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Teleophthalmology Using Remote Retinal Imaging During the COVID-19 Pandemic

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Abstract

Introduction: *Lower insurance reimbursements have limited the financial sustainability of remote eye screening programs. Greater utilization and insurance coverage for teleophthalmology screening during the coronavirus disease 2019 (COVID-19) pandemic in 2020 may enhance awareness and expand remote retinal imaging services. This retrospective cross-sectional study evaluates utilization and insurance coverage for remote retinal imaging in the United States in 2020.*

Methods: *We analyzed teleretinal imaging utilization and insurance payments from January 1 to December 31, 2020, using the Optum Labs Data Warehouse, a comprehensive national database of deidentified administrative claims for commercial and Medicare Advantage enrollees in the United States. We evaluated frequency of claims and insurance payment for services using the Current Procedural Terminology codes 92227 and 92228 for remote eye imaging by any provider, and 92250 for fundus photography by non-eye care providers.*

Results: *The use of remote retinal imaging in the United States declined rapidly during the initial COVID-19 lockdown from 3,627 claims in February 2020 to 1,414 claims in April 2020, but returned to 3,133 claims by December 2020, similar to mean prepandemic levels in 2019 (2,841 ± 174.8 claims). The proportion of insurance payments for remote imaging increased temporarily from 47.4% in February to 56.7% in April, and then returned to 45.9% in December of 2020.*

Discussion: *Utilization of remote retinal imaging declined steeply, while the insurance coverage increased during the initial COVID-19 lockdown in 2020, but returned to prepandemic levels by end of the year. Changes in utilization and relaxed restrictions on insurance reimbursements for teleophthalmology during the COVID-19 pandemic were not sustained.*

Keywords: *ophthalmology, pandemic, telemedicine, telehealth, COVID*

Introduction

The coronavirus disease 2019 (COVID-19) pandemic[1] prompted efforts to reduce person-to-person contact and encourage social distancing and teleworking.[2,3] As a result, the American Academy of Ophthalmology (AAO) recommended suspending nonurgent eye care in March 2020.[4] To encourage the use of telemedicine technologies to deliver health care remotely, the Centers for Medicare and Medicaid Services (CMS) broadened the guidelines in 2020 to enable reimbursements for telehealth services at the same rate as in-person visits.[5] Private payers followed shortly afterward with payment parity between telehealth and in-person visits.[6] Whether these efforts resulted in sustained improvements in telemedicine utilization or insurance coverage is unknown.

Teleretinal imaging allows patients to undergo eye screening at primary care facilities by having fundus photographs captured and sent to an off-site eye care provider for interpretation.[7] Multiple studies have demonstrated that remote retinal imaging can improve rates of diabetic retinopathy (DR) screening and enhance eye care access for underserved populations.[8–13] In addition, teleophthalmology has been used for age-related macular degeneration,[14,15] glaucoma,[16,17] retinopathy of prematurity,[18,19] and military trauma.[20]

Recent advances in camera technology, electronic health record (EHR) integration, and artificial intelligence are improving the efficiency of ophthalmic telehealth. Autofocusing fundus cameras and deep learning-based software can automate DR detection, enhancing speed and workflow to overcome logistic barriers limiting remote eye care.[21–23] However, adoption of these technologies has been modest due to financial, technical, and logistical barriers.

We recently found that while the use of remote retinal imaging increased dramatically over the past decade, insurance coverage has gradually declined.[24] In a study of a remote DR screening program within an integrated health system in California, we also found that only 44.7% of charges for teleophthalmology were paid by noncapitated insurance plans, with most denials indicating remote eye screening as a noncovered benefit.[9]

Disparities in insurance reimbursements may exacerbate inequities in eye health, as DR prevalence is higher in areas with decreased screening capabilities.[25] For example, patients with Medicare Advantage are less likely to receive eye examinations compared with those with commercial insurance.[26] In this study, we examined if the COVID-19 pandemic and Medicare expansion of telemedicine coverage impacted utilization of and insurance reimbursements for remote retinal imaging in 2020.

