

Advanced Technology Intraocular Lens Utilization in Eyes with Glaucoma and Diabetic Retinopathy Across US Academic Centers: Analysis of the SOURCE Repository

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Abstract

Background

Advanced technology intraocular lenses (ATIOLs) expand the refractive goals of cataract surgery, yet real-world patterns of ATIOL selection in patients with glaucoma and diabetic retinopathy (DR) remain poorly characterized. This study evaluated ATIOL utilization patterns in patients with glaucoma or DR and examined associations of disease severity and sociodemographic characteristics with IOL selection.

Methods

This multicenter retrospective cohort study used the Sight Outcomes Research Collaborative (SOURCE) database, a deidentified registry derived from 16 US academic medical centers using Epic electronic health records. Cataract surgeries recorded between January 1, 2009, and December 31, 2024, were included. The primary outcome was implantation of an ATIOL (multifocal, extended depth-of-focus [EDOF], toric, or combination) versus a standard monofocal IOL. A secondary analysis evaluated toric monofocal versus standard monofocal IOL utilization separately. Associations between IOL selection and ocular comorbidity, disease severity, and sociodemographic characteristics were evaluated using odds ratios and chi-square tests.

Results

Among 253,065 cataract surgeries, 30,045 (11.9%) involved ATIOL implantation. ATIOL utilization increased from 5.1% in 2009–2015 to 21.2% in 2022 (OR, 4.99; 95% CI, 4.68–5.32; $P < 0.001$), with marked variation across institutions (OR range, 0.06–26.9). Patients with glaucoma (10.4%; OR, 0.77; 95% CI, 0.74–0.80) and DR (6.7%; OR, 0.48; 95% CI, 0.44–0.52) were less likely to receive ATIOLs than patients without either comorbidity (13.1%; both $P < 0.001$), with utilization declining with increasing disease severity. English-speaking patients had more than twice the odds of receiving an ATIOL compared with non-English-speaking patients (OR, 2.26; 95% CI, 2.10–2.43), while Black patients had lower odds compared with White patients (OR, 0.49; 95% CI, 0.46–0.52).

Conclusions

ATIOL utilization varied substantially across US academic centers and was associated with ocular comorbidity, disease severity, and sociodemographic characteristics. Lower utilization among patients with glaucoma or DR and persistent sociodemographic disparities highlight the need for evidence-based ATIOL candidacy guidelines and further investigation of potential barriers to equitable access.

Background

Advanced technology intraocular lenses (ATIOLs), including multifocal intraocular lenses (MIOLs), extended depth-of-focus (EDOF), and toric intraocular lenses (IOLs), have expanded the refractive goals of modern cataract surgery. Beyond restoring visual acuity, these technologies may reduce spectacle dependence and improve patient satisfaction by correcting presbyopia and corneal astigmatism.^{1–3}

Despite these benefits, ATIOL selection may be challenging in eyes with ocular comorbidities due to potential adverse events. Patients with glaucoma and diabetic retinopathy (DR) frequently experience visual dysfunction related to optic nerve or retinal disease that may limit the benefits of refractive optimization. Presbyopia-correcting lenses, including multifocal and EDOF designs, may further reduce contrast sensitivity and increase photic phenomena such as glare and halos, raising concerns regarding postoperative visual quality in eyes with preexisting pathology.^{4–6} Patients with ocular comorbidities are also at higher risk for postoperative complications and may have reduced fundus visualization during future retinal procedures.^{7–11} For this reason, surgeons often approach ATIOL implantation cautiously in patients with glaucoma or retinal disease.

It is unknown whether surgeons meaningfully differentiate between the relative risk profiles of toric monofocal and presbyopia-correcting IOLs (EDOF and MIOLs) when making lens selection decisions in patients with ocular comorbidities. Unlike multifocal and EDOF lenses, toric monofocal IOLs correct corneal astigmatism without splitting light or reducing contrast sensitivity. Therefore, the rationale for avoiding toric IOLs in eyes with ocular comorbidities differs from that of presbyopia-correcting lenses.

There is currently no clear consensus or widely accepted preferred practice pattern regarding ATIOL candidacy criteria or contraindications in patients with glaucoma or DR, particularly those with early or mild disease.^{1,12} Clinical decision-making largely relies on individual surgeon experience, risk tolerance, institutional practice patterns, and resources to provide appropriate counseling.

The purpose of this study was to evaluate ATIOL utilization patterns in patients with glaucoma and DR within the SOURCE database, and to examine associations of disease severity and sociodemographic characteristics with ATIOL selection.

