Optometric surgical scope expansion "has been successful in other states":

Those who contend that optometric therapeutic, laser, and surgical laws in other states have been successful and without negative ramifications are sadly misinformed. Physicians in those states see misdiagnoses and inappropriate treatment of patients managed by optometrists with significant frequency, as documented in the letters from ophthalmologists in Oklahoma and Kentucky.

Ophthalmology residents are usually in classes of 3-5. This small size allows for intense, personal, hands-on training. Optometry schools and continuing education workshops do not provide enough access to live patients for sufficient hands-on training. Most of the optometric surgical training is done in large groups where students observe rather than perform.

Optometrists do not have the education or training to safely manage the potential complications arising from any of these surgeries. This has been noted many times in states with expanded scope of practice for optometry, particularly Oklahoma and Kentucky.

In addition, ineffective, incorrect, or an excessive number of treatments by inexperienced optometrists is evidenced by the *Journal of the American Medical Association*'s 2015 investigation in Oklahoma where outcomes of laser trabeculoplasty (LTP's) performed by ophthalmologists were compared with those performed by optometrists to determine whether differences existed in the need for additional LTP's.

The result: Among the 1,384 eyes that received laser trabeculoplasty, the proportion of eyes treated by optometrists requiring additional laser trabeculoplasty in the same eye (35.9%) was more than double the proportion of those treated by ophthalmologists (15.1%). Optometrist-treated eyes had a 189% increased risk of requiring additional laser trabeculoplasty.

At the least, this leads to significantly increased costs to the system and patients, but also potentially to incorrect or ineffective treatments.

JAMA Ophthalmol. 2016;134(10):1-7. doi:10.1001/jamaophthalmol.2016.2495 Published online July 28, 2016.

JAMA Ophthalmology | Original Investigation

Comparison of Outcomes of Laser Trabeculoplasty Performed by Optometrists vs Ophthalmologists in Oklahoma

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Invited Commentaries pages 1 and 1

CME Quiz at jamanetworkcme.com and CME Questions eme160010

IMPORTANCE Oklahoma is one of the few states where optometrists have surgical privileges to perform laser trabeculoplasty (LTP). Optometrists in other states are lobbying to obtain privileges to perform LTP and other laser procedures. Little is known whether outcomes of patients undergoing this procedure by optometrists are similar to those undergoing LTP by ophthalmologists.

OBJECTIVE To compare outcomes of LTPs performed by ophthalmologists with those performed by optometrists to determine whether differences exist in the need for additional LTPs.

DESIGN, SETTING, AND PARTICIPANTS This retrospective longitudinal cohort study used a health care claims database containing more than 1000 eyes of Medicare enrollees with glaucoma who underwent LTP in Oklahoma from January 1, 2008, through December 31, 2013. For each procedure, the data specify the type of eye care professional who performed the LTP. The rate of LTPs performed by ophthalmologists that required 1 or more additional LTPs in the same eye was compared with the rate of LTPs performed by optometrists. Regression models determined factors affecting risk of undergoing more than 1 LTP in the same eye.

MAIN OUTCOMES AND MEASURES Proportion of enrollees requiring additional LTPs, hazard ratio with 95% CIs of undergoing additional LTPs.

RESULTS A total of 1384 eyes of 891 eligible patients underwent LTP from January 1, 2008, through December 31, 2013. There were 1150 eyes that received LTP (83.1%) by an ophthalmologist and 234 eyes (16.9%) that had the procedure performed by an optometrist. The mean (SD) age at the initial LTP was 77.7 (7.5) years for enrollees with ophthalmologist-performed LTP and 77.6 (8.0) years for those with optometrist-performed LTP ($P = .89$). Among the 1384 eyes receiving LTP, 258 (18.6%) underwent more than 1 LTP in the same eye. The proportion of eyes undergoing LTP by an optometrist requiring 1 or more subsequent LTP session (35.9%) was more than double the proportion of eyes that received this procedure by an ophthalmologist (15.1%). Medicare beneficiaries undergoing LTP by optometrists had a 189% increased hazard of requiring additional LTPs in the same eye compared with those receiving LTP by ophthalmologists (hazard ratio, 2.89; 95% CI, 2.00-4.17; $P < .001$) after adjusting for potential confounders.

CONCLUSIONS AND RELEVANCE Considerable differences exist among the proportions of patients requiring additional LTPs comparing those who were initially treated by ophthalmologists with those initially treated by optometrists. Health policy makers should be cautious about approving laser privileges for optometrists practicing in other states until the reasons for these differences are better understood.

JAMA Ophthalmol. 2016;134(10):1-7. doi:10.1001/jamaophthalmol.2016.2495
Published online July 28, 2016.

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Laser trabeculoplasty (LTP) is a common procedure that can effectively decrease intraocular pressure in patients with primary and some secondary forms of open-angle glaucoma. It can augment the ability to lower intraocular pressure in patients who are already taking glaucoma medications and is useful in patients who have difficulty administering eye drops or with medication adherence. In fact, LTP may be a more cost-effective option for treating glaucoma than medication, especially for patients who have difficulty with adherence.[1,2] The advent of selective LTP contributed to a 46% increase in this procedure among Medicare beneficiaries from January 1, 2002, through December 31, 2009.[3]

Ophthalmologists have been performing LTP since 1979 when the procedure was first developed by Wise and Witter.[4] Recently, optometrists have been lobbying state legislatures for expanded privileges so they may perform LTP. In Oklahoma, optometrists were given permission to perform LTP on patients with glaucoma in 1998.[5] More recently, legislation was passed in Kentucky and Louisiana allowing optometrists to perform laser ocular surgical procedures.[6,7] Ophthalmologists learn how to perform LTP during residency training. The Accreditation Council for Graduate Medical Education mandates that graduating residents perform a minimum of 5 LTPs.[8] Case logs show that the average ophthalmological resident performs 14 LTPs and 83 other laser procedures during residency training.[9] In Oklahoma, training of optometrists to perform lasers involves a 2-day course, "Laser Therapy for the Anterior Segment," which is held at the Northeastern State University Oklahoma College of Optometry. This course consists of 9 hours of lectures and 4 hours of laboratory sessions, including gonioscopy, LTP, laser iridotomy, and capsulotomy.[10]

To our knowledge, there has never been a study comparing outcomes of LTP performed by ophthalmologists vs procedures performed by optometrists. Using a health care claims database containing more than 1000 eyes of Medicare beneficiaries with glaucoma who underwent LTP in Oklahoma, we compared outcomes of those receiving this procedure by ophthalmologists vs enrollees undergoing LTP by optometrists. These analyses may help guide health policy makers in other states who are trying to decide whether to give optometrists privileges to perform laser procedures.

