ORIGINAL STUDY

Longitudinal Trends in Resource Utilization Associated With Newly Diagnosed Primary Angle Closure Glaucoma in the United States

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Précis: The average cumulative 2-year cost following first primary angle closure glaucoma diagnosis was $2960. Elderly and Black patients were at higher risk of being among the costliest 5% (> $9813) of cases, accounting for 21.3% of costs.

Purpose: To assess longitudinal eye care costs associated with newly diagnosed primary angle closure glaucoma (PACG) in the United States.

Methods: Patients with a diagnosis of PACG between 2009 and 2017 were identified in Optum's deidentified Clinformatics Data Mart Database based on International Classification of Diseases (ICD) codes. Newly diagnosed PACG was defined as: (1) diagnosis by an ophthalmologist or optometrist; (2) observable for at least 12 months before and 24 months after index diagnosis; (3) no prior history of glaucoma treatment; (4) PACG-related treatment initiated after index diagnosis. Logistic regression modeling was performed to identify risk factors for being in the top 5% of cumulative 2-year costs.

Results: Among 12,673 eligible patients, the average cumulative 2-year cost following first PACG diagnosis was $2960. Patient costs were highest in the 6 months immediately following diagnosis, accounting for 52.3% of all 2-year costs. 56.7% of all 2-year costs were related to treatment procedures. The costliest 5% (> $9813) of patients accounted for 21.3% of all 2-year PACG-related costs. Risk factors for being in the costliest 5% ($P < 0.05$) included older age, Black race, PPO or other Medicare insurance product, living in the Midwest or the South, and recent diagnosis of anatomic narrow angles (ANA).

Conclusion: Costs associated with newly diagnosed PACG were found to be disproportionately driven by a small subset of cases. Elderly and Black patients were more likely to be within the top 5% of cumulative 2-year costs. Identifying and preventing the costliest PACG cases could reduce PACG-related eye care expenditures.

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Primary angle closure glaucoma (PACG) is a visually devastating eye condition that is responsible for half of all glaucoma-related blindness worldwide.[1] PACG is preceded by anatomic narrow angles (ANA), which can lead to angle closure, impaired aqueous humor outflow, and elevated intraocular pressure (IOP). Once PACG develops and is diagnosed, treatments such as IOP-lowering medications, laser peripheral iridotomy (LPI), and lens extraction and/or glaucoma surgery can be administered to prevent additional optic nerve damage and vision loss.[2,3] However, none of these treatments are curative, and most patients with PACG require chronic monitoring and treatment by eye care providers.[4] The rising prevalence of PACG due to aging of the world's population contributes to mounting costs of glaucoma care, which total over $3 billion annually in the United States alone.[5]

Cost analysis studies are crucial for understanding the economic impact of disease on health care systems and the cost-effectiveness of current practice patterns. This is especially true in the United States, which has the highest health care expenditure per capita in the world.[6] A previous longitudinal cost analysis study estimated the average adjusted 2-year cost of newly diagnosed primary open angle glaucoma (POAG) from 2001 to 2009 to be $2516 in 2009 US dollars.[7] However, there are several reasons why findings on POAG costs may not generalize to PACG. First, PACG eyes tend to have higher IOP and more severe vision loss at first diagnosis than POAG eyes.[8] In addition, the management of POAG and PACG differs, especially when first diagnosed.[9] Finally, treatments unique to PACG, such as LPI and lens extraction surgery, have potent IOP-lowering effects that may reduce the need for more intensive and costly follow-up treatments.[2,3] While there is some data on costs associated with different treatments for PACG, there is sparse knowledge about eye care costs associated with newly diagnosed PACG.[10]

In this study, we use health care claims data from patients with newly diagnosed PACG to answer 3 questions. First, what are the eye care costs associated with newly diagnosed cases of PACG? Second, are these costs mitigated by earlier detection of ANA before the development of glaucoma? Finally, what are the characteristics of patients with the greatest PACG-related eye care costs? Answering these questions could provide valuable insights into health care resource utilization and cost reduction strategies related to PACG care.