Methods

Study Design and Data Source

A multicenter retrospective observational study was conducted using the Sight Outcomes Research Collaborative (SOURCE) database, a deidentified clinical registry derived from 16 academic medical centers across the United States using the Epic electronic health record system. The database contains demographic, diagnostic, procedural, and implant-level information.

Study Population

All cataract surgeries recorded in the SOURCE database between January 1, 2009, and December 31, 2024, were screened. For the primary analysis, cataract surgery records with documented IOL implantation data were identified. Patients were stratified into three mutually exclusive groups based on International Classification of Diseases (ICD) codes documented before surgery: (1) glaucoma, (2) diabetic retinopathy (DR), or (3) neither diagnosis (control). Patients with both glaucoma and DR were excluded to permit independent evaluation of each cohort. Records with missing implant or diagnostic information were excluded. After exclusions, 175,198 episodes were included in the comorbidity analysis.

Comorbidity Risk Stratification

Within each disease cohort, patients were stratified by disease-related risk for postoperative complications using ICD-based classifications. A total of 263 unique diabetic retinopathy (DR) ICD codes and 283 unique glaucoma ICD codes were identified and categorized into predefined risk groups (low, medium, high, or unspecified). Risk assignments were based on standardized diagnostic descriptors embedded within ICD coding (Additional file 1: Table S1).

IOL Classification

IOL type was identified using implant-level data and manufacturer codes. For the primary analysis, multifocal IOLs (MIOLs), toric IOLs, extended depth-of-focus (EDOF) IOLs, toric MIOLs, and toric EDOF IOLs were classified as advanced technology intraocular lenses (ATIOLs). A secondary analysis evaluated toric monofocal IOL utilization separately, comparing toric monofocal with standard monofocal IOLs and excluding presbyopia-correcting designs.

Statistical Analysis

The unit of analysis was the cataract surgery episode. Because lens selection for the second eye is typically planned together with the first, surgeries on both eyes performed within 100 days of each other were treated as a single episode and counted once. Episodes were classified as ATIOL if an ATIOL was implanted in either eye; fewer than 0.4% of episodes involved different IOL types between eyes. Second-eye surgeries performed more than 100 days after the first were counted as separate episodes; therefore, some patients contributed more than one episode to the analysis.

Descriptive statistics were used to summarize patient demographics, clinical characteristics, and IOL distributions. Between-group differences in ATIOL utilization were assessed using chi-square tests, and mean age was compared using independent-samples t tests. Associations between IOL selection and study period, institution, ocular comorbidity, disease severity, and sociodemographic characteristics were estimated using odds ratios (ORs) with 95% CIs, calculated relative to a prespecified reference category for each factor. For factors with more than two categories, overall P values were obtained from

chi-square tests. To assess potential confounding by age, the comorbidity analyses were repeated within age strata (40–49, 50–59, 60–69, 70–79, and 80–100 years). The results of these analyses are reported in Additional file 1: Tables S3 and S4.

Analyses were performed using IBM SPSS Statistics, version 30.0 (IBM Corp). This study is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline.

Results

Study Cohort

Among 253,065 cataract surgeries performed between 2009 and 2024, 30,045 (11.9%) involved ATIOL implantation and 223,020 (88.1%) involved standard monofocal IOL implantation. Among 165,049 patients with complete demographic information, the mean (SD) age was 69.0 (11.5) years, and 53% were female. Most patients were White (65%), while 8% were Black, 5% were Asian, and 22% were of other or unknown race. Hispanic ethnicity was reported in 6% of patients.

Toric IOLs accounted for most ATIOLs (19,914 [7.9%]), followed by EDOF IOLs (4,207 [1.7%]) and multifocal IOLs (2,927 [1.2%]) (Table 1). Combination ATIOLs, including toric multifocal IOLs (864 [0.3%]) and toric EDOF IOLs (1,260 [0.5%]), were less commonly used.

Table 1. Distribution of IOL types

IOL Type	No. (%)
Monofocal	223,020 (88.1)
Any ATIOL	30,045 (11.9)
Toric	19,914 (7.9)
Multifocal (MIOL)	2,927 (1.2)
EDOF	4,207 (1.7)
Toric MIOL	864 (0.3)
Toric EDOF	1,260 (0.5)

Abbreviations: ATIOL, advanced technology intraocular lens; EDOF, extended depth of focus; MIOL, multifocal intraocular lens.

