



Telemedicine for Retinal Disease During the COVID-19 Pandemic: Survey of the Patient Perspective

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ABSTRACT

Introduction: Amidst the COVID-19 pandemic, telemedicine has emerged as a safe and cost-effective alternative to traditional ophthalmology clinic visits. This study evaluated patient attitudes towards telemedicine at a full-service, retina-only practice to identify areas for growth in implementation.

Methods: A survey was distributed to established patients at University Retina and Macula Associates following the completion of a telemedicine encounter in July 2021. On a 5-point Likert scale, patients compared telemedicine to in-person visits for six domains: ability to ease COVID-related anxiety, efficiency, patient education, quality of care, fulfillment of personal needs, and convenience. Pearson's χ^2 and

Fisher's exact test were used to assess correlations between demographic factors and patient attitudes or preference towards telemedicine.

Results: Among 103 respondents, two-thirds (68.7%) preferred in-person compared to telemedicine encounters. Overall, patients had a neutral attitude towards telemedicine [mean Likert rating (SD) = 3.11/5 ± 0.82]. Questions assessing "patient education" and "telemedicine efficiency" received the greatest proportion of positive and negative responses, respectively. Positive attitudes were more frequent among patients with prior telemedicine experience (87.5%) compared to never-users (71.8%; $p = 0.046$). Patients ≥ 75 years old tended to negatively assess telemedicine regarding reduction of COVID-19-related anxiety, efficiency, patient education, and physician facetime ($p < 0.05$ for all). A positive but non-significant trend was observed between higher education level and positive attitude towards telemedicine ($p = 0.18$). Telehealth never-users more often negatively rated receiving adequate facetime with the physician virtually (54.7%) compared to prior users (25.6%; $p = 0.004$). Younger age, prior history of telemedicine use, and higher education level were associated with increased preference for telemedicine ($p < 0.05$ for all).

Conclusion: Our findings revealed hesitance remains among patients towards adoption of telemedicine. Targeting age-, experience-, and education-related barriers will be invaluable for

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increasing acceptance of this healthcare delivery model.

Keywords: COVID-19; Patient satisfaction; Preference; Telemedicine; Retinal care

Key Summary Points

This article summarily describes the results of a survey assessing patient perspectives towards telemedicine for retinal disease.

Overall, patients had a neutral attitude towards virtual visits.

Factors such as older age, lower educational attainment, and telemedicine inexperience negatively affected patient attitudes.

Patients felt most positively about telemedicine and patient education and most negatively about perceived inefficiencies of the technology.

Telemedicine provides ophthalmologists the ability to better adapt to uncertainties in the current clinical landscape; nonetheless, additional work is indicated to ensure satisfaction with care among patients of diverse backgrounds.

INTRODUCTION

The global coronavirus disease 2019 (COVID-19) pandemic has tremendously altered the clinical landscape, requiring rapid adaptations in healthcare delivery. Ophthalmology, a largely outpatient-based medical specialty, has been forced to adjust to a healthcare crisis laden with uncertainty. Compared to the pre-pandemic period, ambulatory outpatient visits declined by 79% as non-emergent patient visits were rescheduled and clinic workflows were disrupted [1]. Despite innovations in the provision of patient care, an 18% decrease in predicted outpatient volume was observed by the end of 2020 [2].

Considering these challenges, telemedicine has become an invaluable tool for ophthalmologists striving to evaluate and manage patients while simultaneously conforming to social distancing guidelines. Indeed, multiple investigations have reported a rapid acceleration of practice adoption of this alternative care model [3–6].

The opinions of clinicians towards this trend have been queried extensively. In general, reports have indicated positive provider attitudes towards telemedicine and a preference towards its continued use [7–9]. Comparatively, patient attitudes regarding virtual encounters in ophthalmology are less well characterized. Prior investigations have noted patients welcomed the ability to receive persistent care during the pandemic with factors such as ease of use, inexpensiveness, and decreased wait and travel time affecting their satisfaction [10–12]. Nonetheless, significant concerns remain regarding the patient-physician relationship and the potential for medical errors [13, 14]. Furthermore, barriers to the uptake of telemedicine among specific sociodemographic populations have been identified [15].

Despite previous investigations, further description of patient attitudes towards telemedicine in ophthalmology is required to appropriately identify disparities and ensure satisfaction with its continued adoption in the post-COVID era. Additionally, the management of chronic retinal conditions would benefit immensely from the sustained use of telemedicine [16–18]. Therefore, the aim of our study was to characterize patient attitudes towards telemedicine for retinal disease and explore factors associated with satisfaction and preference.

