



Impact of COVID-19 on the Delivery of Eye Care to Uninsured Diabetic Patients at a Student-Run Free Clinic: A Comprehensive Evaluation of Eye Clinic Performance

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Abstract

Background: Diabetic retinopathy is the leading cause of blindness among working-age adults in the United States and requires timely screening and management. This study evaluates the impact of the coronavirus disease 2019 (COVID-19) pandemic on diabetic retinopathy screening (DRS) for uninsured, predominantly Latino patients at the University of California San Diego Student-Run Free Clinic Project (SRFCP).

Methods: A retrospective chart review was conducted of all living diabetic patients at SRFCP who were seen in 2019 (n=196), 2020 (n=183), and 2021 (n=178). Ophthalmology clinic referrals, scheduled patient visits, and visit outcomes were analyzed longitudinally to determine the impact of the pandemic on screening patterns.

Results: The study population was 92.1% Latino, 69.5% female, with a mean age of 58.7 years. The distribution of patients seen ($p<0.001$), referred ($p=0.012$), and scheduled ($p<0.001$) in 2020 and 2021 significantly differed from 2019. In 2019, 50.5% of 196 patients eligible for DRS were referred, 49.5% were scheduled, and 45.4% were seen. In 2020, 41.5% of 183 eligible patients were referred, but only 20.2% were scheduled and 11.4% were seen. In 2021, there was a rebound: 63.5% of 178 patients were referred, 56.2% scheduled and 46.1% seen. No shows and cancellations represented 12.4% and 6.2% of the 97 encounters scheduled in 2019, but were markedly higher (10.8% and 40.5% respectively) for the 37 encounters scheduled in 2020.

Conclusions: The COVID-19 pandemic significantly impacted the delivery of eye care at SRFCP. The need for annual DRS exceeded the capacity of the ophthalmology clinic in all years studied, but the difference was especially pronounced with more stringent COVID-19 restrictions in 2020. SRFCP patients could benefit from telemedicine DRS programs to improve screening capacity.

Introduction

Diabetic retinopathy (DR) is the most common complication of diabetes that can progress irreversibly to vision loss and blindness when left undetected. DR is responsible for 15 to 17% of adult blindness in developed nations¹ and is now the leading cause of new cases of blindness among adults aged 20 to 74 years in the United States.² This problem is expected to grow as the total

number of individuals worldwide with diabetes is projected to rise to 366 million by 2030.³ This is expected to disproportionately impact populations of low socioeconomic status (SES) and certain ethnic and racial minorities. Studies have shown an increased prevalence of diabetes, sight-threatening DR, and decreased uptake and access of DR screening (DRS) in these populations.^{4,5} DR progression due to low DRS rates may cascade into financial crisis, exacerbating limited medical

access, thus furthering disease and disability. This vicious cycle exacts large costs to not only individuals, but the healthcare system as a whole as diabetes-related blindness costs the United States approximately \$500 million annually.⁶ As the impact of the diabetes epidemic grows, there is a clear need for innovative approaches for timely DRS and effective disease management to halt DR progression and avert blindness, particularly in underserved populations with reduced access to regular eye screenings.

The racial disparity in diabetic care is especially profound in the Latino population, which makes up the largest and fastest growing ethnic minority group in the United States. In 2018, the incidence of newly diagnosed diabetes was the highest for Latino patients (9.7 per 1,000 US adults aged 18 or older).⁷ In California, the percentage of adults with diabetes in 2020 among the Latino population was 12.9% compared to 8.6% and 4% for White and Asian populations, respectively.⁸ These numbers are especially staggering given that in 2010, only 55% of Latino patients with diabetes received a dilated eye exam.⁴ Home to a large Latino population that accounts for 30.3% of the total population, San Diego County demonstrates this healthcare crisis. In addition, 9.5% of people living in San Diego are below the poverty line.⁹ In California, recent estimates show a considerable disparity in diabetes prevalence between people earning less than \$25,000 per year (17.8%) and more than \$75,000 per year (7.1%).⁸ Furthermore, 8.9% under the age of 65 do not have access to health insurance in San Diego,⁹ posing additional challenges as the lack of health insurance has been associated with greater barriers to preventive services and treatment of various health conditions including diabetes.¹⁰

