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Geographic Variation in the Rate and Timing of Cataract Surgery Among US Communities

Courtney Y. Kauh, MD, MS, **Taylor S. Blachley, MS**, **Paul R. Lichter, MD, MS**, **Paul P. Lee, MD, JD**, and **Joshua D. Stein, MD, MS**

Department of Ophthalmology and Visual Sciences, W. K. Kellogg Eye Center, University of Michigan, Ann Arbor (Kauh, Blachley, Lichter, Lee, Stein); Institute for Healthcare Policy and Innovation, University of Michigan, Ann Arbor (Lee, Stein); Department of Health Policy and Management, School of Public Health, University of Michigan, Ann Arbor (Stein)

Abstract

IMPORTANCE—Previous studies using data from the 1980s found relatively little geographic variation in cataract surgery rates across the United States. We do not know whether similar patterns hold true today, nor do we know the patient- and community-level factors that might explain any recent geographic variations in the rate and timing of cataract surgery.

OBJECTIVE—To assess the extent of geographic variation in patient age at initial cataract surgery and the age-standardized cataract surgery rate in a large group of insured US patients with cataracts.

DESIGN, SETTING, AND PARTICIPANTS—Retrospective cross-sectional study of 1 050 815 beneficiaries older than 40 years of age with cataracts who were enrolled in a nationwide managed-care network during the period from 2001 to 2011. The data analysis was started in 2014 and refined in 2015.

MAIN OUTCOMES AND MEASURES—Median age at initial cataract extraction, age-standardized cataract surgery rate, and time from initial diagnosis to first surgery for patients with cataracts were compared among 306 US communities. Multivariable regression modeling generated hazard ratios (HRs) with 95% CIs identifying factors associated with patients' likelihood of undergoing cataract surgery.

Corresponding Author: Joshua D. Stein, MD, MS, Department of Ophthalmology and Visual Sciences, W. K. Kellogg Eye Center, University of Michigan, 1000 Wall St, Ann Arbor, MI 48105 (jdstein@med.umich.edu).

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RESULTS—A total of 243 104 patients with cataracts (23.1%) underwent 1 or more surgical procedures (55.1% were female patients). Communities with the youngest and oldest patients at initial surgery differed in age by nearly 20 years (59.9–60.1 years in Lansing, Michigan, and Aurora, Illinois, vs 77.0–79.6 years in Marquette, Michigan; Rochester, New York; and Binghamton, New York). The highest age-standardized cataract surgery rate (37.3% in Lake Charles, Louisiana) was 5-fold higher than the lowest (7.5% in Honolulu, Hawaii). The median time from initial cataract diagnosis to date of first surgery ranged from 17 days (Victoria, Texas) to 367 days (Yakima, Washington). Compared with white patients, black patients had a 15% decreased hazard of surgery (HR, 0.85 [95% CI, 0.83–0.87]), while Latino patients (HR, 1.08 [95% CI, 1.05–1.10]) and Asian patients (HR, 1.09 [95% CI, 1.05–1.12]) had an increased hazard. For every 1° higher latitude, the hazard of surgery decreased by 1% (HR, 0.99 [95% CI, 0.98–0.99]). For every additional optometrist per 100 000 enrollees in a community, the hazard of surgery increased 0.1% (HR, 1.001 [95% CI, 1.001-1.001]).

CONCLUSIONS AND RELEVANCE—In recent years, patient age at first cataract surgery and the age-standardized surgery rate have varied considerably among some US communities. Future research should explore the extent to which such variations may affect patient outcomes.

Cataract is a leading cause of visual impairment, affecting more than 24 million Americans.[1] With the aging of the US population, this number is projected to increase to 38.7 million by 2030.[2] The rate of cataract surgery has also increased over the past several decades. From 1980 to 2003, the cataract surgery rate for Medicare beneficiaries increased from 13.4 to 61.8 persons per 1000 person-years.[3]

Using Medicare claims data from the late 1980s, Javitt and colleagues[4] found that cataract surgery rates in US communities varied relatively little compared with other surgical procedures. In addition to identifying communities with disproportionately high and low surgery rates, they ascertained several variables associated with communities' cataract surgery rate, including patient age, sex, race, latitude, density of optometrists, and allowed cataract surgery charge. Other variables, including density of practicing ophthalmologists, were not statistically significant.

Approximately 20 years after Javitt and colleagues' seminal work,[4] we revisit geographic variation in cataract surgery rates among US communities using 2001–2011 data from a large managed-care network. We assess whether communities with relatively low and high surgery rates in the earlier study[4] continue to show similar patterns. Moreover, we assess variation in the time from first cataract diagnosis to surgery and evaluate whether factors affecting cataract surgery rates years ago remain important now.

Methods

Data Source

The Clinformatics DataMart database (OptumInsight) has deidentified records of all beneficiaries in a nationwide managed-care network. We had access to data for all eye care recipients during the period from 2001 to 2011. Beneficiaries were included in the data set if they had 1 or more *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*) codes for any eye-related diagnosis (*ICD-9-CM* codes 360–

379.9); a *Current Procedural Terminology* (*CPT*) code for any eye-related visits or for diagnostic or therapeutic procedures (*CPT* codes 65091–68899 or *CPT* codes 92002–92499); or any other ophthalmologist- or optometrist-submitted claim during their time in the plan. The data contain all of beneficiaries' medical claims for ocular and nonocular conditions and their sociodemographic information (age, sex, race, education, and income); they have been used in other ocular disease–related studies.[5–7] The University of Michigan institutional review board approved our study as a nonregulated study. Informed consent was not obtained because the data were deidentified.

