivity for telemedicine.
- 7. 2020** - The COVID-19 pandemic accelerates telemedicine adoption across healthcare sectors, including optometry because of restrictions for in-person interactions (social distancing and lockdowns).
- 8. Present and Future** - Telemedicine is continuously advancing, with ongoing efforts to overcome technological obstacles and regulatory hurdles, improving diagnostic precision, prioritizing patient care and optimizing treatment choices and reimbursement challenges, because of the incorporation of artificial intelligence (AI) and machine learning algorithms. Joint research projects and clinical trials on tele-optometry seek to confirm its effectiveness, cost-efficiency, and long-term results, facilitating its broad acceptance and integration into routine practice.

APPLICATION OF TELEMEDICINE IN OPTOMETRY^[22, 23]

The telemedicine platform facilitates remote monitoring of patients with chronic eye diseases, such as glaucoma or age-related macular degeneration. The effective role

of optometrists is to track disease progression and monitor treatment adherence and management strategies for the optimization of patient outcomes. A wide range of applications associated with Telemedicine in optometry to serve patient care, improve access to services, and streamline clinical workflows.

1. The remote consultation is given by the optometrist to address the patient for advice, treatment options, follow-up appointments to the patients, medication schedule and suggestions for non-urgent ocular conditions.
2. The virtual eye examination is performed by video conferencing and digital imaging devices, the tests are basic visual acuity tests, pupil reactions, colour vision tests and external eye evaluations.
3. Retinopathy screening is completed by the capturing of retinal images by the handheld fundus cameras which are further transmitted to ophthalmologists or trained optometrists for interpretation, early detection and intervention to prevent vision loss along with the education program.
4. Low vision rehabilitation teleservices maximize remaining vision and improve quality of life, advised by the optometrist with the assessment of visual function, counselling and training to help patients with assistive devices.
5. Contact lens consultations remotely are served by the optometrist according to patients' visual needs, required type of contact lenses, instructions on lens insertion, removal, and care along with the use of digital imaging technology for the evaluation of corneal curvature (topography) and ocular surface characteristics to ensure proper lens fitting.
6. The optometrist remotely monitors Postoperative follow-up appointments for the patient's ocular surgeries, recovery, and visual outcomes, and addresses any concerns or complications.
7. Optometrists provide personalized guidance and deliver educational resources, counselling sessions, and lifestyle interventions to patients according to their ocular conditions affected by dry eye syndrome, glaucoma, or macular degeneration.
8. Optometrists provide consultation and make referrals of patients to appropriate in-person care if necessary otherwise manage according to the severity of symptoms and triage eye care cases for eye injuries, sudden vision changes, or acute ocular conditions.

BENEFITS OF TELEMEDICINE IN OPTOMETRY^[15, 24-26]

With technological advancements, healthcare landscapes can improve the availability of eye care services across different populations. The significant immense potential in the optometry field is available due to the sufficient availability of eye care professionals to handle the situations in rural and remote areas. Some of the key aspects are.

1. EMPHASIZED ACCESS TO EYE CARE CONSULTATION: Telemedicine reduces the travel time to eye care centres and overcomes geographical barriers, especially for the population of rural and underserved areas. The benefits of the technology include improved visual outcomes and quality of life with timely specialized care and eye exams, diagnostic assessments with treatment, by providing virtual consultation, advice, and counselling.

2. SCREENING AND EARLY DETECTION OF OCULAR ISSUES: Community screening programs can be approached remotely for ocular health like cataracts, glaucoma, diabetic retinopathy, and refractive errors, to cure the risk of vision loss, enabling early detection and intervention to prevent blindness and visual impairment.

3. CONTINUING EDUCATION AND TRAINING IN OPTOMETRY: Telemedicine plays a vital role for optometrists and allied eye care professionals to stay abreast of the latest advancements in eye care practice through continuing education and training along with online learning platforms, webinars, and virtual conferences for knowledge exchange, and skill development.

In the telehealth camp, several data are recorded regarding patient registration, and optometric evaluation including vision check, refraction, slit lamp examination, intraocular pressure estimation, fundus examination and ophthalmologist consultation with patient counselling and spectacle delivery.^[14]

4. TELEREHABILITATION AND LOW VISION SERVICE: It improves the quality of life of individuals, particularly in areas where access is limited to specialized low-vision services, by maintaining low-vision rehabilitation services for visual impairments, including assessment, counselling, training in assistive technologies and adaptive strategies.

