Expanded Scope of Practice for Optometrists and Access to Laser Eye Surgery

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Abstract

Many U.S. states have adopted scope of practice (SOP) expansions for non-physician medical practitioners to address healthcare shortages. In recent years, optometrists, among the most advanced non-physician practitioners, have gradually obtained independent surgical authority with the advancement of medical laser technology. These reforms aim to improve access to primary eye care, but their effects have been understudied. We examine the impact of SOP reforms that grant optometrists laser surgical authority. Leveraging geographic and temporal variation in state-level policies, we find large increases in the number of Medicare beneficiaries receiving laser surgery from optometrists. Moreover, our results point to an increase in competition and a gradual substitution between optometrists and ophthalmologists in the market for laser surgeries. Finally, our analysis provides suggestive evidence that impacts are larger in rural areas than in urban areas, implying that populations with the most severe access problems may benefit most. Our work can inform ongoing efforts to expand access to eye care through regulatory reform.

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I. Introduction

In the United States, the role of non-physician medical practitioners has been growing with scope of practice (SOP) expansions (Plemmons 2025; Bae and Timmons 2022). For example, nurse practitioners are allowed to practice and prescribe medications without supervision of or collaborative agreement with a physician in a majority of states (McMichael and Markowitz 2022). Existing studies of the effects of SOP expansion heavily focus on advanced practice registered nurses (Adams and Markowitz 2018) with growing interest in dental hygienists, pharmacists, psychologists, and other practitioners (Langelier et al. 2016; Grossman et al. 2025), Shakya et al. 2025; Choudhury and Plemmons 2023; Shoulders and Plemmons 2025). However, little is known for the implications of SOP expansions affecting optometrists, despite these reforms being among the broadest SOP expansions in U.S. medical history.

In the early 20th century, optometrists were known as "refractionists" who primarily measured visual acuity. The profession evolved rapidly from the 1960s to the 1990s as optometrists gained prescription authority for the diagnosis and treatment of eye diseases or disorders such as glaucoma in all U.S. states (Bae and Timmons 2025). With these SOP expansions, optometrists were transformed into "eye doctors."[1] Moreover, optometrists' role in delivering primary eye care has grown over the last 30 years relative to ophthalmologists. The number of optometrists per capita has grown from 11.06 per 100,000 individuals in 1990 to 16.11 in 2017, while the number of ophthalmologists has declined from 6.30 in 1995 to 5.68 in 2017 (Feng et al. 2020).

Given limited access to ophthalmologists (Gibson 2015), states have started to further expand the role of optometrists in eye care by granting laser surgical authority. As of 2024, twelve states have authorized optometrists to use laser surgical procedures to treat patients within the scope of their education and training. This is an unprecedented SOP expansion; no other non-physician practitioners in the U.S. have experienced comparable reforms. Moreover, the effects of optometrist SOP expansions will increasingly be felt by patients as deepening physician shortages (Dall et al. 2024) and private equity acquisitions of medical practices (O'Donnell et al. 2020; Bruch et al. 2023) drive up demand for non-physician practitioners. Therefore, the optometrist SOP expansion to laser surgical authority could have profound implications as a case study to inform SOP policies for other non-physician practitioners.

In economic theory, the SOP expansion of optometrists is expected to relax the monopoly of laser procedures by ophthalmologists and subsequently increase the provision or utilization of laser treatment, and reduce its price, in equilibrium. These effects could lead to improvements in

[1] There are two types of "eye doctors" in the U.S. and several other countries, including the United Kingdom, Canada, Australia, and New Zealand (Lighthizer et al. 2024). The first is an ophthalmologist who is a medical doctor (with an MD or DO degree) specializing in eye care. The other is an optometrist with a Doctor of Optometry (OD) degree. The federal government has classified optometrists as medical doctors for the purpose of Medicare reimbursement since the Medicare Optometry Parity Amendment in 1986 (Garland 1987). Also, a recent study showed that a Google search of the phrase "eye doctor near me" provides results on both optometrists and ophthalmologists and even over-represents optometrists relative to ophthalmologists (Soares et al. 2022).

population health by broadening access to treatment. But researchers have never tested these straightforward theoretical predictions.

Prior research shows mixed findings on the effects of optometrist SOP expansion to laser surgical authority on access to eye care practitioners. While Mahr and Erie (2017) show no significant difference in driving distance to the practitioner's office between Medicare beneficiaries who received a surgery from an optometrist and those who received a surgery from an ophthalmologist, Stein et al. (2018) find that about half of Medicare beneficiaries who received laser surgeries from optometrists lived beyond a 30-min travel distance from the nearest ophthalmologist office. Moreover, these studies on travel time or driving distance do not account for the policy's effect on the number of practitioners or beneficiaries receiving services.

In this paper, we examine whether the expansion of optometrist SOP to laser surgical authority improved access to the YAG laser posterior capsulotomy procedure, which is allowed in twelve states as of 2024.[2] The YAG procedure, also known as a secondary cataract surgery, is a medically necessary procedure to treat posterior capsule opacification, a common condition that can develop after cataract surgery.[3] In 2022, more than 450,000 Medicare beneficiaries received a YAG procedure.[4] The YAG procedure is typically done in an office setting in less than 10 minutes and is covered by Medicare insurance (Lipton et al. 2024). Our main measure of access to the YAG procedure is the number of Medicare beneficiaries receiving YAG procedures.

We find that the number of Medicare beneficiaries for YAG procedures increased following optometrist SOP expansions for laser surgical procedures. We also show that the policy's effect is larger in early treated states than in later treated states, suggesting that it takes time for the policy to improve access to laser surgeries. Moreover, we provide suggestive evidence that increased competition reduces the average price for YAG procedures. Additionally, our analysis suggests that SOP expansions had larger positive effects in rural areas than in urban areas.