METHODS

Optum's deidentified Clinformatics Data Mart Database (Optum CDM) is derived from a database of deidentified administrative health claims data warehouse of commercial and Medicare Advantage health claims. The database includes ~17 to 19 million annual covered lives for a total of over 65 million unique lives over 13 years (January 2007 through December 2019). The data provided includes demographics, insurance eligibility information, as well as medical and prescription drug claims. The Optum CDM socioeconomic view also includes variables such as race, education level, home ownership status, and net worth ranges. These variables are derived from health information deterministically linked to data licensed from a consumer data vendor. Insurance products were categorized as either commercial or Medicare, and then as either a health maintenance organization (HMO) or exclusive provider organization (EPO), a preferred provider organization (PPO), or another (OTH) type of plan. Available clinical data included first dates of ANA and PACG diagnoses, health care provider type, prescription medications, diagnostic tests, treatment procedures, and first/last date of enrollment in an insurance plan observable in the Optum CDM. The University of Southern California Institutional Review Board exempted this study from IRB approval. The study adhered to the tenets of the Declaration of Helsinki and complied with the Health Insurance Portability and Accountability Act.

Study Definitions

Inclusion in the study population required an index diagnosis of PACG based on International Classification of Diseases, Ninth Revision (ICD-9, 365.2x) or *Tenth Revision* (ICD-10, H40.2xx) codes. The index date of diagnosis was defined as the date of the first claim associated with a PACG diagnosis. Inclusion also required a 3-year (36 mo) period of continuous enrollment in the Optum CDM, comprised of a 1-year (12 mo) lookback period before the index date and a 2-year (24 mo) study period after the index date. The lengths of these periods were standardized to those used by Stein et al[7] to enhance comparability of cost findings. Newly diagnosed PACG cases with prior diagnosis of ANA based on ICD-9 (365.02, 365.06) or ICD-10 (H40.03x, H40.069) codes were included in the analysis to assess the effect of earlier ANA detection on resource utilization after index diagnosis of PACG. Patients with a prior diagnosis of ANA were divided into 2 groups: those with PACG diagnosis within 6 months of first ANA diagnosis (referred to as recent ANA) and those with PACG after 6 months of first ANA diagnosis (referred to as established ANA). This distinction was made to separate out patients who already had PACG at the time of first ANA diagnosis but experienced delays in diagnosis (eg, due to lack of diagnostic testing).

Newly diagnosed PACG cases met the following criteria: (1) PACG diagnosis by an ophthalmologist or optometrist, identified using Optum CDM health care provider type codes, between 2009 and 2017 to increase the fidelity of the diagnosis; (2) age 18 years or older on date of PACG diagnosis to rule out cases of congenital glaucoma; (3) a PACG diagnosis > 24 months after the index date to ensure continuity of care through the study period; (4) no history of glaucoma surgery, including trabeculectomy, tube shunt, or cyclophotocoagulation, during the 1 year lookback period to rule out established cases of PACG; (5) no history of IOP-lowering medications, LPI, or iridectomy during the 1 year lookback period unless preceded or accompanied by a diagnosis of ANA to rule out uncoded cases of PACG. These criteria were also standardized to those used by Stein et al when applicable.[7]

Cost Analysis

Glaucoma-related charges were divided into 4 categories: office visits, diagnostic procedures, treatment procedures, and prescription medications. Office visits, diagnostic tests, and treatment procedures were identified based on current procedural terminology (CPT) billing codes (Supplementary Table 1, Supplemental Digital Content 1, http://links.lww.com/IJG/B25). Diagnostic tests included gonioscopy, visual fields, and OCT. Treatment procedures included LPI, iridoplasty, lens extraction/cataract surgery,

TABLE 1. Sociodemographic and Clinical Characteristics of Eligible Patients Diagnosed With Primary Angle Closure Glaucoma (PACG) on the Index Date of Diagnosis

Variable	Value	Frequency (%)
Age	Less than 50	856 (6.8)
	50 to 59	1825 (14.4)
	60 to 69	3491 (27.5)
	70 to 79	4684 (37.0)
	80+	1817 (14.3)
Sex	Female	8158 (64.4)
	Male	4512 (35.6)
Race	White	8125 (64.1)
	Asian	886 (7.0)
	Black	1469 (11.6)
	Hispanic	1356 (10.7)
	Unknown	837 (6.6)
Education	High School Diploma or Less	3259 (25.7)
	Less than Bachelor's Degree	6561 (51.8)
	Bachelor's Degree Plus	2299 (18.1)
	Unknown	554 (4.4)
Household income	< \$40k	2902 (23.9)
	\$40k–\$59k	1813 (14.9)
	\$60k–\$99k	3073 (25.3)
	\$100k+	3156 (26.0)
	Unknown	1204 (9.9)
Early ANA detection	No	9152 (72.2)
	Recent (within 6 mo)	1421 (11.2)
	Established (> 6mo)	2100 (16.6)
Location	Northeast	2966 (23.4)
	Midwest	2565 (20.3)
	Mountain	632 (5.0)
	Pacific	1163 (9.2)
	South	5339 (42.2)
Gonioscopy (on or after index)	No	5554 (43.8)
	Yes	7119 (56.2)
LPI (on or after index)	No	7928 (62.6)
	Yes	4745 (37.4)
Glaucoma surgery (on or after index)	No	12087 (95.4)
	Yes	586 (4.6)

Gonioscopy, laser peripheral iridotomy (LPI), and glaucoma surgery occurred between the index date and the end of the 2-year study period.