Founded in 1997, the University of California San Diego Student-Run Free Clinic Project (UCSD SRFCP) is uniquely positioned to provide healthcare for these underserved populations in San Diego. UCSD SRFCP offers services in the highest need areas, providing independently scheduled primary care and specialty clinics to uninsured, predominantly Latino patients with limited to no healthcare access. In 2015, UCSD SRFCP had 201 patients with type 2 diabetes (99.0% Latino and 73.6% female). Also, 74.0% (318/430) of the UCSD SRFCP patients were

considered to be food insecure based on the 6-Item United States Department of Agriculture Food Security Survey questionnaire, and 30.7% (132/430) were considered to be very low food security.¹¹

DRS is fundamental eye care for this population. UCSD SRFCP operates three eye clinics that offer free ophthalmology specialty services monthly in Normal Heights, Pacific Beach, and Downtown of San Diego. These eye care visits include vitals, history, acuity and ocular function testing, and full anterior and posterior chamber dilated slit lamp examination to screen for DR. Medical students, supervised by attending ophthalmologists, lead history-taking and examination procedures. In providing these visits, the UCSD SRFCP has helped ameliorate health inequities experienced by the underserved.

In March 2020, the United States healthcare system responded to the coronavirus disease 2019 (COVID-19) pandemic with sweeping lockdowns. The governor of California ordered all non-essential services suspended, and the mayor of San Diego County quickly followed by instituting a county-wide shutdown. As a result, the UCSD SRFCP and many other free clinics halted in-person clinics in March of 2020. In addition, guidelines set forth by the American Academy of Ophthalmology ceased all ophthalmology clinic care for any in-person treatment other than urgent or emergency care from March 18, 2020, to July 2020. While a necessary measure to avert widespread morbidity and mortality from COVID-19, the closure of the UCSD SRFC clinic greatly limited access to care for the uninsured Latino population in San Diego County. We aimed to evaluate the impact of the COVID-19 pandemic on the delivery of DRS to uninsured, low-income populations at the UCSD SRFCP.

Methods

Study Design and Participants

This study was approved by the UCSD Institutional Review Board as a quality improvement project. We retrospectively reviewed the electronic medical records (EMR) of all diabetic patients referred to ophthalmology at the UCSD SRFCP from 2019 to 2021. Information on all diabetic patients seen at UCSD SRFCP during the

years 2019, 2020, and 2021 (n=196, 183, and 178, respectively) were extracted from the institutional EMR (2021, Epic, Verona, WI) using International Classification of Disease codes related to diabetes (E11.9, E11.65, Z79.4, E11.8, E10.9, E11.3591, E08.22, E11.3393, E11.3492, E11.3499, E11.610) on the EMR problem list. Data regarding demographics (age, sex, self-reported race, and self-reported ethnicity) were extracted from the EMR data warehouse using standardized queries that excluded patients who previously declined sharing their EMR data ("mandatory research exclusion" per institutional policies).

Data Collection

Manual chart review was performed to evaluate ophthalmology clinic performance before (2019), during (2020), and after (2021) the COVID-19 pandemic-related lockdowns. Variables measured included the number and proportion of diabetic patients referred for ophthalmology evaluation, scheduled into ophthalmology clinics, and seen with completed visits or encounters in ophthalmology clinics. Cancellations and no shows were also recorded, as well as visit outcomes as defined by new disease diagnoses with referrals for subsequent care at retina, cataract, glaucoma, or optometry clinics.