Key Points

Question Are there differences in the frequency and likelihood of undergoing additional laser trabeculoplasty among Medicare enrollees in Oklahoma who underwent this procedure by an ophthalmologist vs others who underwent the procedure by an optometrist?

Findings Among the 1384 eyes receiving laser trabeculoplasty, the proportion of eyes treated by optometrists requiring additional laser trabeculoplasty in the same eye (35.9%) was more than double the proportion of those treated by ophthalmologists (15.1%). Optometrist-treated eyes had a 189% increased risk of requiring additional laser trabeculoplasty.

Meaning Future work seems warranted to substantiate whether the differences identified affect clinical outcomes and costs.

Methods

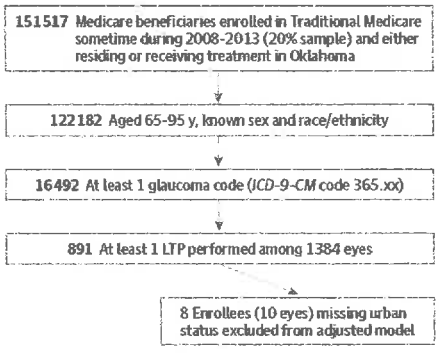
Data Source

We used a 20% nationally representative sample of Medicare claims to identify beneficiaries undergoing LTP. The database contained information including *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*)[11] diagnosis codes, *Current Procedural Terminology* (*CPT-4*)[12] procedure codes, National Provider Identifier numbers to identify specific eye care professionals, and service dates for all encounters. Claims data were merged with Medicare denominator files for information on enrollment dates in Medicare and demographic characteristics of the beneficiaries. Data were linked by a patient identifier, allowing longitudinal, person-specific analysis from January 1, 2008, through December 31, 2013. A similar data source was used previously to study patients with ocular diseases.[13,14] The University of Michigan institutional review board approved this study, which used deidentified claims data.

Study Sample

We identified all individuals with any form of glaucoma (*ICD-9-CM* code 365.xx) who underwent 1 or more LTP (*CPT-4* code 65855) from January 1, 2008, through December 31, 2013, in Oklahoma (**Figure 1**). *Current Procedural Terminology* codes do not distinguish argon LTP, selective LTP, and micropulse LTP; therefore, beneficiaries who underwent any of these procedures were included. Individuals younger than 65 and older than 95 years were excluded as were enrollees in Medicare Advantage plans because our data source does not fully describe all care received by persons in such plans. Procedures that were submitted for payment but not paid and those missing eye laterality were also excluded. Each claim specifies whether an ophthalmologist or optometrist performed the LTP and whether it was performed on the right or left eye. Bilateral codes were counted as separate procedures for each eye.

Figure 1. STROBE Sample Selection Figure



Identification of beneficiaries eligible for current study from 20% Medicare claims database. *ICD-9-CM* indicates *International Classification of Diseases, Ninth Revision, Clinical Modification*; LTP, laser trabeculoplasty.

Statistical Analysis

All analyses were performed using SAS software, version 9.4 (SAS Inc) and R, version 3.2.3 (R Foundation for Statistical Computing). Characteristics of the study population were summarized using means (SDs) for continuous variables and frequencies and percentages for categorical variables. For all inference procedures, $P < .05$ (Kaplan-Meier method, Wald test, and Cox proportional hazards regression model) was considered statistically significant.

Receipt of Additional LTPs

The primary outcome was receipt of additional LTPs in the same eye. This outcome was identified as another record of *CPT-4* code 65855 on a separate date on the same eye as the initial procedure. Subsequent LTPs could have been performed by the same eye care professional or an ophthalmologist or optometrist other than the health care professional who performed the initial procedure. The unit of observation was the eye, but a clustering term was included to allow for the correlation between eyes of the same beneficiary.[15] Observations were right censored at the end of eligibility.

We calculated product limit estimates (with robust SEs) of the time to the second LTP as a function of the type of initial eye care professional (ophthalmologist or optometrist). These estimates were compared at 6 months and 3 years with Wald tests. We used proportional hazards regression models (created by generalized estimating equations to allow for correlated observations) to determine a single estimate of the effect of the key predictor variable: type of eye care professional who performed the initial LTP. An additional model was created adjusting for age at initial LTP, sex, race/ethnicity, where the enrollee lived (urban, large rural, or small rural town), and year of the procedure. In a separate model, we studied whether an interaction between race/ethnicity (non-Hispanic white vs black, Hispanic, American Indian, and persons of other races/ethnicities) and type of eye care professional performing the initial LTP affected the hazard of undergoing additional LTPs.

Receipt of Incisional Glaucoma Surgical Procedures After LTP

Finally, we determined the proportion of patients receiving LTP by each type of eye care professional who subsequently underwent incisional glaucoma surgery (trabeculectomy or glaucoma drainage-device insertion) during the follow-up.

Results

A total of 1384 eyes of 891 eligible patients underwent 1 or more LTPs in Oklahoma during the study period. There were 1150 eyes that received LTP (83.1%) by an ophthalmologist and 234 eyes (16.9%) that had the procedure performed by an optometrist. A total of 493 patients (55.3%) underwent LTP at least once in both eyes. The number of LTPs performed by ophthalmologists ranged from 1 to 277 procedures; 57 ophthalmologists performed this procedure at least once. Optometrists each performed from 1 to 38 LTP procedures; 23 optometrists performed LTP at least once. The most common *ICD-9-CM* glaucoma diagnosis code listed on the date of the initial LTP was 365.11 (1206 [87.1%]) and was similar for both types of eye care professionals (975 [86.6%] of patients with an ophthalmologist-performed LTP and 231 [89.7%] with an optometrist-performed procedure). All enrollees in both groups were observed for up to 72 months. The median time from study eligibility to the first LTP was 28.8 months for patients first treated by ophthalmologists and 20.0 months for patients first treated by optometrists. The median times from the first LTP to the end of follow-up were 31.3 and 42.4 months, respectively. The mean (SD) age at the initial LTP was 77.7 (7.5) years for enrollees with ophthalmologist-performed LTP and 77.6 (8.0) years for those with optometrist-performed LTP ($P = .89$). The proportions of white, black, and other patients receiving LTP by ophthalmologists vs optometrists were 85.2% vs 75.5% ($P = .004$), 8.2% vs 10.8% ($P = .33$), and 6.5% vs 13.7% ($P = .004$), respectively (**Table 1**). Twenty-five enrollees (2.8%) received bilateral LTP on the same day.