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surgical iridectomy or iridotomy, goniosynechialysis, and glaucoma surgeries, including trabeculectomy, tube shunt, and cyclophotocoagulation. Prescription medications were identified using the First DataBank Drug Database and included prostaglandin analogs, beta blockers, carbonic anhydrase inhibitors, alpha agonizts, and miotics (Supplementary Table 2, Supplemental Digital Content 2, http://links.lww.com/IJG/B26). Charges were based on Optum CDM's standard price for each visit, test, procedure, or medication. All costs were adjusted for inflation to the value of United States dollars ($) in the 2020 calendar year by using Optum CDM-provided inflation rates for each cost type and calendar year. Charges were binned in 6-month intervals for the 1 year preceding and 2 years following the index diagnosis date. The primary cost estimates and analyses included all PACG-related charges from patients in the first 2 years following PACG diagnosis. The secondary cost estimates extended from years 2 to 5 following PACG diagnosis and excluded patients once they no longer had PACG-related costs in the database.

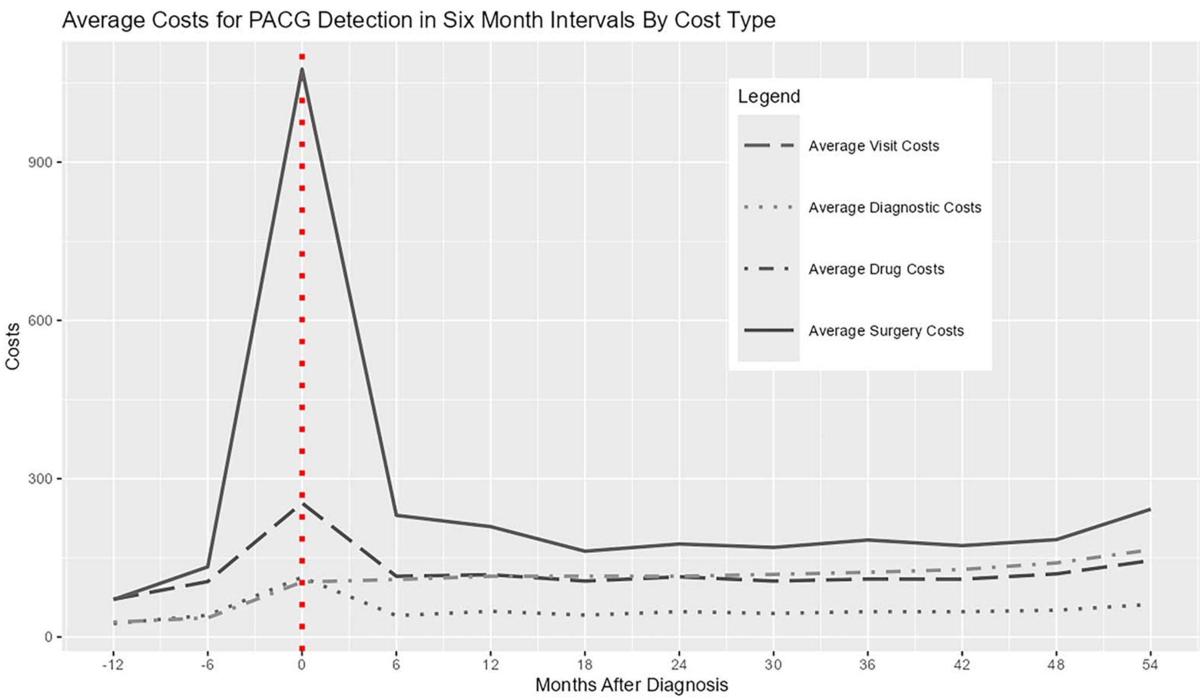
Statistical Analysis

Continuous data were expressed as means and SDs. Categorical data were expressed in proportions and percentages. Univariable and multivariable logistic regression analyses were performed to identify factors associated with being among the costliest 5% of patients in the first 2 years following PACG diagnosis. Factors with $P < 0.15$ on univariable analysis were included in the multivariable analysis. Adjusted odds ratios (ORs) were considered clinically significant if they were at least 15% higher (OR ≥ 1.15) or lower (OR ≤ 0.85) compared with the reference and reached a significance level of 0.05. All analyses were performed using the R software version 4.3.2 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