Patients who did not receive routine care at the UCSD SRFCP from 2019 to 2021 (n=39) and those who were deceased (n=3) on chart review at the time of conducting manual review (October 2021) were excluded from the study. Overall patient visits, outcomes, and referrals to subspecialty services were sorted year-to-year to establish a baseline patient population in the year 2019 before the COVID-19 pandemic. Comparisons were then made to the year 2020 to analyze the impact of the COVID-19 pandemic and reduced clinic capacity, and the year 2021 to study the clinic returning to normal capacity albeit with safety modifications to clinic protocols.

Statistical Analysis

Descriptive analyses were completed to generate summary statistics for demographics and counts/proportions for the outcomes described above. To examine distributions of patients referred, scheduled, and seen, chi-squared analyses for goodness of fit were used to compare

distributions by year. Statistical significance was defined as $p < 0.05$. Analyses were conducted in Excel (Version 16.015811.35904, Microsoft Corporation, Redmond, WA).

Results

Among diabetic patients with demographic data available (n=164), 151 (92.1%) self-reported as Latino and 114 (69.5%) identified as female (Table 1). The mean age was 58.7 years, with a standard deviation of 10.6. Table 1 details characteristics of the study population.

Comprehensive Sankey diagrams depicting referrals, scheduled appointments, and outcomes of scheduled visits from 2019 to 2021 are shown in Figure 1. During COVID-related shutdowns in 2020, the ophthalmology clinics operated by the UCSD SRFCP provided a fraction of the DRS compared to 2019. In 2019 prior to COVID, 99 (50.5%) of 196 patients needing DRS were referred to the eye clinic, 97 (49.5%) were scheduled, and 89 (45.4%) were seen (Figure 1A). In contrast, in 2020 fewer patients (76, 41.5%) were referred, and the number of patients scheduled and seen fell to 37 (20.2%) and 21 (11.4%), respectively (Figure 1B). In 2021, clinic performance rebounded with 113 (63.5%) of 178 patients requiring DRS referred, 100 (56.2%) scheduled, and 82 (46.1%) seen (Figure 1C). This distribution can be compared across 2019 to 2020 in Figure 2.

Not only did the number of patients referred and scheduled decrease, but the outcome of the scheduled visits changed drastically in 2020. Of the relatively few patients scheduled in 2020, cancellation rates were many times higher (Figure 1B). While cancellation rates shrunk in 2021 to roughly half their value in 2020, they remained much higher than in 2019 prior to COVID-19 (Figure 1C).