Sample Selection

We identified all persons older than 40 years of age who had 1 or more diagnoses of cataract (*ICD-9-CM* codes 366, 366.0-04, 366.09, 366.1x, 366.41, and 366.45) during their time in the plan. Prior work comparing billing records with medical records found that billing records accurately capture persons with cataracts.[8]

Identification of Cataract Surgery Recipients

Cataract surgery recipients were identified based on the following *CPT* codes: 66830, 66840, 66850, 66852, 66920, 66930, 66940, and 66982-4. Validation studies have demonstrated that billing records accurately capture receipt of cataract surgery.[9] Enrollees who were documented to be pseudophakic or aphakic (*ICD-9-CM* codes V43.1, 379.3, and 379.31) prior to their first cataract surgery were excluded because they must have undergone surgery in the contralateral eye prior to entry into the plan.

Geographic Areas

We divided the United States into 306 hospital referral regions (HRRs) representing regional health care markets for tertiary medical care,[10] according to methods described in *The Dartmouth Atlas of Health Care*.[11] Hospital referral regions have been used extensively to study geographic variation in medical service utilization.[12,13] Each enrollee was assigned to a given HRR based on his or her residential zip code.

Analyses

Statistical analyses were performed using SAS, version 9.3 (SAS Institute Inc). Participants' characteristics were summarized for the entire sample using mean values and standard deviations (SDs) for continuous variables and frequencies and percentages for categorical variables.

In each HRR, we determined the median age of enrollees who had received a diagnosis of cataract, and were thus eligible for surgery, and the median age at first cataract surgery among surgery recipients. To account for differences among HRRs in the ages of persons eligible for cataract extraction, we calculated age-standardized cataract surgery rates by HRR using an indirect standardization technique.[14]

To assess variation in age at first cataract surgery within a given HRR, we computed the SD for the age of all the cataract surgery recipients in each HRR and then compared the SDs across HRRs. Next, we assessed timing from the first-recorded cataract diagnosis to the date

of first extraction. To do this, we determined the median number of days between the time of first diagnosis and first surgery for enrollees residing in each HRR. We compared the timing from first cataract diagnosis by any eye care professional (ophthalmologist or optometrist) to that of cataract surgery among the HRRs. We also assessed the timing from first cataract diagnosis by the same ophthalmologist who performed the surgery and compared the median timing from first diagnosis to surgery among the HRRs.

Factors Affecting Receipt of Cataract Surgery

Hierarchical Cox regression modeling was performed to identify community- and patient-level variables affecting receipt of cataract surgery. The community-level variables considered in the model were supply of ophthalmologists and optometrists,[15] average cost of living,[16] number of days of sunshine annually,[16] latitude,[16] longitude,[16] UV index,[16] proximity to an ophthalmology residency program, median charge, and proportion of persons in the HRR who drive to work.[16] Patient-level variables included race, sex, income, educational level, urban/rural status of residence, common medical and ocular comorbidities, and the Charlson Comorbidity Index,[17] which is a measure of overall health. The best subset selection method identified which covariates to include in the model. The regression models generated hazard ratios (HRs) with 95% CIs. For all analyses, $P < .05$ was considered statistically significant.

Results

Of the 1 050 815 eligible enrollees who received a diagnosis of cataracts, 243 104 (23.1%) underwent cataract surgery in 1 or 2 eyes during their time in the plan. The mean (SD) duration in the plan of all eligible enrollees was 1539 (977) days; 238 242 enrollees (98.0%) were followed up for 6 months or more while in the plan. Among cataract surgery recipients, the mean (SD) time from plan enrollment to first cataract surgery was 933 (814) days. A higher proportion of men with cataracts than women with cataracts underwent surgery (109 106 of 460 615 men [23.7%] vs 133 998 of 590 200 women [22.7%]; $P < .001$). The proportions of white, black, Latino, and Asian patients who underwent surgery were 24.4% (176 518 of 723 262), 21.2% (11 816 of 55 624), 22.2% (10 321 of 46 414), and 19.5% (4284 of 21 966), respectively ($P < .001$). Among all eligible enrollees (except those with missing data in their records), 202 794 of 900233 enrollees (22.5%) had at least a college diploma, and 166 802 of 862 970 enrollees (19.3%) had an income of $100 000 or more (Table 1). The mean and median number of eligible patients with cataracts in a given HRR was 3434 and 1312, respectively (range, 61–68 872 patients). The mean and median number of patients undergoing surgery in an HRR were 795 and 307, respectively (range, 21–16 259 patients).

Median Age of Patients at First Cataract Surgery

The overall median age of patients at first cataract surgery was 67.7 years. The median age of patients at first cataract surgery was youngest among residents of Lansing, Michigan; Aurora, Illinois; and Lafayette, Indiana (range, 59.9–61.0 years), and was oldest among residents of Marquette, Michigan; Rochester, New York; and Binghamton, New York (range, 77.0–79.6 years) (Figure 1; Table 2; Table 3).