A total of 22,299 patients ages 18 years and older in the Optum CDM received a diagnosis of PACG by an ophthalmologist or optometrist between January 1, 2009, and December 31, 201,7 and were observable for at least 1 year before the index date (Supplementary Fig. 1, Supplemental Digital Content 3, http://links.lww.com/IJG/B27). Among patients with a prior diagnosis of ANA, 3521 remained after excluding those with prior glaucoma surgery (n = 33) or without a PACG diagnosis 2 or more years after the index date (n = 999). Among patients without a prior diagnosis of ANA, 9152 remained after excluding those with prior IOP-lowering medication use (n = 5314), surgery (n = 100), or without a PACG diagnosis 2 or more years after the index date (n = 3180).

A total of 12,673 patients were included in the analysis (Table 1). One thousand four hundred twenty-one (11.2%) had a recent diagnosis of ANA, 2100 (16.6%) had an established diagnosis of ANA, and 9152 (72.2%) did not have a diagnosis of ANA before PACG diagnosis. The average age was 68.2 ± 11.0 years, and 64.4% were female and 35.6% were male. The most common race/ethnicity was



Sample Size	-12	-6	0	6	12	18	24	30	36	42	48	54
All Patients With New PACG	12673	12673	12673	12673	12673	12673	12673	10736	9127	7577	5962	4050

FIGURE 1. Average costs among patients with newly diagnosed primary angle closure glaucoma (PACG) in 6-month intervals, starting 1 year before PACG diagnosis and ending 5 years after diagnosis. The vertical red dotted line marks the index date, and patients were omitted beyond 2 years once they had no additional cost data. The table below shows the number of patients remaining at each time interval. Figure 1 can be viewed in color online at www.glaucomajournal.com.

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non-Hispanic White (64.1%), followed by Black (11.6%), Hispanic (10.7%), Asian (7.0%), and Unknown (6.6%). The most common education level and annual household income were less than a bachelor's degree (51.8%) and more than $100,000 (26.0%), respectively. The most common geographic regions were South (42.2%), Northeast (23.4%), Midwest (20.3%), Pacific (9.2%), and Mountain (5.0%).

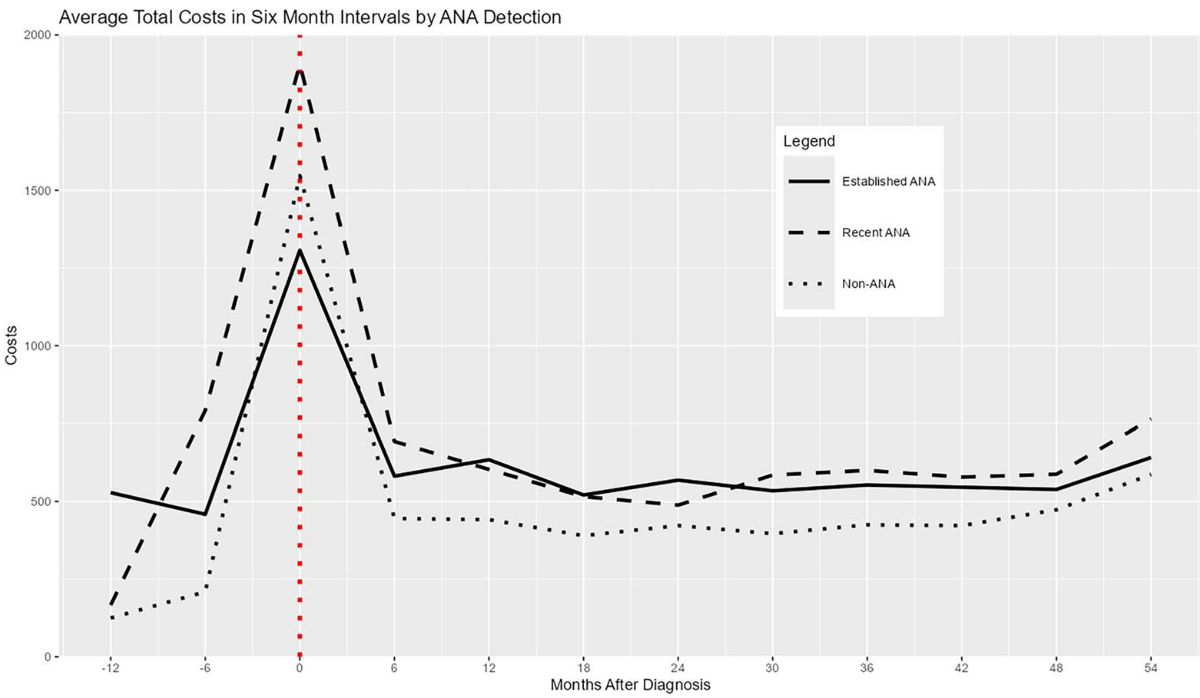
In the year before PACG diagnosis (not including the index date), 2569 patients (20.3%) received gonioscopy, 702 (5.5%) received LPI, and 516 (4.1%) received lens extraction. In the 2 years following PACG diagnosis (including the index date), 7119 patients (56.2%) received gonioscopy, 4745 patients (37.4%) received LPI, 2904 (22.9%) received lens extraction, 256 (2.0%) received trabeculectomy, 199 (1.6%) received an aqueous shunt, and 180 (1.4%) received cyclophotocoagulation.