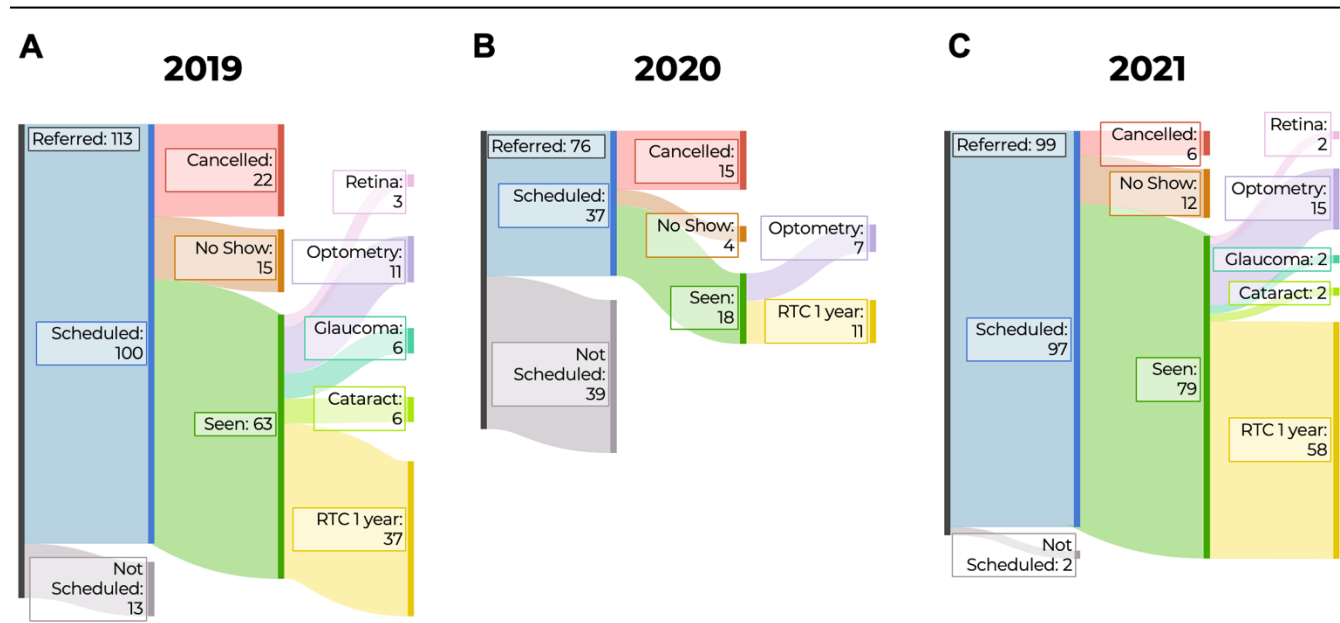
Unsurprisingly, due to the inability to see as many patients in 2020, a greater number and proportion of the patients in 2021 had issues more serious than optometry referrals than in 2019. For example, cataract and glaucoma referral rates were less than 10% in 2019 and increased to over 20% in 2021 (Figure 3). Also, due to limitations on primary care visits, many of conditions that would require referrals to services other than optometry simply were not identified and thus

Table 1. Baseline characteristics of study population

Characteristic	Combined, N (%)	2019, n (%)	2020, n (%)	2021, n (%)
Age, mean (SD)	58.7 (10.6)	58.5 (10.6)	59.1 (10.8)	59.0 (10.5)
Sex				
Female	114 (69.5)	112 (69.6)	106 (70.2)	101 (68.7)
Male	50 (30.5)	49 (30.4)	45 (29.8)	46 (31.3)
Race				
Black or African American	1 (0.6)	0 (0.0)	1 (0.7)	1 (0.7)
Other or Mixed Race	90 (54.9)	90 (55.9)	86 (57.0)	84 (57.1)
Unknown	52 (31.7)	50 (31.1)	46 (30.5)	44 (29.9)
White	21 (12.8)	21 (13.0)	18 (11.9)	18 (12.2)
Ethnicity				
Hispanic or Latino	151 (92.1)	149 (92.6)	140 (92.7)	136 (92.5)
Multi-Racial	1 (0.6)	1 (0.6)	1 (0.7)	1 (0.7)
Not Hispanic or Latino	6 (3.7)	5 (3.1)	6 (4.0)	6 (4.1)
Unknown	6 (3.7)	6 (3.7)	4 (2.7)	4 (2.7)
Total	164	161	151	147

