

# Article • Patient-Reported Satisfaction with a Novel, Tele-Optometric Comprehensive Eye Exam

Jaymeni Patel, OD • Illinois College of Optometry • Chicago, Illinois

Christina E. Morettin, OD • Illinois College of Optometry • Chicago, Illinois

Elizabeth Wyles, OD • Illinois College of Optometry • Chicago, Illinois

Kimberly Fazio, OD • Illinois College of Optometry • Chicago, Illinois

Harneet K. Randhawa, OD • Illinois College of Optometry • Chicago, Illinois

Leonard V. Messner, OD • Illinois College of Optometry • Chicago, Illinois



**Jaymeni Patel, OD**

Chicago, Illinois

Assistant Professor of Optometry, ICO

Assistant Dean for Community Based Education and International Programs, ICO

Ocular Disease and Primary Care Residency, ICO, 2017

OD, ICO, 2016

BS in Biology and Psychology, University of Illinois at Chicago, 2012

DigitalOptometrics tele-optometric examination was comparable to that for the gold-standard, in-person comprehensive eye examination.

**Conclusions:** Our data suggests that the initial reported patient satisfaction was positive or comparable to that for an in-person comprehensive eye examination, supporting our hypothesis.

**Keywords:** patient satisfaction, telehealth, tele-optometry

## ABSTRACT

**Background:** Technology is becoming a pivotal component of day-to-day tasks, and its implementation in healthcare must be thoroughly investigated. This study aimed to compare the DigitalOptometrics tele-optometric examination experience to the traditional in-person comprehensive eye examination with post-examination satisfaction surveys.

**Methods:** This study included 30 optometry students who were enrolled at the Illinois College of Optometry (ICO). Participants with active ocular pathology or a history of ocular surgery in the past 90 days were excluded. A tele-optometric comprehensive eye examination via the DigitalOptometrics platform was performed, and participants were provided with a post-examination survey. This was followed by an in-person comprehensive eye examination, and participants were provided with the same post-examination survey. After the completion of both examinations, participants were asked to complete a final satisfaction survey comparing the examinations.

**Results:** Statistical analysis using Fisher analysis concluded that patient-reported satisfaction for the

## Introduction

With advances in technology and limitations in access to care, alternate methods of healthcare delivery and their impact on patient care must be considered. Advances in technological development allow us to deliver healthcare remotely via tele-medicine. Introducing tele-medicine in practices can allow access in areas with limited health care due to doctor availability and accessibility and increase compliance with follow-up care. Tele-optometry can be considered as a means to deliver eyecare in areas where healthcare would otherwise be difficult to obtain, such as rural and underserved areas.<sup>1</sup> While there may be hurdles to overcome to employ this new method of healthcare delivery, its benefits are abundant. Numerous studies have shown that tele-ophthalmology addresses patients' healthcare concerns and has higher patient satisfaction as it saves time and costs.<sup>2-7</sup> Previous studies suggest that factors leading to non-compliance with follow-up visits can be eliminated with tele-medicine.<sup>6,7</sup> DigitalOptometrics tele-optometry system can be used to address not only the ocular health concerns that a patient may have but also visual system issues related to their refractive system or binocular vision. This study aimed to evaluate tele-optometry and various components of an optometric eye examination.

The World Health Organization (WHO) announced the public health emergency related to coronavirus

disease 2019 (COVID-19) in 2020.<sup>7</sup> Healthcare delivery methods needed to be altered to address the rampant spread of COVID-19. Eyecare providers' proximity to patients during examinations was found to be a challenge during the COVID-19 pandemic.<sup>6,8</sup> Providers were found to be at high risk due to the close contact during slit lamp examination.<sup>4,6</sup> Globally, there was an increase in demand for face masks, shields, goggles, and protective barriers on equipment. Telehealth was essential as personal protective equipment (PPE) was limited and the virus continued to spread.<sup>9</sup> With the increase in utilization of tele-optometry to decrease patient-doctor exposure, elements of the examination including patient satisfaction needed to be evaluated.

This study aimed to evaluate the DigitalOptometrics tele-optometry platform versus the traditional, in-person comprehensive eye examination. The data reported comes from post-examination and post-study surveys.