Among the 1150 eyes undergoing LTP by an ophthalmologist, 174 (15.1%) received 1 or more LTPs on the same eye during the follow-up. Of the 234 eyes treated with LTP by optometrists, 84 (35.9%) underwent 1 or more additional LTPs on the same eye during follow-up ($P < .001$). **Figure 2** displays the distribution of time to second procedure. Second procedures within 6 months were much less common when the first procedure was performed by an ophthalmologist (3.9%) vs an optometrist (24.9%) ($P < .001$). The difference persisted with time, for example, 17.7% vs 34.3% at 3 years ($P < .001$).

We also studied the timing of the additional LTPs by the 2 eye care professional groups relative to the 10-day global period (ie, the immediate post-LTP period, when charges for normal postoperative care are included in the global surgical procedure fee). For patients first treated by ophthalmologists, no additional procedures occurred during the global period, and the probability of a subsequent LTP between 11 and 30 days was 1.1% (95% CI, 0.7%-1.9%). For patients first treated by optometrists, the probability of subsequent LTPs in the global period was 0.4% (95% CI, 0.1%-3.0%) and between days 11 and 30 was 10.3% (7.0%-15.0%).

For the 174 eyes that received LTP by ophthalmologists that required additional laser treatment, 155 (89.1%) received the subsequent LTP by the same ophthalmologist, 13 (7.5%) by a different ophthalmologist, and 6 (3.4%) by an optometrist. Among the 1150 eyes initially treated by ophthalmologists, 21 (1.8%) underwent 3 or more LTPs on the same eye. In comparison, for the 84 eyes that received LTP by optometrists that required additional LTPs, 73 (86.9%) received the subsequent LTP by the same optometrist, 5 (6.0%) by a different optometrist, and 6 (7.1%) by an ophthalmologist. Of the 234 eyes treated initially by optometrists, 11 (4.7%) underwent 3 or more LTPs on the same eye.

After adjustment for potential confounding factors, eyes that received LTP by optometrists had a 189% greater hazard for a subsequent LTP in the same eye during follow-up (hazard ratio, 2.89; 95% CI, 2.00-4.17; $P < .001$) compared with those undergoing LTP by an ophthalmologist. Female patients had a 43% increased hazard of undergoing a subsequent LTP in the same eye during follow-up (hazard ra-

Table 1. Demographics of Patients Receiving LTP by an Ophthalmologist or Optometrist

Characteristic	Overall	LTP Initially by an Ophthalmologist	LTP Initially by an Optometrist	P Value
Individuals, No.	891	752	139	
Eyes, No.	1384	1150	234	
Patient age, mean (SD), y	77.7 (7.6)	77.7 (7.5)	77.6 (8.0)	.89
Sex, No. (%)				
Male	345 (39)	294 (39)	51 (37)	.59
Female	546 (61)	458 (61)	88 (63)	
Race, No. (%)				
White	746 (84)	641 (85)	105 (76)	
Black	77 (9)	62 (8)	15 (11)	
Hispanic	7 (<1)	6 (<1)	1 (<1)	.02
Native	57 (6)	40 (5)	17 (12)	
Other	4 (<1)	3 (<1)	1 (<1)	
Year of first procedure, mean (SD)[a]	2010.3 (1.7)	2010.4 (1.7)	2009.9 (1.6)	.001
Year of first procedure, No. (%)				
2008	171 (19.2)	135 (18.0)	36 (26.0)	.04
2009	168 (18.9)	137 (18.2)	31 (22.3)	
2010	147 (16.5)	120 (16.0)	27 (19.4)	
2011	148 (16.6)	131 (17.4)	17 (12.2)	
2012	135 (15.2)	120 (16.0)	15 (10.8)	
2013	122 (13.7)	109 (14.4)	13 (9.4)	

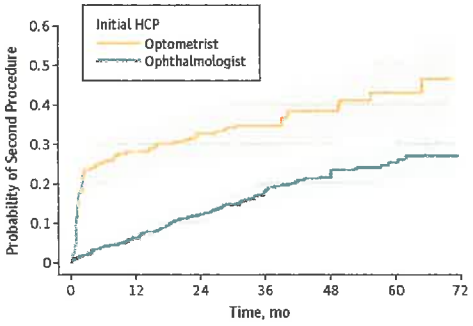
Abbreviation: LTP, laser trabeculoplasty.

[a] The average of the 1384 dates of the initial LTP.

tio, 1.43; 95% CI, 1.02-2.01; $P = .04$). There was no association between age (hazard ratio, 1.04 per 10 years; 95% CI, 0.84-1.28) at initial LTP ($P = .72$), between black, Hispanic, or American Indian individuals, and persons of other races/ethnicities vs white ($P = .79$; hazard ratio, 1.06; 95% CI, 0.71-1.57), or between large rural vs urban residence of the patient ($P \geq .15$; hazard ratio, 0.75; 95% CI, 0.48-1.17) and between small rural vs urban residence of the patient ($P \geq .15$; hazard ratio, 0.73; 95% CI, 0.48-1.12) and the hazard of additional LTPs (**Table 2**). The interaction model used to investigate whether race/ethnicity affected the hazard ratio of additional LTPs for ophthalmologist-performed vs optometrist-performed LTP was not statistically significant.

Among the 1150 eyes that underwent LTP by ophthalmologists, 49 (4.3%) subsequently underwent incisional glaucoma surgery. By comparison, of the 234 eyes that underwent LTP by an optometrist, 5 (2.1%) subsequently underwent such surgery.

Figure 2. Time to Second Laser Trabeculoplasty in Same Eye for Beneficiaries Receiving Initial Treatment by Ophthalmologists and Optometrists



No. at risk

Optometrist	234	154	117	83	52	27
Ophthalmologist	1150	890	624	387	219	100

Kaplan-Meier estimates of cumulative incidence for each group. Data are clustered because of some beneficiaries having both eyes studied. The study lasted 72 months: follow-up began at the first laser trabeculoplasty. Therefore, there was none at risk at month 72. HCP indicates health care professional.

Discussion

In this analysis of more than 1000 eyes of Medicare beneficiaries with glaucoma who underwent LTP in Oklahoma from January 1, 2008, through December 31, 2013, we note substantial differences in the receipt of additional LTPs by patients who underwent the procedure by an ophthalmologist compared with an optometrist. After adjustment for demographic and other factors, patients who underwent LTP by an optometrist had an approximate 2-fold higher likelihood of undergoing additional LTPs in the same eye compared with others who received this procedure by an ophthalmologist. Most additional LTPs performed by optometrists were done soon after the initial procedure and were performed by the same optometrist as the initial LTP.