Mean Charges for PACG-Related Services

The average 2-year cost for all patients newly diagnosed with PACG in our sample was $2,960.37. Costs were highest in the first 6 months following diagnosis with an average of $1547.79 (52.3%), $495.45 (16.7%) in months 6 to 12, $491.46 (16.6%) in months 12 to 18, and $425.66 (14.4%) in months 18 to 24 (Fig. 1). When stratifying average 2-year costs by type, the largest cost was treatment procedures at an average of $1678.85 (56.7%), followed by office visits at $593.31 (20.0%), prescription medications at $444.02 (15.0%), and diagnostic tests at $244.19 (8.2%).

Total 2-year costs differed significantly between the 3 groups (ANOVA $P < 0.001$), with average costs highest for patients with a recent diagnosis of ANA ($3717.52), followed by established ANA diagnosis ($3043.58), and lowest for those without prior ANA ($2823.72) (Fig. 2). All pairwise cost differences between groups were statistically significant (Tukey HSD test; $P \leq 0.02$ for all comparisons). Patients with established ANA had borderline statistically significantly higher 2-year medication costs than recent ANA ($744.08 vs. $652.55, $P = 0.05$), but both groups had higher medication costs than those without ANA ($342.80, $P < 0.001$). Average treatment costs (procedures plus medications) were highest for recent ANA followed by established ANA ($2857.87 vs. $2190.88, $P < 0.001$) and higher for established ANA compared with non-ANA ($2190.88 vs. $1993.15, $P = 0.02$). These relationships persisted up to 5 years after PACG diagnosis; recent ANA had the highest overall costs followed by established ANA ($7735.87 vs. $6592.14, $P < 0.01$), and established ANA costs were borderline statistically significantly higher than non-ANA costs ($6592.14 vs. $6046.12, $P = 0.05$).

Eye care costs were significantly higher the year before PACG diagnosis among patients detected with ANA ($975.54 vs. $333.96, $P < 0.001$), primarily due to higher medication and procedure costs. There was no difference



Sample Size	-12	-6	0	6	12	18	24	30	36	42	48	54
Established ANA	2100	2100	2100	2100	2100	2100	2100	1758	1487	1215	928	618
Recent ANA	1421	1421	1421	1421	1421	1421	1421	1174	988	811	646	444
Non-ANA	9152	9152	9152	9152	9152	9152	9152	7804	6652	5551	4388	2988

FIGURE 2. Average costs for patients with newly diagnosed primary angle closure glaucoma (PACG) stratified by anatomic narrow angle (ANA) status: non-ANA (no ANA diagnosis), recent ANA (ANA diagnosed within 6 mo of PACG) diagnosis, and established ANA (ANA diagnosed more than 6 mo from PACG). Cost data are plotted in 6-month intervals starting 1 year before PACG diagnosis and including 5 years after diagnosis. The vertical red dotted line marks the index date, and patients were omitted beyond 2 years once they had no additional cost data. The table below shows the number of patients remaining at each time interval. Figure 2 can be viewed in color online at www.glaucomajournal.com.