Variation in Age of Patients at First Cataract Surgery

Communities with the highest variation in median age of patients at first cataract surgery (ie, there is a wide age range from younger to older beneficiaries undergoing surgery within the community) include Bloomington, Illinois; Santa Cruz, California; Flint, Michigan; Altoona, Pennsylvania; and Marquette, Michigan. In these communities, the variation in median age of patients at first cataract surgery ranged from 12.4 to 12.7 years. By comparison, communities with the lowest variation include Lawton, Oklahoma; Yakima, Washington; Victoria, Texas; Petoskey, Michigan; and Binghamton, New York, where the dispersion in age of surgery recipients was 6.4 to 7.8 years (eFigure 1 in the Supplement; Tables 2 and 3). eFigure 2 in the Supplement shows a distribution of the median age of patients at initial cataract surgery for all the communities, stratified by urban/rural status, along with error bars capturing the variability in the point estimates.

Age-Standardized Cataract Surgery Rates

After excluding 82 of the 306 HRRs with limited numbers of enrollees to adequately perform the age-standardization procedure to account for differences in the average age of patients at the first diagnosis of cataract among the various HRRs, we observe a nearly 5-fold difference in the cataract surgery rate between the HRRs with the lowest and the HRRs with the highest age-standardized cataract surgery rates (7.5% in Honolulu, Hawaii, vs 37.3% in Lake Charles, Louisiana). Of the 10 HRRs with the highest age-standardized cataract surgery rates, 2 were in Indiana (Indianapolis, 33.8%; Gary, 31.3%), and 2 were in Colorado (Denver, 31.6%; Colorado Springs, 32.2%). Six of the 10 HRRs with the lowest age-standardized rates were in New York or northern New Jersey (Figure 2; Tables 2 and 3).

Timing From Diagnosis to Surgery

Communities with the longest median time from initial cataract diagnosis to first surgery include Yakima, Washington (367 days); Mason City, Iowa (278 days); and San Francisco, California (232 days). By comparison, those with the shortest time include Victoria, Texas (17 days); Hattiesburg, Mississippi (20 days); and Oxford, Mississippi (21 days) (Tables 2 and 3).

Communities with the highest median number of days between initial diagnosis and surgery by the same ophthalmologist include San Francisco, California (90 days); San Mateo County, California (78 days); and Burlington, Vermont (69 days), while the communities with the lowest median number of days include Muncie, Indiana (14 days); Dothan, Alabama (15 days); Abilene, Texas (17 days); and Jackson, Tennessee (17 days) (eFigure 3 in the Supplement; Tables 2 and 3).

Factors Associated With Cataract Surgery

After adjusting potential confounders, we found that for every additional year of patient age at initial cataract diagnosis, the hazard for surgery increased by 2.5% (adjusted HR, 1.02 [95% CI, 1.02–1.03]). Compared with white patients, black patients had a 15% decreased hazard for surgery (adjusted HR, 0.85 [95% CI, 0.83–0.87]), whereas Asian patients (adjusted HR, 1.09 [95% CI, 1.05–1.12]) and Latino patients (adjusted HR, 1.08 [95% CI, 1.05–1.10]) had an increased hazard for surgery. Beneficiaries earning less than $30000 had

an elevated hazard for cataract surgery, relative to those with incomes of $60000 or more ($P$ < .001 for all comparisons), and the higher one's income level, the lower the hazard for surgery. Compared with the least-educated patient group, all other patients had a lower likelihood of surgery (P < .001 for all comparisons).

For every 1° increase in latitude, the likelihood of cataract surgery decreased by 1% (adjusted HR, 0.99 [95% CI, 0.98–0.99]). For example, the hazard for cataract extraction was 20% lower in Portland, Oregon (45° latitude), than in Miami, Florida (25° latitude). Persons residing in rural communities had a 5% to 7% increased hazard of surgery compared with those living in urban locales (P < .001). For every additional optometrist in the community per 100000 enrollees, the hazard increased by 0.1% (adjusted HR, 1.001 [95% CI, 1.001-1.001]). Persons with ocular trauma had a 30% increased hazard for surgery. Patients with diabetes (uncomplicated or involving end-organ damage) had a lower hazard for surgery than did patients without diabetes (P < .001). The hazard for surgery was 60% decreased in communities with higher, vs lower, overall practice expenses for medical care (adjusted HR, 0.40 [95% CI, 0.38–0.43]) (Table 4).

Discussion

In this large analysis of insured US patients with cataracts, we find substantial variation across communities in the median age of patients at first cataract surgery and in the age-standardized cataract surgery rate. The median age of patients at initial cataract surgery was as young as 60 years in some communities but approached 80 years in others. Furthermore, the age-standardized cataract surgery rate varied considerably among communities—notably, from 7.5% in Honolulu, Hawaii, to 37.3% in Lake Charles, Louisiana.