Methods

DATA SOURCE

We conducted this study using the Optum Labs Data Warehouse (OLDW), which contains deidentified retrospective administrative claims, including medical and pharmacy claims, eligibility information, and EHR data for more than 200 million individuals. The database contains longitudinal health information on enrollees and patients, representing a mixture of ages and geographical regions across the United States.[27] Since this study involved the analysis of preexisting deidentified data, it was exempt from the University of California, Davis, Institutional Review Board. This study was also performed in accordance with the Declaration of Helsinki and in compliance with the Health Insurance Portability and Accountability Act.

STUDY POPULATION

We identified administrative claims in the OLDW database from January 1 to December 31, 2020, using Current Procedural Terminology (CPT) codes for (1) remote eye imaging (92227 and 92228) by any provider and (2) fundus photography (92250) by non-eye care providers, defined as neither an ophthalmologist, optometrist, nor an optician in the provider specialty field, given in *Table 1* as previously described.[24] CPT codes 92227 and 92228 were introduced by the CMS in 2011 for reporting remote imaging for detection (92227) or monitoring (92228) of retinal diseases.

Billing 92227 does not require physician interpretation or documentation of eye disease, and was assigned a total relative value unit (RVU) of 0.40 in 2019. By contrast, 92228 requires both physician report and history of preexisting retinal disease, and has a total RVU of 0.97. Code 92250 has the highest total RVU at 1.43, but unlike the other two CPT codes is not specifically restricted to teleretinal imaging. However, non-eye care providers often utilize this code for billing remote retinal imaging services due to higher reimbursements or unfamiliarity with the newer, more specific billing codes.[28]

PRIMARY OUTCOMES

We analyzed the incidence of administrative claims for remote retinal imaging and payment determination by the insurance payer (paid or denied) by month and CPT code, compared with the mean incidence and payment proportion from 2017 to 2019. Incidence of claims per month was normalized to the total number of insurance claims per month.

Results

UTILIZATION OF TELEOPHTHALMOLOGY

The use of remote eye imaging declined sharply at the time of the initial COVID-19 lockdown in March and April of 2020, with a 61.0% decrease from 3,627 total adjusted claims in February to 1,414 claims in April. All three codes showed a similar decline during this period, from 340 to 113 claims for codes 92227/92228 and 3,287 to 1,300 claims for code 92250. The proportion of claims using codes 92227 and 92228 was similar throughout this period, with 2,184 claims using 92227 and 679 claims using 92228, consistent with the ratio observed across 2011–2020 as reported in our previous study.[24]

In the latter half of 2020, the incidence of claims increased back to 260 claims for 92227/92228 and 2,873 claims for 92250, which were similar to prepandemic means (standard deviation [SD]) of 318.5 (125.3) claims for 92227/92228 and 2363.1 (92.6) claims for 92250 averaged across 2017 to 2019

Table 1. List of Non-Eye Providers for Current Procedural Terminology 92250

NON-EYE PROVIDERS		
Accidental dental/ medical dental	ER services center	Home health/home IV
Licensed practical nurse	Reciprocity specialist	Endodontist
Nuclear medicine	Orthodontist	Therapeutic radiology
Ambulance	Pharmacy	Vascular surgeon
Colon and rectal surgery	Urologist	Nutritionist
Surgicenter	Speech therapist	Podiatrist—non-MD
Dermatologist	Nephrologist	Neonatology
Dentist	Psychologist	Independent laboratory
Chiropractor	Neurosurgeon	Hematologist
Pediatric specialist	Home health	Audiologist
Podiatrist/MD	Rheumatologist	Oncologist
Infectious disease specialist	Allergist	Plastic surgeon
Physical/occupational therapy	Rehabilitation medicine	Medical supply firm
Thoracic surgeon	Orthopedist	Social worker
Hospitalist	Ob/gyn	Pathologist
After hours clinic/urgent care	Gastroenterologist	Pulmonary disease
Family practice specialist	Anesthesiologist	Clinic groups
Internal medicine specialist	Other	Pediatrician
Cardiologist	Otolaryngologist	Emergency medicine
Surgeon	RN, special service	Radiologist
Family practice/clinic	Family practice	Neurologist
Endocrinologist	Psychiatrist	Internist
Special provider agreement		

IV, intravenous; Ob/gyn, obstetrics/gynecology; RN, registered nurse.