TABLE 2. Percentile Costs in United States Dollars ($) Following PACG Diagnosis in 6-Month Intervals

Time after PACG diagnosis	Mean (SD) Costs	5%	10%	25%	50%	75%	90%	95%	Mean cumulative charges
0–6 mo	1547.79 (2204.96)	120.09	156.02	272.02	722.80	1671.05	4199.33	6755.48	1547.79
6–12 mo	495.45 (1201.97)	0	0	0	147.44	388.28	1064.54	2307.74	2043.25
12–18 mo	491.46 (1162.56)	0	0	0	165.87	389.30	1071.17	2048.76	2534.71
18–24 mo	425.66 (1011.25)	0	0	0	144.46	367.44	949.76	1681.43	2960.37

between patients with recent and established ANA ($958.51 vs. $987.06, $P=0.72$) during this period.

Characteristics of the Most Expensive Patients

The costliest 5% (>$9813.50) of PACG cases accounted for 21.3% of all 2-year PACG-related costs (Table 2). The costliest 10% (>$7630.48) accounted for 35.7% of all costs, and the costliest 25% (>$3999.87) accounted for 64.8% of costs. For comparison, the least expensive 50% of the patients were only responsible for 13.3% of all 2-year PACG-related costs.

In the univariable logistic regression analysis, all potential risk factors were significantly associated with being in the costliest 5% group ($P<0.05$). In the multivariable logistic regression analysis (Fig. 3), significant risk factors included older age, with patients aged 70 to 79 years (OR: 1.83, 95% CI: 1.12–3.15) and age 80 years or above (OR: 2.01, 95% CI: 1.20–3.53) being at higher risk compared with patients <50. Black patients were also at higher risk (OR: 1.53, 95% CI: 1.20–1.92) compared with non-Hispanic White patients. Other risk factors for most costly care included Midwest (OR: 1.52, 95% CI: 1.19–1.95) or South (OR: 1.32, 95% CI: 1.05–1.65) compared with Northeast geographic region, recent diagnosis of ANA (OR: 1.71, 95% CI: 1.36–2.13), and Medicare PPO plans (OR: 1.77, 95% CI: 1.09–2.94), or other Medicare plans (OR: 2.56, 95% CI: 1.69–4.02) compared with commercial HMO and EPO plans.