METHODS

Study Design

This cross-sectional study constituted an electronic survey at University Retina and Macula Associates (University Retina), a multi-provider, retina-only practice with several offices in southwest Illinois. Survey respondents were

established patients previously seen by one of the providers at University Retina. Patients who had never been evaluated at the practice or been seen by an ophthalmologist in general were excluded. Patients provided verbal consent, responses were not coerced, and patients were able to terminate participation in the survey at any point. No stipend was provided for participation. Institutional review board approval was exempt, as this study did not obtain identifying information, and all subject data were recorded anonymously. This study adhered to the Declaration of Helsinki.

Data Collection

A 14-item questionnaire (SurveyMonkey®) was distributed to patients following completion of a telemedicine encounter between the dates July 8, 2021, and July 22, 2021. This questionnaire was structured to assess patient satisfaction with their virtual visit in six domains: ability to ease anxiety of contracting COVID-19 (1 question), efficiency (1 question), patient education (1 question), quality of care (2 questions), fulfillment of personal needs (2 questions), and convenience (1 question). Responses were recorded using a 5-point Likert scale (strongly disagree, disagree, neutral, agree, and strongly agree; 1–5). Patients were additionally queried to determine preference for telemedicine encounters relative to standard in-office visits. Finally, patients with prior telemedicine experience were asked if they would use telemedicine again in the future. The complete list of survey questions is available in Supplementary Material.

Patient demographic information collected included age, gender, highest level of education attained, knowledge of diagnosis, and previous history of telemedicine use.

Outcome Measures

The primary outcome measure was the attitude regarding telemedicine in our patient population. A numerical value was calculated as the average of the ordinal responses from Likert scale across all questions. For example, if a

patient answered “strongly agree” for all eight Likert-scale questions, their individual attitude was calculated as 5. Attitudes were reported as an ordinal variable, with a “positive” attitude defined as ≥ 4 average Likert rating for all questions. Negative attitudes were defined as ≤ 2 . All other attitudes were considered to be “neutral.”

Statistical Analysis

Frequencies of positive attitudes were compared across demographic factors by Pearson's χ^2 or Fisher's exact test, where appropriate. Similar analysis was employed to evaluate demographic factors associated with patient preference for telemedicine compared to in-person visits. All statistical analyses were performed using GraphPad Prism 9 (San Diego, CA), with the level of significance set at $p < 0.05$.

The internal consistency of the distributed questionnaire was assessed using Cronbach's α . Using a power (π) of 0.80, with a β error of 0.20, approximately 88 observations were required to detect a hypothesized modest effect (Cohen $w = 0.3$) of binary characteristics (gender, education [high school or lower vs. beyond high school], knowledge of diagnosis, prior experience with telehealth) on the attitude of patients (positive or neutral/negative) towards telemedicine and approximately 80 observations were required to detect a more robust effect ($w = 0.5$) between different age groups. Therefore, a target of 88 patients was determined for our sample size.

RESULTS

Patient Demographics

In total, 103 patients completed a telemedicine visit at University Retina and Macula Associates and completed the survey. Their demographic data are summarized in Table 1. Of all respondents, 54.4% ($n = 56$) were female. Ages of respondents varied: 25–34 (1.0% [$n = 1$]), 35–44 (1.0% [$n = 1$]), 45–54 (10.7% [$n = 11$]), 55–64 (20.4% [$n = 21$]), 65–74 (35.0% [$n = 36$]), and

Table 1 Demographic characteristics of 103 adult patients who participated in telemedicine encounters at University Retina and Macula Associates

Characteristic	n (%)
Female	56 (54.37%)
Age (years)	
25–34	1 (0.97%)
35–44	1 (0.97%)
45–54	11 (10.68%)
55–64	20 (20.39%)
65–74	36 (34.95%)
≥ 75	33 (32.04%)
Highest level of education	
Did not complete high school	7 (6.8%)
High school	48 (48.6%)
Some college	11 (10.68%)
Bachelor's degree	26 (25.24%)
Master's degree or other graduate degree	11 (10.68%)
Knowledge of diagnosis	
No	41 (39.81%)
Yes, macular degeneration	40 (38.83%)
Yes, diabetic retinopathy	22 (21.36%)
Prior history of telehealth usage	
No	64 (62.14%)
Yes	39 (37.86%)

≥ 75 (32.0% [$n = 33$]). The highest level of education completed by most respondents was high school (46.2% [$n = 48$]), followed by college (25.5% [$n = 26$]), some college (10.7% [$n = 11$]), master's or other graduate-level degree (10.7% [$n = 11$]). Seven respondents (6.8%) did not finish high school.