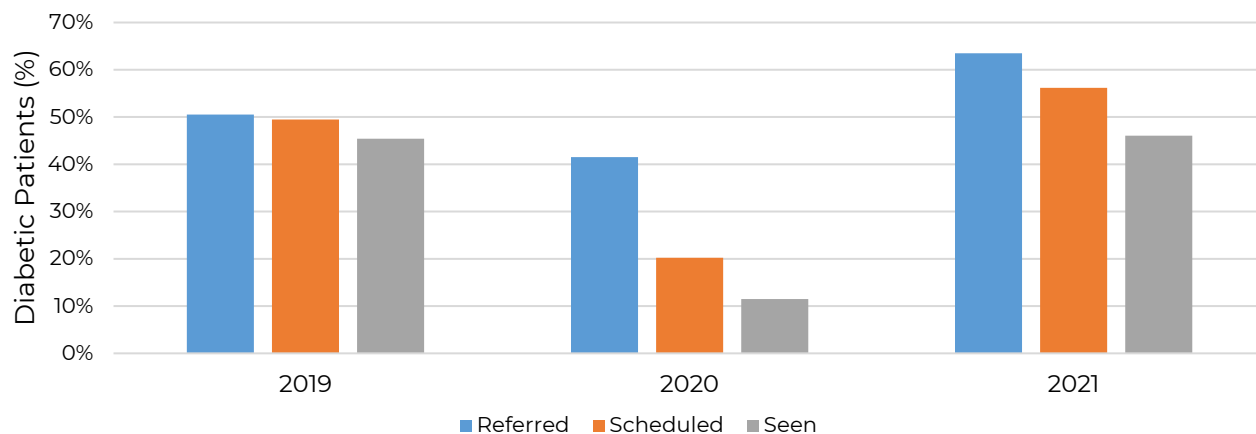
Demographic characteristics of the UCSD SRCP ophthalmology patient population for years 2019 – 2021. UCSD SRFCP: University of California San Diego Student-Run Free Clinic Project; SD: standard deviation

Figure 1. Systematic flow of patients



Sankey diagram showing outcomes of ophthalmology referrals, scheduled appointments, and visit outcomes by year. RTC: return to clinic.

Figure 2. Stratified patient visit status by year



Percentage of free clinic patients with diabetes mellitus referred, scheduled, and seen by year.

not referred to ophthalmology by primary care. Furthermore, in much of 2020, of the patients seen we could only evaluate for refractive error (and therefore only refer to glasses) due to COVID restrictions precluding slit lamp exams and the relatively close face-to-face interaction that exam requires.

Lastly, chi-squared test for goodness of fit showed that the distribution of patients seen ($p < 0.001$), referred ($p = 0.012$), or scheduled ($p < 0.001$) in 2020 and 2021 differed significantly when compared to 2019.

