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Factors That Affect Telehealth Utilization and In-Person Glaucoma Care During the COVID-19 Pandemic

The sudden emergence of coronavirus disease 2019 (COVID-19) caused significant disruptions to health care delivery. To offset the limited ability to see patients in person, many eye care providers rapidly implemented telehealth services to assess patients remotely, provide health education, and manage eye conditions, including glaucoma.^{1–3} This study evaluated factors that predict which patients with open-angle glaucoma utilized telehealth services and successfully returned for in-person follow-up care after the outbreak of COVID-19.

Included in the study were 1843 patients with open-angle glaucoma who were seen at an outpatient ophthalmology clinic in 2019 and were due for a return examination in the period after the recognized outbreak of COVID-19 on March 15, 2020, through December 31, 2020. Telehealth was offered to any patient who could not be seen in the clinic because of the prevailing public health conditions for both scheduled and problem visits, as appropriate. Services delivered by telehealth included a check of symptoms, refilling of any medication, health education, and assuring future follow-up. Logistic regression was employed to identify factors associated with telehealth utilization and in-person follow-up. All tests were 2-sided, and *P* values of < 0.05 were considered significant (SPSS Statistics 28.0, IBM Corp.).

Telehealth encounters were completed by 823 patients (45%). Most of those encounters were conducted by ophthalmologists (95%) via the telephone (99%). Patients who accessed telehealth did not show any differences in age, sex, race, or disease severity (Table S1, available at www.ophtalmologyglaucoma.org). Patients insured by Medicare (odds ratio [OR], 1.4; 95% confidence interval [CI], 1.0–1.9; *P* = 0.049), who had more severe visual impairment in their worse eye (OR, 1.2; 95% CI, 1.0–1.5; *P* = 0.031), or who had up-to-date visual field testing (OR, 1.3; 95% CI, 1.1–1.6; *P* = 0.004) or disc imaging (OR, 1.6; 95% CI, 1.3–1.9; *P* < 0.001) were more likely to access care by means of telehealth (Table S2, available at www.ophtalmologyglaucoma.org).

In-person follow-up visits were completed by 1249 (68%) patients. Most of these evaluations (98%) were conducted by ophthalmologists. The demographic characteristics are summarized in Table S3 (available at www.ophtalmologyglaucoma.org). Patients with larger cup-to-disc ratios (OR, 2.4; 95% CI, 1.3–4.3; *P* = 0.003), insured by Medicare (OR, 1.8; 95% CI, 1.3–2.6; *P* < 0.001), or who had a prior trabeculectomy (OR, 1.9; 95% CI, 1.2–3.0; *P* = 0.009) or trabeculectomy (OR, 1.6; 95% CI, 1.1–2.3; *P* = 0.011) were more likely to complete an in-person follow-up. Older patients (OR, 0.98; 95% CI, 0.97–1.0; *P* = 0.009), those with prior cyclophotocoagulation (OR, 0.52; 95% CI, 0.28–0.97; *P* = 0.039), or those who had recent visual field testing (OR, 0.23; 95% CI, 0.18–0.28; *P* < 0.001) or disc imaging (OR, 0.54; 95% CI, 0.43–0.67; *P* < 0.001) were less likely to complete an in-person follow-up (Table S2).

To our knowledge, this study is among the first to explore how eye care was delivered to patients with glaucoma after the

recognized outbreak of COVID-19.^{1–3} We determined that patients with more severe open-angle glaucoma, as indicated by a larger cup-to-disc ratio, or a prior history of trabeculectomy or trabeculectomy were more likely to return for in-person care. Notably, older patients were less likely to return for in-person evaluations. One possible explanation for this is that contracting COVID-19 posed a disproportionate risk to older individuals. Additionally, patients who had undergone cyclophotocoagulation were also less likely to return. This procedure is predominantly used to manage end-stage glaucoma. Although many of these individuals may have been at risk of vision loss, they may have had relatively less to gain from in-person evaluation and management under the circumstances of the COVID-19 pandemic.

Patients with glaucoma are known to be at risk of vision loss from loss to follow-up. The outbreak of COVID-19 exacerbated this problem. Before the COVID-19 pandemic, telehealth was used to reach patients with glaucoma in remote or underserved communities, to provide additional time for counseling, or to improve adherence.^{4–7} Although most traditional examination elements are lacking in telehealth encounters, important clinical services and health education can be delivered to reduce the likelihood of experiencing lapses in glaucoma care.

In our study, we found that patients who had recent ancillary testing had an increased utilization rate of telehealth but a lower rate of completing in-person visits. It may be that providers relied on recent visual field testing or optic nerve imaging as an objective way to evaluate the state of glaucoma severity or to assess the risk of its progression. In contrast, those overdue for glaucoma testing would have been prioritized by their providers to return for in-person visits. From the data available, we cannot determine a precise set of criteria governing these management decisions. However, the fact that patients with more severe glaucoma were more likely to receive an in-person evaluation suggests that patients at greatest risk of further vision loss were able to access eye care services when needed throughout the pandemic.