Temporal trends in ATIOL utilization

ATIOL implantation increased from 5.1% of cataract surgeries during 2009–2015 to 21.2% in 2022 (OR, 4.99; 95% CI, 4.68–5.32; $P<0.001$) (Table 2). Similar trends were observed for toric monofocal IOLs. Data for 2023–2024 were limited because of incomplete processing at the time of data extraction.

Table 2. ATIOL utilization over time

Year	Monofocal (n)	ATIOL (n)	ATIOL, % (95% CI)	OR (95% CI)
2009–2015	26,398	1,426	5.1 (4.9–5.4)	1 [Reference]
2016	13,242	1,255	8.7 (8.2–9.1)	1.75 (1.62–1.90)
2017	17,088	1,885	9.9 (9.5–10.4)	2.04 (1.90–2.19)
2018	20,962	2,880	12.1 (11.7–12.5)	2.54 (2.38–2.72)
2019	21,759	3,276	13.1 (12.7–13.5)	2.79 (2.61–2.97)
2020	15,206	2,472	14.0 (13.5–14.5)	3.01 (2.81–3.22)
2021	16,724	3,323	16.6 (16.1–17.1)	3.68 (3.45–3.93)
2022	14,425	3,888	21.2 (20.6–21.8)	4.99 (4.68–5.32)
2023*	5,244	659	11.2 (10.4–12.0)	2.33 (2.11–2.56)
2024*	175	30	14.6 (10.1–20.2)	3.17 (2.11–4.62)

*Abbreviation: ATIOL, advanced technology intraocular lens; OR, odds ratio; CI, confidence interval. *Limited data available due to incomplete data processing at time of extraction.*

Variation in ATIOL utilization across sites

Substantial variation in ATIOL utilization was observed across the 16 participating institutions, with implantation rates ranging from less than 1% to greater than 80% (OR range, 0.06–26.9; $P<0.001$) (Additional file 1: Table S2).

ATIOL practice patterns among Glaucoma and DR patients

Compared with patients without ocular comorbidities, patients with glaucoma and DR were less likely to receive ATIOLs. ATIOLs were implanted in 13.1% of patients without comorbidities, compared with 10.4% of patients with glaucoma and 6.7% of patients with DR (both $P<0.001$). Glaucoma was associated with lower odds of ATIOL implantation (OR, 0.77; 95% CI, 0.74–0.80), while DR was associated with lower odds of ATIOL implantation (OR, 0.48; 95% CI, 0.44–0.52).

The magnitude of the reduction was smaller for toric monofocal IOLs than for ATIOLs overall in both comorbidity groups, although the pattern of lower utilization was consistent. Toric monofocal IOLs were implanted in 9.2% of patients without comorbidities, compared with 7.9% of patients with glaucoma and

5.2% of patients with DR (both $P<0.001$). Although patients with glaucoma were slightly older and patients with DR were younger than controls on average (70.4, 64.4, and 69.4 years, respectively), age-stratified analyses demonstrated consistent patterns across all age groups (Figure 1; Additional file 1: Tables S3 and S4).

Association Between Disease Severity and ATIOL Utilization

Within both disease cohorts, ATIOL utilization declined with increasing disease severity (Table 3; Figure 2). Among patients with glaucoma, ATIOL utilization decreased from 12.3% in the low-risk group to 9.7% in the medium-risk group (OR, 0.76; 95% CI, 0.67–0.87; $P<0.001$) and 8.6% in the high-risk group (OR, 0.67; 95% CI, 0.60–0.74; $P<0.001$). Among patients with DR, ATIOL utilization was 8.5% in the medium-risk group compared with 5.7% in the high-risk group (OR, 0.65; 95% CI, 0.56–0.76; $P<0.001$).

A similar pattern was observed for toric monofocal IOLs. Among patients with DR, utilization was lower in the high-risk group than in the medium-risk group (4.5% vs 6.4%; OR, 0.68; 95% CI, 0.57–0.81; $P<0.001$). Among patients with glaucoma, toric monofocal IOL utilization was similar between the low- and medium-risk groups (8.9% vs 8.8%; OR, 0.98; $P=0.82$) but was lower in the high-risk group (6.8%; OR, 0.75; 95% CI, 0.66–0.84; $P<0.001$).