Although this study highlights major differences in outcomes of patients undergoing subsequent LTPs after the initial procedure performed by ophthalmologists and procedures performed by optometrists, it is difficult with claims data to discern the reasons for the differences observed. Possible

Table 2. Factors Affecting the Hazard of Requiring Additional Laser Trabeculoplasty[a]

Factor	Model	Hazard Ratio (95% CI)[b]	P Value
Initial LTP by an OD vs initial LTP by an EyeMD	Crude	2.58 (1.84-3.61)	<.001
Initial LTP by an OD vs initial LTP by an EyeMD	Adjusted	2.89 (2.00-4.17)	<.001
Each year later LTP was initially performed (eg, 2013 vs 2012)	Adjusted	1.03 (0.92-1.16)	.57
Female vs male	Adjusted	1.43 (1.02-2.01)	.04
Other races vs white	Adjusted	1.06 (0.71-1.57)	.79
Each additional decade of age	Adjusted	1.04 (0.84-1.28)	.72
Large rural town vs urban	Adjusted	0.75 (0.48-1.17)	.20
Small rural town vs urban	Adjusted	0.73 (0.48-1.12)	.15

Abbreviations: EyeMD, ophthalmologist; LTP, laser trabeculoplasty; OD, optometrist.

[a] The adjusted model included all of the covariates listed in the table: whether the LTP was performed by an optometrist (vs an ophthalmologist), calendar year the LTP was performed, sex, race/ethnicity, age, and patient residence. The interpretation of the calendar year of the initial LTP is as follows: Persons who underwent their initial LTP in 2013 had a 3.4% increased hazard of requiring additional LTPs compared with those who had their initial LTP in 2012. This difference was not statistically significant. SEs were adjusted for clustering because of some beneficiaries having both eyes studied. P values and 95% CIs are from robust Wald procedures.

[b] Hazard ratios are calculated from crude and adjusted proportional hazards regression models for time to event (second procedure in same eye).

explanations include differences in the sociodemographic characteristics of ophthalmologists' vs optometrists' patients and how each group responds to LTP, differences in disease severity between the 2 groups, differences in selection of patients who are appropriate candidates for LTP between the 2 types of eye care professionals, and differences in how the LTP was performed, including the type of laser used, laser settings, amount of the drainage angle treated in one setting, or whether the procedure was performed properly. Unfortunately, without access to clinical data, such as the preoperative and postoperative intraocular pressure levels, gonioscopy findings, and records describing how the procedures were performed, it is impossible to identify which of these or other factors are contributing to the observed differences in receipt of subsequent LTPs between the groups.

Another possible explanation for differences observed may be that ophthalmologists can perform incisional surgery on patients with failed LTP, whereas optometrists, who cannot do so, may perform additional LTPs. Likewise, because incisional glaucoma surgery is reimbursed more than LTP, this could influence decision making. However, we doubt that this factor is contributing much to the differences observed because a subset of ophthalmologists routinely performs incisional glaucoma surgery, whereas most eye care professionals (optometrists and comprehensive ophthalmologists) would refer patients to glaucoma subspecialists for surgery and thus not benefit financially from recommending incisional surgery vs additional LTPs. Furthermore, few patients in both groups underwent incisional glaucoma surgery during the follow-up; therefore, it is unlikely that this is a major factor responsible for the differences in additional LTPs between the 2 groups.

Some of the patients undergoing LTP by optometrists may reside in communities where access to incisional glaucoma surgery is limited, which may explain some of the differences. Moreover, despite the fact that all the patients in this analysis had Medicare, patients of ophthalmologists may have been better able to make the copayments of incisional glaucoma surgery compared with those receiving care by optometrists. Additional research is needed to study these various potential explanations.

The success of LTP depends on various patient-related and health care professional–related factors. Laser trabeculoplasty has been most effective in patients with primary open-angle glaucoma, exfoliation glaucoma, and pigmentary glaucoma.[16-18] Other glaucoma types, such as angle-closure and angle-recession glaucoma, usually respond poorly to LTP. The degree of angle pigmentation can also affect the success of the procedure and risk for intraocular pressure increases after LTP.[19,20] Experience and expertise of the eye care professional can also affect outcomes because the effectiveness of LTP requires proper identification of the angle structures to treat. Although, to our knowledge, this is the first study that directly compared LTP performed by ophthalmologists vs optometrists, Lowry et al[21] showed that LTP performed by attending ophthalmologists was more effective than procedures performed by resident physicians, suggesting that experience in performing the procedure is important.

An interesting finding from these analyses is that many of the patients who underwent additional LTPs by optometrists did so soon after the initial LTP, whereas additional LTPs among patients treated by ophthalmologists tended to occur much later after the initial procedure. One can speculate the reasons for the differences observed. One possibility is that the optometrists performing this procedure may have been more cautious, scheduling the procedure into 2 or more sessions to try to limit postoperative inflammation or intraocular pressure increases.[22,23] Alternatively, to maximize reimbursement, some optometrists may schedule LTP into more than 1 session, with the timing of subsequent LTPs after the 10-day global period of the initial procedure. The large increase in additional LTPs for the patients undergoing the procedure by optometrists immediately after the global period suggests that this may be a contributing factor, although we are unaware of any reports indicating that optometrists systematically practice in this manner. A third possibility is that because the pres-

sure-decreasing effect of LTP may take several weeks to months to occur, ophthalmologists may be more aware that it may take some time to observe the effect of the initial LTP before proceeding with additional LTPs. However, we know of no studies directly comparing the knowledge level about LTP of these 2 eye care professional groups. With claims data, we cannot tell whether any of these or other factors are responsible for the differences in performance of subsequent LTPs immediately after the global period.

Several studies have assessed the outcomes of additional LTPs.[24] Feldman et al[25] found a 35% success rate at 6 months with additional argon LTPs, which decreases to 11% after 24 months. Starita et al[26] reported that 18% of patients who underwent additional argon LTPs had an intraocular pressure increase of more than 10 mm Hg. As a result, authorities often discourage the performance of additional argon LTPs. The success of additional selective LTPs has been more promising. Hong et al[27] described additional intraocular pressure reduction after additional selective LTPs. Durr and Harasymowycz[28] did as well. Others have shown that selective LTP can decrease intraocular pressure in eyes that have undergone argon LTP previously.[29] Unfortunately, our data source lacks details regarding the amount of the angle treated and the type of laser used during the initial procedure to assess whether the subsequent LTPs performed by eye care professionals in both groups are consistent with recommended clinical practice guidelines.