At their virtual visit, 39.8% ($n = 41$) of respondents were unaware of their specific diagnosis, 38.8% ($n = 40$) were aware of their diagnosis of age-related macular degeneration, and 20.4% ($n = 21$) were aware of their

diagnosis of diabetic retinopathy. Nearly two-thirds (62.1% [$n = 64$]) of patients had no prior history of using telemedicine.

Patient Attitudes and Associated Factors

Collectively, patients had a net neutral attitude towards telemedicine (mean Likert rating \pm standard deviation [SD] = 3.11 ± 0.82 ; Cronbach's $\alpha = 0.837$); 18.4% ($n = 19$) of patients felt positively overall, 9.7% ($n = 10$), felt negatively, and 71.8% ($n = 74$) felt neutral.

Attitudes varied significantly across certain demographic groups (Table 2). Stratification of attitude by age revealed that patients ≥ 75 years old were significantly *less* likely to report a positive attitude towards telemedicine ($\chi^2 = 11.7$, $p = 0.003$). Additionally, there was a positive but statistically non-significant correlation between higher education level and positive attitude towards telemedicine ($p = 0.18$); a positive attitude was not observed in any of the seven respondents who did not complete high school. Conversely, 36.4% ($n = 4$) of patients with master's or other graduate-level degrees possessed a positive attitude, which constituted the highest proportion of positive attitudes for any group by educational attainment. No correlation was observed between attitude and gender of the patient or knowledge of diagnosis ($p = 0.5$ and $p = 0.46$, respectively). Likewise, the specific retinal diagnosis did not influence the frequency of positive attitudes ($p = 0.29$). However, prior history of telemedicine use correlated with a positive overall attitude ($\chi^2 = 3.97$, $p = 0.046$). The frequency of positive attitudes across various demographic factors is displayed in Fig. 1. All questionnaire response data are provided in Table 3.

Domains of Telemedicine

Responses to individual questions are shown in Fig. 2. Questions related to telemedicine's ability to allow for "patient education" garnered the greatest proportion of positive responses ("agree" or "strongly agree"; 63.1% [$n = 65$]). By contrast, the topic of virtual encounter "efficiency" received the greatest proportion of

Table 2 Associations of patient demographics and positive attitude towards telemedicine

	Positive attitude, <i>n</i> (%)	Neutral attitude, <i>n</i> (%)	Negative attitude, <i>n</i> (%)	<i>p</i> value*
Age				0.003
25–64 years	12 (35.3%)	21 (61.8%)	1 (2.9%)	
64–74 years	6 (16.7%)	27 (75.0%)	3 (8.3%)	
≥ 75 years	1 (3.0%)	26 (78.8%)	6 (18.2%)	
Gender				0.50
Female	9 (16.1%)	43 (76.8%)	4 (7.1%)	
Male	10 (21.3%)	31 (66.0%)	6 (12.8%)	
Education level				0.18 [†]
Did not complete high school	0 (0%)	6 (85.7%)	1 (14.3%)	
High school	6 (12.5%)	34 (70.8%)	8 (16.7%)	
Some college	2 (18.2%)	9 (81.8%)	0 (0.0%)	
Bachelor’s degree	7 (26.9%)	18 (69.2%)	1 (3.8%)	
Master’s degree or other graduate degree	4 (36.4%)	7 (63.6%)	0 (0.0%)	
Knowledge of diagnosis				0.46
No	9 (22.0%)	29 (70.7%)	3 (7.3%)	
Yes, macular degeneration	5 (12.5%)	28 (70.0%)	7 (17.5%)	
Yes, diabetic retinopathy	5 (22.7%)	17 (77.3%)	0 (0.0%)	
Prior history of telehealth usage				0.046
No	8 (12.5%)	47 (73.4%)	9 (14.1%)	
Yes	11 (28.2%)	27 (69.2%)	1 (2.6%)	

**p*-values reflect differences in proportion of positive attitudes and non-positive (neutral and negative) attitudes (Pearson’s χ^2 or Fisher’s exact test, where appropriate)

[†]Due to the limited sample size, patient education was aggregated into > high school education and ≤ high school education when reporting statistics

negative responses (“disagree or “strongly disagree”, 63.1% [*n* = 65]). The most polarizing question assessed the “convenience” of telehealth, with 38.8% (*n* = 40) responding either “strongly agree” or “strongly disagree” to the question.