Table 3. ATIOL Utilization by Disease Severity

Complication Risk	Monofocal (n)	ATIOL (n)	ATIOL, % (95% CI)	OR (95% CI)	P Value
Glaucoma					
Low	17,904	2,521	12.3 (11.9–12.8)	1 [Reference]	
Medium	2,510	270	9.7 (8.6–10.9)	0.76 (0.67–0.87)	<0.001
High	5,045	475	8.6 (7.9–9.4)	0.67 (0.60–0.74)	<0.001
Diabetic Retinopathy					
Medium	3,312	309	8.5 (7.6–9.5)	1 [Reference]	
High	6,513	394	5.7 (5.2–6.3)	0.65 (0.56–0.76)	<0.001

Abbreviation: ATIOL, advanced technology intraocular lens; OR, odds ratio; CI, confidence interval.

Influence of sociodemographic factors on ATIOL selection

Several sociodemographic characteristics were associated with ATIOL utilization (Table 4; Figure 3). Female patients were slightly more likely to receive ATIOLs ($P=0.036$), while male patients had slightly

higher toric monofocal IOL utilization ($P=0.043$). Compared with White patients, ATIOL implantation was lower among Black patients (OR, 0.49; 95% CI, 0.46–0.52), Asian patients (OR, 0.75; 95% CI, 0.70–0.80), and patients in other racial groups (all $P<0.001$). Hispanic patients were less likely to receive ATIOLs than non-Hispanic patients (8.1% vs 12.4%; OR, 0.62; 95% CI, 0.57–0.66; $P<0.001$).

Primary language represented one of the largest observed differences: English-speaking patients had more than twice the odds of receiving an ATIOL compared with non-English-speaking patients (12.6% vs 6.0%; OR, 2.26; 95% CI, 2.10–2.43; $P<0.001$). Patients with commercial insurance had the highest ATIOL utilization (13.5%), followed by Medicare (12.3%) and Medicaid (6.8%). Employed patients had higher ATIOL utilization (15.9%) than retired (12.4%) or disabled patients (7.1%; all $P<0.001$). Similar patterns were observed for toric monofocal IOLs (Additional file 1: Table S5).

Table 4. ATIOL Utilization by Sociodemographic Factors

Factor	Monofocal (n)	ATIOL (n)	ATIOL, % (95% CI)	OR (95% CI)	P Value (Overall)
Sex					0.036
Female	82,822	11,561	12.3 (12.0–12.5)	1 [Reference]	
Male	62,251	8,415	11.9 (11.7–12.2)	0.97 (0.94–1.00)	
Race					<0.001
White	101,150	15,904	13.6 (13.4–13.8)	1 [Reference]	
Black	19,436	1,495	7.1 (6.8–7.5)	0.49 (0.46–0.52)	
Asian	8,471	1,000	10.6 (9.9–11.2)	0.75 (0.70–0.80)	
Other	16,021	1,578	9.0 (8.6–9.4)	0.63 (0.59–0.66)	
Ethnicity					<0.001
Non-Hispanic	129,005	18,307	12.4 (12.3–12.6)	1 [Reference]	
Hispanic	10,000	876	8.1 (7.6–8.6)	0.62 (0.57–0.66)	
Language					<0.001
Non-English	12,526	803	6.0 (5.6–6.4)	1 [Reference]	
English	132,552	19,174	12.6 (12.5–12.8)	2.26 (2.10–2.43)	
Insurance					<0.001
Commercial	35,873	5,619	13.5 (13.2–13.9)	1 [Reference]	
Medicare	80,597	11,314	12.3 (12.1–12.5)	0.90 (0.87–0.93)	
Medicaid	5,217	383	6.8 (6.2–7.5)	0.47 (0.42–0.52)	
Other	23,391	2,661	10.2 (9.9–10.6)	0.73 (0.69–0.76)	
Employment					<0.001
Working	27,897	5,279	15.9 (15.5–16.3)	1 [Reference]	

Retired	69,513	9,792	12.4 (12.1–12.6)	0.74 (0.72–0.77)
Disabled	5,208	400	7.1 (6.5–7.8)	0.41 (0.36–0.45)
Other	42,460	4,506	9.6 (9.3–9.9)	0.56 (0.54–0.59)

Abbreviation: ATIOL, advanced technology intraocular lens; OR, odds ratio; CI, confidence interval.

Discussion

In this multicenter cohort study of more than 250,000 cataract surgeries performed at 16 U.S. academic centers, ATIOL utilization increased substantially over time but varied considerably based on ocular comorbidity status, disease severity, and patient sociodemographic characteristics. To our knowledge, this represents the largest multicenter analysis of ATIOL selection in eyes with glaucoma and diabetic retinopathy. Patients with glaucoma and DR were significantly less likely to receive ATIOLs than patients without ocular comorbidity, and ATIOL utilization declined progressively with increasing disease severity. In addition, substantial disparities in ATIOL utilization were observed across race, ethnicity, language, insurance, and employment categories. Together, these findings provide a large-scale view of contemporary ATIOL utilization patterns and highlight substantial variation in real-world IOL selection.