II. Study Data and Methods

a. Data Sources

[2] Another type of measurement for access to eye care is a self-reported outcome on visits to an eye doctor's office (Lipton and Decker 2015), which is not relevant for our study on a specialized treatment procedure (i.e., YAG laser surgery).

[3] Globally, cataract is the leading cause of blindness and the second important factor for vision impairment (Pascolini and Mariotti 2012). About half of Americans have cataracts by age 75 (National Eye Institute 2025). Cataract surgery is a common procedure to treat cataracts, and some patients experience secondary cataracts after the surgery. The incidence of secondary cataracts has been declining with advancements in artificial intraocular lenses, but it has not yet been eliminated (Apple et al. 2020, Tassignon 2020).

[4] We obtain this estimate from the 2022 Medicare Physician & Other Practitioners by Provider and Service dataset produced by the Centers for Medicare & Medicaid Services (CMS). It includes procedures performed by optometrists and ophthalmologists. Since the dataset is truncated below 11 beneficiaries, we interpret this estimate as a lower bound.

We mainly rely on the Medicare Physician & Other Practitioners by Provider and Service datasets produced annually by the Centers for Medicare & Medicaid Services (CMS) based on administrative claims records. The datasets contain practitioner-level information on health service use, payments, and submitted charges among fee-for-service Medicare Part B beneficiaries. Variables include National Provider Identifier and provider specialty, which allows us to examine optometrists and ophthalmologists separately. Services are identified with Healthcare Common Procedure Coding System (HCPCS) codes. To preserve confidentiality, CMS omits data for services performed on 10 or fewer beneficiaries.[5] We combine ten years of data, from 2013 to 2022.[6]

We focus on two outcomes: the volume of YAG procedures and the average Medicare standardized payment amount for YAG procedures. In standardizing payment amounts, CMS attempts to adjust for geographic differences in input costs.

We identify YAG procedures using the HCPCS code 66821. We measure the number of YAG procedures based on the number of beneficiaries, not the number of services; this accounts for possible differences in practice styles between optometrists and ophthalmologists. For example, Robin (2016) notes that some providers prefer to perform YAG procedures over two visits, treating one eye at a time, while others perform a bilateral procedure in a single visit. Using CMS data on annual enrollment in the Medicare program, we express this variable as the number of beneficiaries receiving YAG procedures per 100,000 Medicare enrollees.

In our regression analyses, we include two covariates: the number of beneficiaries receiving cataract procedures (HCPCS code 66984) from ophthalmologists[7] and the number of beneficiaries receiving an eye exam (HCPCS codes 92002, 92004, 92012 and 92014) from optometrists and ophthalmologists combined. The volume of eye exams helps to account for differences in provider capacity and demand for vision care. We derive these measures from the CMS provider files. When analyzing data aggregated to the state level, we normalize both control variables to 100,000 Medicare enrollees. When analyzing practitioner-level data, we use raw counts of both variables measured at the county level.

We collect information on state scope-of-practice laws related to YAG procedures from Lighthizer et al. (2024). As of the end of 2024, twelve states authorize optometrists to perform YAG procedures.[8]

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[5] In some analyses, we estimate truncated regressions to account for this.
[6] Data for previous years is not publicly available.
[7] Cataract procedures involve the surgical removal of a cataract and the insertion of an intraocular lens. YAG capsulotomy is sometimes undertaken to improve vision following cataract surgery.
[8] These states (with the year the reform took effect) are Oklahoma (1988), Kentucky (2011), Louisiana (2014), Alaska (2017), Indiana (2018), Arkansas (2019), Mississippi (2021), Wisconsin (2021), Wyoming (2021), Colorado (2022), Virginia (2022), and South Dakota (2024).

b. Empirical Approach

We adopt several methods to shed light on the impact of optometrist SOP expansion on the provision of YAG procedures to Medicare beneficiaries. To account for the staggered adoption of SOP reforms across states, we implement the robust estimator proposed by Callaway and Sant'Anna (2021) using aggregated state-level data. We use never-treated states as comparison units. Unfortunately, this approach forces us to exclude Oklahoma and Kentucky from the analysis since both states were treated prior to the start of our study period.

To supplement our causal analysis, we estimate cross-sectional regression models using the latest year of data available (2022). We do so for both state-level aggregated data and practitioner-level data. Given the possibility that expanded SOP for optometrists could affect the practice patterns of other providers of YAG services (i.e., ophthalmologists), we examine three distinct samples: optometrists only, ophthalmologists only, and optometrists and ophthalmologists combined.

In our state-level regressions, we estimate the following equation using ordinary least squares:

$$Y_i = \beta_0 + \beta_1 * Early\ Treat_i + \beta_2 * Late\ Treat_i + \beta_3 * Eye\ Exams_i + \beta_4 * Cataract_i + \varepsilon_i \quad (1)$$

where Y_i is the number of beneficiaries receiving YAG procedures per 100,000 Medicare enrollees in state i. $Early\ Treat$ is a dummy variable that takes a value of 1 for Oklahoma and Kentucky and 0 for all other states. Analogously, $Late\ Treat$ is a dummy variable that takes a value of 1 for Alaska, Arkansas, Colorado, Indiana, Louisiana, Mississippi, Virginia, Wisconsin, and Wyoming, and 0 for all other states. $Eye\ Exams$ and $Cataract$ represent the two state-level control variables discussed in Section II.a. The term ε_i captures residual variation. We report heteroskedasticity-robust standard errors.

We supplement our state-level results with cross-sectional models using practitioner-level data from 2022. In the analysis, we estimate the policy's effect on the proportion of providers who claimed for 11 or more YAG beneficiaries and the truncation-adjusted average number of YAG beneficiaries per provider. To do so, we estimate models analogous to Equation (1) using truncated Poisson models. In our truncated Poisson models, we use the raw count of YAG procedures at the practitioner-level and the county-level aggregate of eye exams and cataract procedures, respectively, without adjusting for the number of Medicare beneficiaries in each jurisdiction.