5. PUBLIC HEALTH INITIATIVES: Public health programs like blindness control, preventable eye diseases, and eye health awareness in India, are supported by telemedicine in collaboration with government agencies, non-profit organizations, community health workers, school eye health programs, and outreach initiatives targeting underserved populations.

6. TECHNOLOGICAL INNOVATION AND RESEARCH: Telemedicine gives a platform to technological innovation and research work in optometry in coordination with digital imaging devices, and artificial intelligence algorithms. Further, the benefits of research work are intended with the evaluation of the efficacy, feasibility, and cost-effectiveness of telemedicine interventions, informing about evidence-based practice and policy formulation.

7. POLICY AND REGULATORY

FRAMEWORK: The issued guidelines by the Ministry of Health and Family Welfare and professional bodies of Ophthalmic science support Telemedicine for optometry. This framework provides safe, ethical, and quality-driven telemedicine practice standards with licensure requirements, data privacy, and reimbursement mechanisms.

WHAT STUDIES SAYS

Teleophthalmology is often dependent on optometrists and other skilled health workers to capture and transmit patient information. Teleophthalmology can effectively be used for triage, screening, consultation, and remote supervision. One common application in the United States, performed by the optometrist, is screening for diabetic retinopathy.^[27, 28]

A survey by All India Ophthalmological Society (AIOS) includes 1180 responses and among them, 17.5 per cent of eye care experts were found involved with telemedicine service and 98.6 per cent showed their interest in telemedicine services.^[12]

The predominant mode of consultancy in person with the patient is completed by the optometrists through teleophthalmology. Across 19 studies, optometrists play a key role in facilitating referrals, communication, and the implementation of management plans through teleophthalmology services.^[11, 29-46]

In eight studies, tele-optometry was independently utilized by patients and optometrists for comprehensive eye examinations for subjective refractions through digital platforms incorporating video conferencing, seeking consultations from fellow optometrists via tele-optometry, facilitating low-vision rehabilitation via teleconferencing, often with technical support on-site with the patient.^[47-54]

According to a study, occasional instances of alternative collaborative arrangement were noted where technical support acts as intermediaries between optometrists and ophthalmologists as the optometrist took fundus photography for interpretation by technical support of the hospital. This study indicates the optometrists' responsibilities were primarily focused on refractive care.^[40]

Optometry-supported telehealth was predominantly found in general teleophthalmology services, comprising nine of the studies analyzed that indicate the role of optometrists in other subspecialties of teleophthalmology like orbital, anterior and triage of retina. Glaucoma screening through telemedicine is explored in one study. However, These studies highlight the use of videoconference calls with optometrists to facilitate interactions between patients and specialists.^[11, 29, 30-44]

Two studies examined the level of concordance between optometrist clinical findings, evaluated by either an ophthalmologist or another optometrist. With the help of telerehabilitation, optometrists can assist with low vision service with the help of technical assistance with the patient in person.^[47-52, 54]

Teleoptometry was widely used during the pandemic COVID-19 for serving primary eye care, but how it was conducted was not reported there.^[53]

The tele-optometry uses synchronous mode more widely than that of asynchronous as it was defined by the Thirteen included studies divided into eight for synchronous, two for asynchronous and three for mixed format.^[11, 29-33, 39,45, 49-52]

SCOPE OF TELE-OPTOMETRY

The World Report on Vision issued by the WHO (2019) advocates the rise in the availability of eye-care services for counteracting the increase in the prevalence of preventable visual impairment all over the world. The healthcare system in India faces a substantial burden due to avoidable blindness and vision impairment, as the country has the highest number of blind individuals in the world. Optometry is a crucial primary eye-care profession, and during the COVID-19 pandemic, tele-optometry proved effective in numerous areas. These included geriatric and pediatric eye care, early intervention for retinopathy of prematurity, screening and referral, binocular vision, contact lenses, and rehabilitation. For the elderly, tele-optometry facilitated screening and referral for conditions that can cause blindness, such as glaucoma, age-related macular degeneration, and diabetic retinopathy.^[9, 28, 55]

LIMITATIONS

Teleoptometry is in its infancy world widely, and the majority of the population is not aware of the telemedicine service; until the involvement of the people increases. Practitioners and patients are actively adopting telehealth services in cities and developed areas to provide and receive remote care respectively for save their time, additional costs and more satisfaction.^[56, 57]

The obvious limitations stem from the fact that expensive medical equipment is only available at clinics or hospitals, necessitating in-person visits for comprehensive testing. However, smartphones with optical and sensory capabilities may be able to conduct eye examinations through their cameras.^[58]

The availability of limited support of optometry services delivered via telehealth, to explain it as it is safe, time-saving, acceptable and cost-effective. Further, there is a lack of policies and protocols for delivering optometry services via telehealth platforms, so globally; There is an immediate need to gather current evidence on the use of optometric care, as none of the studies conducted

included a safety analysis, underscoring the critical necessity for research in this field.