## Methods

Thirty optometry students from the Illinois College of Optometry participated in the study. Those with active ocular disease or a history of ocular surgery within the last 90 days were excluded. The study was approved by the institutional review board (IRB) at the Illinois College of Optometry, and it adhered to the tenets of the declaration of Helsinki. Written and verbal consent were obtained from all participants.

Participants completed two comprehensive eye examinations. Both eye examinations included entering visual acuities, objective and subjective manifest refraction, baseline binocular vision testing, baseline accommodative testing, anterior and posterior segment evaluation, and intraocular pressure. First, the tele-optometric comprehensive eye examination was completed by an in-person technician, a remote refracting technician via the DigitalOptometrics platform, and videoconferencing with an investigator optometrist. The tele-optometric examination used a 14-second Reichert® slit lamp video recording to evaluate the anterior segment and the Eidon ultra-widefield retinal photographer to evaluate the posterior segment. This was then followed by the gold standard in-person comprehensive eye examination, performed by another optometrist. The in-person examination used traditional slit lamp examination methods as well as dilation with 2.5% phenylephrine and 1% tropicamide. Dilated fundus examination was completed with 90D biomicroscopy and binocular indirect ophthalmoscopy (BIO). Intraocular pressure

(IOP) measurements were taken via non-contact tonometry (NCT) by an in-person technician for the telehealth exam, while the gold standard exam used Goldmann applanation tonometry (GAT) with Fluress and was performed by the investigator optometrist.

A Likert-scale survey was provided to participants at the conclusion of each examination type. Participants were asked whether their concerns were addressed, whether they were satisfied with their care, and to rate the quality of each examination. At the conclusion of the study, participants were given another Likert-scale survey with various questions comparing the two study types to pinpoint specific areas of the exam with which they may have been dissatisfied. Two blinded clinicians independently reviewed and compared the examination findings between the tele-optometric examination and the in-person examination to determine whether the two examinations were equivalent in various categories. The survey findings were compared, and meta-analysis of results was completed via Fisher's method.

## Results

There were 9 males and 21 females in the study, and the mean age of the participants was 24.7 years, ranging from 22-33 years old. All 30 patients completed all three surveys. On a 3-point Likert scale, about 96.67% (29/30) believed that the tele-optometric examination addressed their concerns, while the remaining 3.33% (1/30) were neutral. Eighty percent (24/30) of tele-optometric participants were satisfied with their care, while 20% (6/30) were neutral; none were dissatisfied. Seventy-three percent (22/30) rated the quality of the examination as positive, 23.3% (7/30) neutral, and 3.3% (1/30) negative. All participants were provided with the same survey following the in-person examination. One hundred percent (30/30) of the participants believed that the in-person examination addressed their concerns, 100% (30/30) were satisfied with the care that they received, and 100% (30/30) rated examination quality positively. As neutral was not a discriminating factor for positive or negative experiences, neutral responses were omitted from statistical calculations. Using Fisher analysis,  $p \approx 1$  for all three questions in Table 1. Preliminary analysis indicated no statistically significant difference between the 2 examinations based on concerns addressed, satisfaction, and quality of examination given  $p > 0.05$ . Within the limits of our pilot study, the results support the null hypothesis of non-inferiority.

**Table 1. Post-Traditional In-Person Examination and Tele-Optometry Examination Survey Questions and Results**

|   | In-Person Examination |               |                | Tele-Optometry Examination |                   |                |
|---|-----------------------|---------------|----------------|----------------------------|-------------------|----------------|
| The examination addressed my concerns.                    | Agree<br>100%         | Neutral<br>0% | Disagree<br>0% | Agree<br>96.67%            | Neutral<br>3.33%  | Disagree<br>0% |
| I am thoroughly satisfied with the care I received today. | Agree<br>100%         | Neutral<br>0% | Disagree<br>0% | Agree<br>80%               | Neutral<br>20%    | Disagree<br>0% |
| Rate the quality of the exam you had today.               | Agree<br>100%         | Neutral<br>0% | Poor<br>0%     | Agree<br>73.33%            | Neutral<br>23.33% | Poor<br>3.33%  |