When examined by patient characteristics, there were statistically significant differences in attitude to individual questions depending on patient age. Individuals > 75 years more often responded negatively to questions concerning

telemedicine’s reduction of COVID-related anxieties, efficiency of virtual visits, patient education, and facetime with a physician (all *p* < 0.05).

Furthermore, level of education significantly influenced the proportion of positive and negative responses to specific questions. Patients educated beyond high school had a greater likelihood of positively assessing their physician’s ability to virtually educate patients (75% [*n* = 36]; *p* = 0.03).

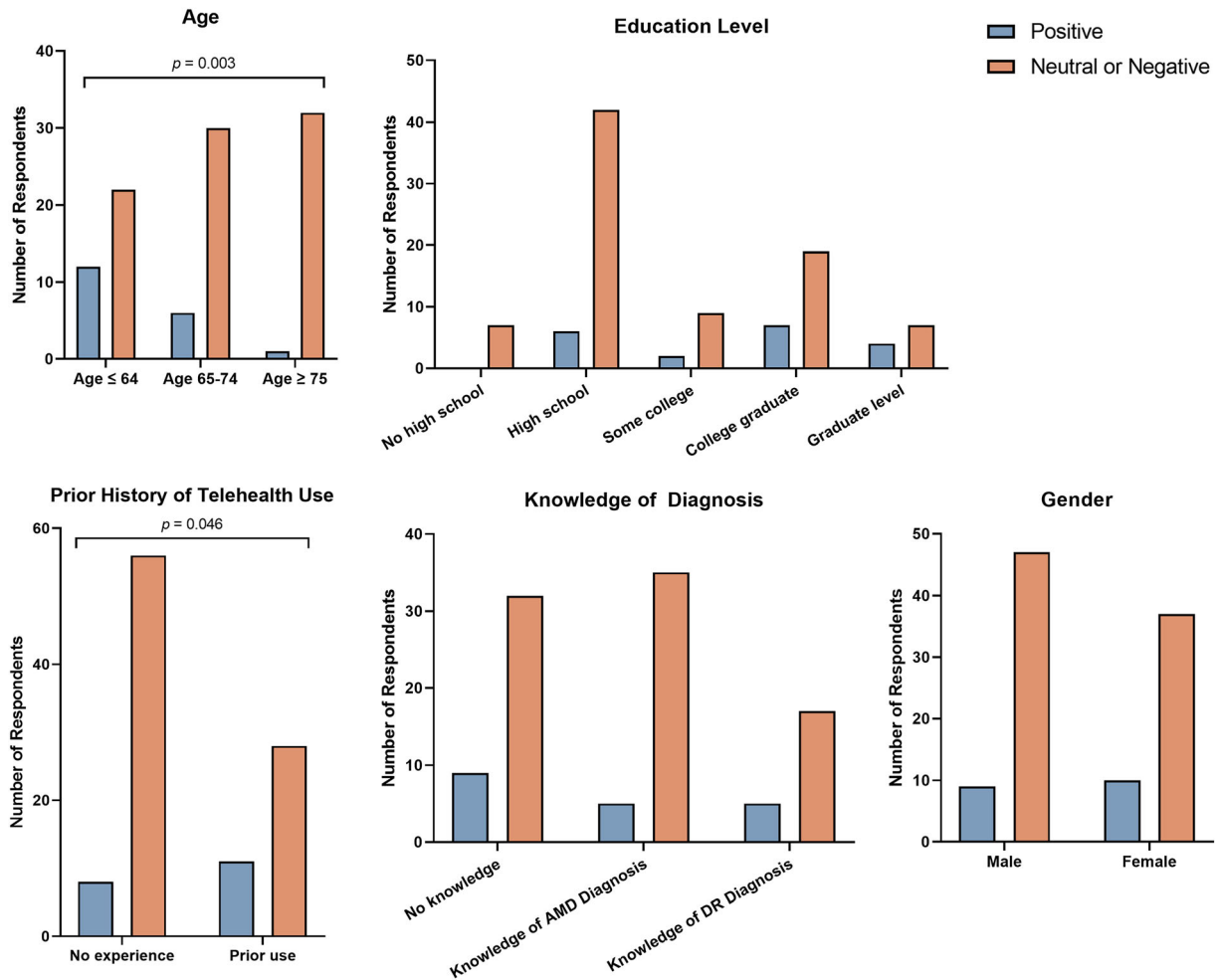


Fig. 1 Frequency of positive attitudes across various demographic factors

Patient history with telemedicine was similarly a significant factor in determining positive attitude, specifically regarding the topic of “fulfillment of needs.” Relative to patients with no prior history of telemedicine usage, those with experience more often reported receiving adequate virtual facetime with the physician (74.4% [$n = 29$] vs. 45.3% [$n = 29$]; $p = 0.004$).

Factors Associated with Preference for Telemedicine

Across all 103 patients, only 32 (31.37%) indicated that they prefer telemedicine to an in-person visit for ophthalmic care. Among the 39 patients with prior telemedicine experience, 26 (66.7%) would schedule another virtual visit.

Univariate analysis was performed to examine associations between demographic factors and preference for telemedicine (Table 4). Younger age was the strongest associated factor, with patients < 75 years old exhibiting significantly greater preference for telemedicine (41.4% [$n = 29$]) compared to patients ≥ 75 (12.1% [$n = 4$]; $p = 0.003$). Furthermore, education beyond high school (some college, bachelor’s, or graduate degree) was associated with increased preference for telemedicine ($\chi^2 = 5.66$; $p = 0.017$). Prior history of telemedicine was a positive factor, with 43.6% ($n = 17$) of prior users exhibiting a preference for telemedicine compared to 25% ($n = 16$) of never-users. There was no correlation between

Table 3 Patient telemedicine survey responses

Domain	Survey question	Mean Likert rating \pm SD
Ease of COVID-related anxiety	I believe that a telehealth visit would ease my worries about being exposed to other potentially sick patients during this pandemic	3.33 \pm 1.27
Efficiency	I believe that a telehealth visit would be more efficient than a standard in-person visit	2.56 \pm 1.18
Patient education	I believe that the doctor would be able to explain things in a way that is easy to understand during a telehealth visit	3.46 \pm 1.25