ATIOL implantation rates in this cohort (~12%) were somewhat lower than national market estimates of approximately 15%–18%,¹⁹ likely reflecting the academic practice settings captured in SOURCE, where patient complexity and institutional practices may differ from private or refractive-focused surgical centers. The marked variation in ATIOL utilization across institutions, ranging from under 1% to over 80%, suggests that local practice culture, surgeon preferences, and institutional resources have considerable influence on lens selection. Such variation may reflect uncertainty regarding ATIOL candidacy in patients with ocular comorbidities and highlights the absence of widely adopted evidence-based selection criteria.

Lower ATIOL utilization among patients with glaucoma and DR is consistent with longstanding concerns about visual quality and postoperative outcomes in eyes with underlying optic nerve or retinal disease.^{12–18} The progressive reduction in ATIOL utilization with increasing disease severity suggests that the presence and extent of ocular comorbidity are associated with IOL selection. This pattern may reflect greater caution regarding refractive optimization in eyes with more advanced disease, in which postoperative visual potential may be limited or less predictable. However, because surgeon rationale and patient preferences were not available in the SOURCE database, the factors underlying these patterns cannot be determined from the present analysis.

Notably, lower utilization among patients with glaucoma and DR extended to toric monofocal IOLs. Unlike multifocal and EDOF lenses, toric monofocal IOLs correct corneal astigmatism without relying on

light-splitting optics and are not subject to the same concerns regarding reduced contrast sensitivity associated with presbyopia-correcting designs. The persistence of lower utilization in the toric-specific analysis therefore suggests that the observed differences in IOL selection may not be explained solely by concerns regarding the optical properties of multifocal and EDOF lenses. Other considerations, such as anticipated visual potential, perceived benefit of refractive optimization, preoperative corneal astigmatism, patient preference, or financial factors, may contribute. Because these factors were not directly measured, their relative contributions cannot be determined. Outcomes-based studies evaluating toric monofocal IOLs in eyes with glaucoma and DR are needed to determine whether differences in utilization correspond to differences in postoperative benefit and to better define appropriate candidacy in these populations.

Lastly, sociodemographic characteristics were also strongly associated with ATIOL utilization. Patients who were White, non-Hispanic, English-speaking, commercially insured, and employed were consistently more likely to receive ATIOLs. ATIOLs typically involve out-of-pocket costs not covered by traditional insurance plans, creating financial barriers for lower-income and publicly insured patients.¹⁹ However, the persistence of disparities in the toric-specific analysis, where out-of-pocket costs are generally lower, and the magnitude of the language disparity suggest that financial barriers alone do not fully explain these inequities. Communication barriers, health literacy, variation in counseling practices, and broader structural inequities may also influence patient awareness of ATIOL options and participation in shared decision-making. Standardized counseling protocols, multilingual educational materials, and decision-support tools may help promote more equitable access.

Limitations

At the time of this analysis, the SOURCE database solely represented data shared by academic medical centers and does not reflect patterns in private practice settings. As participating institutions were limited and converted to the Epic platform at varying times, the volume of cataract surgeries captured represents a small sample from the 3–4 million procedures performed annually in the U.S., thereby constraining the overall data available within the consortium.²⁰ At the time of data extraction in 2025, many sites had not yet fully processed their 2023 data, and even fewer had completed transfer of 2024 data. Consequently, results for the most recent years should be interpreted with caution given inherent data lag. Furthermore, this study evaluated IOL selection rather than postoperative outcomes and therefore cannot determine whether observed utilization patterns are clinically appropriate. Disease severity was classified using ICD-based diagnostic coding, which may not fully capture clinical severity and is subject to variability in coding practices. Precise details concerning surgeon rationale, patient preferences, financial factors, and preoperative corneal astigmatism could not be evaluated, a limitation inherent to clinical documentation and the retrospective nature of this analysis. Lastly, because second-eye surgeries performed more than 100 days after the first were analyzed as separate episodes, some patients contributed more than one observation, and this within-patient correlation was not accounted for in the analysis.