In addition to Javitt and colleagues' US-based analysis,[4] the literature contains studies of within-country geographic variation in cataract surgery in England and Canada, where considerable variation was documented.[18,19] Although these analyses and our analysis had different study designs and insurance types, making direct comparison difficult, all 4 studies identified substantial differences in communities between the lowest and highest surgery rates. Javitt and coworkers[4] found many communities with similar cataract surgery rates but observed an 11-fold difference between the communities with the lowest (Billings, Montana) and the communities with highest (Lake Charles, Louisiana) rate. Likewise, we find a 5-fold difference between the lowest (Honolulu, Hawaii) and highest (Lake Charles, Louisiana) age-standardized cataract surgery rates. Of interest, Lake Charles, Louisiana, had the country's highest cataract surgery rate in both studies despite the studies' use of different data sources (commercial insurance plan vs Medicare) and an approximately 20-year difference in observation periods. Although it is unclear why this particular community has such high surgery rates, possible reasons include patient-related factors (eg, increased patient motivation for surgery), health care professional–related factors (eg, differences in health care professionals' aggressiveness in recommending surgery), or factors specific to that particular community (eg, environmental exposures). Lake Charles is a major center for petrochemical refining, and chronic exposure to naphthalene and other pollutants involved in the refinery process increase the risk for cataracts.[20] In contrast, Billings, Montana, which

had the lowest surgery rate in the study by Javitt and colleagues,[4] is among the top 10 communities with the highest age-standardized cataract surgery rates in our analysis.

We are unaware of other studies comparing age at initial cataract surgery among persons residing in different communities throughout the United States. While our analysis identified large variations in the timing of first cataract surgery, more work is required to understand the factors contributing to the large differences in timing observed. Communities differ with respect to the characteristics of the patients residing in them, eye care professional availability, how assertive the ophthalmologists are at recommending surgery, and different environmental and lifestyle factors that can affect the timing of surgery. Visual demands may also vary among persons residing in one community vs another. For example, some communities have better public transportation systems, so there may be less of a need to see well enough to operate a motor vehicle to drive to work.

Factors Associated With Cataract Surgery

Age—Our study and the study by Javitt and colleagues[4] indicate an increased likelihood of cataract surgery among older patients. Studies have shown that lens opacities of all types are more likely to be present in older persons. This is attributable to the natural aging process. Increased cataract density has a greater effect on visual acuity and quality of life, and this effect is likely influencing the decision for surgery.[21–25] In addition, as patients age, the majority of them have spouses or acquaintances who have undergone successful cataract surgery, which may factor into their decision-making process.

Race—Our finding of a reduced likelihood for cataract surgery among black patients, as was noted 2 decades ago, indicates that racial disparities persist. While it is known that racial inequities exist in the proportions of patients carrying health insurance and that this affects utilization,[26,27] in both our analysis and that of Javitt and coworkers,[4] all the eligible patients had health insurance; thus, at least theoretically, everyone had access to eye care services. Possible explanations for black patients' decreased hazard for surgery include racial differences in the type of lens opacification present by race,[28] reduced health care resource use,[3,29] and less awareness of the potential benefits of cataract surgery.[30] In focus groups of older black patients and eye care professionals, the most frequently cited barrier to care was the lack of transportation and accessibility to ophthalmologists' offices for the surgery and postoperative care.[31] Other barriers to surgery for black patients may include issues with trust and communication with physicians, differences in social support, and out-of-pocket costs (copayments, deductibles, and prescription medications).[31] Given that cataracts are a leading cause of blindness among black people,[26,32] and yet racial disparities in receipt of cataract surgery persist, additional work is needed to better identify and to eliminate black patients' barriers to surgery.

Socioeconomic Status and Education—In our analyses, persons with incomes of less than $30000 had an increased hazard for surgery. Some,[18,33–35] but not all,[36] previous studies similarly found that lower socioeconomic status was associated with an increased likelihood of cataract surgery. Less-affluent persons may have greater exposure to environmental influences (eg, sunlight and pollutants) from their jobs, increasing their

cataract density and precipitating the need for surgery. Lifestyle factors, including cigarette smoke, diet, UV exposure, and stress, may also contribute.[37–39] Our finding regarding persons of lower socioeconomic status is particularly noteworthy given that this population has been documented generally to have lower utilization rates and poorer access to health care services.[40]

UV Light Exposure—In our study and in the study by Javitt and colleagues,[4] the hazard of surgery was reduced for persons living in communities further away from the equator (higher latitude). This highlights the importance that UV light exposure can have on the development and progression of cataracts.

Urban vs Rural Residence—An interesting finding from our analysis is the relationship between location of residence and likelihood of undergoing cataract surgery. We find that patients in rural communities are more likely than patients in urban communities to undergo cataract extraction. This may be due to differences in environmental, employment, and lifestyle factors, with greater exposure to sunlight among those living in rural communities. Alternatively, those living in rural communities, where there is less access to public transportation and greater distances to travel for work and leisure activities, may require better vision for driving.

Number of Ophthalmologists or Optometrists—We and Javitt and colleagues[4] found that cataract surgery rates were not associated with the number of ophthalmologists in the community but were associated with the number of optometrists per 100 000 residents. It may be easier for patients who are struggling with their eyesight to access eye care services in communities with more optometrists. With increased access, more patients are receiving cataract diagnoses and referrals for surgery.