Thus, extensive research is needed to establish safe and effective models for incorporating optometry service delivery via telehealth.

CONCLUSION

As the prevalence of eye-related diseases continues to soar in India, it has become more important than ever to spread awareness of eye diseases and bring more people under the ambit of quality eye care. Tele-ophthalmology can be an essential tool for "reaching the unreached," facilitating more routine eye exams in rural areas and thereby enhancing the detection and treatment of different ocular diseases.

The involvement of optometrists in delivering eye care services through telehealth is quickly growing, offering significant potential and value for many, including the elderly, individuals with disabilities, and those in rural areas lacking in-person optometric support.

Moreover, the regulations and procedures that govern the provision of optometry services through telehealth platforms are few and will be valuable for future study and policy development. By tackling the financial obstacles, more studies will improve the creation of policies and the proper payment of optometric services.

REFERENCES

- Mair F, Whitten P. Systematic review of studies of patient satisfaction with telemedicine. *BMJ*, 2000; 320: 1517–1520.
- Ekeland AG, Bowes A, Flottorp S. Effectiveness of telemedicine: A systematic review of reviews. *Int J Med Inform*, 2010; 79: 736–771.
- Hjelm NM. Benefits and drawbacks of telemedicine. *Great Britain: Royal Society of Medicine Press Limited*, 2005: 60.
- Ryu S. Telemedicine: Opportunities and developments in Member States: Report on the Second Global Survey on eHealth 2009 (Global Observatory for eHealth Series, Volume 2). *Healthc Inform Res*, 2012; 18: 153–155.
- Kalra G, Williams AM, Commiskey PW, et al. Incorporating video visits into ophthalmology practice: A retrospective analysis and patient survey to assess initial experiences and patient acceptability at an academic eye center. *Ophthalmol Ther*, 2020; 9: 549–562.
- Mechanic OJ, Persaud Y, Kimball AB. Telehealth systems. 2020. Available at <https://www.ncbi.nlm.nih.gov/books/NBK459384> (last accessed October 12, 2020).
- Burton MJ, Ramke J, Marques AP, et al. The Lancet Global Health Commission on Global Eye Health: Vision beyond 2020. *Lancet Glob Health*, 2021; 9: e489–e551.
- Woodward MA, Ple-Plakon P, Blachley T, et al. Eye care providers' attitudes towards tele-ophthalmology. *Telemed J E Health*, 2015; 21: 271–273.
- Sreelatha OK, Ramesh SV. Teleophthalmology: Improving patient outcomes? *Clin Ophthalmol*, 2016; 10: 285–295.
- Kurji K, Kiage D, Rudnisky CJ, Damji KF. Improving diabetic retinopathy screening in Africa: Patient satisfaction with teleophthalmology versus ophthalmologist-based screening. *Middle East Afr J Ophthalmol*, 2013; 20: 56–60.
- Host BK, Turner AW, Muir J. Real-time teleophthalmology video consultation: An analysis of patient satisfaction in rural Western Australia. *Clin Exp Optom*, 2018; 101: 129–134.
- Vikram Thaploo. Eyeing for a better tomorrow with Tele-Ophthalmology Services in rural areas, September 18, 2022, 12: 33 PM IST Vikram Thaploo in Voices, India, Lifestyle, TOI.
- Telemedicine and Eye Care, <https://prasadnetralaya.com/telemedicine-and-eye-care-all-you-need-to-know>.
- apollothealth.com/telehealth-services/tele-ophthalmology
- Jessica Massie et. al. The Role of Optometry in the Delivery of Eye Care via Telehealth: A Systematic Literature Review, *Telemed J E Health*, December 2022; 28(12): 1753–1763. doi: 10.1089/tmj.2021.0537, PMID: 35612473
- What Are the Requirements for Telemedicine? <https://letstalkinteractive.com/blog/what-are-the-requirements-for-telemedicine>, Posted: August 01, 2022.
- blog.curogram.com/telehealth-tech-requirements.
- Samikshan Sarkar, Telemedicine System Requirements, selecthub.com/telemedicine/telemedicine-system-requirements.
- Anawade P A, Sharma D, Gahane S (March 12, 2024) A Comprehensive Review on Exploring the Impact of Telemedicine on Healthcare Accessibility. *Cureus*, 16(3): e55996. doi: 10.7759/cureus.55996
- Sonu Bhaskar et. al. Telemedicine as the New Outpatient Clinic Gone Digital: Position Paper From the Pandemic Health System REsilience PROGRAM (REPROGRAM) International Consortium, *Front Public Health*, 2020; 8: 410. doi: 10.3389/fpubh.2020.00410, PMID: 33014958 <https://doi.org/10.1177//doi.org/10.1177/25158414221123526>
- Justine H. Pidgeon, Mahesh K. Bhardwaj, Patrick Titterington, Karen Latulippe, Shiyong Roh and David J. Ramsey, Assessing optometric care delivered by telehealth during the COVID-19 public health emergency, journals.sagepub.com/home/oed 1, 2022; 14: 1–10, DOI: 10.1177/25158414221123526.

