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Comparing Access to Laser Capsulotomy Performed by Optometrists and Ophthalmologists in Oklahoma by Calculated Driving Distance and Time

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Purpose: To quantify Medicare beneficiary proximity to his or her yttrium–aluminum–garnet (YAG) laser capsulotomy–providing ophthalmologist and optometrist in Oklahoma by calculating driving distances and times.

Design: Cross-sectional cohort study using 2014 Oklahoma Medicare 100% and 5% data sets and Google Maps distance and travel time application programming interfaces.

Participants: U.S. fee-for-service Medicare beneficiaries and Oklahoma ophthalmologist and optometrist laser capsulotomy providers.

Methods: The 2014 Medicare Provider Utilization and Payment Limited 100% and 5% datasets from the Centers for Medicare and Medicaid (CMS) were obtained to identify the office street addresses of Oklahoma ophthalmologists and optometrists who submitted claims to Medicare for a YAG laser capsulotomy, and the county addresses of the corresponding Medicare beneficiaries who received the laser capsulotomy. The shortest travel distances and travel times between the beneficiary and the laser provider were calculated by using Google Maps distance and travel time application programming interfaces.

Main Outcome Measures: Beneficiary driving distances and times to his or her YAG laser capsulotomy–providing Oklahoma ophthalmologist and optometrist.

Results: In 2014, 90 (57%) of 157 Oklahoma ophthalmologists and 65 (13%) of 506 Oklahoma optometrists submitted a total of 7521 and 3751 YAG laser capsulotomy claims to Medicare, respectively. By using the Medicare Limited 5% dataset, there was no difference in driving distance between beneficiaries who received a laser capsulotomy from an ophthalmologist (median, 39 miles; interquartile range [IQR], 13–113 miles) compared with an optometrist (median, 46 miles; IQR, 13–125 miles; $P = 0.93$) or in driving time to an ophthalmologist (median, 47 minutes; IQR, 19–110 minutes) compared with an optometrist (median, 50 minutes; IQR, 17–117 minutes; $P = 0.76$).

Conclusions: For Medicare beneficiaries, there was no difference in geographic access to YAG laser capsulotomy whether performed by an Oklahoma ophthalmologist or optometrist as determined by calculated driving distances and times. *Ophthalmology 2017;■:1–6 © 2017 by the American Academy of Ophthalmology*

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Access to eye care, especially in rural areas, has been cited as a medical burden[1] and as a reason to expand the responsibilities and the scope of practice of optometrists.[2–4] Access to eye care was a motivating factor in optometry successfully lobbying state legislatures for laser privileges, including yttrium–aluminum–garnet (YAG) posterior capsulotomy in Oklahoma in 1998[5] and recently in Kentucky and Louisiana.[6,7]

Access to eye care traditionally has been evaluated by the number of eye care providers per 100 000 persons[8] or by visit rates to an eye care provider.[9,10] Geographic proximity of physicians relative to patients is another important consideration in determining access to health care.[11] Travel distances and travel times are now being used to estimate access to medical care and to measure medical outcomes in fields of medicine and in ophthalmology.[12–15] For example, it is estimated that more than 90% of Medicare beneficiaries live within a 30-minute drive of an ophthalmologist and within 15 minutes of an optometrist.[16]

The public release of Medicare claims data provides an opportunity to observe the habits of different health care providers, including optometrists and ophthalmologists, throughout the United States.[17,18] Despite acknowledged limitations, analysis of these Medicare claims is valid.[19] Oklahoma is a unique and mature cohort for comparing geographic access to YAG laser capsulotomies performed by ophthalmologists and optometrists, because Oklahoma optometrists have had laser surgery privileges for more than 15 years.

Travel distances and times serve as quantitative measurements to assess possible geographic barriers to health

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care.[12–16] The aim of this study is to estimate and compare access to YAG laser capsulotomy for Medicare beneficiaries when provided by Oklahoma ophthalmologists versus Oklahoma optometrists by using calculated driving distances and times. Geographic proximity information will be useful in future planning of eye care delivery and workforce needs in the United States.

Methods

Both the 2014 Medicare Provider Utilization and Payment Dataset and the 2014 Limited 5% Dataset Standard Analytic Files were obtained from the Centers for Medicare and Medicaid (CMS). The CMS created the datasets based on information from CMS's National Claims History Standard Analytic Files, which has final-action Medicare Part B fee-for-service claims. These claims include information on services and procedures provided to Medicare beneficiaries by physicians and noninstitutional health care providers. The dataset has information for more than 950 000 distinct health care providers in all 50 states, District of Columbia, and Puerto Rico.