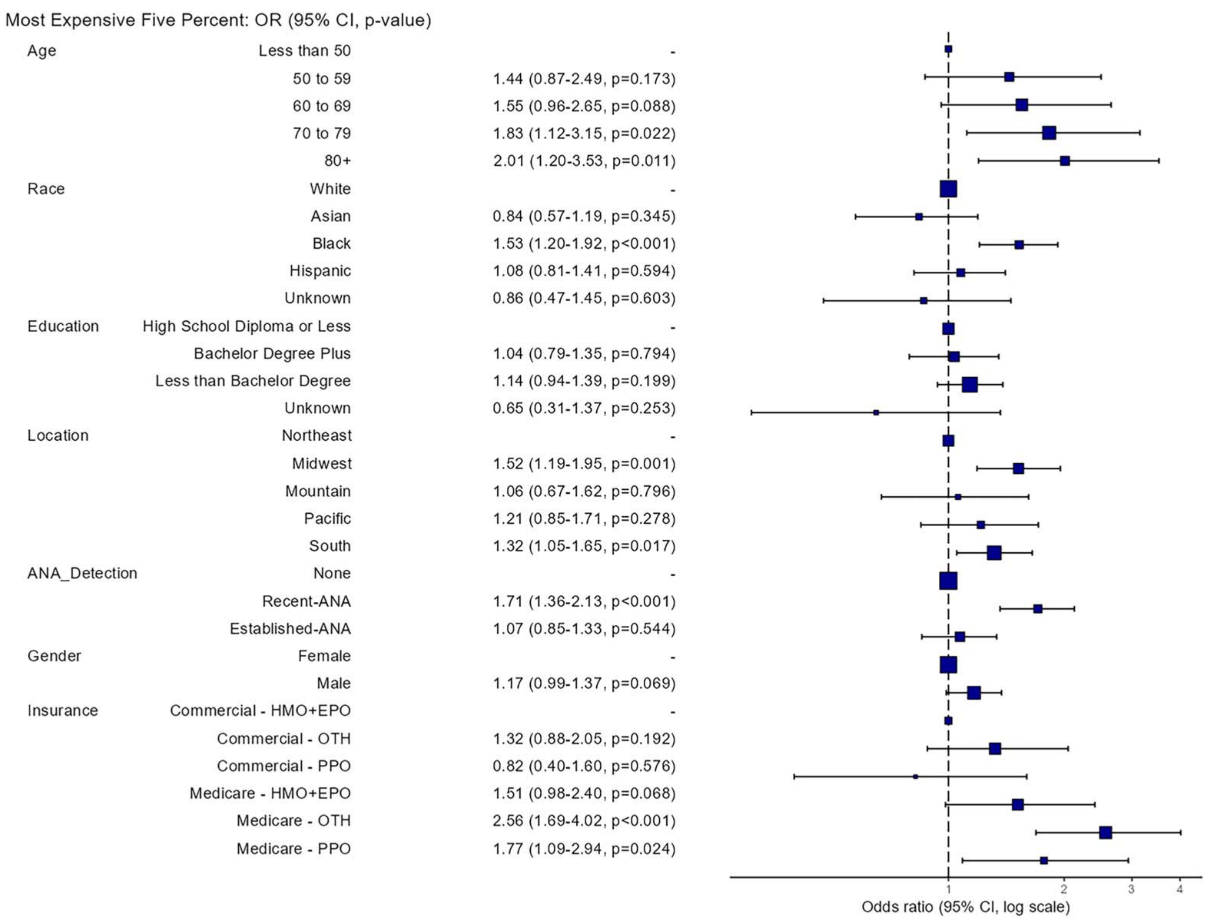


FIGURE 3. Forest plot of logistic regression analysis of patients with 2-year costs in the top fifth percentile (>$9813.50). Income omitted for lack of statistical significance. Figure 3 can be viewed in color online at www.glaucomajournal.com.

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DISCUSSION

In this study, we analyzed the average 2-year cost in inflation-adjusted 2020 USD of newly diagnosed PACG in the United States from 2009 to 2017. Our cost analysis yielded 3 primary findings. First, newly diagnosed patients incurred on average $2960 in eye care costs in the first 2 years following PACG diagnosis. Second, patients with a recent or established diagnosis of ANA before diagnosis of PACG incurred significantly higher costs compared with patients without a prior diagnosis of ANA, both in the year before diagnosis and 2 years after diagnosis. Finally, there were multiple risk factors for being in the costliest 5% group, including older age, Black race, recent ANA diagnosis, PPO or other Medicare insurance, and location in the Midwest or South geographic regions. These findings provide important insights into the economic impact of PACG based on current practice patterns.

Although the clinical management of PACG and POAG differs, it was previously unclear how these differences impacted health care costs associated with the 2 conditions. Our analyses showed an average 2-year cost estimate for newly diagnosed PACG ($2960). This estimate was lower than the average 2-year cost estimate for newly diagnosed POAG ($3486) reported by Stein et al[7] after converting their finding of $2519 in 2009 US dollars to 2020 US dollars based on a flat 3% inflation rate. However, our PACG cohort had a larger fraction of treatment procedure costs (56.7% vs. 20.5%) and a lower fraction of medication (15.0% vs. 30.8%) and visit costs (20.0% vs. 32.4%). This finding is consistent with recent findings by Fujita et al[11] that surgeries accounted for a large proportion of total PACG treatment costs in Japan. We also found procedure costs were the highest in the first 6 months, and 53.0% of newly diagnosed PACG patients in our study had some kind of procedure-related spending in the first 2 years compared with 12.4% of newly diagnosed POAG in Stein et al.[7] Overall, these cost-related findings suggest that treatments with laser and surgery play a more central role in PACG than POAG, and that medications play a smaller long-term role in PACG, perhaps due to effective IOP lowering produced by these treatment procedures.[2,3,12,13]

We compared costs between PACG patients with and without prior diagnosis of ANA to assess if costs were mitigated by earlier detection of angle closure. Interestingly, eye care costs of PACG patients with either a recent or established diagnosis ANA were higher after PACG diagnosis. Less surprisingly, eye care costs were also higher for these patients the year before PACG diagnosis. Although we were unable to observe measures of ocular health, such as intraocular pressure (IOP), that could explain these differences, we speculate that the higher prediagnosis cost reflects diagnostic testing to confirm the diagnosis of PACG or treatments administered to prevent conversion from ANA to PACG. After conversion to PACG, more intensive interventions with surgery and medication may have contributed to higher costs in eyes previously treated for ANA. Although studies suggest that gonioscopy is underperformed and current practice patterns are inadequate for detecting patients at risk for PACG, the current data do not support a cost-saving benefit of earlier ANA detection.[14–17] However, it is important to note that our cost analyses do not factor in the potential cost benefit of improved clinical outcomes (eg, visual acuity or visual field) or quality of life measures that may be associated with earlier ANA detection and treatment.[18]