To our knowledge, this is the first study to examine differences in outcomes of LTP between patients receiving care by ophthalmologists and those by optometrists. A strength of this study is its large diverse population of patients with glaucoma enrolled in Medicare throughout Oklahoma. We are not only including patients receiving care at one particular academic institution or by a small group of eye care professionals but are also including patients who underwent LTP performed by 57 ophthalmologists and 23 optometrists. We had longitudinal follow-up for several years after the initial LTP to compare the longer-term outcomes. Finally, the data come from claims submitted by ophthalmologists and optometrists, and not from patient self-report, which may be less reliable.[30]

Our study has several limitations. First, claims data lack clinical details, such as intraocular pressure levels before or after LTP, slitlamp and gonioscopy findings, or details of how the procedures were performed. Second, our study focused on Medicare beneficiaries. It is unclear whether the findings would be similar for younger patients or those with other forms of health insurance. Third, there may be systematic differences between the patients receiving care by ophthalmologists and those by optometrists, including differences in disease severity between the groups. Unfortunately, there were not enough eyes that were coded with the new glaucoma severity codes to assess for this difference. One would expect that patients with more severe glaucoma would be receiving their care by ophthalmologists and thus would be more, not less, likely to require additional LTPs. Although we adjusted our models for some confounding factors, including age and race/ethnicity, there are other unmeasured confounders not included in claims data.

Conclusions

Based on the findings of these analyses, we urge state legislatures and health policy makers to be cautious about giving optometrists privileges to perform LTP in other states until additional research is performed to better delineate the reasons for the differences in the use of additional LTP we are observing in Oklahoma. Furthermore, researchers should determine the effect that these differences have on costs of care and, most important, on clinical outcomes such as disease progression.

ARTICLE INFORMATION

Accepted for Publication: May 27, 2016.

Published Online: July 28, 2016. doi:10.1001/jamaophthalmol.2016.2495

Author Contributions: Dr Stein had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.
Acquisition, analysis, or interpretation of data: All authors.
Drafting of the manuscript: Stein, Zhao.
Critical revision of the manuscript for important intellectual content: Zhao, Andrews, Skuta.
Statistical analysis: Andrews.
Administrative, technical, or material support: Stein.
No additional contributions: Zhao, Skuta.

Conflict of Interest Disclosures: All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none were reported.

Funding/Support: This study was supported by a Research to Prevent Blindness Physician Scientist Award, the American Academy of Ophthalmology, and an unrestricted grant from Research to Prevent Blindness.

Role of the Funder/Sponsor: The funding organizations had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

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Invited Commentary

Public Health Policy Lessons From Oklahoma

Alan L. Robin, MD

Laser trabeculoplasty (LTP) was popularized in 1979[1] in eyes receiving maximal medical therapy. Various prospective clinical trials sponsored by the National Institutes of Health have since better defined its usefulness in early and advanced glaucoma. Today, the American Academy of Ophthalmology Primary Open Angle Glaucoma Preferred Practice Pattern finds that argon LTP and selective LTP have comparable intraocular pressure (IOP) lowering efficacy and safety profiles, but additional LTP (regardless of the laser type) has a decreased rate of success and an increased complication profile, including permanent IOP increase.[2]

Related article

Stein et al[3] find a clinically significant difference in the frequency of additional LTPs between optometrists and ophthalmologists in Oklahoma. The study's data analysis is valid.[4] Despite acknowledged limitations, the use of claims allows us to observe the habits of many different health care professionals rather than a select few practices or academic centers. These data do not rely on patients' self-report but rather coding as performed by health care professionals. Finally, the number of patients and treatments is an order of magnitude larger than existing data sources.

Historically, claims data have helped us better understand how LTP is used. We have successfully used insurance claims data when assessing LTP's frequency and geographic patterns of use.[5,6] Claims data have also allowed us to better understand associated costs when compared with medical therapy with a prostaglandin analogue.[7]

Three events occurred between 2001 and 2002, which dramatically changed the number of LTPs performed. First, in 2001, the Q-switched Nd:YAG LTP entered widespread use, with no thermal damage and possible repeatability. Second, the global period for payment of LTP decreased from 90 to 10 days. Third, the Centers for Medicare & Medicaid Services reimbursement for LTP began to decrease (−14% between 2001 and 2002). From 76 000 procedures in 2001, the number of procedures quickly increased to 157 000 by 2004.

We initially treated a full 360° of the trabecular meshwork in 1 session. In 1983, a single small prospective study found a marked increase in the incidence and magnitude of the immediate IOP increase in eyes undergoing 360° vs 180° of LTP. This increase worried many surgeons, causing them to change their treatment patterns to two 180° sessions per eye. However, additional LTPs can be harmful.[8] In addition, in the National Eye Institute-sponsored Glaucoma Laser Trial, an eye that developed an IOP increase after the first treatment session was at significantly higher risk of developing an increase during the second session. Moreover, studies in humans found that performing an LTP more than once, after 360° treatment, could permanently increase the IOP.[2]

The US Food and Drug Administration approved apraclonidine, 1%, in December 1987. The concept of two 180° treatments ended for most because 2 pivotal trials using 360° argon LTP found the rate of large IOP increases more than 10 mm Hg over baseline diminished from 17% to 0% and from 19% to 5%.[9] Most ophthalmologists quickly implemented prophylactic topical alpha agonist therapy, and 360° LTP was again performed in a single session.[7] It is a rare circumstance when two 180° sessions might be preferable to a single session.

It is concerning that more than twice as many (36% [84] vs 15% [174]) eyes treated by optometrists required 1 or more LTP compared with those treated by ophthalmologists, especially considering how quickly the retreatment occurred after the initial LTP. In the group of eyes operated on by ophthalmologists, no additional treatments occurred in the global reimbursement period, whereas the chance of an additional treatment was 0.4% (95% CI, 0.1%-3.0%) if treated by an optometrist. Outside the global period, during days 11 to 30, the chance of an additional LTP was 1.1% (95% CI, 0.7%-1.9%) if performed by an ophthalmologist, whereas it was almost 10-fold higher (10.3%; 95% CI, 7%-15%) for procedures performed by an optometrist. There are direct and indirect costs to the patient and the accompanying person for additional office visits or laser treatments because both must take time from work, incur the costs of travel, and time away from other responsibilities. These costs and inconveniences may be more difficult for elderly individuals. Costs are higher in rural areas in a state like Oklahoma, where distances are farther, and lost time and transportation costs are increased.