Study Strengths and Limitations

Our large sample of patients with cataracts enabled us to compare the timing and rates of surgery among various communities. Second, because all the enrollees had health insurance, we could identify the variables associated with the timing and rate of surgery beyond the known factor of inadequate access to care. Third, the use of health care professional–submitted billing codes to identify the presence of cataracts and the timing of surgery provides greater accuracy than self-reports by patients.[41]

Our study has several limitations. First, we could not consider information absent in claims data, including best-corrected visual acuity, degree of symptoms, and the visual needs of each enrollee. These variables all clearly affect the decision to undergo surgery and the timing of surgery; yet, the variation among communities is unknown. Second, our findings may not be generalizable to persons with other insurance types or to noninsured individuals who would surely have lower surgery rates. Third, with claims data alone, we cannot assess the appropriateness of the surgical procedures that were performed. Fourth, some community-level variation in median age and rate of surgery could be due to chance alone. However, because most of the communities studied contributed hundreds of patients or more, this is unlikely to have much of an effect on our results. Finally, the patients'

community of residence was known only for the time of plan enrollment, and we could not account for persons who may have moved from one community to another.

Conclusions

In conclusion, considerable geographic variation exists in the timing of initial cataract surgery and in the cataract surgery rates among different US communities. Future studies should explore the underlying causes for this geographic variation and its effect on patient outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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At a Glance

- We determined geographic variation in the median age of patients at initial cataract surgery and the age-standardized cataract surgery rate among many US communities.
- The median age of patients at initial cataract surgery was as young as 60 years in some communities and nearly 80 years in others.
- The age-standardized cataract surgery rate varied 5-fold across communities, from 7.5% in Honolulu, Hawaii, to 37.3% in Lake Charles, Louisiana.
- Black patients had a 15% decreased hazard of undergoing cataract surgery compared with white patients.

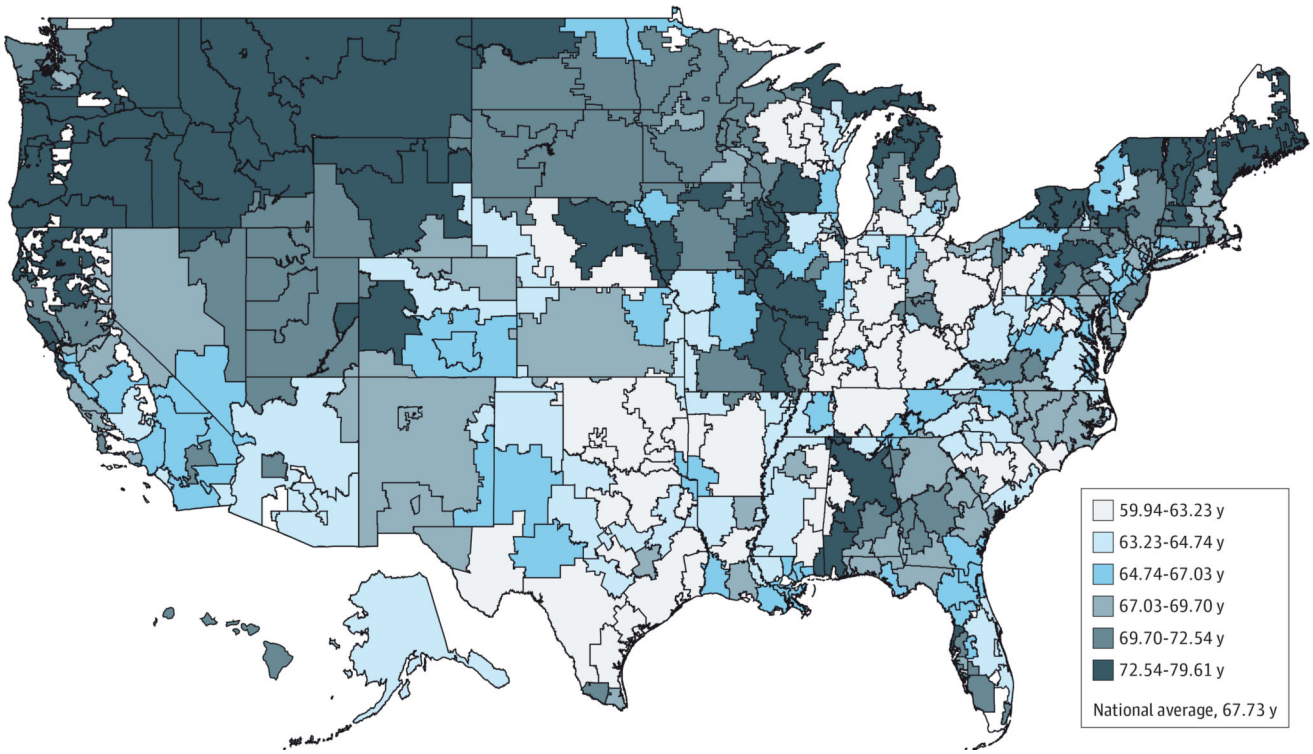

Figure 1. Geographic Variation in the Median Age of Patients at Initial Cataract Surgery Throughout the United States

Communities with a younger median age of patients at initial cataract surgery are shaded lighter in color, while those an older median age of patients at initial cataract surgery are shaded with darker colors.