III. Results

a. Descriptive Statistics

Descriptive statistics are presented in Table 1. The data is drawn from the 2022 CMS provider file. We show results separately for all states, Oklahoma, Kentucky, late treated states, and untreated states.

Panel A focuses on optometrists in our sample. A clear correlation exists between SOP reform and the volume of optometrist-performed YAG procedures. At the practitioner-level, we observe that 17.9% of optometrists report performing YAG procedures in Oklahoma, followed by Kentucky (8.9%), late treated states (4.7%), and untreated states (1.6%). The average number of YAG procedures per optometrist follows a similar pattern: highest in Oklahoma and Kentucky (39.1 and 42.3, respectively), lower in late treated states (22.3), and lowest in untreated states (19.1). We also note that the average Medicare standardized payment amount for YAG procedures is highest in early-reform states ($224.62 in Oklahoma and $214.58 in Kentucky), lower in late treated states ($161.29), and lowest in untreated states ($47.72). This is probably because optometrists with laser surgical authority can practice and claim reimbursement for YAG surgeries, while those without it can provide and claim reimbursement only for post-surgery care or co-management.[9] Aggregating the data at the state-level and adjusting for the size of the Medicare population in each state does not substantially alter these patterns.

Among ophthalmologists (Panel B), we see few differences in our outcome measures across states, although we note some indication that ophthalmologists in treated states perform more YAG procedures, on average, than in untreated states. Finally, when we consider optometrists and ophthalmologists combined (Panel C), we still find a correlation – albeit weaker than in Panel A – between SOP reform and larger total volumes of YAG procedures.

Table 1: Descriptive Statistics
[See Exhibits section below]

b. Effects of SOP on Access to Care (State-Level, Callaway & Sant'Anna Method)

The results of our staggered difference-in-differences analysis are shown in Figure 1.[10] We plot the dynamic treatment effects over time. Pre-treatment differences between treated and comparison states are negligible, giving us confidence that the parallel trends assumption holds. In addition, the overall treatment effect is given in the upper left corner of each sub-figure. We find that SOP reform increases the number of beneficiaries for YAG procedures (per 100,000

[9] Medicare's billing system permits practitioners to attach modifiers to HCPCS codes that provide more information about the nature of the practitioner's involvement in an episode of care. Unfortunately, the CMS data files do not include these modifiers, so we are not able to shed additional light on this issue.
[10] Descriptive statistics for this sample are provided in Appendix Table A1

Medicare enrollees) performed by optometrists by 45.80, corresponding to 186.6% of the sample mean. Our results also indicate that the average standardized Medicare payments optometrists receive for these services increases by $102.30, corresponding to 177.7% of the sample mean, reflecting that more optometrists claim reimbursement for YAG procedures rather than post-surgery care or co-management. In both cases, treatment effects appear to grow in magnitude over time, consistent with the idea that optometrist practices gradually adapt to the new regulatory environment.

Turning to ophthalmologists, we find no significant overall effect of SOP reform on either outcome. Both point estimates are negative but fairly small in magnitude (<3.5% of the sample mean). However, there is evidence that negative effects grow over time, particularly for average Medicare standardized payments for YAG procedures. One possible explanation for this finding is that ophthalmologists may do more post-operative care or co-management following SOP reform as optometrists perform more direct surgical tasks.

Among optometrists and ophthalmologists combined, we find no significant overall effect on either outcome. The dynamic effects reveal some indication that the number of beneficiaries for YAG procedures (per 100,000 Medicare enrollees) increases 5-6 years after treatment, but these estimates are not statistically significant. SOP reform appears to have no discernable impact on the average Medicare standardized payment in this sample.

Figure 1: Effects of Expanded SOP on YAG Procedures (State-Level, Callaway & Sant'Anna Method)
[See Exhibits section below]

c. Association between SOP and Access to Care (State-Level Estimation)

Cross-sectional regression results using 2022 state-level aggregated data are shown in Table 2. Among optometrists (Panel A), early SOP reform is associated with an economically and statistically significant increase in both the number of beneficiaries for YAG procedures per 100,000 Medicare enrollees (343.29, or 706.2% of the sample mean) and the average Medicare standardized payment for YAG procedures ($182.03, or 230.2% of the sample mean). Late SOP reform is also associated with statistically significant – but smaller – increases in both outcomes.

Among ophthalmologists (Panel B), early SOP reform is associated with statistically significant declines in the number of beneficiaries for YAG procedures per 100,000 Medicare enrollees (-200.10, or -27.6% of the sample mean) and the average Medicare standardized payment for YAG procedures (-$5.85, or -2.3% of the sample mean). Late SOP reform is also negatively correlated with both outcomes, but the coefficients are smaller and only significant in the case of the average Medicare standardized payment for YAG procedures. This finding indicates that

ophthalmologists may gradually be replaced with optometrists in the market for YAG procedures.

Finally, we consider optometrists and ophthalmologists combined (Panel C). Early SOP reform is associated with a statistically significant and economically meaningful increase in the number of beneficiaries for YAG procedures per 100,000 Medicare enrollees (143.19, or 18.5% of the sample mean). Late SOP reform is also associated with an increase in the volume of YAG procedures, but the magnitude is smaller and not statistically significant. The impact of SOP reform (early and late) on the average Medicare standardized payment for YAG procedures is negative in sign but not statistically significant and very small in magnitude.

To provide additional texture to our analysis, in the Appendix we show results for samples stratified by metropolitan status (see Tables A2 and A3). Although we find that SOP reform is significantly associated with larger volumes of YAG services in both metropolitan and non-metropolitan areas, our results indicate larger effects (relative to the sample mean) in non-metropolitan areas. From this, we cautiously conclude that SOP reform may be particularly beneficial for communities that often lack adequate access to eye care services.