Potential reasons for such differences in patterns of treatment are many. Is the absence of intensive training of optometrists in gonioscopy—a crucial necessity to perform appropriate laser treatment—a significant part of the problem? First, one must learn gonioscopy to determine the type of glaucoma because some forms with open angles do not respond to LTP. Second, it has to be confirmed that the angle is open and treatable. Finally, treatment applications in the trabecular meshwork must be accurately placed. Most optometrists have a limited exposure to glaucoma and gonioscopy during their rotations in optometric schooling, and less than one-quarter of optometric students take pathological rotations and residencies in which glaucoma and gonioscopy may be taught and practiced. Perhaps the optometric training did not include a thorough understanding of the variation and diurnal fluctuation of IOP? Could it be that the training did not include that one must wait at least a month to determine whether the treatment is successful?

The higher rate of additional treatment in the first month may be caused by the unwarranted fear of an acute IOP increase because the optometrist may not perform filtration surgery. In addition, eyes treated initially with argon LTP, if performed more than once, may have permanent IOP increase.

One must remember the following. Dividing an LTP into two 180° sessions is almost always unnecessary and more costly. Also, if a 360° LTP has been performed, an additional treatment is less likely to be successful, is costly, and potentially harmful. There are direct and indirect costs of extra visits associated with additional LTPs to the health care system and, equally important, to patients and their families.

Studies such as this by Stein et al[3] should be used when establishing and guiding policy decisions including who should perform ophthalmic procedures. Supplementary studies to understand the rationale for the additional treatment are needed. We hope that all would desire the safest, best quality, and most cost-effective care for their constituents. Therefore, until these differences are more thoroughly studied and understood and the additional costs and safety concerns are considered, granting optometrists permission to perform LTP should await the outcomes of these further studies.

ARTICLE INFORMATION

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Published Online: July 28, 2016. doi:10.1001/jamaophthalmol.2016.2573.

Conflict of Interest Disclosures: The author has completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Dr Robin has a position on the scientific advisory board of Aerie Pharmaceuticals as well as stock equity and options.

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Expanding Optometric Scope of Practice Will Not Lower Costs:

A simple assessment of medical economics shows that this notion is incorrect. The cost for medical services is set by a payment formula created by Medicare, not by traditional supply and demand. Each procedure and service has a specific code and a set payment.

In 1986, federal law established that optometrists would be reimbursed for services by the Centers for Medicare and Medicaid Services (CMS) at the same rate as ophthalmologists. In other words, reimbursement is based on the procedure, not the provider. Optometrists are paid exactly the same as an ophthalmologist.

Private insurers use the same set of codes and their payments are based upon those established by Medicare. Private insurers ALSO reimburse ophthalmologists and optometrists the same amount for medical procedures. There is no cost savings.

Optometric scope expansion would only serve to increase the overall healthcare costs in our state. On average, non-physicians order more tests because they are less sure of their diagnosis. This insecurity arises from the fact that they do not have a medical school education and surgical residency from which to draw. Moreover, their lack of education and experience can potentially result in optometrists performing unnecessary surgeries. If there is an increase in unnecessary surgeries, there is an increased cost to patients and the insurance system at large. More providers, more procedures, more costs.

A 2015 study published in the *Journal of the American Medical Association Internal Medicine* concluded the following: advanced practice clinicians (APC's) are associated with more imaging services than primary care physicians (PCP's) for similar patients during E&M office visits. Expanding the use of APC's may alleviate PCP shortages. While the increased use of imaging appears modest for individual patients, it may have ramifications on care and overall costs at the population level.

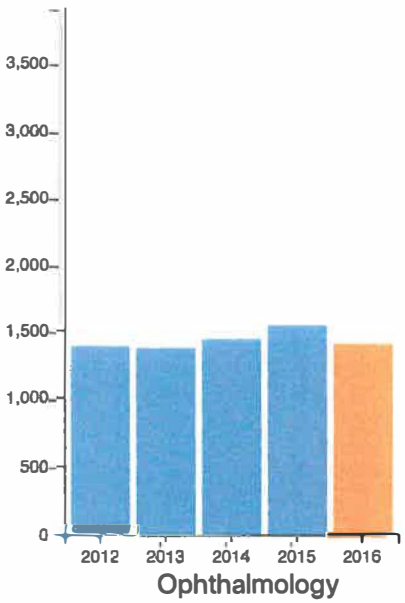
Hughes DR, Jiang M, Duszak R. A Comparison of Diagnostic Imaging Ordering Patterns Between Advanced Practice Clinicians and Primary Care Physicians Following Office-Based Evaluation and Management Visits. *JAMA Intern Med.* 2015;175(1):101–107. doi:10.1001/jamainternmed.2014.6349

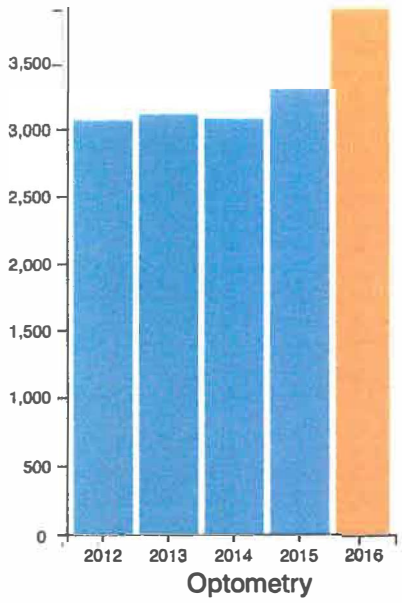
Data from the American Academy of Ophthalmology shows that in 2016, Vermont optometrists billed well over twice the number of fundus photos (non-diagnostic photographs of the back of the eye: retina, optic nerves) as Vermont ophthalmologists while performing nearly the same number of new and established patient dilated eye exams. (see attached graphs)

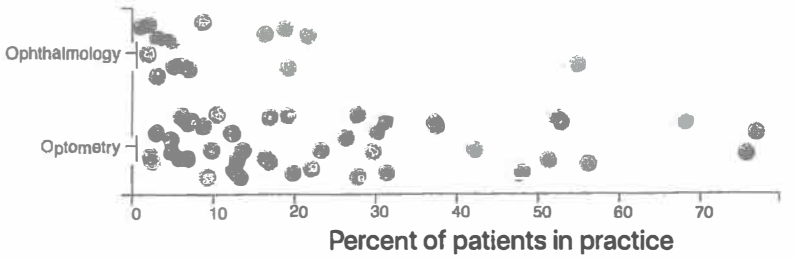
The request to perform "laser procedures to create a capsulorhexis prior to cataract surgery" implies a desire to "assist" high-volume cataract surgeons who perform Femto laser-assisted cataract surgery or FLACS. There is NO Femto laser in the state of Vermont. These lasers are only present where a sufficient volume of surgeries can be done to financially support their extra cost such as in larger metropolitan areas or high-volume ASCs. FLACS generally costs the patient roughly 4x that of standard cataract surgery with no greater improvement in visual acuity or recovery time. (*Journal of Cataract and Refractive Surgery* 2016;42:1779-1790)