22. Eye Care from Anywhere: 5 Benefits of Virtual Eye Exams, <https://tenovi.com/telemedicine-for-eye-care>.
23. Raffaele Nuzzi, Davide Bovone, Fabio Maradei, Paolo Caselgrandi, and Alessandro Rossi. Teleophthalmology Service, Organization, Management, Actual Current Applications, and Future Prospects, 2021 | Article ID 8876957 | <https://doi.org/10.1155/2021/8876957>
24. prasadnetralaya.com/telemedicine-and-eye-care-all-you-need-to-know
25. Mark A. Chia and Angus W. Turner. Benefits of Integrating Telemedicine and Artificial Intelligence Into Outreach Eye Care: Stepwise Approach and Future Directions. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8982071/> Front Med (Lausanne), 2022; 9: 835804, Published online 2022 Mar 11. doi: 10.3389/fmed.2022.835804, PMID: 35391876.
26. What are the Advantages of Telemedicine?, October 18th, 2018, <https://digitaloptometrics.com/what-are-the-advantages-of-telemedicine>.
27. Sandhu P, de Wolf M. The impact of COVID-19 on the undergraduate medical curriculum Med Educ Online, 2020; 25: 1764740.
28. Organization WHO. World report on vision World report on vision, 2019.
29. Bartnik SE, Copeland SP, Aicken AJ, Turner AW. Optometry-facilitated teleophthalmology: An audit of the first year in Western Australia. Clin Exp Optom, 2018; 101: 700–703.
30. Johnson KA, Meyer J, Yazar S, Turner AW. Real-time teleophthalmology in rural Western Australia. Aust J Rural Health, 2015; 23: 142–149.
31. Nguyen AA, Baker A, Turner AW. On-call telehealth for visiting optometry in regional Western Australia improves patient access to eye care. Clin Exp Optom, 2020; 103: 393–394.
32. O'Day R, Smith C, Muir J, Turner A. Optometric use of a teleophthalmology service in rural Western Australia: Comparison of two prospective audits. Clin Exp Optom, 2016; 99: 163–167.
33. Turner A, Copeland SP, Aicken AJ. Optometry-facilitated videoconference uptake in Western Australia following introduction of new MBS item numbers. Clin Exp Optom, 2016; 44: 42.
34. Tahhan N, Ford BK, Angell B, et al. Evaluating the cost and wait-times of a task-sharing model of care for diabetic eye care: A case study from Australia. BMJ Open, 2020; 10: e036842.
35. Owsley C, Rhodes LA, McGwin G Jr., et al. Eye Care Quality and Accessibility Improvement in the Community (EQUALITY) for adults at risk for glaucoma: Study rationale and design. Int J Equity Health, 2015; 14: 135.
36. Sapru S, Berkthold J, Crews JE, et al. Applying RE-AIM to evaluate two community-based programs designed to improve access to eye care for those at high-risk for glaucoma. Eval Progr Planning, 2017; 65: 40–46.
37. Hanson C, Tennant MTS, Rudnisky CJ. Optometric referrals to retina specialists: Evaluation and triage via teleophthalmology. Telemed J E Health, 2008; 14: 441.
38. Verma S, Arora S, Kassam F, et al.. Northern Alberta remote teleglaucoma program: Clinical outcomes and patient disposition. Can J Ophthalmol, 2014; 49: 135–140.
39. Verma M, Raman R, Mohan R. Application of teleophthalmology in remote diagnosis and management of adnexal and orbital diseases. Indian J Ophthalmol, 2009; 57: 381–384.
40. de Bont A, Bal R. Telemedicine in interdisciplinary work practices: On an IT system that met the criteria for success set out by its sponsors, yet failed to become part of every-day clinical routines. BMC Med Inform Decis Mak, 2008; 8: 47.
41. de Mul M, de Bont AA, Reus NJ, et al.. Improving the quality of eye care with tele-ophthalmology: Shared-care glaucoma screening. J Telemed Telecare, 2004; 10: 331–336.
42. Keenan J, Shahid H, Bourne RR, et al.. Cambridge community Optometry Glaucoma Scheme. Clin Exp Ophthalmol, 2015; 43: 221–227.
43. Kern C, Fu DJ, Kortuem K, et al.. Implementation of a cloud-based referral platform in ophthalmology: Making telemedicine services a reality in eye care. Br J Ophthalmol, 2020; 104: 312–317.
44. Ghazala FR, Dall'Ozzo S, McGowan G, Livingstone IAT. Teleophthalmology-enabled direct vitreoretinal surgery listing from community optometric practice: Enhanced efficiency during coronavirus disease 2019, and beyond? Telemed J E Health, 2021; 27: 816–819.
45. Giorgis AT, Alemu AM, Arora S, et al.. Results from the first teleglaucoma pilot project in Addis Ababa, Ethiopia. J Glaucoma, 2019; 28: 701–707.
46. Zapata MA, Arcos G, Fonollosa A, et al.. Telemedicine for a general screening of retinal disease using nonmydriatic fundus cameras in optometry centers: Three-year results. Telemed J E Health, 2017; 23: 30–36.
47. Smythe JL. Teleoptometry: Contact lens consultation via the internet [Dissertation]. Forest Grove, OR: College of Optometry, Pacific University, 1999.
48. Randhawa H, Morettin C, McLeod H, et al.. The validity of spectacle prescriptions via tele-optometric comprehensive eye examinations; a pilot study. Invest Ophthalmol Vis Sci, 2020; 61: 1604.
49. Ihrig C. Steps to offering low vision rehabilitation services through clinical video telehealth. J Visual Impairment Blindness, 2016; 110: 441–447.
50. Ihrig C. Rural healthcare pilot clinic: Low vision clinical video telehealth. Optometry Educ, 2014; 40: 14–17.