**Table 2. Post-Study Survey Statements and Results**

|  |                    |                        |                     |
|--|--------------------|------------------------|---------------------|
| It was a concern that you did not have the optometrist in the examination room today.                                  |                    |                        |                     |
| Agree<br>36.7%   | Neutral<br>36.7%   | Disagree<br>26.6%      | Not answered<br>0%  |
| I would recommend tele-optometric comprehensive eye examination to my friends and/or family members.                   |                    |                        |                     |
| Agree<br>36.7%   | Neutral<br>40%     | Disagree<br>23.3%      | Not answered<br>0%  |
| Would you be more likely to return for a tele-optometric or in-person for your annual comprehensive eye examination?   |                    |                        |                     |
| Tele-optometric<br>10%   | In-person<br>90%   | Not answered<br>0%     |                     |
| I am in favor of having digital images attached to my health record.   |                    |                        |                     |
| Agree<br>100%  | Neutral<br>0%      | Disagree<br>0%         | Not answered<br>0%  |
| Technology will improve the quality of medical care.   |                    |                        |                     |
| Agree<br>80%   | Neutral<br>20%     | Disagree<br>0%         | Not answered<br>0%  |
| Technology will result in poor doctor-patient relationships.   |                    |                        |                     |
| Agree<br>36.7%   | Neutral<br>43.3%   | Disagree<br>20%        | Not answered<br>0%  |
| What is the likelihood that you would choose an optometrist offering tele-optometric exams over those that do not?     |                    |                        |                     |
| Agree<br>16.7%   | Neutral<br>40%     | Disagree<br>43.3%      | Not answered<br>0%  |
| Please answer the following questions regarding comparisons between tele-optometric and in-person office examinations. |                    |                        |                     |
| a. Overall quality of the visit.   |                    |                        |                     |
| Tele-optometric<br>0%  | In-person<br>70%   | No difference<br>10%   | Not answered<br>20% |
| b. Personal connection I feel with the clinician.  |                    |                        |                     |
| Tele-optometric<br>0%  | In-person<br>73.3% | No difference<br>6.7%  | Not answered<br>20% |
| c. Confidence my ocular concern is being taken care of.  |                    |                        |                     |
| Tele-optometric<br>0%  | In-person<br>52.3% | No difference<br>26.7% | Not answered<br>20% |
| d. Comfort I feel sharing personal or private information.   |                    |                        |                     |
| Tele-optometric<br>0%  | In-person<br>53.3% | No difference<br>26.7% | Not answered<br>20% |
| e. Amount of time I spend with my clinician.   |                    |                        |                     |
| Tele-optometric<br>10%   | In-person<br>56.7% | No difference<br>13.3% | Not answered<br>20% |

Table 2 outlines the results of the survey provided at the conclusion of the visit to determine areas of concern that the participant may have had. The following questions were presented via the Likert-scale survey to the 30 participants:

1. It was a concern that you did not have an optometrist in the room with you today: 36.67% (11/30) of patients felt that this was of concern, 36.67% (11/30) of patients remained neutral, 26.67% (8/30) of patients did not find the lack of an optometrist in the room to be of concern.
2. I would recommend the tele-optometric examination to my family and friends: 36.67% (11/30) of patients felt that they would recommend the examination to family and friends, 40% (12/30) remained neutral, and 23.3% (7/30) reported that they would not recommend to family or friends.
3. Would you be more likely to return for an in-person eye examination or a digital eye examination for your future annual exam: 90% (27/30) reported that they would prefer to report for an in-person examination, and 10% (3/30) would prefer to report for a tele-optometric examination.
4. I am in favor of having digital images attached to my health record: 100% (30/30) of participants felt that it was a benefit to have their digital fundus images and slit lamp recordings attached to their health records.
5. Technology will improve the quality of medical care: 80% (24/30) agreed with this statement, while 20% (6/30) were neutral.
6. Technology will result in poor doctor-patient relationships: 36.67% (11/30) agreed with this statement, 43.33% (13/30) remained neutral, and 20% (6/30) disagreed with this statement.
7. What is the likelihood that you would choose an optometrist that offers tele-optometric examinations over one that does not: 16.67% (5/30) reported that they would be likely to seek an optometrist who is affiliated with a telehealth examination, 43.33% (13/30) reported that they would not be likely to seek tele-optometric care, and 40% (12/30) were neutral.