(*Fig. 1A, B*). CPT 92250 represented the majority of claims (91.8%) compared with 92227 (6.3%) and 92228 (1.9%), consistent with our prior findings.[24]

INSURANCE REIMBURSEMENTS FOR TELEOPHTHALMOLOGY

The proportion of claims paid for remote imaging increased only temporarily from 47.6% in January to 56.7% in April, but declined back to 45.9% by December 2020. The transient increase was more pronounced for the more specific telehealth codes 92227/92228, which increased from 57.2% in January to 83.1% in April, but decreased to 53.5% in December, similar to the payment proportion (SD) of 56.5% (18.9%) averaged across 2017 to 2019 (*Fig. 1C*). Insurance coverage using fundus photography code 92250 by non-eye care providers also showed a slight increase from 46.8% in January to 54.4% in April before returning to 45.3% in December, even lower than the prepandemic payment proportion (SD) of 63.4% (2.9%) averaged across 2017 to 2019 (*Fig. 1D*).

Discussion

The COVID-19 pandemic in 2020 highlighted the importance of expanding telemedicine to improve eye care access. Although remote retinal imaging provides the advantage of minimizing in-person visits with eye care providers, we found that utilization of these services declined in March and April, corresponding to the initial period of the COVID-19 lockdown and AAO's recommendation to cease nonessential eye care at the time.

Interestingly, adoption of other teleophthalmology services such as virtual or video visits was also disproportionately lower among ophthalmologists than other surgical subspecialties during the pandemic at one academic institution.[29] Although use of teleretinal imaging gradually returned after the initial lockdown period, the utilization rates did not exceed prepandemic levels, indicating no clearly sustained overall increase in utilizing teleophthalmology technologies even as lockdown restrictions were eased.

Despite broadened guidelines for telehealth reimbursements from the CMS during the COVID-19 public health emergency, insurance coverage for remote retinal imaging increased only temporarily in March and April, and largely returned to prepandemic levels by end of the year. CMS expanded telehealth payments for Medicare enrollees under Section 1135 of the Social Security Act from March 1, 2020, which had not yet expired by the end of 2020. Surprisingly, although 92227 and 92228 are telehealth codes in the CPT book, these codes were not included in CMS's list of telehealth services. Nonetheless, the transient increase in claims paid was mostly observed when teleophthalmology screening codes such as 92227 and 92228 were used, while coverage for the nonspecific 92250 billing code for fundus photography by non-eye care providers did not exhibit a significant change during this period.

Ironically, our previous study found that most denied claims from 2011 to 2019 were from Medicare Advantage enrollees rather than commercial enrollees.[24] Such inconsistent insurance coverage for teleophthalmology services, even during the expanded flexibilities for other telemedicine services afforded by the ongoing COVID-19 pandemic, demonstrates the economic challenges of utilizing remote retinal imaging to enhance eye care access.