51. Ihrig C. Travel cost savings and practicality for low-vision telerehabilitation. *Telemed J E Health*, 2018; 25: 649–654.
52. Bittner AK, Yoshinaga P, Bowers A, et al.. Feasibility of telerehabilitation for low vision: Satisfaction ratings by providers and patients. *Optom Vis Sci*, 2018; 95: 865–872.
53. Karthikeyan KS, Nandagopal P, Suganthan VR, Nayak A. Challenges and impact of COVID-19 lockdown on Indian optometry practice: A survey-based study. *J Optom*, 2020; 15: 145–153.
54. Patel J, Morettin C, McLeod H, et al.. Patient experience of tele-optometry in the comprehensive eye examination; a pilot study. *Investig Ophthalmol Vis Serv*, 2020; 61: 1596.
55. Nicola M, Alsafi Z, Sohrabi C, Kerwan A, Al-Jabir A, Iosifidis C, et al The socio-economic implications of the coronavirus pandemic (COVID-19): A review *Int J Surg*, 2020; 78: 185–93
56. Kruse CS, Krowski N, Rodriguez B, et al.. Telehealth and patient satisfaction: A systematic review and narrative analysis. *BMJ Open*, 2017; 7: e016242.
57. Thiyagarajan A, Grant C, Griffiths F, Atherton H.. Exploring patients' and clinicians' experiences of video consultations in primary care: A systematic scoping review. *BJGP Open*, 2020. DOI: 10.3399/bjgpopen20X101020.
58. Telemedicine And Eye Care <https://prasadnetralaya.com/telemedicine-and-eye-care-all-you-need-to-know>.