Conclusions

In this multicenter cohort study of over 250,000 cataract surgeries, patients with glaucoma and DR were significantly less likely to receive ATIOLs than those without comorbidities, with utilization declining with disease severity and extending to toric monofocal lenses, suggesting that conservative lens selection in comorbid eyes reflects a broader pattern not limited to presbyopia-correcting technologies. Substantial sociodemographic disparities in ATIOL utilization further highlight inequitable access to advanced refractive options. Prospective outcomes-based studies are needed to establish evidence-based candidacy criteria for ATIOLs in eyes with glaucoma and DR, and targeted interventions are needed to reduce barriers to equitable access.

Abbreviations

ATIOL	
Advanced technology intraocular lens	
CI	
Confidence interval	
DME	
Diabetic macular edema	
DR	
Diabetic retinopathy	
EDOF	
Extended depth of focus	
ICD	
International Classification of Diseases	
IOL	
Intraocular lens	
MIOL	
Multifocal intraocular lens	
NPDR	
Nonproliferative diabetic retinopathy	
OR	
Odds ratio	
PDR	
Proliferative diabetic retinopathy	
SOURCE	
Sight Outcomes Research Collaborative	

Declarations

Ethics approval and consent to participate: This study was approved by the Albert Einstein College of Medicine Institutional Review Board (protocol 2024-16442), with a waiver of informed consent because all data were deidentified. The study adhered to the tenets of the Declaration of Helsinki.

Consent for publication: Not applicable.

Clinical trial number: Not applicable.

Availability of data and materials: The SOURCE database contains deidentified patient data derived from Epic electronic health records at 16 academic medical centers. Individual-level data cannot be shared because of institutional data use agreements. Aggregate data supporting the findings of this study are provided in the manuscript and supplementary materials. Investigators interested in collaboration may contact the corresponding author.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions: RG and AS conceived and designed the study. JYM performed the statistical analyses. All authors contributed to data interpretation and critically revised the manuscript. All authors read and approved the final manuscript.

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21. Supplemental. material.