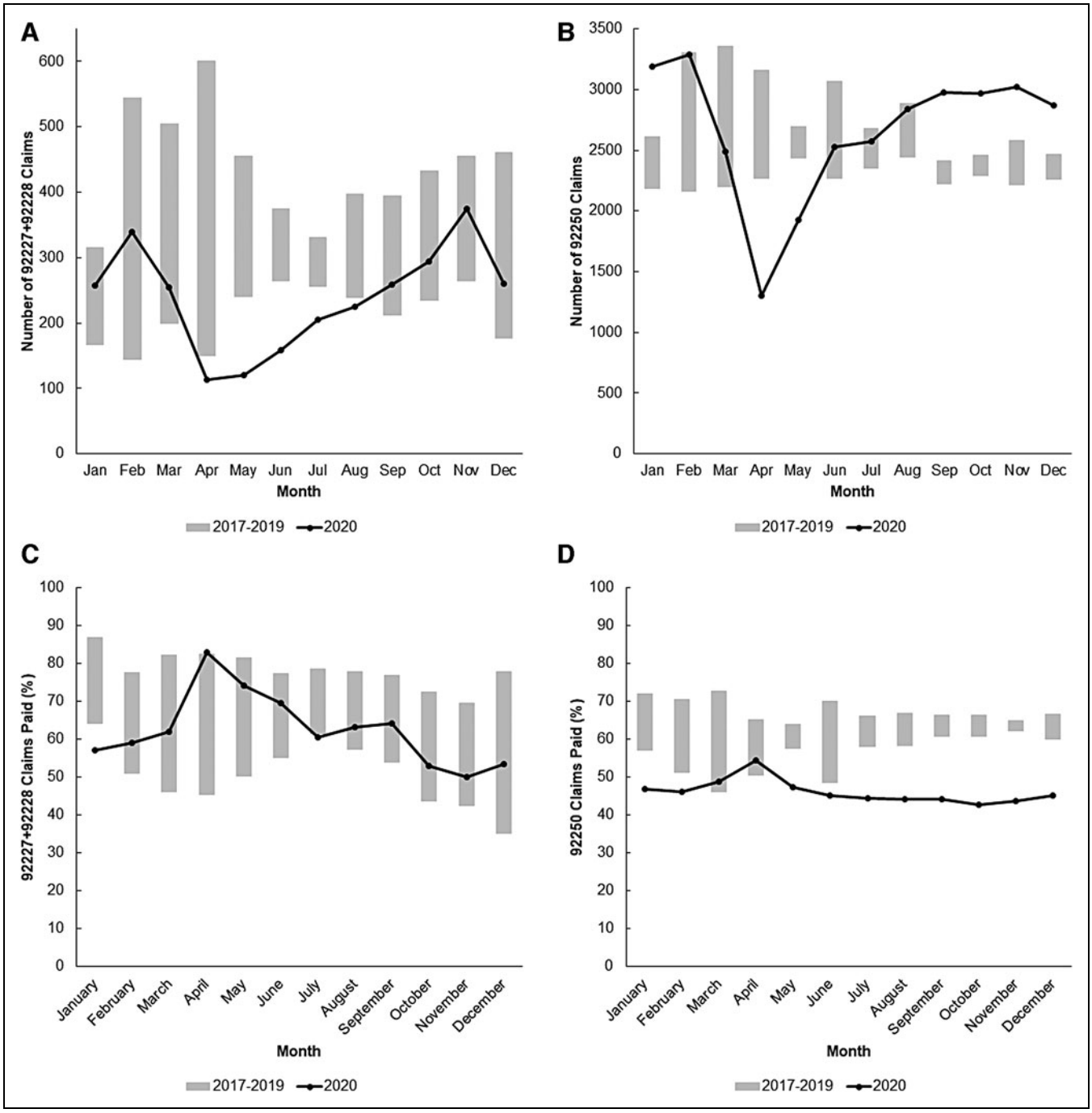

Fig. 1. Utilization of teleophthalmology services over time by diagnosis. Line graphs showing teleophthalmology utilization by month of 2020 for CPT codes **(A)** 92227 + 92228 and **(B)** 92250 and the proportion of approved payments by month for CPT codes **(C)** 92227 + 92228 and **(D)** 92250. Gray-shaded columns indicate 95% confidence interval ranges from 2017 to 2019 per month. CPT, Current Procedural Terminology.

Our study focused on remote retinal imaging, and does not address the broader use of teleophthalmology services such as virtual or video visits or e-consultations. In fact, a recent study that focused on a single payer in Michigan demonstrated increases in both asynchronous retinal imaging and synchronous video visits, possibly reflecting the differential use of telemedicine for preventative eye screening versus acute management of eye diseases.[30] Because CPT codes 92227 and 92228 are designated for asynchronous remote eye imaging only, we did not capture synchronous telehealth visits that may have increased during the COVID-19 lockdown.

Also, the CMS updated definitions for these CPT codes in 2021 and added new codes for retinal imaging with automated point-of-care using artificial intelligence, and so, we did not evaluate longer term changes beyond 2020.[31] Furthermore, using the fundus photography code 92250 by non-eye care providers may exclude ophthalmologists billing for remote image interpretations, and inappropriately include general providers who perform fundus photography without store-and-forwarding to eye care specialists for interpretation.