Quality of care	I believe that I will receive a thorough assessment during a telehealth visit	2.84 \pm 1.14
	I believe that I would receive the same care during a telehealth visit compared to a standard in-person visit	2.68 \pm 1.20
Fulfillment of personal needs	I believe that I will have enough facetime with my physician during a telehealth visit	3.35 \pm 1.06
	I believe that I will be able to address all of my concerns effectively during a telehealth visit	3.21 \pm 1.15
Convenience	I believe a telehealth visit would be more convenient than a standard in-person visit	3.45 \pm 1.38

patient gender and knowledge of diagnosis and preference for telemedicine ($p > 0.05$ for both).

DISCUSSION

Our study found that patients had a neutral attitude towards telemedicine for retinal care, highlighting the substantial potential for growth. An examination of underlying factors revealed that the oldest group of patients possessed significantly greater concerns with telemedicine, particularly in the areas of reducing their COVID-related anxieties, efficiency of visits, patient education, and physician facetime. In addition, these oldest patients tended to prefer telemedicine less frequently than their younger counterparts. Although the vast majority of patients did not prefer telemedicine, preference was greater with younger age, prior history of use, and higher education level. Overall, these findings offer valuable insights into the perspectives of patients seeking virtual retinal care during the COVID-19 pandemic.

Future efforts to enhance satisfaction are crucial as telemedicine becomes increasingly integrated into our contemporary healthcare system.

Historically, direct patient-physician communication via telemedicine has been underutilized in ophthalmology [19]. Before the COVID-19 pandemic, telehealth was primarily incorporated asynchronously through the “store-and-forward” model, whereby clinical data are collected electronically and then transmitted to another site for specialist evaluation [20–22]. However, with the expansion of Medicare payment for services to telemedicine, as well as innovations in telemedicine infrastructure, telemedicine’s role has shifted towards the delivery of synchronous ophthalmic care [6, 23]. Indeed, within weeks of Medicare regulatory changes that established reimbursement parity for virtual and in-person encounters, telehealth usage increased by 400% [24]. Furthermore, the proportion of claims representing telehealth services increased from 1 to 25% [24]. Although the long-term prospects of telemedicine in ophthalmology remain uncertain,