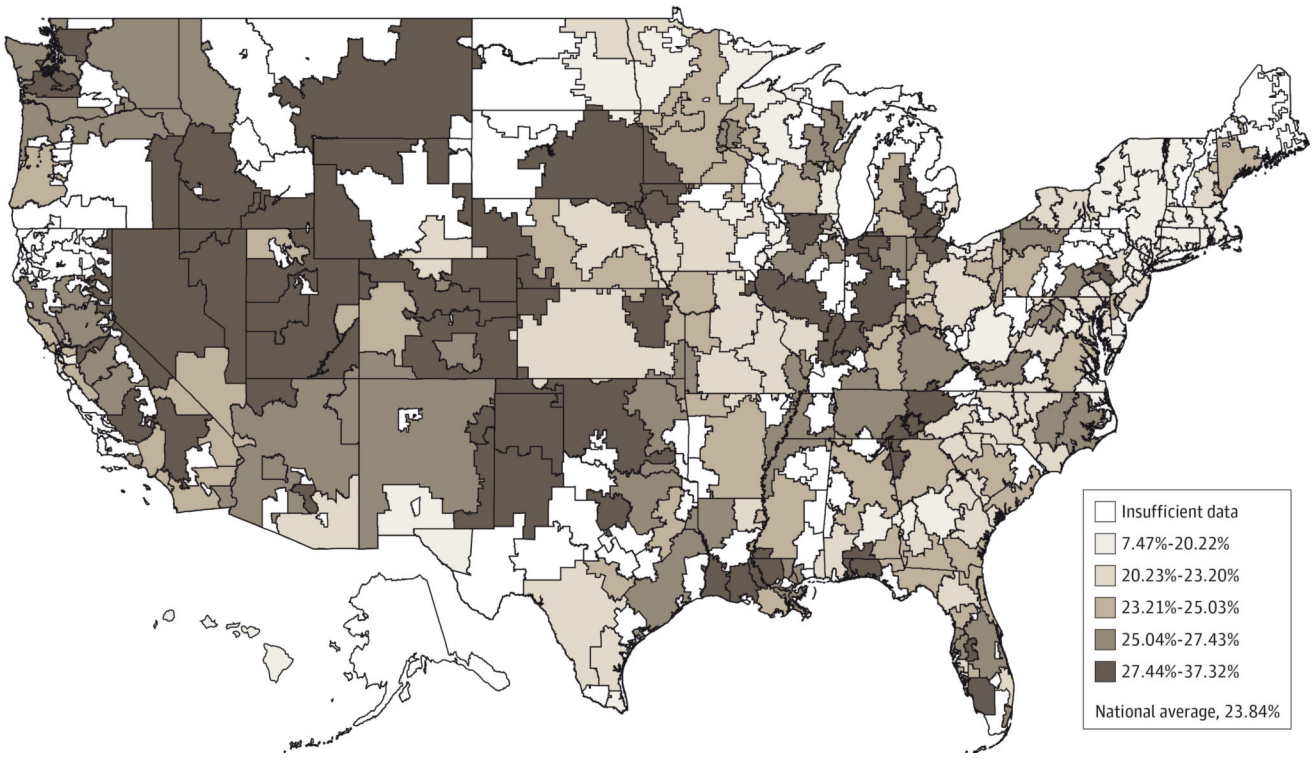

Figure 2. Geographic Variation in the Age-Standardized Cataract Surgery Rate Throughout the United States

Communities with a lower age-standardized rate of initial cataract surgery are shaded lighter in color, while those a higher age-standardized rate of initial cataract surgery are shaded with darker colors.

Table 1

Sociodemographic Characteristics of Enrollees With Cataracts and Those Who Underwent Cataract Surgery

Characteristic	Patients With Cataracts, No. (%)			*P* Value
	Who Did Not Undergo Surgery	Who Underwent Surgery	All	
Total	807 711 (76.9)	243 104 (23.1)	1 050 815 (100.0)	
Race (n = 196 131[a])				
White	546 744 (84.1)	176 518 (86.3)	723 262 (84.6)	<.001[b]
Black	43 808 (6.7)	11 816 (5.8)	55 624 (6.5)	
Latino	36 093 (5.6)	10 321 (5.0)	46 414 (5.4)	
Asian	17 682 (2.7)	4284 (2.1)	21 966 (2.6)	
Other	5779 (0.9)	1639 (0.8)	7418 (0.9)	
Sex				
Male	351 509 (43.5)	109 106 (44.9)	460 615 (43.8)	<.001[b]
Female	456 202 (56.5)	133 998 (55.1)	590 200 (56.2)	
Education (n = 151 223[a])				
<High school	10 417 (1.5)	3370 (1.6)	13 787 (1.5)	<.001[b]
High school diploma	253 961 (37.1)	86 452 (40.1)	340 413 (37.8)	
Some college	260 333 (38.0)	82 906 (38.5)	343 239 (38.1)	
College diploma	158 228 (23.1)	42 408 (19.7)	200 636 (22.3)	
Advanced degree	1784 (0.3)	374 (0.2)	2158 (0.2)	
Income, $ (n = 188 518[a])				
<30 000	79 956 (12.2)	32 314 (15.7)	112 270 (13.0)	<.001[b]
30 000 to <60 000	238 263 (36.3)	81 778 (39.6)	320 041 (37.1)	
60 000 to <100 000	204 497 (31.1)	59 360 (28.8)	263 857 (30.6)	
100 000 to <125 000	69 895 (10.6)	17 987 (8.7)	87 882 (10.2)	
≥125 000	63 905 (9.7)	15 015 (7.3)	78 920 (9.1)	
Diabetes[c]				
None	561 117 (69.5)	161 282 (66.3)	722 399 (68.7)	<.001[b]
Uncomplicated	148 861 (18.4)	44 551 (18.3)	193 412 (18.4)	
Complicated	97 733 (12.1)	37 271 (15.3)	135 004 (12.8)	
Age at enrollment, y				
Mean (SD)	61.45 (9.95)	65.39 (10.85)	62.36 (10.30)	<.001[d]
Median	61.00	65.20	62.00	
Time in the plan, d				
Mean (SD)	1487.53 (971.89)	1710.47 (975.57)	1539.10 (977.28)	<.001[d]
Median	1280	1675	1430	
Time from enrollment to first surgery, d				
Mean (SD)	NA	932.58 (814.14)	NA	