Table 2: Association of Expanded SOP and YAG Procedures in 2022 (State-Level)
[See Exhibits section below]

d. Association between SOP and Access to Care (Practitioner-Level Estimation)

In Table 3, we replicate the analysis in Table 2 at the practitioner level. Importantly, this allows us to explicitly adjust for the truncation in the CMS claims data. Panel A shows statistically significant evidence that SOP reform is associated with a higher probability that optometrists perform YAG procedures on at least 11 beneficiaries (an 11.8 percentage point increase, or 472.0% of the sample mean), as well as an increase in the truncation-adjusted average number of YAG procedures performed by optometrists (104.2%). While the association is particularly evident for early reform states, we also detect a small, positive, and statistically significant association between late reform states and these outcomes.[11]

Our results for ophthalmologists (Panel B) do not reveal any statistically significant relationship between SOP reform and the volume of YAG procedures. Moreover, the estimated coefficients for this subsample tend to be small in magnitude.

Finally, our analysis of optometrists and ophthalmologists combined indicates that practitioners in early reform states are more likely to perform YAG procedures on at least 11 beneficiaries (3.8

[11] We obtain virtually identical results from a conventional Poisson regression with no adjustment for truncation.

percentage points, or 19.5% of the sample mean), while at the same time these states tend to have a lower volume of YAG procedures per practitioner (-8.9%).

Table 3: Association of Expanded SOP and YAG Procedures in 2022 (Practitioner-Level)
[See Exhibits section below]

IV. Discussion

This paper investigates the impact of states' expansion of optometrist SOP to laser surgery. Our results complement prior research with mixed findings on access to eye care after optometrist SOP expansions. A study finds no evidence on a change in the average travel time to the nearest ophthalmologist or optometrist for laser procedures after the policy's implementation (Mahr and Erie 2017), whereas another study suggests that about a half of Medicare beneficiaries who received laser surgeries from optometrists lived beyond a 30-min travel distance from the nearest ophthalmologist office (Stein et al. 2018). Using alternative measurements for healthcare provision and utilization — the number of providers and beneficiaries — we provide additional evidence on an improvement in access to medically necessary laser eye surgeries following the implementation of optometrist SOP expansions. This result is consistent with a positive effect of optometrist prescription authority on public eye health (Bae and Timmons 2025).

We also provide evidence on increased competition and substitution between optometrists and ophthalmologists in the market for laser surgeries. Our cross-sectional analysis of 2022 data shows that the number of beneficiaries for YAG procedures by optometrists was higher in early treated states than untreated states (Table 2 Panel A Column 1), whereas the volume of beneficiaries served by ophthalmologists was significantly lower in these states (Table 2 Panel B Column 1). These findings suggest that optometrists gradually replaced ophthalmologists for this relatively simple laser procedure after states relaxed a legal monopoly of the procedure by ophthalmologists.

Moreover, our results have broader implications on the expanding role of optometrists for medically necessary eye services such as post-operative cataract care and YAG surgeries. A relevant study documented that the prevalence of optometrists is positively associated with the utilization of cataract surgeries, possibly driven by diagnosis by optometrists and referral to surgery by ophthalmologists (Kauh et al. 2016). Our study indicates that the availability of optometrists with laser surgical authority directly increases the utilization of YAG surgeries, which may provide optometrists with additional incentive for post-cataract care or co-management.

In supplementary analyses, we additionally find that optometrist SOP expansions improve access to eye care in both metro and non-metro areas. Our cross-sectional analysis of 2022 data on metro areas show that the number of beneficiaries for YAG procedures was higher in early

treated states than untreated states by 193 per 100,000 Medicare beneficiaries, or 21% of the sample mean (Table A2 Panel C column 1). In rural areas, we observe a larger difference in percentage (32% of the sample mean) between early treated and untreated states (Table A3 Panel C column 1). These findings suggest that policymakers should consider optometrist SOP expansions as a means of promoting access to care in rural areas (Carroll et al. 2024). The findings also indicate that benefits from optometrist SOP expansions may be larger for elderly, low-income, or marginalized populations, who may have more limited access to vision care than the general population (Stein et al. 2016; Willink et al. 2020; Bae and Timmons 2025).

A back-of-the-envelope calculation suggests that optometrist SOP expansions to laser surgeries would benefit approximately 96,000 elderlies nationwide, according to our cross-sectional estimate of the policy's effect on early treated states (143 per 100,000 Medicare beneficiaries) in Table 2 Panel C and the number of Medicare beneficiaries (67,250,139 in January 2024).

There are several additional methodological considerations in our estimation of the effects of optometrist SOP expansions. Above all, our baseline estimation using the staggered policy adoption (Table 1) – using the Callaway and Sant'anna method – is likely to underestimate the policy's effects for two reasons. The policy's effects may grow over time as optometrists adapt to the new regulatory environment with different business models or locations. Our estimation using cross-sectional variations in the policies in 2022 confirms that the policy's effects were larger in early treated states like Oklahoma and Kentucky than they were in later treated states (Table 2). Also, our estimation using the state-level aggregated number of YAG beneficiaries may underestimate the policy's effects because it does not account for potential effects on truncated observations in the sample – i.e., optometrists who provide the procedure to less than 11 beneficiaries. Our provider-level data analysis, which corrects for truncation, reveals a significant increase in the average number of YAG procedures by optometrists associated with SOP expansion (Table 3). Lastly, since our analysis relies on Medicare data, it does not capture potential effects of the policy on non-Medicare beneficiaries.

V. Conclusion

We demonstrate that optometrist SOP expansions for laser surgical procedures increase the number of providers and Medicare beneficiaries for these procedures. Our study also shows that early treated states benefit much more than later treated states, implying that it takes time for practitioners to adapt and for states to fully benefit from the policies. Additionally, our study indicates that the polices benefit populations in non-metro areas more than those in metro areas. These findings suggest that expanding optometrist SOP fills a gap in eye care, given the shortage of ophthalmologists, especially in rural areas. Moreover, since the reforms only allows medically necessary laser procedures to be performed by optometrists within the scope of their education and training, there is limited possibility of the policies leading to unscrupulous use of these procedures threatening public health and safety.