All Oklahoma ophthalmologists and optometrists who billed Medicare in 2014 for more than 10 YAG laser capsulotomies (Current Procedural Terminology 66821) were extracted from the 2014 Medicare Provider Utilization and Payment Dataset. These files contain information (1) at the individual provider level indexed by the provider's National Provider Identifier and (2) for the specific services the provider furnished by using unique Healthcare Common Procedure Coding System/Place of Service billing codes. Available data (directly or through publicly available linked files) include the number of services furnished, the average Medicare allowed payment (including both expected Medicare and patient payments) for service, the gender of the beneficiary and provider, the office street address of the provider, and the provider specialty (optometry vs. ophthalmology). Modifiers used when billing specific services and the addresses of the beneficiaries are not included in this dataset, but they are included in the Medicare Limited 5% dataset. Detailed information regarding the content and limitation of the datasets may be obtained at https://www.cms.gov/Research-Statistics-Data-and-Systems/Files-for-Order/LimitedDataSets.

The 2014 Medicare Limited 5% Dataset was then used to obtain the county addresses of beneficiaries receiving a YAG laser capsulotomy. Data were aggregated and summarized by the laser-providing optometrist and ophthalmologist using the National Provider Identifier as a unique index. All provider street addresses and beneficiary county-level addresses were de-identified and sent electronically to Google Maps through an application programming interface (https://developers.google.com/maps/documentation/distance-matrix/intro). Google Maps distance and travel time application programming interfaces use actual road networks and travel conditions to determine the shortest travel distances and travel times between the county centroid of the beneficiary and the office address of the specific ophthalmologist or optometrist laser provider.

The Medicare claims datasets contain only 1 office location per provider. No data from possible satellite offices or possible laser coverage provided by satellite offices are included in the datasets. Consequently, provider data was manually searched for secondary office addresses. In addition, provider addresses were cross-referenced to identify laser-providing ophthalmologists and optometrists who may share the same address.

To determine how much farther a beneficiary would have to drive to see a YAG laser–providing ophthalmologist instead of their current laser-providing optometrist, we calculated the travel distance and travel time from the laser-providing optometrist's office to the nearest laser-providing ophthalmologist's office.

Data analyses was performed by using Microsoft Excel 2013 (Microsoft Corp., Redmond, WA) with PowerPivot, PowerQuery, PowerView, Google Maps, and PowerMap Preview plug-ins. Because of the skewed nature of the data, the travel distances and travel times were estimated by using medians and interquartile range (IQR). Means with standard deviations were included for reference. Comparisons between provider types were completed by using Wilcoxon rank-sum tests. Categoric comparisons between provider types were completed using the chi-square test for independence.

Results

Among all health care providers who submitted claims to Medicare in 2014, 90 (57%) of 157 Oklahoma ophthalmologists and 65 (13%) of 506 Oklahoma optometrists submitted a total of 7521 and 3751 neodymium:YAG laser capsulotomy claims to Medicare, respectively (Table 1). A statewide distribution map of all ophthalmologists and optometrists who submitted >10 YAG laser posterior capsulotomy claims to Medicare in 2014 is shown in Figure 1. Six (9%) of the 65 laser-providing optometrists shared the same office address with an ophthalmologist. Seven of 90 (8%) ophthalmologists and 15 of 65 (23%) optometrists listed a secondary office address.

There was no difference in driving distance for Medicare beneficiaries who received their laser capsulotomy from an Oklahoma ophthalmologist (median, 39 miles; IQR, 13–113 miles) compared with an Oklahoma optometrist (median, 46 miles; IQR, 13–125 miles; $P = 0.93$) (Table 2, Fig 2). Likewise, there was no difference in median driving time to an ophthalmologist (median, 47 minutes; IQR, 19–110 minutes) compared with an optometrist (50 minutes; IQR, 17–117 minutes; $P = 0.76$) (Table 2, Fig 2). Some 47% and 42% of beneficiaries traveled ≤30 miles to receive a laser capsulotomy by an ophthalmologist or optometrist, respectively, and 41% and 38% of beneficiaries traveled >60 miles to their ophthalmologist or optometrist, respectively (Fig 3).

If, for example, the beneficiary did not receive their YAG laser capsulotomy from their current optometrist, the additional travel distance to the closest laser-providing ophthalmologist's office

Table 1. Demographic Characteristics and Laser Capsulotomies Performed by Oklahoma Ophthalmologists and Optometrists for Medicare Beneficiaries in 2014

		Gender				
		Male	*Female*	**Laser Providers**	**Lasers Performed**	**Beneficiaries Receiving Laser**
Provider	**All**	*No. (%)*	*No. (%)*	*No. (%)*	*No.*	*No.*
Ophthalmologists	157	132 (84)	25 (16)	90 (57)	7521	6078
Optometrists	506	360 (71)	146 (29)	65 (13)	3751	2768