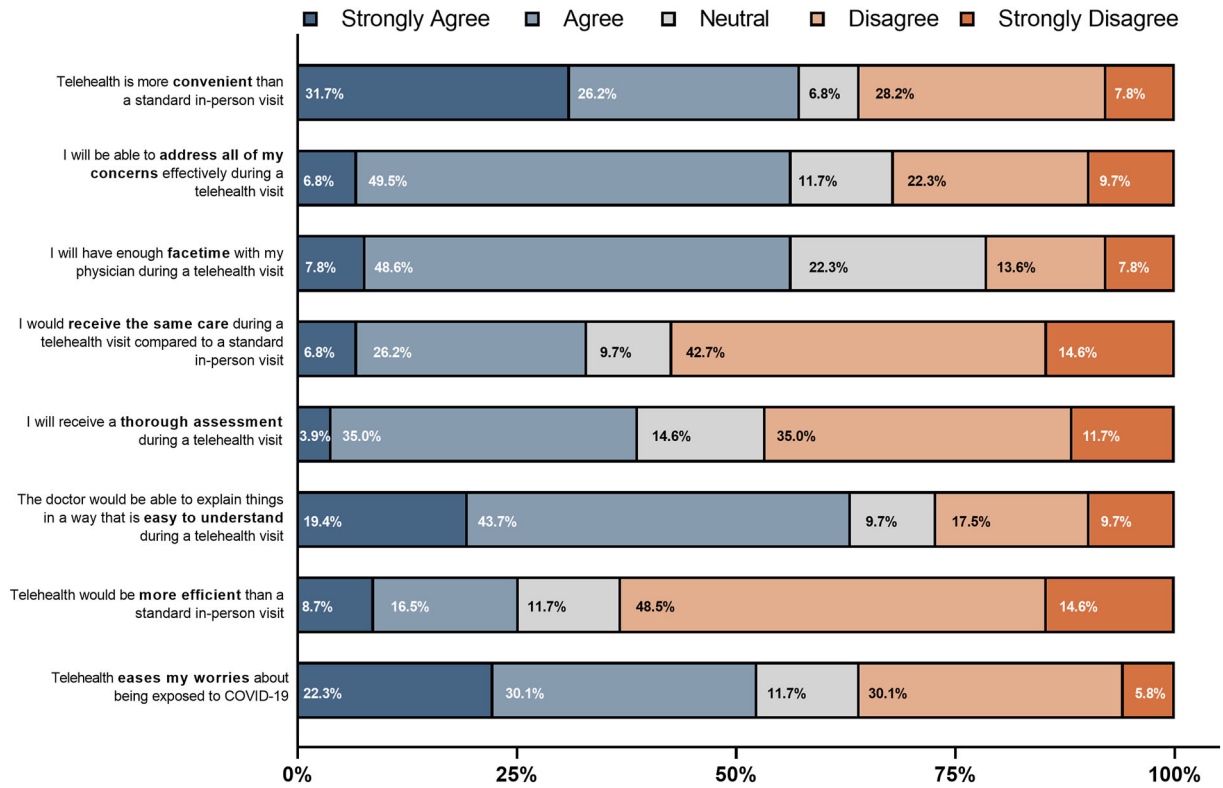


Fig. 2 Responses to individual questions assessing satisfaction with various domains of telemedicine

Table 4 Factors associated with preference for telemedicine

Factor	Statistical test	Correlation statistic	p value*
Age ≥ 75	Fisher exact	8.85	0.003
Gender	Pearson χ^2	0.20	0.654
Education level	Pearson χ^2	5.66	0.017
Knowledge of diagnosis	Pearson χ^2	0.65	0.421
History of telehealth use	Pearson χ^2	3.85	0.05

*Significant results bolded for clarity

our findings suggest a significant role for this method of care delivery in the future [25]. While surveyed patients had a net neutral attitude, factors such as prior experience, greater

level of education, and younger age were associated with improved perceptions. Particularly for visits where imaging is not necessary, telehealth could address barriers to care including transportation costs and concerns of disease exposure [26].