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Exhibits

Table 1: Descriptive Statistics

	(1)	(2)	(3)	(4)	(5)
	All states	Oklahoma	Kentucky	Late treated states	Untreated states
Panel A – *Optometrists*					
Practitioner-level data					
Proportion of providers claiming YAG procedures (11 or more beneficiaries)	0.025	0.179	0.089	0.047	0.016
Average number of YAG procedures per provider (among providers with 11 or more beneficiaries)	24.099	39.078	42.289	22.287	19.072
Observations	29,443	574	503	3,960	24,406
State-level aggregated data					
Number of beneficiaries for YAG procedures per 100,000 Medicare enrollees	28	519	198	55	14
Average Medicare standardized payment amount for YAG procedure ($ per service)	112.73	224.62	214.58	161.29	47.72
Number of beneficiaries for cataract procedures per 100,000 Medicare enrollees	201	680	504	316	173
Number of beneficiaries for eye exams per 100,000 Medicare enrollees	7,518	12,594	5,782	8,676	7,315
Observations	51	1	1	9	40
Panel B – *Ophthalmologists*					
Practitioner-level data					
Proportion of providers claiming YAG procedures (11 or more beneficiaries)	0.493	0.553	0.524	0.560	0.484
Average number of YAG procedures per provider (among providers with 11 or more beneficiaries)	52.684	60.714	55.939	60.192	51.530
Observations	16,796	152	189	1,719	14,736
State-level aggregated data					
Number of beneficiaries for YAG procedures per 100,000 Medicare enrollees	684	657	576	764	675
Average Medicare standardized payment amount for YAG procedure ($ per service)	250.39	251.31	244.18	248.07	250.79

Number of beneficiaries for cataract procedures per 100,000 Medicare enrollees	1,459	2,016	1,526	1,650	1,423
Number of beneficiaries for eye exams per 100,000 Medicare enrollees	11,575	8,407	5,024	10,015	11,953
Observations	51	1	1	9	40
Panel C – *Optometrists and ophthalmologists*					
Practitioner-level data					
Proportion of providers claiming YAG procedures (11 or more beneficiaries)	0.195	0.258	0.208	0.203	0.193
Average number of YAG procedures per provider (among providers with 11 or more beneficiaries)	50.344	48.797	51.674	54.001	49.799
Observations	46,239	726	692	5,679	39,142
State-level aggregated data					
Number of beneficiaries for YAG procedures per 100,000 Medicare enrollees	712	1,176	774	819	689
Average Medicare standardized payment amount for YAG procedure ($ per service)	239.68	236.35	235.24	234.96	240.58
Number of beneficiaries for cataract procedures per 100,000 Medicare enrollees	1,660	2,696	2,030	1,966	1,597
Number of beneficiaries for eye exams per 100,000 Medicare enrollees	19,093	21,002	10,806	18,691	19,268
Observations	51	1	1	9	40

Notes: This table gives the means of key variables used in our analysis. We define an eye exam as any of the following: intermediate eye exam for a new patient (HCPCS code 92002), intermediate eye exam for an established patient (HCPCS code 92012), comprehensive eye exam for a new patient (HCPCS code 92004), or comprehensive eye exam for an established patient (HCPCS code 92014). Cataract procedures are identified by HCPCS code 66984. Late treated states consist of Alaska, Arkansas, Colorado, Indiana, Louisiana, Mississippi, Virginia, Wisconsin, and Wyoming. Untreated states consist of states that had not authorized optometrists to perform YAG procedures as of 2022 (hence, this group includes states that authorized optometrists to perform YAG procedures after 2022, as well as states that have never authorized optometrists to perform YAG procedures). We do not correct for truncation in the underlying data. At the practitioner level, the number of observations reported for each panel represents the number of unique providers in the dataset. At the state level, states with no beneficiaries for a given procedure are coded as 0. In states with no beneficiaries reported for YAG procedures, the variable "Average Medicare standardized payment amount for YAG procedure ($ per service)" is coded as missing and excluded from the calculations.

Source: Authors' calculations based on 2022 data from the Medicare Physician & Other Practitioners by Provider and Service dataset produced by the Centers for Medicare & Medicaid Services.

Table 2: Association of Expanded SOP and YAG Procedures in 2022 (State-Level)

Outcome:	(1) Number of beneficiaries for YAG procedure per 100,000 Medicare enrollees	(2) Average Medicare standardized payment amount for YAG procedure ($ per service)
Panel A — *Optometrists*		
Early Treat (OK, KY)	343.289***	182.032***
	(112.922)	(10.542)
Late Treat (LA, AK, IN, AR, MS, WI, WY, CO, VA)	86.870**	96.946***
	(39.347)	(35.038)
Sample mean	48.613	79.086
Observations	51	39
Panel B — *Ophthalmologists*		
Early Treat (OK, KY)	-200.104***	-5.847**
	(55.702)	(2.628)
Late Treat (LA, AK, IN, AR, MS, WI, WY, CO, VA)	-12.898	-5.563**
	(39.010)	(2.470)
Sample mean	725.515	251.082
Observations	51	51
Panel C — *Optometrists and ophthalmologists*		
Early Treat (OK, KY)	143.185**	-0.019
	(69.576)	(5.169)
Late Treat (LA, AK, IN, AR, MS, WI, WY, CO, VA)	73.972	-3.898
	(53.566)	(6.985)
Sample mean	774.128	238.429
Observations	51	51