Despite overall satisfaction with both types of exams, as outlined in Table 1, there were some areas of concern that participants had, outlined in Table 2. Participants had concerns about the telehealth exam as it pertained to the optometrist not being in the room during the examination. The concerns also

highlighted that the telehealth examination may lead to poor doctor-patient relationships. Some participants would not recommend a telehealth exam to family, and a majority preferred to return for an in-person examination. These questions were presented to find out whether there were reasons for dissatisfaction and whether further alteration of the telehealth model needed to be investigated. Statistical analysis was not completed on these questions, although it is evident that there are still concerns about the telehealth examination that need to be addressed when implementing this mode of examination.

## Discussion

Technology is rapidly evolving, and its integration in healthcare delivery needs to be evaluated continually. Various platforms, including the DigitalOptometrics platform used in this study, allow optometrists to maintain a similar test sequence to that of a traditional in-person examination. Components of the examination can be completed with this novel delivery method without having to compromise patient care. This study demonstrated that the overall satisfaction with the tele-optometric eye examination is comparable to the traditional in-person eye examination, based on results shown in Table 1.

However, the survey outline in Table 2 allowed us to address areas with which participants were dissatisfied. Overall, more patients felt that it was of concern versus no concern that an optometrist was not present in the room during the digitally administered examination. Increasing the time spent with the virtual optometrist could ensure that all concerns are addressed while still allowing for a distance examination. This would potentially decrease a patient's apprehension with the optometrist not physically being present in the room during the examination. Interestingly, more people reported that they would recommend the examination to a friend than those who would not, despite finding it of concern that there was not an optometrist in the room. Following up with why they would not recommend it could help us address this issue and possibly increase the number of those who would recommend a tele-optometric examination.

More participants were likely to return for an in-person eye examination over a digital eye examination for future annual examinations. The data suggests that this cohort is less likely to seek out tele-optometric care, but both survey questions may be influenced by the patient cohort. Optometry students are future optometrists and may have innate biases towards

an in-person examination versus tele-optometric examination. These questions may provide more useful data when asked of a general patient population. In addition, the ease with which the participant was able to complete the in-person examination may be influenced by the cohort of healthy optometry students, who require less troubleshooting.

Given the average age of the patients of 24.7 years old, the level of exposure to technology may have influenced participants being in favor having digital images attached to their health records. A younger patient population may be more in tune with technology and digital imagery. This is likely why a majority also agreed that technology will improve the quality of medical care. More people agree that having digitally administered examinations will negatively affect the patient-doctor relationship than those who do not despite believing that technology will improve the quality of medical care. There are some inconsistencies in answers as it pertains to technology and its effect on healthcare.

The post-study survey that included the five questions in Table 2 directly compared the two types of examinations, and there was a clear preference for the in-person examination. Unfortunately, as a forced-choice question, and given the biases due to the study participants being optometric students, this portion of the survey did not support the patient satisfaction seen in the first survey questions. This would need to be re-evaluated prior to phase 2 of the study.

Telehealth may play a role in patient compliance with yearly eye examinations due to convenience. While dilation should not be deferred in all patients, we can consider using photos for healthy individuals periodically. Ramchandran et al. found motivational barriers with dilated fundus examinations.<sup>10</sup> As dilating drop side effects would not be an issue, patients could resume their normal activities immediately after their examination. This could potentially promote yearly examination and increase compliance to care.