Figures

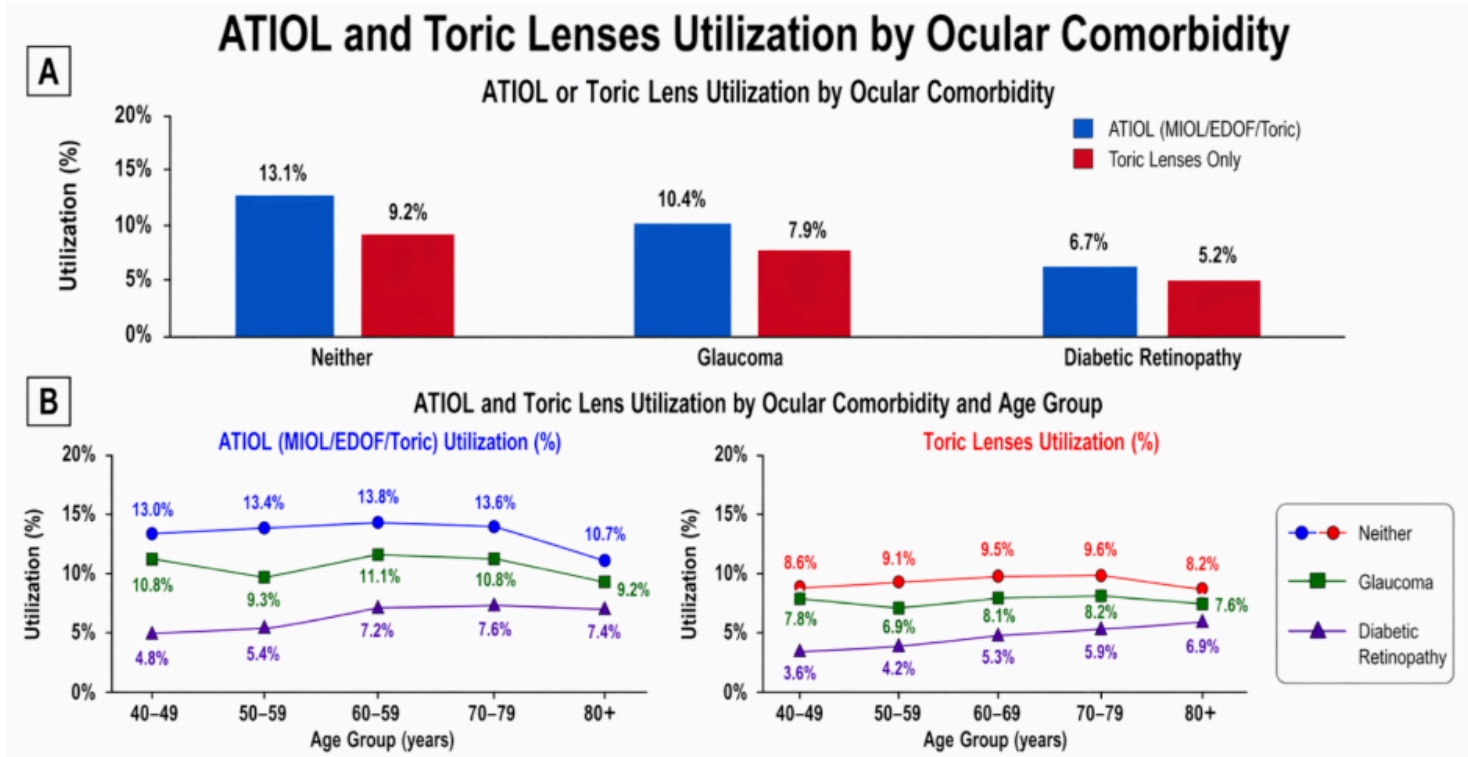


Figure 1

ATIOL and Toric Lens Utilization by Ocular Comorbidity and Age. (A) Percentage of cataract surgeries using ATIOLs and toric lenses among patients without ocular comorbidity, with glaucoma (GL), and with diabetic retinopathy (DR). (B) Utilization of ATIOLs (left panels) and toric lenses (right panels) across age groups, stratified by comorbidity status. Error bars represent 95% confidence intervals. Age-stratified data are provided in Tables S3 and S4 of the Supplement.