Notes: Models are estimated with ordinary least squares (OLS) regression. All variables are measured at the state level. In states with no beneficiaries of YAG procedures reported in a given subsample, the variable "Number of beneficiaries for YAG procedure per 100,000 Medicare enrollees" is coded as 0 and the variable "Average Medicare standardized payment amount for YAG procedure ($ per service)" is coded as missing. The 'Early Treat' variable is a dummy that takes a value of 1 for Oklahoma and Kentucky, and 0 for all other states. Similarly, the 'Late Treat' takes a value of 1 for Alaska, Arkansas, Colorado, Indiana, Louisiana, Mississippi, Virginia, Wisconsin, and Wyoming, and 0 for all other

states. All regressions control for the number of Medicare beneficiaries receiving eye exams (performed by optometrists and ophthalmologists combined) per 100,000 Medicare enrollees and the number of Medicare beneficiaries receiving cataract procedures performed by ophthalmologists per 100,000 Medicare enrollees. We identified eye exams using the following codes: intermediate eye exam for a new patient (HCPCS code 92002), intermediate eye exam for an established patient (HCPCS code 92012), comprehensive eye exam for a new patient (HCPCS code 92004), and comprehensive eye exam for an established patient (HCPCS code 92014). We identified cataract procedures using HCPCS code 66984. We do not correct for truncation in the underlying data. Heteroskedasticity-robust standard errors are given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Authors' calculations based on 2022 data from the Medicare Physician & Other Practitioners by Provider and Service dataset produced by the Centers for Medicare & Medicaid Services.

Table 3: Association of Expanded SOP and YAG Procedures in 2022 (Practitioner-Level)

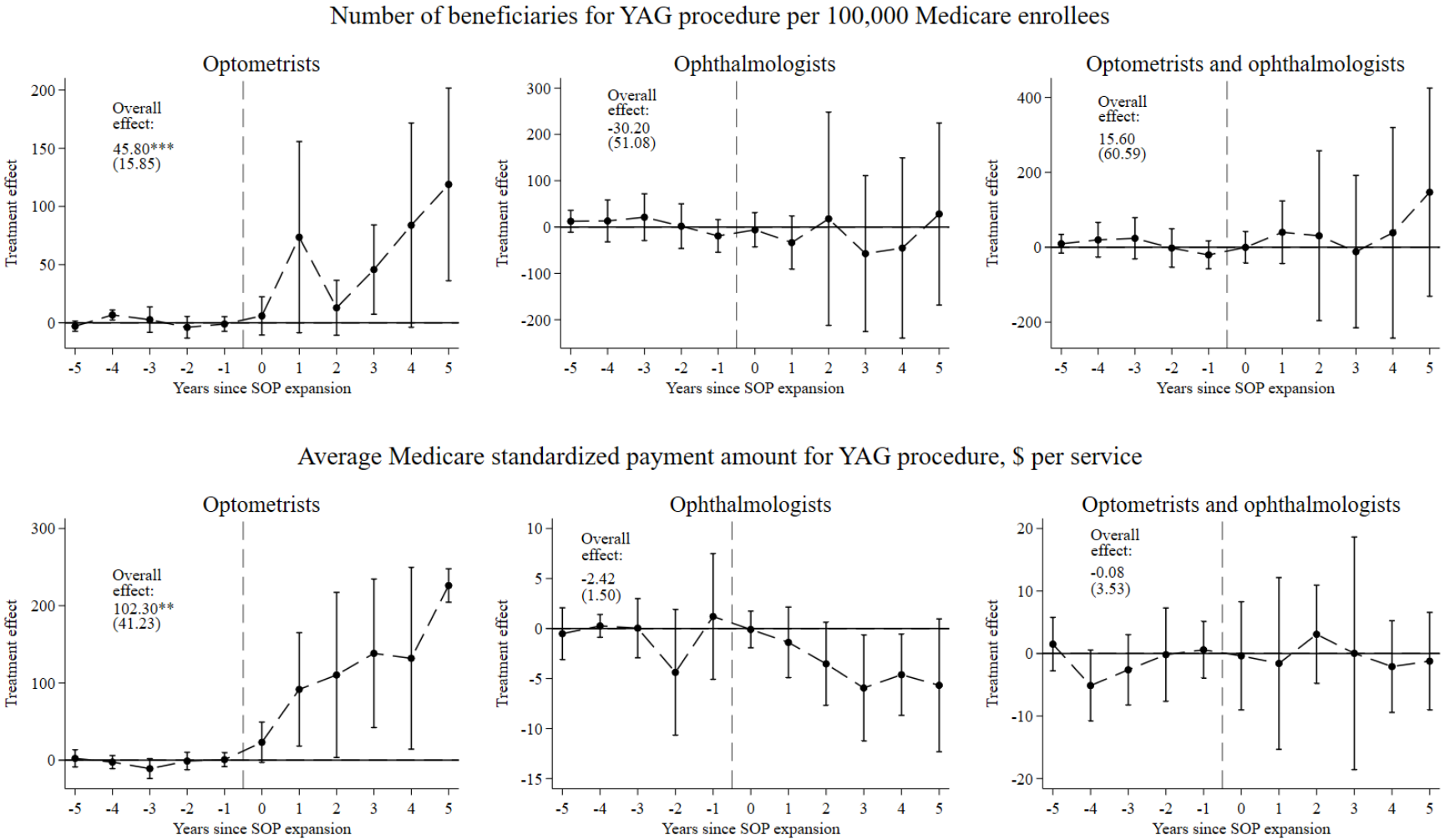
Outcome:	(1) Indicator for providers with 11 or more YAG procedures (beneficiaries)	(2) Number of YAG procedures (beneficiaries)
Panel A — *Optometrists*		
Early Treat (OK, KY)	0.118***	0.714***
	(0.033)	(0.050)
Late Treat (LA, AK, IN, AR, MS, WI, WY, CO, VA)	0.027*	0.191*
	(0.016)	(0.113)
Sample mean	0.025	24.099
Observations	29,442	738
Panel B — *Ophthalmologists*		
Early Treat (OK, KY)	0.018	-0.012
	(0.026)	(0.050)
Late Treat (LA, AK, IN, AR, MS, WI, WY, CO, VA)	0.034	0.104
	(0.026)	(0.107)
Sample mean	0.493	52.684
Observations	16,796	8,279
Panel C — *Optometrists and ophthalmologists*		
Early Treat (OK, KY)	0.038**	-0.093*
	(0.017)	(0.052)
Late Treat (LA, AK, IN, AR, MS, WI, WY, CO, VA)	0.012	0.048
	(0.013)	(0.080)
Sample mean	0.195	50.344
Observations	46,238	9,017