Our logistic regression analysis revealed several disparities among PACG patients in the costliest 5% group, which comprised 21.3% of total eye care costs. Among these disparities, Black patients had 1.53 times higher odds of being in the most expensive group compared with non-Hispanic White patients. Although it is not possible to ascertain clinical factors underlying this difference using the Optum CDM, we speculate that patients incurring higher costs have greater disease severity (eg, higher IOP or worse vision) at initial PACG diagnosis. In this context, our findings are consistent with previous findings that Black patients have a higher risk of blindness and are more likely to receive laser or surgical treatment at initial PACG, ANA, and POAG diagnosis compared with non-Hispanic White patients.[15,18–22] These findings are also consistent with racial disparities in rates of gonioscopy and detection of ANA before the development of PACG.[16,23] Together, recent findings on racial disparities in the detection, treatment, and cost of PACG in the US support the need for additional research to identify the underlying cause of these disparities and develop novel objective methods to risk-stratify patients for PACG.[24–27]

Other factors conferring a higher risk of being in the costliest 5% group included older age, PPO or other Medicare insurance products, and location in the Midwest or South geographic regions. Older age is a risk factor for both cataracts and PACG; therefore, it is intuitive that older patients with PACG are more likely to have visually significant cataracts and receive lens extraction as a primary treatment. Although we accounted for age in our multivariable analysis, types of Medicare insurance product remained a significant predictor of being in the costliest 5% group, which could indicate easier access to PACG-related procedures compared with patients with commercial HMOs. Finally, previous research has shown regional differences in eye care provider density and glaucoma detection rates.[28] The relative lack of providers could contribute to later detection of patients with high-risk ANA or manifest PACG, which contributes to higher costs once PACG is eventually diagnosed.[29]

Our findings reveal aspects of current practice patterns that may have implications for recommendations regarding PACG management. In the 2 years after the initial PACG diagnosis, LPI was the most common procedure (37.4% of the cohort) followed by lens extraction (22.9% of the cohort). However, among patients who underwent lens extraction at any time in our sample or lookback period, 41.1% received at least one LPI within the preceding 2 years. Although LPI effectively widens the angle in most eyes with narrow angles, the EAGLE Trial reported a cost-saving benefit associated with earlier lens extraction compared with LPI.[3,30] This approach is supported by our finding that overall eye care costs were higher among those who received LPI anytime in our sample period versus those who did not ($3729.28 vs. $2415.67). Although we do not have granular data on disease progression that may have motivated sequential treatment with LPI followed by lens extraction or glaucoma surgery, recent research supports earlier lens extraction as an effective method to lower IOP and eye care costs associated with PACG.[31]

Our study has several limitations. First, we relied on ICD codes to identify cases of PACG. While the reliability of PACG codes is unknown, a previous study found POAG codes to be highly reliable.[32] In addition, to prevent inclusion of cases of ANA miscoded as PACG, we excluded patients who did not receive glaucoma treatment after PACG diagnosis. Second, our study is a retrospective analysis, and our cost estimates could have been affected by patients no longer being observable within the Optum CDM. For this reason, we required 2 full years of continuous observable enrollment and a PACG diagnosis more than 24 months after the index date, a requirement that is consistent with Stein et al[7] and enhances the comparability of our cost findings. Third, all analyses were conducted on the patient rather than eye level. This approach was primarily due to 79.3% of our study cohort having ICD9 codes for PACG that did not specify laterality. Although we could not differentiate between unilateral and bilateral cases of ANA or PACG. ANA and PACG tend to be bilateral conditions, and our patient-level approach conformed with the methodology proposed by Stein and colleagues. Finally, the Optum CDM does not provide data on clinical findings that would let us assess treatment efficacy or compute costs in terms of quality-adjusted life years (QALYs). Therefore, further study using alternative data sets is warranted to examine the efficacy of current practice patterns in the context of care costs.

In conclusion, we estimate the average 2-year eye care cost for newly diagnosed PACG patients to be $2960, which is driven more by procedures and less by medications than POAG. Earlier detection of ANA does not appear to mitigate costs after PACG diagnosis, and there are sociodemographic factors associated with patients being in the costliest 5% group that warrant consideration when developing cost-reduction strategies. Although our study provides novel insights into costs and practice patterns associated with newly diagnosed PACG, further research on methods to improve the precision of angle closure care and the cost-effectiveness of personalized PACG treatments are needed.

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