The limitations of our study include its retrospective nature and its restriction to a suburban population from a single academic center, potentially impacting the generalizability of our findings. The data available did not allow us to assess treatment history that was not captured by Current Procedural Terminology codes, such as use of glaucoma medications, or provide information on which patients were offered (or refused) telehealth services. The lack of specificity of the *International Statistical Classification of Diseases, Tenth Revision*, coding for glaucoma in our sample precluded us from using these data to stage the disease. Additionally, clinical outcomes between the groups were not evaluated, given the limited study interval. Finally, changing state-specific guidelines, and the expansion of reimbursement for telehealth services by Medicare, could have potentially affected patients' eligibility or their likelihood to utilize virtual services. The continued use of telehealth on a large scale will likely depend on the extent of coverage for such services, which vary greatly by region.

Our study demonstrates that most patients with open-angle glaucoma who were due for a return evaluation after the outbreak of COVID-19 were able to be cared for through a combination of in-person care and telehealth consultations (Figure 1). This is a very

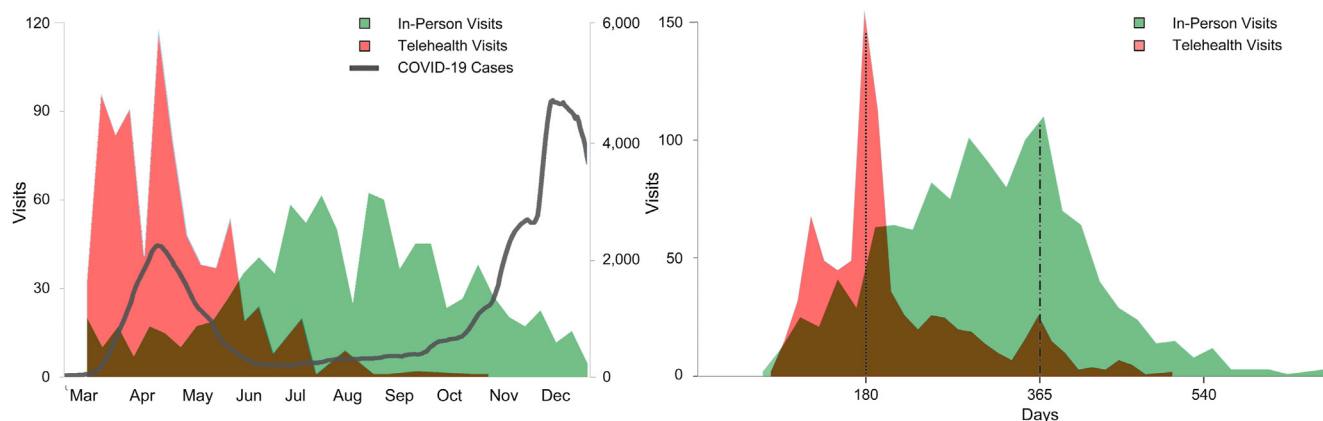


Figure 1. Telehealth and in-person visits completed by patients with glaucoma after the recognized outbreak of coronavirus disease 2019 (COVID-19). **A**, In-person weekly visits to the eye clinic (green) dramatically decreased after the state of emergency for COVID-19 was declared on March 15, 2020, in Massachusetts. Telehealth visits (red) were rapidly implemented during the stay-at-home period ordered by the governor of Massachusetts (COVID-19 Order No. 13, March 23, 2020), and during the subsequent period when prevailing public health measures limited clinic operations. The number of patients with glaucoma seen each week during the study period negatively correlated with the 7-day average number of confirmed cases recorded by the Department of Public Health (gray line, $r = -0.444$; $P = 0.003$). Patients began returning for in-person eye examinations during the summer and fall when local case counts were declining and businesses, including eye care practices, reopened. A second local peak in COVID-19 cases occurred on December 7, 2020 (4779 cases), prompting additional public health measures to be imposed and total clinic visits to decrease again. Relatively few telehealth visits were conducted during this period. This may reflect an expectation that COVID-19 cases would decline once more, permitting in-person care to resume, or may be a response to the development and approval of vaccines effective for the prevention of COVID-19. **B**, Timing of in-person (green) and telehealth visits (red) relative to the last completed ophthalmology visit. Many telehealth visits corresponded to 6-month follow-up visits (43% within 28 days of a 6-month return), whereas more in-person visits corresponded to annual follow-up visits (21% within 28 days of a 12-month return).

encouraging finding because it demonstrates how telehealth can potentially be used to augment the delivery of care to patients with glaucoma beyond the COVID-19 state of emergency. Future studies should seek to determine whether the continued use of telehealth services, especially when combined with visits for ancillary testing, can reduce health care costs and improve patient outcomes.

ALEXANDER HUTHER, MD^{1,2}
SHIYOUNG ROH, MD^{1,2}
DAVID J. RAMSEY, MD, PhD^{1,2}

¹Department of Ophthalmology, Lahey Hospital & Medical Center, Peabody, Massachusetts; ²Department of Ophthalmology, Tufts University School of Medicine, Boston, Massachusetts

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Analysis and interpretation: Ramsey, Roh, Huther

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Abbreviations and Acronyms:

CI = confidence interval; **COVID-19** = coronavirus disease 2019; **OR** = odds ratio.

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Correspondence: David J. Ramsey MD, PhD, MPH, Lahey Medical Center, 1 Essex Center Drive, Peabody, MA 01960. E-mail: david.j.ramsey@lahey.org.

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