Notes: Linear probability models (OLS) were used to estimate the probability that a provider performed at least 11 YAG procedures (column 1). Truncated Poisson models were used to estimate the number of YAG procedures per provider (column 2). The 'Early Treat' variable is a dummy that takes a value of 1 for Oklahoma and Kentucky, and 0 for all other states. Similarly, the 'Late Treat' takes a value of 1 for Alaska, Arkansas, Colorado, Indiana, Louisiana, Mississippi, Virginia, Wisconsin, and Wyoming, and 0 for all other states. All regressions control for the number of Medicare beneficiaries receiving eye exams (performed by optometrists and ophthalmologists combined) and the number of Medicare beneficiaries receiving

cataract procedures performed by ophthalmologists. We identified eye exams using the following codes: intermediate eye exam for a new patient (HCPCS code 92002), intermediate eye exam for an established patient (HCPCS code 92012), comprehensive eye exam for a new patient (HCPCS code 92004), and comprehensive eye exam for an established patient (HCPCS code 92014). We identified cataract procedures using HCPCS code 66984. Both control variables – eye exams and cataract procedures – are measured at the county level. In aggregating data to the county level, missing values were recoded as zeroes. State-clustered standard errors are given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Authors' calculations based on 2022 data from the Medicare Physician & Other Practitioners by Provider and Service dataset produced by the Centers for Medicare & Medicaid Services.

Figure 1: Effects of Expanded SOP on YAG Procedures (State-Level, Callaway & Sant'Anna Method)



Notes: This figure depicts dynamic treatment effects estimated using the method proposed by Callaway & Sant'Anna (2021). We use never-treated states as comparison units. All variables are measured at the state level. In states with no beneficiaries of YAG procedures reported in a given subsample, the variable "Number of beneficiaries for YAG procedure per 100,000 Medicare enrollees" is coded as 0 and the variable "Average Medicare standardized payment amount for YAG procedure ($ per service)" is coded as

missing. We exclude Oklahoma and Kentucky, which were already treated at the start of our sample period. Treated cohorts consist of the following states: 2014 (Louisiana), 2017 (Alaska), 2018 (Indiana), 2019 (Arkansas), 2021 (Mississippi, Wisconsin, and Wyoming), and 2022 (Colorado and Virginia). All models incorporate the following covariates using augmented inverse-probability weighting: 1) the number of Medicare beneficiaries receiving eye exams (performed by optometrists and ophthalmologists combined) per 100,000 Medicare enrollees, and 2) the number of Medicare beneficiaries receiving cataract procedures performed by ophthalmologists per 100,000 Medicare enrollees. We identified eye exams using the following codes: intermediate eye exam for a new patient (HCPCS code 92002), intermediate eye exam for an established patient (HCPCS code 92012), comprehensive eye exam for a new patient (HCPCS code 92004), and comprehensive eye exam for an established patient (HCPCS code 92014). We identified cataract procedures using HCPCS code 66984. We do not correct for truncation in the underlying data. Standard errors are clustered at the state level. 95% confidence intervals are shown. We provide the overall treatment effect in the upper left corner of each sub-figure. Standard errors are given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Authors' calculations based on 2013-2022 data from the Medicare Physician & Other Practitioners by Provider and Service dataset produced by the Centers for Medicare & Medicaid Services.

Appendix

Table A1: Descriptive Statistics for Callaway & Sant'Anna Analysis

	(1)	(2)	(3)
	Full sample	Treated states	Comparison states
Panel A — *Optometrists*			
Number of beneficiaries for YAG procedure per 100,000 Medicare enrollees	24.550	43.201	20.354
Observations	490	90	400
Average Medicare standardized payment amount for YAG procedure ($ per service)	57.570	77.458	51.953
Observations	386	85	301
Panel B — *Ophthalmologists*			
Number of beneficiaries for YAG procedure per 100,000 Medicare enrollees	846.399	874.334	840.114
Observations	490	90	400
Average Medicare standardized payment amount for YAG procedure ($ per service)	252.364	250.258	252.838
Observations	490	90	400
Panel C — *Optometrists and ophthalmologists*			
Number of beneficiaries for YAG procedure per 100,000 Medicare enrollees	870.950	917.536	860.468
Observations	490	90	400
Average Medicare standardized payment amount for YAG procedure ($ per service)	239.295	232.569	240.808
Observations	490	90	400

Notes: This table gives the means of key variables used in our Callaway & Sant'Anna analysis. In states with no beneficiaries of YAG procedures reported in a given subsample, the variable "Number of beneficiaries for YAG procedure per 100,000 Medicare enrollees" is coded as 0 and the variable "Average Medicare standardized payment amount for YAG procedure ($ per service)" is coded as missing. We exclude Oklahoma and Kentucky, which were already treated at the start of our sample period. The treated group consists of the following states: Alaska, Arkansas, Colorado, Indiana, Louisiana, Mississippi, Virginia, Wisconsin, and Wyoming. We do not correct for truncation in the underlying data.

Source: Authors' calculations based on 2013-2022 data from the Medicare Physician & Other Practitioners by Provider and Service dataset produced by the Centers for Medicare & Medicaid Services.