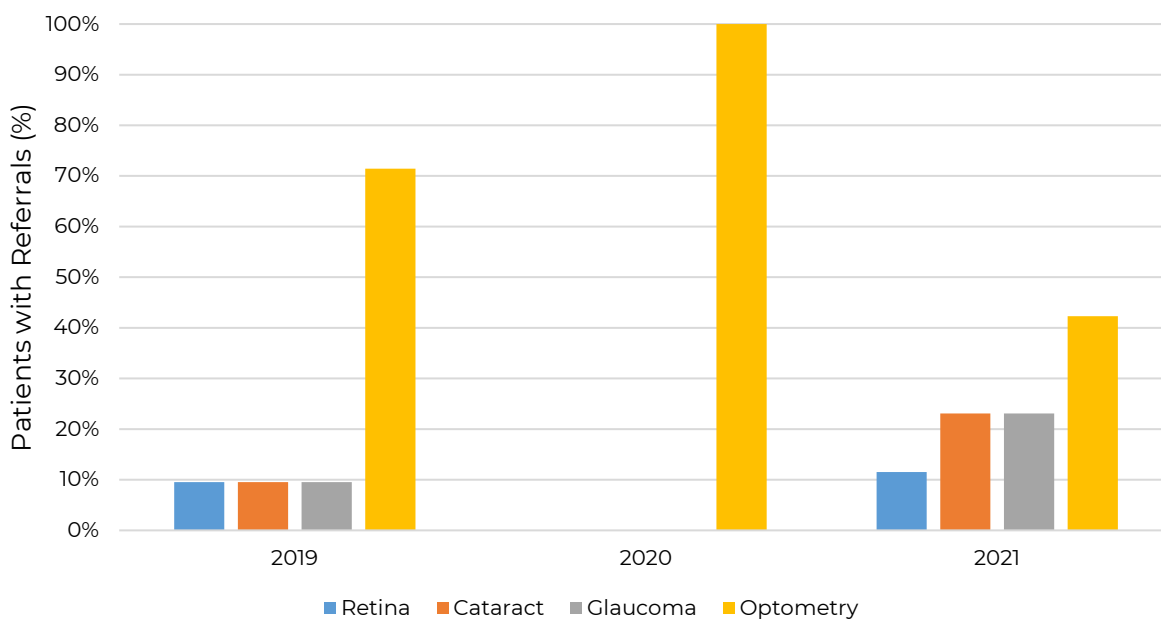
Discussion

Since its inception in 1996, the UCSD SRFCP has expanded rapidly and provides a uniquely powerful perspective. The findings of this research have profound meaning and relevance for the local underserved patient population and hold implications for free clinics across the nation. A strength of this study is that the UCSD SRFCP operates one of the largest student-operated free clinic systems in the United States in a high-need, low SES population. The ophthalmology specialty clinics at the UCSD SRFCP are similarly robust. As a result, sample sizes are relatively large for studies originating from student-run free clinics, and the impact of the COVID-19 clinic shutdowns may be more fully understood in a meaningful way.

The COVID-19 pandemic and its associated lockdowns negatively impacted UCSD SRFCP performance in the delivery of eye care in 2020 for all metrics. The number of patients referred, scheduled, and seen all plummeted in that time. Fortunately, most of these effects were reversed in 2021, but cancellations remained abnormally high, compared to rates established in years prior to 2020. The decrease in clinic volume and diabetic retinopathy screenings experienced by the UCSD SRFCP is consistent with trends in ophthalmic clinics across the nation, where screenings were frequently postponed for various reasons including patient fear of transmission, short staffing, and infection control guidelines.¹²⁻¹⁴ More concerning, the transition to tele-medicine has been challenging in ophthalmology relative to some other specialties due to its reliance on specialized equipment and in-person examinations.¹⁵

Fears regarding COVID-19 persist, leading to high cancellation rates for specialty clinics and screening services like the DRS provided by the UCSD SRFCP. However, it is important to note that even in years undisrupted by the pandemic, clinical resources are limited such that these populations remain underserved. A report in 2014 showed that while the intermediate clinical outcomes data for diabetic patients at UCSD SRFCP outcomes of insured and uninsured diabetic patients in nearly all measures, it failed to do so for

Figure 3. Vision outcomes based on referral type



Referral type after visit to the ophthalmology specialty free clinic, calculated as a percentage of patients who received referrals ($n = 21$ in 2019, $n = 7$ in 2020, $n = 26$ in 2021).

DRS.¹⁶ Indeed, in this study the data demonstrate that even prior to the onset of pandemic lockdowns and restrictions, only approximately half of qualifying patients being treated at the UCSD SRFPC were even referred to DR screening, and even less were scheduled and seen in clinic. Even outside of the free clinic setting, several studies have demonstrated disparities in care and decreased diabetes screening rates for low SES and minority populations, leading these groups to present with more advanced disease at diagnosis and poorer clinical outcomes.¹⁷⁻¹⁹ While UCSD SRFPC has added additional ophthalmology clinic sites and sessions, innovative approaches are needed to continue to improve DRS rates among under-served, diabetic patients.