Nonetheless, uptake of telemedicine among certain demographics is limited [15, 27], a concern that mandates further review. Older patients in our sample had significantly poorer opinions related to telemedicine compared to other groups. Similarly, investigations of phone and video-call usage among practices during the COVID-19 pandemic have illustrated older age is related to a substantially decreased likelihood of completing a video-based appointment. Comparatively, completion of telephone-based visits did not demonstrate a negative association with age, indicating barriers in access to devices capable of video teleconferencing and gaps in technological literacy are important considerations for the achievement of equitable care [15]. Increasing age is inversely

correlated with internet access and ownership of devices such as laptops and smartphones [28]. Technological literacy, furthermore, has been cited as an important factor limiting usage of telemedicine. Studies involving elderly populations have demonstrated that inexperience with the requisite technology was frequently reported as a primary obstacle to the acceptance of telemedicine [29, 30]. Other concerns affecting uptake include generational differences in perspectives towards healthcare technology and sensory deficits that hinder accessibility [31, 32].

With current technologies, visualization of the posterior segment is significantly more difficult compared to visualization of the anterior segment. Accordingly, the use of telemedicine within the field of retina has been limited relative to other subspecialties, such as cornea [33]. However, there is significant utility for the adoption of telemedicine for management of chronic retinal conditions, particularly to identify early progression of disease. When implemented in the primary care setting, tele-screening for retinal diseases increased rates of evaluation among traditionally underserved communities [17]. Economically, such programs represent a significantly more efficient use of resources when compared to routine in-person visits [34]. Thus, as a modality of healthcare delivery, telemedicine provides the opportunity to substantially expand coverage of patients who would otherwise be underdiagnosed.

Addressing barriers to telehealth is an arduous endeavor that will mandate extensive consideration of systemic issues affecting patients. Among individuals with poor technological literacy, such as the elderly, strategies to increase uptake include education targeted to local community establishments and utilization of non-electronic media (e.g., newspapers, flyers, etc.) [35]. Bridging virtual and traditional encounters through the adoption of hybrid healthcare delivery models would be an additional stride towards developing acceptance of telemedicine. This platform would be useful to acquire ancillary testing including visual fields, optical coherence tomography, and fundus photographs for patients, while simultaneously

minimizing the number of required in-person visits [36, 37]. Besides enhancing perceptions of telemedicine, efforts should be concentrated on reducing the technological gap among disadvantaged populations. Policy changes in the public and private spheres expanding internet access and providing subsidies for devices capable of video teleconferencing may improve long-term engagement.

Because our investigation's primary intention was to preliminarily explore the perception of telemedicine among patients, there are several limitations. First, we did not utilize a validated questionnaire. This would have been difficult to achieve, as the intersection of COVID-19 and telemedicine represents an emerging topic with few standardized measures available. Other limitations, including the study period of approximately one month and small sample size, precluded a more comprehensive analysis of factors (e.g., economic status, disease severity, presence of comorbidities, etc.), influencing patient perceptions of telemedicine. As widespread adoption of clinical video teleconferencing is a nascent trend in ophthalmology, the practice's ability to rapidly scale the technology to comprise a greater number of patients was limited. Furthermore, the patient population in this cohort was largely confined to southwestern Illinois, potentially reducing the generalizability of findings. Nevertheless, patients treated at University Retina and Macula Associates are ethnically and racially diverse, thereby reflecting populations of urban centers. Additionally, although data were collected from multiple sites, we acknowledge these findings may not be applicable to different settings. Finally, new patients presenting to the practice for their initial visit were not encompassed in this analysis. We excluded this subset of patients as, historically, their evaluation via telemedicine has been difficult to achieve because of a necessity to establish rapport and to acquire essential baseline information exclusively available through in-person examination [38, 39].

CONCLUSION

Despite the immense potential that exists for telemedicine, our investigation indicated patients continue to demonstrate hesitance towards its adoption, with factors such as older age, lower educational attainment, and telehealth inexperience affecting perceptions. Considering these groups have traditionally demonstrated reduced levels of technological access and literacy, eliminating the digital divide that promotes negative attitudes towards telemedicine will be invaluable to reducing inequities. Telemedicine offers ophthalmologists the opportunity to better adapt to uncertainties arising from local, national, and global crises; however, significant work is required to ensure patients of all backgrounds are satisfied with their virtual care.

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Compliance with Ethics Guidelines. Institutional review board (IRB) approval was exempt by the Advarra IRB protocol: University Retina and Macula Associates, PC - 2021OPH001, Population Health Analysis/Evaluation of Patient Perspective on Effectiveness of Telehealth visits for patients with Retinal Disease (Pro00054456) on June 10, 2021.

Data Availability. Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

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