The COVID-19 pandemic underscored the need to expand telehealth services, but did not appear to confer any sustained improvements in the utilization or insurance coverage of teleophthalmology by remote imaging in the U.S. health care market. Use of teleretinal imaging decreased briefly during the initial lockdown in March 2020, with a concomitant increase in insurance coverage. Despite continued expansion of Medicare coverage of telemedicine during the COVID-19 public health emergency announced by CMS, our analysis of national claims data showed that insurance reimbursement rates dwindled back to prepandemic levels by the end of 2020. We encourage policy makers and health care advocates to strengthen efforts to promote teleophthalmology screening and access to eye care.

Authors' Contributions

G.Y. and S.A. had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: G.Y.

Acquisition, analysis, or interpretation of data: S.C.L., S.A., and G.Y.

Drafting of the article: S.C.L. and G.Y.

Critical revision of the article for important intellectual content: S.C.L., M.K.L., S.A., P.E.-N., and G.Y.

Statistical analysis: S.A.

Study supervision: G.Y.

Disclosure Statement

All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Dr. Yiu reports grants and personal fees from Alimera, Allergan, Carl Zeiss Meditec, Clearside Biomedical, Genentech, Gyroscope Therapeutics, Intergalactic Therapeutics, Iridex, NGM Biopharmaceutical, Regeneron, Topcon, and Verily, all outside of the submitted work. No other disclosures were reported.

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REFERENCES

1. World Health Organization. *WHO Director-General's opening remarks at the media briefing on COVID-19-11 March 2020*. Geneva: World Health Organization, **2020**.
2. Olivia Li JP, Shantha J, Wong TY, et al. Preparedness among ophthalmologists: during and beyond the COVID-19 pandemic. *Ophthalmology* **2020;**127: 569–572.
3. Adalja AA, Toner E, Inglesby TV. Priorities for the US Health Community responding to COVID-19. *JAMA* **2020;**323:1343–1344.
4. American Academy of Ophthalmology. Recommendations for urgent and nonurgent patient care. **2020.** Available at https://www.aao.org/headline/new-recommendations-urgent-nonurgent-patient-care (last accessed September 7, 2021).
5. Services CfMM. Medicare telemedicine healthcare provider fact sheet. **2020.** Available at https://www.cms.gov/newsroom/fact-sheets/medicare-telemedicine-health-care-provider-fact-sheet (last accessed September 7, 2021).
6. Physicians AAAoF. *COVID-19 private payer frequently asked questions*. **2020**. Available at https://www.aafp.org/dam/AAFP/documents/practice_management/covid-19/payer-faqs.pdf (last accessed May 15, 2022).
7. Ellis MP, Lent-Schochet D, Lo T, et al. Emerging concepts in the treatment of diabetic retinopathy. *Curr Diab Rep* **2019;**19:137.
8. Mansberger SL, Sheppler C, Barker G, et al. Long-term comparative effectiveness of telemedicine in providing diabetic retinopathy screening examinations: A randomized clinical trial. *JAMA Ophthalmol* **2015;**133:518–525.
9. Ellis MP, Bacorn C, Luu KY, et al. Cost analysis of teleophthalmology screening for diabetic retinopathy using teleophthalmology billing codes. *Ophthal Surg Lasers Imaging Retina* **2020;**51:S26–S34.
10. Daskivich LP, Vasquez C, Martinez C, et al. Implementation and evaluation of a large-scale teleretinal diabetic retinopathy screening program in the Los Angeles County Department of Health Services. *JAMA Intern Med* **2017;**177: 642–649.
11. Davis RM, Fowler S, Bellis K, et al. Telemedicine improves eye examination rates in individuals with diabetes: A model for eye-care delivery in underserved communities. *Diabetes Care* **2003;**26:2476.
12. Owsley C, McGwin G, Lee DJ, et al. Diabetes eye screening in urban settings serving minority populations: Detection of diabetic retinopathy and other ocular findings using telemedicine. *JAMA Ophthalmol* **2015;**133:174–181.
13. Kirkizlar E, Serban N, Sisson JA, et al. Evaluation of telemedicine for screening of diabetic retinopathy in the Veterans Health Administration. *Ophthalmology* **2013;**120:2604–2610.
14. Li B, Powell AM, Hooper PL, et al. Prospective evaluation of teleophthalmology in screening and recurrence monitoring of neovascular age-related macular degeneration: A randomized clinical trial. *JAMA Ophthalmol* **2015;**133:276–282.