If overall patient satisfaction is reached, we can increase compliance with examinations and consider expanding outreach to underserved populations.<sup>1,5,10,11</sup> Tele-optometry can be considered for communities that would otherwise be left without optometric care. The opportunity to see patients remotely in rural areas and the decrease in travel time, costs, and unnecessary referrals has deemed tele-medicine to be invaluable.<sup>6,7</sup>

As we continue to use telehealth during the COVID-19 pandemic, it is another avenue to consider to protect providers and patients from spreading the

virus, especially in community-acquired outbreaks.<sup>12,13</sup> Patients who are concerned about risks related to COVID-19 can now be seen by a remote optometrist to decrease exposure time face-to-face. In addition, it allows optometrists to save and regulate use of personal protective equipment for cases that must be seen in person. Bhuvu et al. found that 87% of participants had no issues with a tele-medicine examination for spine physical medicine and rehabilitation, and 67.4% of participants would choose to have their follow-up via tele-medicine.<sup>14</sup> In a study done by Gerbutavicius et al., all video-consulted patients stated that they would recommend a video consultation approach to others.<sup>4</sup> When reviewing tele-medicine across various professions, patient satisfaction was commonly found to be positive.<sup>2-4,14-21</sup>

As technology varies, satisfaction can vary with the ease of use of the platform. Some studies found that challenges related to technology influence the satisfaction results of their study.<sup>4,8,22</sup> Gerbutavicius et al. had tech issues in 9 of their 29 examinations and were unable to complete those 9 examinations.<sup>4</sup> Poor image qualities, slow Wi-Fi speed in rural areas, and software issues were all identified in a study done by Chong et al.<sup>8</sup> Further studies evaluating newer technology that may have been released since this study was conducted need to be considered.

Limitations of the study include our cohort size, gender, career aspirations, and age. Currently enrolled optometry students may have vested interest in in-person comprehensive care and biases against tele-optometry. The average age of participants may play a role in acceptance to technology, as the participants grew up with technology as a part of their everyday lives. In addition, the exclusion criteria limited the study to healthy individuals, which can impact satisfaction with the examination as most results were positive. A larger, more appropriate study population with fewer exclusion factors than this initial pilot is necessary to ensure consistency in findings and to allow for more thorough analysis of patient-reported satisfaction.

Patient satisfaction is a crucial component in ensuring that telehealth can be successful. Within the limits of our initial pilot study, the results support the null hypothesis of non-inferiority for the tele-optometric examination versus the traditional in-person optometric examination as it pertains to patient satisfaction. The positive outcome when comparing the gold-standard, in-person examination to a tele-optometric study shows that its utilization can be

beneficial. As technology continues to advance, we can expect to see tele-optometry continue to grow.

## Conclusion

Patient satisfaction is a key component in ensuring that patients are receptive of this novel healthcare delivery. With the integration of technology in various professions, tele-optometry will continue to be adopted, not only for disease management or in rural areas, but also for comprehensive eye examinations. Our data suggests that initial experiences of patient-reported satisfaction were positive or comparative to that of an in-person, gold-standard comprehensive eye examination, supporting our hypothesis based on questions asked in Table 1. Additional survey questions asked in Table 2 indicate that patients still may have concerns with the telehealth exam despite believing that the technology will have a positive impact on their health. Further research, with a larger cohort of varying ages, fewer restrictions on pathology, and additional questions to pinpoint patients' concerns, is required to further evaluate patient satisfaction in all types of patients.

## Acknowledgements: DigitalOptometrics

## References

1. Sreelatha OK, Ramesh SV. Teleophthalmology: Improving patient outcomes? Clin Ophthalmol 2016;10:285-95.
2. Alwabili AA, Alotaibi EA, AlE'ed AA, Alqunibut I, Alotaibi OA. Measurement of patient satisfaction with the trend of virtual clinics during the COVID-19 pandemic. Cureus 2021;13(6):e16016.
3. Donelan K, Barreto EA, Sossong S, Michael C, et al. Patient and clinician experiences with telehealth for patient follow-up care. Am J Manag Care 2019;25(1):40-4.
4. Gerbutavicius R, Brandlhuber U, Gluck S, Kortum GF, et al. [Evaluation of patient satisfaction with an ophthalmology video consultation during the COVID-19 pandemic]. Ophthalmologie 2020;117(7):659-67.
5. Liu Y, Torres Diaz A, Benkert R. Scaling up teleophthalmology for diabetic eye screening: Opportunities for widespread implementation in the USA. Curr Diab Rep 2019;19(9):74.
6. Satgunam P, Thakur M, Sachdeva V, Reddy S, Rani PK. Validation of visual acuity applications for teleophthalmology during COVID-19. Indian J Ophthalmol 2021;69(2):385-90.
7. Bursell SE, Brazionis L, Jenkins A. Telemedicine and ocular health in diabetes mellitus. Clin Exp Optom 2012;95(3):311-27.
8. Chong JC, Tan CHN, Chen DZ. Teleophthalmology and its evolving role in a COVID-19 pandemic: A scoping review. Ann Acad Med Singap 2021;50(1):61-76.
9. Calton B, Abedini N, Fratkin M. Telemedicine in the time of