Characteristic	Patients With Cataracts, No. (%)			*P* Value
	Who Did Not Undergo Surgery	Who Underwent Surgery	All	
Median	NA	702	NA	

Abbreviation: NA, not applicable.

[a]Number of patients with missing data in records for the given variables.

[b]Determined by use of the χ^2 test.

[c]Uncomplicated diabetes refers to diabetes with no record of end-organ damage from this condition. Complicated diabetes refers to diabetes with a record of end-organ damage (eg, nephropathy).

[d]Determined by use of the 2-sample *t* test.

Table 2

Top 10 Communities With the Highest Values in Timing and Rate of Cataract Surgery

Parameter and HRR	Value	Patients, No.	
		Total	Surgery
Age of patients at initial cataract surgery, median, y			
Binghamton, NY	79.61	503	176
Rochester, NY	78.42	1070	306
Marquette, MI	77.02	88	22
Lebanon, NH	77.00	272	62
San Francisco, CA	76.76	2940	840
Iowa City, IA	76.54	1013	192
Springfield, IL	76.42	1332	532
Great Falls, MT	76.23	178	66
Medford, OR	76.20	723	276
Yakima, WA	75.77	325	100
Age of patient at initial cataract surgery, SD, y			
Bloomington, IL	12.74	106	33
Santa Cruz, CA	12.74	272	60
Flint, MI	12.58	145	40
Altoona, PA	12.51	111	35
Marquette, MI	12.42	88	22
Bangor, ME	12.31	279	60
Alameda County, CA	12.11	1506	269
Minneapolis, MN	12.10	34 643	9592
Duluth, MN	12.08	3965	793
Santa Barbara, CA	11.96	324	58
Age-standardized cataract surgery rate[a]			
Lake Charles, LA	0.373	1617	547
Indianapolis, IN	0.338	3895	1211
Billings, MT	0.326	827	317
Springfield, IL	0.325	1332	532
Colorado Springs, CO	0.322	2787	863
Denver, CO	0.316	11 755	3428
Gary, IN	0.313	1165	318
Mesa, AZ	0.311	5460	1538
Topeka, KS	0.310	397	119
Reno, NV	0.308	1015	303
Time from cataract diagnosis to cataract surgery,[b] median, d			
Yakima, WA	367	325	100

Parameter and HRR	Value	Patients, No.	
		Total	Surgery
Mason City, IA	278	300	55
San Francisco, CA	232	2940	840
Springfield, IL	218	1332	532
San Mateo County, CA	188	2201	529
Traverse City, MI	174	124	25
Sayre, PA	174	372	106
Olympia, WA	167.5	503	154
Minot, ND	159	61	21
Medford, OR	152	723	276
Time from cataract diagnosis to cataract surgery by same physician,[c] median, d			
San Francisco, CA	90	2940	840
San Mateo County, CA	78	2201	529
Burlington, VT	69	289	56
Lebanon, NH	67	272	62
Hartford, CT	64	4537	836
Manchester, NH	61	1406	302
Worcester, MA	61	975	206
Springfield, MA	60	1090	206
Ridgewood, NJ	58	1563	263
Newport News, VA	58	967	159
Portland, OR	57.5	4447	1283

Abbreviation: HRR, hospital referral region.

[a]The HRR was omitted if there were less than 20 patients in any age group (40–49, 50–59, 60–69, 70–79, or ≥80 years).

[b]Length of time between first diagnosis of cataract by any eye care professional (ophthalmologist or optometrist) and surgery.

[c]Length of time between first diagnosis of cataract (by the same ophthalmologist who performed the surgery) and surgery.