15. Chew EY, Clemons TE, Bressler SB, et al. Randomized trial of a home monitoring system for early detection of choroidal neovascularization home monitoring of the Eye (HOME) study. *Ophthalmology* **2014;**121:535–544.

16. Thomas SM, Jeyaraman MM, Jeyaraman M, et al. The effectiveness of teleglaucoma versus in-patient examination for glaucoma screening: A systematic review and meta-analysis. *PLoS One* **2014;**9:e113779.

17. Maa AY, Medert CM, Lu X, et al. Diagnostic accuracy of technology-based eye care services: The technology-based eye care services compare trial part I. *Ophthalmology* **2020;**127:38–44.

18. Wang SK, Callaway NF, Wallenstein MB, et al. SUNDROP: Six years of screening for retinopathy of prematurity with telemedicine. *Can J Ophthalmol* **2015;**50: 101–106.

19. Daniel E, Quinn GE, Hildebrand PL, et al. Validated system for centralized grading of retinopathy of prematurity: Telemedicine approaches to evaluating acute-phase retinopathy of prematurity (e-ROP) study. *JAMA Ophthalmol* **2015;**133:675–682.

20. Mines MJ, Bower KS, Lappan CM, et al. The United States Army Ocular Teleconsultation program 2004 through 2009. *Am J Ophthalmol* **2011;**152: 126–132.e122.

21. Grzybowski A, Brona P, Lim G, et al. Artificial intelligence for diabetic retinopathy screening: A review. *Eye (Lond)* **2020;**34:451–460.

22. Sosale B, Sosale AR, Murthy H, et al. Medios—An offline, smartphone-based artificial intelligence algorithm for the diagnosis of diabetic retinopathy. *Indian J Ophthalmol* **2020;**68:391–395.

23. Bellemo V, Lim G, Rim TH, et al. Artificial intelligence screening for diabetic retinopathy: The real-world emerging application. *Curr Diab Rep* **2019;**19:72.

24. Lee SC, Lieng MK, Alber S, et al. Trends in remote retinal imaging utilization and payments in the United States. *Ophthalmology* **2022;**129:354–357.

25. French DD, Behrens JJ, Jackson KL, et al. Payment reform needed to address health disparities of undiagnosed diabetic retinopathy in the city of Chicago. *Ophthalmol Ther* **2017;**6:123–131.

26. Gange WS, Xu BY, Lung K, et al. Rates of eye care and diabetic eye disease among insured patients with newly diagnosed type 2 diabetes. *Ophthalmol Retina* **2021;**5:160–168.

27. OptumLabs. *OptumLabs and OptumLabs Data Warehouse (OLDW) Descriptions and Citation*. Eden Prairie, MN: Optum Labs, **2020**.

28. Horton MB, Brady CJ, Cavallerano J, et al. Practice guidelines for ocular telehealth-diabetic retinopathy, third edition. *Telemed J E Health* **2020;**26: 495–543.

29. Aguwa UT, Aguwa CJ, Repka M, et al. Teleophthalmology in the era of COVID-19: Characteristics of early adopters at a large academic institution. *Telemed J E Health* **2021;**27:739–746.

30. Portney DS, Zhu Z, Chen EM, et al. COVID-19 and use of teleophthalmology (CUT group): Trends and diagnoses. *Ophthalmology* **2021;**128:1483–1485.

31. Larson P. What's New for 2021?. **2021.** Available at https://www.reviewofophthalmology.com/article/whats-new-for-2021 (last accessed December 16, 2021).

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