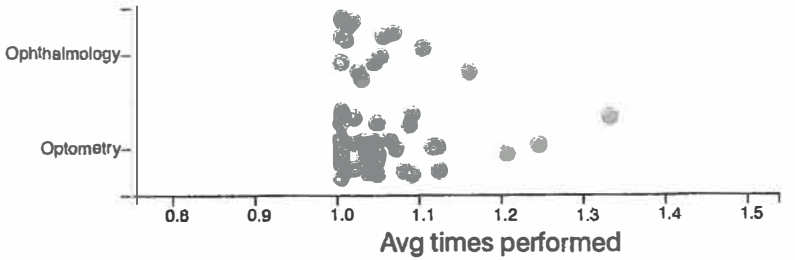
The argument that an increase in the number of providers (and thus an increase in competition between providers) correlates with a decrease in prices is true for other sectors of the economy, but not for healthcare. There is no competition or price comparison in medicine because the patient's insurance, a third-party payor, is paying the bill. This, coupled with the identical reimbursement for ophthalmologists and optometrists, negates the claim that an expanded scope of practice results in lower costs. It is a flawed and false argument.

CPT BILLING CODE 92250 FUNDUS PHOTOGRAPHY 2016









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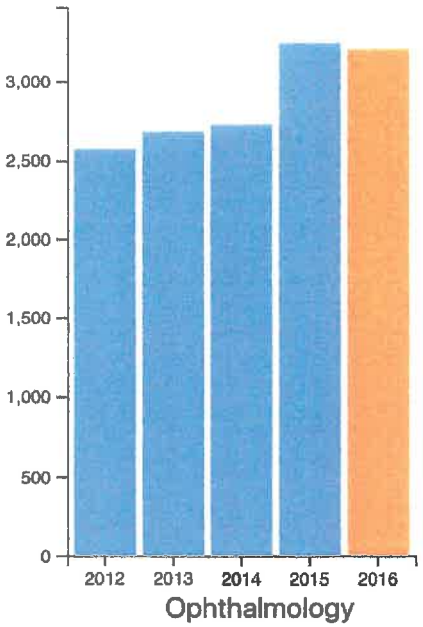