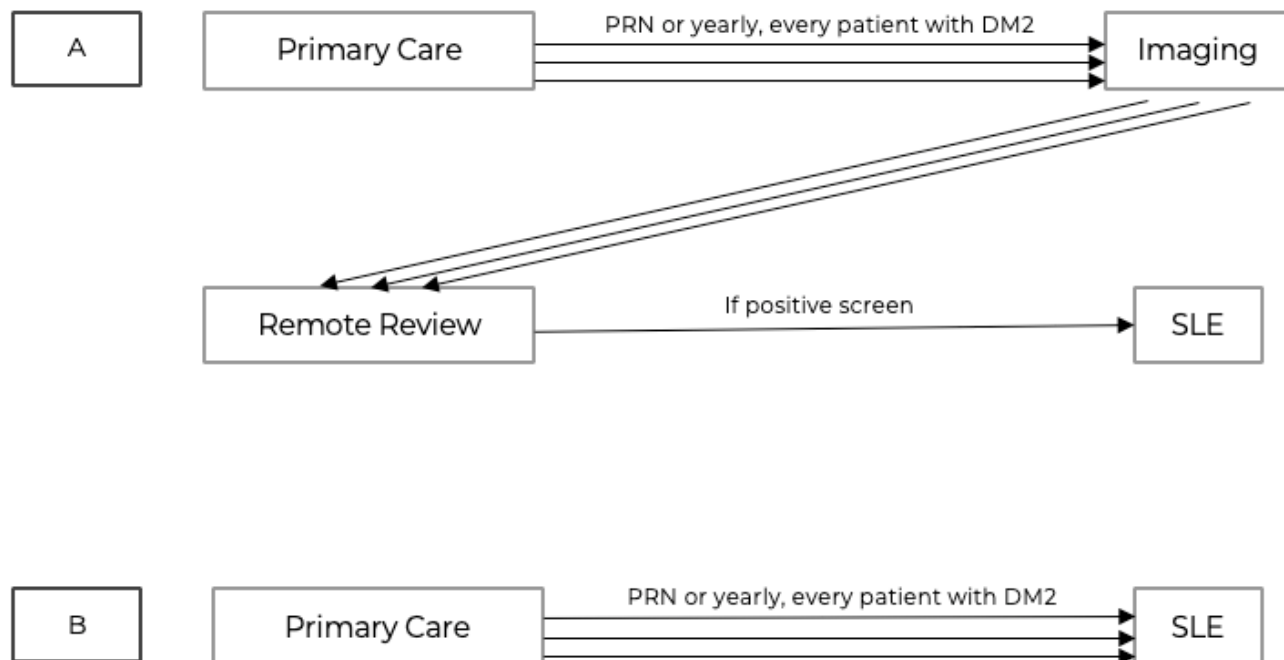
The study has limitations. First, we were primarily interested in the binary output of whether each outcome took place any time that year or not. No distinction was made between patients who may have undergone multiple visits in a year as opposed to one. This may have underestimated the care provided by the ophthalmology free clinic. In addition, although we compiled data from several free clinic sites, these were all located in a single metropolitan area (greater San Diego County) and affiliated with a single

umbrella organization, therefore limiting generalizability.

To meet the need for more DRS while limiting the number of patient visits, which has special importance during pandemic restrictions, the UCSD SRFPC intends to implement fundoscopic imaging with remote interpretation through use of a teleretinal camera during primary care appointments. Telemedicine has been a growing field for decades, but the advent of COVID-19 has spurred rapid adoption throughout the US.²⁰ It lends itself particularly well to DRS due to its speed, ease of use, improved workflows, and generally high-quality imaging results that have high sensitivity for DR (Figure 4),²¹ and has already been piloted in many primary care clinic settings across the nation.^{22,23}

By incorporating teleretinal imaging,²⁴ the eye clinic may improve the screening efficiency such that in the resource-limited setting of a free clinic, patient needs for DRS may be successfully met. The teleretinal imaging would improve capacity by enabling screening of patients during primary care clinics and not just during ophthalmology clinics, thereby expanding availability of screening services beyond the limitations of attending ophthalmologist availability. A camera system

Figure 4. Potential workflow improvements with a teleretinal camera



A. Teleretinal workflow; B. Current process.

PRN: pro re nata; DM2: diabetes mellitus type 2; SLE: slit lamp examination.

using this workflow proposal is now being implemented at a select location in UCSD SRFCP to validate this concept. With respect to future pandemics and other prolonged periods of increased load on resource-limited settings, this intervention has the potential to mitigate the challenges arising from the overall decreases in services vital to the prevention of blindness in uninsured minority patients that were demonstrated in this paper.

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Disclosures

The authors have no conflicts of interest to disclose.

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