Table A2: Association of Expanded SOP and YAG Procedures in 2022 (State-Level, Metro Areas)

Outcome:	(1) Number of beneficiaries for YAG procedure per 100,000 Medicare beneficiaries	(5) Average Medicare standardized payment amount for YAG procedure ($ per service)
Panel A — *Optometrists*		
Early Treat (OK, KY)	358.190*** (86.651)	193.603*** (10.983)
Late Treat (LA, AK, IN, AR, MS, WI, WY, CO, VA)	123.736* (71.917)	132.161*** (33.947)
Sample mean	51.740	89.565
Observations	50	34
Panel B — *Ophthalmologists*		
Early Treat (OK, KY)	-164.861*** (38.151)	-4.111* (2.159)
Late Treat (LA, AK, IN, AR, MS, WI, WY, CO, VA)	11.571 (63.726)	-4.507* (2.251)
Sample mean	882.042	251.722
Observations	50	50
Panel C — *Optometrists and ophthalmologists*		
Early Treat (OK, KY)	193.330*** (66.550)	0.880 (4.541)
Late Treat (LA, AK, IN, AR, MS, WI, WY, CO, VA)	135.307 (106.800)	-0.769 (5.819)
Sample mean	933.781	243.816
Observations	50	50

Notes: Models are estimated with ordinary least squares (OLS) regression. Metro and non-metro areas are defined at the county-level based on rural-urban continuum codes developed by the U.S. Department of Agriculture's Economic Research Service. Each practitioner is mapped to a county based on their ZIP code. In states with no beneficiaries of

YAG procedures reported in a given subsample, the variable "Number of beneficiaries for YAG procedure per 100,000 Medicare enrollees" is coded as 0 and the variable "Average Medicare standardized payment amount for YAG procedure ($ per service)" is coded as missing. Connecticut is excluded because CMS did not report county-level Medicare enrollment in the state in 2022. The 'Early Treat' variable is a dummy that takes a value of 1 for Oklahoma and Kentucky, and 0 for all other states. Similarly, the 'Late Treat' takes a value of 1 for Alaska, Arkansas, Colorado, Indiana, Louisiana, Mississippi, Virginia, Wisconsin, and Wyoming, and 0 for all other states. All regressions control for the number of Medicare beneficiaries receiving eye exams (performed by optometrists and ophthalmologists combined) per 100,000 Medicare enrollees and the number of Medicare beneficiaries receiving cataract procedures performed by ophthalmologists per 100,000 Medicare enrollees. We identified eye exams using the following codes: intermediate eye exam for a new patient (HCPCS code 92002), intermediate eye exam for an established patient (HCPCS code 92012), comprehensive eye exam for a new patient (HCPCS code 92004), and comprehensive eye exam for an established patient (HCPCS code 92014). We identified cataract procedures using HCPCS code 66984. We do not correct for truncation in the underlying data. Heteroskedasticity-robust standard errors are given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Authors' calculations based on 2022 data from the Medicare Physician & Other Practitioners by Provider and Service dataset produced by the Centers for Medicare & Medicaid Services.

Table A3: Association of Expanded SOP and YAG Procedures in 2022 (State-Level, Non-Metro Areas)

Outcome:	(1) Number of beneficiaries for YAG procedure per 100,000 Medicare beneficiaries	(5) Average Medicare standardized payment amount for YAG procedure ($ per service)
Panel A — *Optometrists*		
Early Treat (OK, KY)	309.483**	158.995***
	(143.710)	(14.998)
Late Treat (LA, AK, IN, AR, MS, WI, WY, CO, VA)	65.848***	80.732**
	(24.010)	(34.866)
Sample mean	65.143	78.870
Observations	46	35
Panel B — *Ophthalmologists*		
Early Treat (OK, KY)	-150.687**	-7.220
	(73.358)	(6.220)
Late Treat (LA, AK, IN, AR, MS, WI, WY, CO, VA)	-50.820	-4.799
	(30.742)	(3.921)
Sample mean	435.452	249.642
Observations	46	45
Panel C — *Optometrists and ophthalmologists*		
Early Treat (OK, KY)	158.796**	16.625
	(75.603)	(15.389)
Late Treat (LA, AK, IN, AR, MS, WI, WY, CO, VA)	15.028	8.278
	(43.793)	(18.246)
Sample mean	500.595	207.026
Observations	46	46

Notes: Models are estimated with ordinary least squares (OLS) regression. Non-metro areas are defined at the county-level based on rural-urban continuum codes developed by the U.S. Department of Agriculture's Economic Research Service. Each practitioner is mapped to a county based on their ZIP code. In states with no beneficiaries of YAG procedures reported in a given subsample, the variable "Number of beneficiaries for YAG procedure per 100,000 Medicare enrollees" is coded as 0 and the variable "Average Medicare standardized payment amount for YAG procedure ($ per service)" is coded as missing. Connecticut is excluded because CMS did not report county-level Medicare enrollment in

the state in 2022. The following jurisdictions are excluded because they do not have any non-metro counties: Delaware, District of Columbia, New Jersey, and Rhode Island. The 'Early Treat' variable is a dummy that takes a value of 1 for Oklahoma and Kentucky, and 0 for all other states. Similarly, the 'Late Treat' takes a value of 1 for Alaska, Arkansas, Colorado, Indiana, Louisiana, Mississippi, Virginia, Wisconsin, and Wyoming, and 0 for all other states. All regressions control for the number of Medicare beneficiaries receiving eye exams (performed by optometrists and ophthalmologists combined) per 100,000 Medicare enrollees and the number of Medicare beneficiaries receiving cataract procedures performed by ophthalmologists per 100,000 Medicare enrollees. We identified eye exams using the following codes: intermediate eye exam for a new patient (HCPCS code 92002), intermediate eye exam for an established patient (HCPCS code 92012), comprehensive eye exam for a new patient (HCPCS code 92004), and comprehensive eye exam for an established patient (HCPCS code 92014). We identified cataract procedures using HCPCS code 66984. We do not correct for truncation in the underlying data. Heteroskedasticity-robust standard errors are given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Authors' calculations based on 2022 data from the Medicare Physician & Other Practitioners by Provider and Service dataset produced by the Centers for Medicare & Medicaid Services.