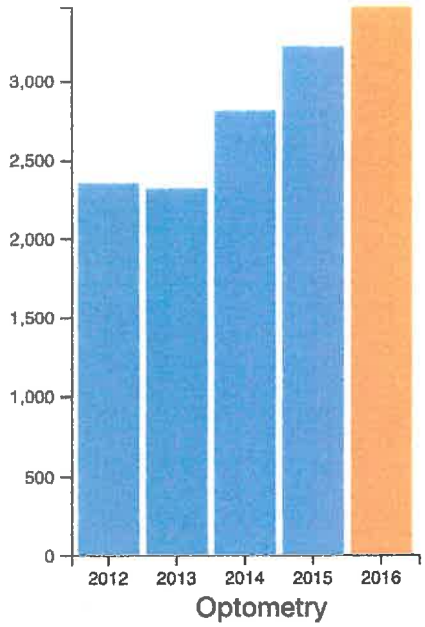

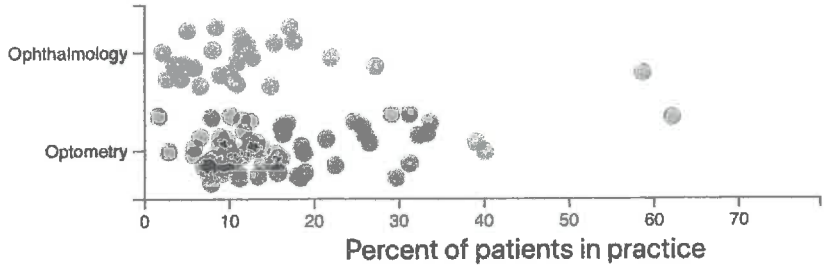

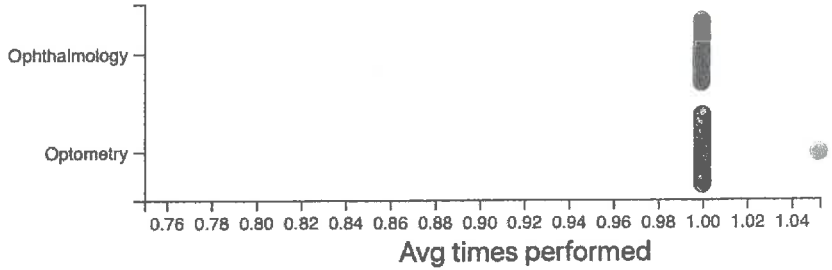

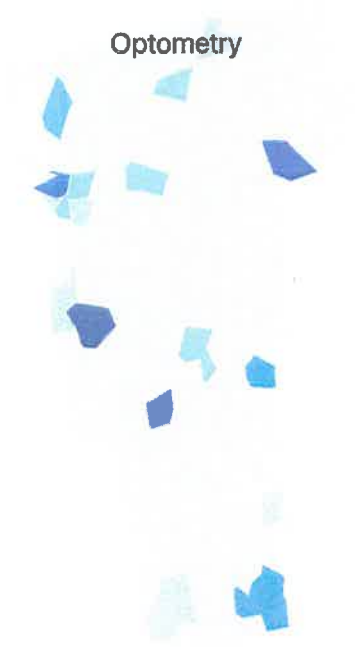

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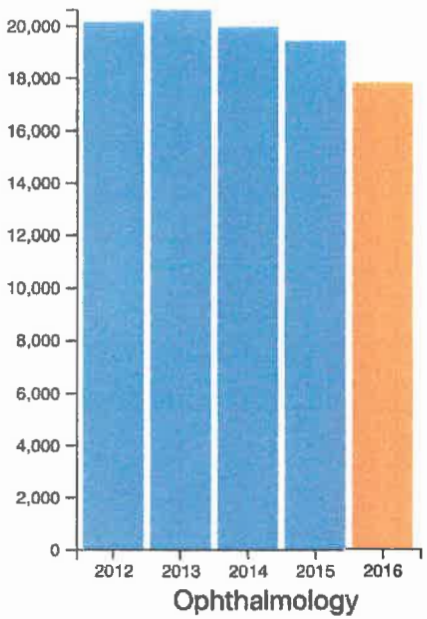
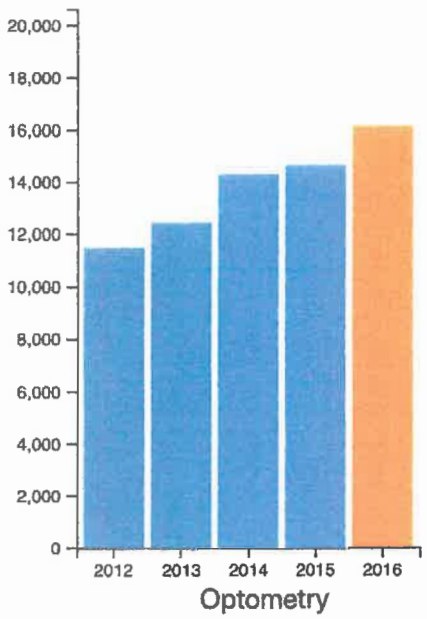
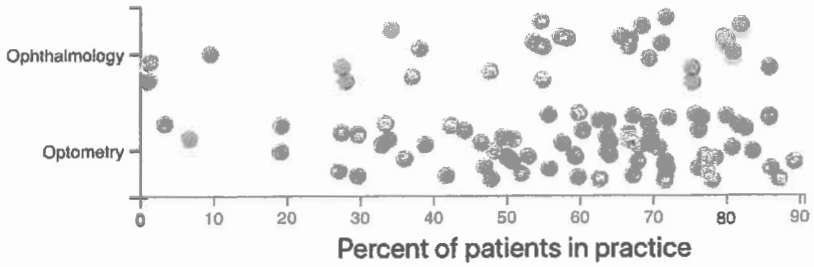
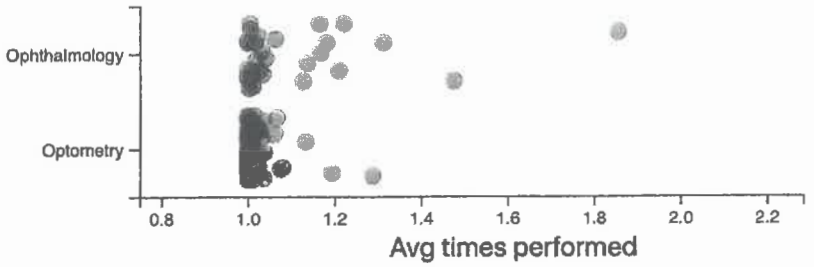
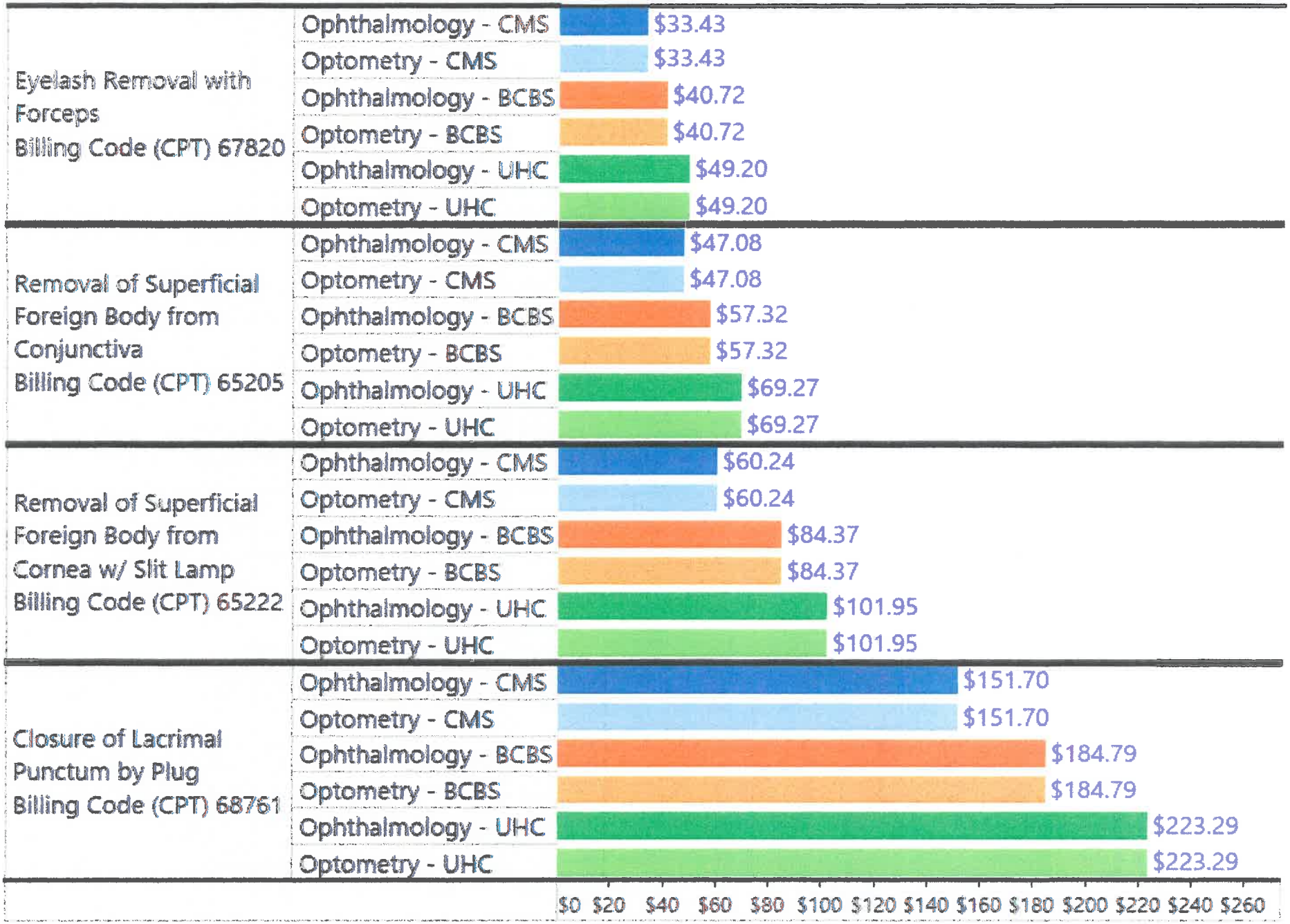








Payers May Set Different Payment Amounts for Eye Procedures but Each Payor Pays the Same Amount to Both Ophth. .mologists and Optometrists



CMS = Medicare Part B **BCBS = Blue Cross/Blue Shield** **UHC = United Health Care**

Cost to healthcare:

Combination YAG/SLT laser machine costs $20-$40,000 new/used

Reimbursement:

YAG cap Medicare $338

LPI Medicare $305

SLT Medicare $251

ROI for a laser purchase would not be economically viable with the low case numbers of lasers in VT and would add to medical costs for the health care system.