- coronavirus. J Pain Symptom Manage 2020;60(1):e12-e4.
10. Ramchandran RS, Yilmaz S, Greaux E, Dozier A. Patient perceived value of teleophthalmology in an urban, low income US population with diabetes. PLoS One 2020;15(1):e0225300.
11. Ayatollahi H, Nourani A, Khodaveisi T, Aghaei H, Mohammadpour M. Teleophthalmology in practice: Lessons learned from a pilot project. Open Med Inform J 2017;11:20-8.
12. Nikolaidou A, Tsaousis KT. Teleophthalmology and artificial intelligence as game changers in ophthalmic care after the COVID-19 pandemic. Cureus 2021;13(7):e16392.
13. Saleem SM, Pasquale LR, Sidoti PA, Tsai JC. Virtual ophthalmology: Telemedicine in a COVID-19 era. Am J Ophthalmol 2020;216:237-42.
14. Bhuvu S, Lankford C, Patel N, Haddas R. Implementation and patient satisfaction of telemedicine in spine physical medicine and rehabilitation patients during the COVID-19 shutdown. Am J Phys Med Rehabil 2020;99(12):1079-85.
15. 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(1):129-34.
16. Kruse CS, Krowski N, Rodriguez B, Tran L, et al. Telehealth and patient satisfaction: A systematic review and narrative analysis. BMJ Open 2017;7(8):e016242.
17. Labiris G, Fanariotis M, Christoulakis C, Petounis A, et al. Teleophthalmology and conventional ophthalmology using a mobile medical unit in remote Greece. J Telemed Telecare 2003;9(5):296-9.
18. Mohammadpour M, Heidari Z, Mirghorbani M, Hashemi H. Smartphones, tele-ophthalmology, and VISION 2020. Int J Ophthalmol 2017;10(12):1909-18.
19. Orrange S, Patel A, Mack WJ, Cassetta J. Patient satisfaction and trust in telemedicine during the COVID-19 pandemic: Retrospective observational study. JMIR Hum Factors 2021;8(2):e28589.
20. Paul PG, Raman R, Rani PK, Deshmukh H, Sharma T. Patient satisfaction levels during teleophthalmology consultation in rural South India. Telemed J E Health 2006;12(5):571-8.
21. Ramaswamy A, Yu M, Drangsholt S, Ng E, et al. Patient satisfaction with telemedicine during the COVID-19 pandemic: Retrospective cohort study. J Med Internet Res 2020;22(9):e20786.
22. Rose S, Hurwitz HM, Mercer MB, Hizlan S, et al. Patient experience in virtual visits hinges on technology and the patient-clinician relationship: A large survey study with open-ended questions. J Med Internet Res 2021;23(6):e18488.

---

*Correspondence regarding this article should be emailed to Jaymeni Patel, OD at [jpatel@ico.edu](mailto:jpatel@ico.edu). All statements are the authors' personal opinions and may not reflect the opinions of the representative organization, OEPF, Optometry & Visual Performance, or any institution or organization with which the authors may be affiliated. Permission to use reprints of this article must be obtained from the editor. Copyright 2023 Optometric Extension Program Foundation.*

Patel J, Morettin CE, Wyles E, Fazio K, Randhawa HK, Messner LV. Patient reported satisfaction with a novel, tele-optometric comprehensive eye exam. Optom Vis Perf 2023;11(1):58-63.

---