Table 3

Top 10 Communities With the Lowest Values in Timing and Rate of Cataract Surgery

Parameter and HRR	Value	Patients, No.	
		Total	Surgery
Age of patients at initial cataract surgery, median, y			
Lansing, MI	59.94	1907	502
Aurora, IL	60.12	316	66
Lafayette, IN	60.97	464	163
Lawton, OK	61.51	98	29
Tuscaloosa, AL	61.57	206	47
Florence, SC	61.59	313	67
Gary, IN	61.70	1165	318
Odessa, TX	61.88	437	115
Lexington, KY	61.92	2740	597
Columbus, OH	62.04	22 278	4407
Age of patient at initial cataract surgery, SD, y			
Lawton, OK	6.43	98	29
Yakima, WA	7.20	325	100
Victoria, TX	7.21	200	90
Petoskey, MI	7.66	143	47
Binghamton, NY	7.84	503	176
Hattiesburg, MS	7.92	1684	374
Great Falls, MT	7.92	178	66
Albany, GA	8.13	1338	337
Muncie, IN	8.20	133	46
Meridian, MS	8.31	663	136
Age-standardized cataract surgery rate[a]			
Honolulu, HI	0.075	2651	226
Salisbury, MD	0.138	1440	187
White Plains, NY	0.145	3172	438
East Long Island, NY	0.153	16 705	2417
Manhattan, NY	0.160	11 778	1876
Syracuse, NY	0.162	2629	408
Elmira, NY	0.162	560	85
Hackensack, NJ	0.163	4811	751
Providence, RI	0.166	26 013	4634
Harlingen, TX	0.167	502	77
Time from cataract diagnosis to cataract surgery,[b] median, d			
Victoria, TX	16.5	200	90

Parameter and HRR	Value	Patients, No.	
		Total	Surgery
Hattiesburg, MS	20	1684	374
Oxford, MS	20.5	111	30
Lawton, OK	22	98	29
Lafayette, IN	23	464	163
Flint, MI	23	145	40
Muncie, IN	24	133	46
Miami, FL	24	19 925	5066
Altoona, PA	24	111	35
Dothan, AL	24.5	747	170
Time from cataract diagnosis to cataract surgery by same physician,[c] median, d			
Muncie, IN	14	133	46
Dothan, AL	15	747	170
Abilene, TX	17	245	67
Jackson, TN	17	490	126
Tuscaloosa, AL	18	206	47
Flint, MI	18	145	40
Minot, ND	18	61	21
Idaho Falls, ID	18.5	233	101
Fort Myers, FL	19	10 252	3127
Springdale, AR	19	1125	237
Fort Smith, AR	19	787	182

Abbreviation: HRR, hospital referral region.

[a] The HRR was omitted if there were less than 20 patients in any age group (40–49, 50–59, 60–69, 70–79, or ≥80 years).

[b] Length of time between first diagnosis of cataract by any eye care professional (ophthalmologist or optometrist) and surgery.

[c] Length of time between first diagnosis of cataract (by the same ophthalmologist who performed the surgery) and surgery.

Table 4

Cox Proportional Hazards Model Estimating the Hazard of Cataract Surgery[a]

Covariate	HR (95% CI)	*P* Value
Race		
White	1 [Reference]	
Black	0.85 (0.83–0.87)	<.001
Latino	1.08 (1.05–1.10)	<.001
Asian	1.09 (1.05–1.12)	<.001
Other	1.04 (0.99–1.10)	.01
Income, $		
<30 000	1 [Reference]	
30 000 to <60 000	0.99 (0.98–1.01)	.35
60 000 to <100 000	0.94 (0.93–0.96)	<.001
100 000 to <125 000	0.90 (0.88–0.92)	<.001
≥125 000	0.84 (0.82–0.87)	<.001
Education		
<High school	1 [Reference]	
High school diploma	0.91 (0.88–0.95)	<.001
Some college	0.83 (0.80–0.86)	<.001
College diploma	0.76 (0.73–0.79)	<.001
Advanced degree	0.69 (0.61–0.78)	<.001
Diabetes[b]		
None	1 [Reference]	
Uncomplicated	0.94 (0.93–0.95)	<.001
Complicated	0.95 (0.93–0.96)	<.001
Urban vs rural status		
Urban	1 [Reference]	
Large rural	1.07 (1.05–1.09)	<.001
Small rural	1.05 (1.03–1.07)	<.001
Age at cataract diagnosis	1.02 (1.02–1.03)	<.001
Eye trauma	1.30 (1.26–1.34)	<.001
Charlson Comorbidity index	1.01 (1.01-1.01)	<.001
Latitude	0.99 (0.98–0.99)	<.001
PE GPCI	0.40 (0.38–0.43)	<.001
Average time in plan	1.00 (1.00-1.00)	<.001
No. of optometrists per 100 000 population	1.00 (1.00-1.00)	<.001

Abbreviations: ACGME, Accreditation Counsel for Graduate Medical Education; HR, hazard ratio; PE PGCI, Practice Expense–Geographic Practice Cost Index.

[a]Community-level covariates that were considered but not selected as part of the best subset include cost of living index, number of ophthalmologists per 100 000 population, number of physicians per 100 000 population, proportion of population driving to work, longitude,

median total charges per patient, number of days of sunshine, UV index, and ACGME Ophthalmology Residency. Patient-level covariates that were considered but not selected as part of the best subset include sex, dementia, and depression.

[b]Uncomplicated diabetes refers to diabetes with no record of end-organ damage from this condition. Complicated diabetes refers to diabetes with a record of end-organ damage (eg, nephropathy).