ATIOL and Toric Lenses Utilization by Disease Severity

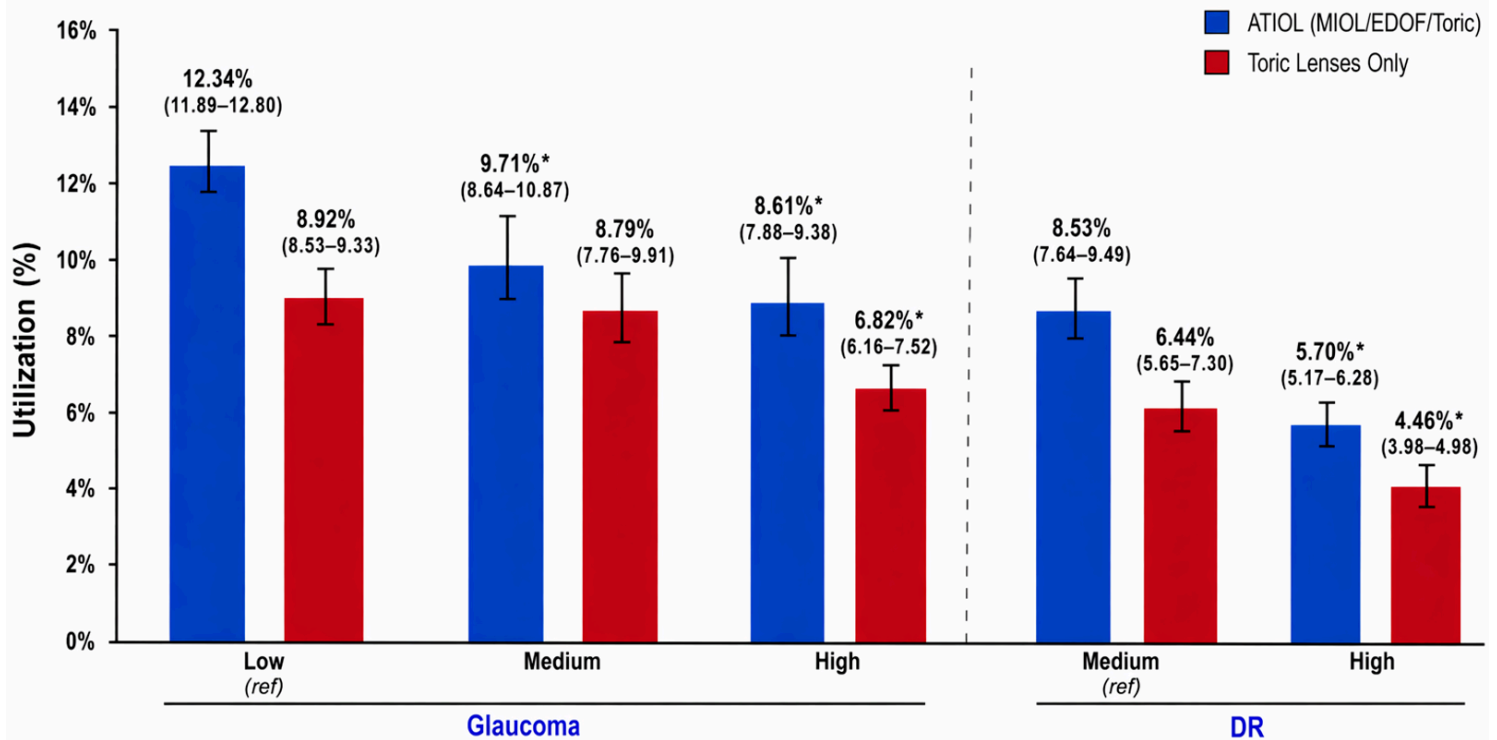


Figure 2

ATIOL and Toric Lens Utilization by Disease Severity. Bar chart showing the proportion of patients receiving ATIOLs (blue) and toric lenses (red) across increasing severity of glaucoma and DR. Error bars represent 95% confidence intervals; asterisks indicate statistically significant differences compared with the reference group within each condition.

Sociodemographic Disparities in ATIOL and Toric Lenses Utilization

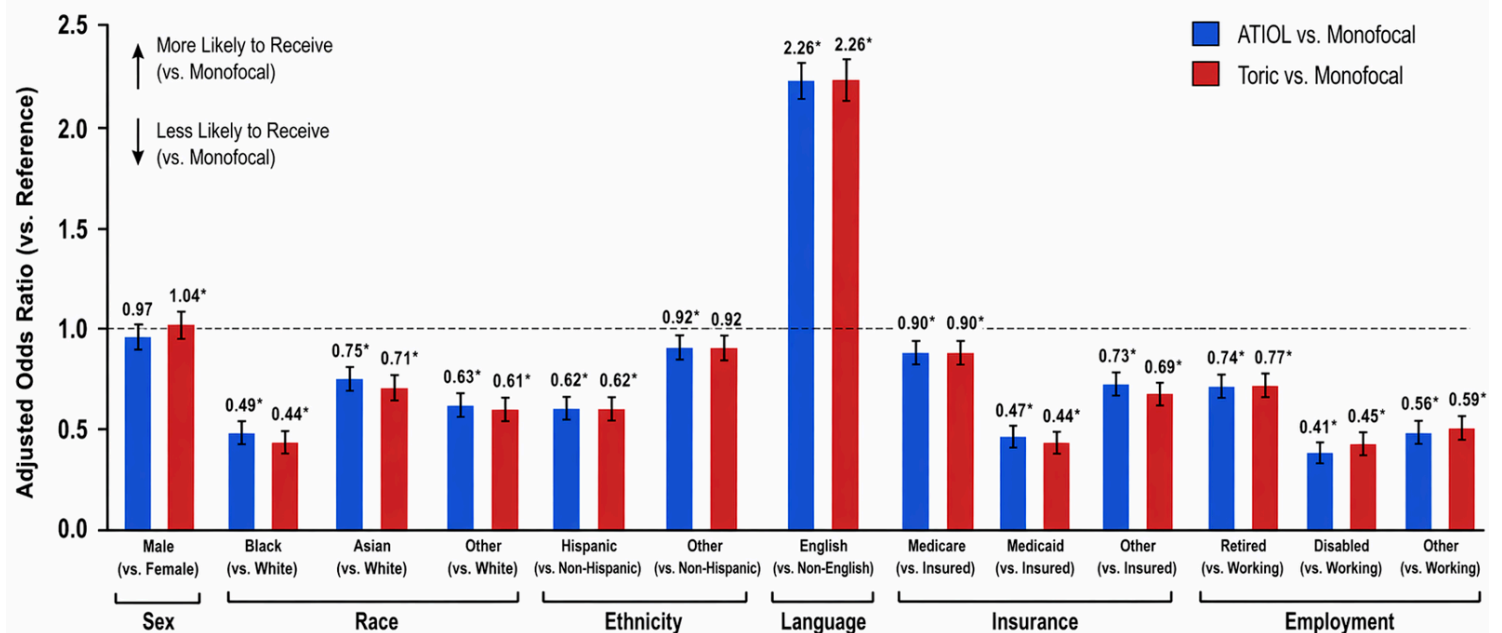


Figure 3

Sociodemographic Disparities in ATIOL and Toric Lens Utilization. Odds ratios for receiving ATIOLs (blue) and toric lenses (red) compared with monofocal lenses across sociodemographic groups, including sex, race, ethnicity, language, insurance, and employment status. Error bars represent 95% confidence intervals; asterisks indicate statistically significant differences.

Supplementary Files

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