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Five-Year Postoperative Refractive Outcomes and Predictors After Manual Small-Incision Cataract Surgery in Ghana.

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Additional Declarations: The authors declare potential competing interests as follows: Enoch Yelzaala Dagoe is one of the three surgeons whose operations are included in this audit, and both he and Joachim Boadi Amponim are employed at St Mary Catholic Hospital, Drobo, where the study was conducted. To limit the influence of these roles, surgeon identities were coded (A, B and C) and are not reported. Data abstraction and statistical analysis were performed by authors not involved in the surgical procedures. The authors report no financial conflict of interest.

Abstract

Clinical relevance:

Reliable refractive outcomes after cataract surgery help optometrists identify residual ametropia, guide spectacle correction and recognise modifiable refractive error.

Background

This study aimed to characterise postoperative refractive outcomes after manual small-incision cataract surgery, assess refractive accuracy against benchmarks, and identify associated factors.

Methods

This retrospective audit included patients aged 40 years or older who underwent manual small-incision cataract surgery with intraocular lens implantation from 2021 to 2025 at a district hospital in Ghana. Of 640 operations, 204 records met eligibility and data-completeness criteria, including manifest refraction at 4–6 weeks. Prediction error was the achieved postoperative spherical equivalent minus the intended target; absolute prediction error was its absolute value. Refractive surprise was an absolute prediction error greater than 1.00D. Surgically induced astigmatism was calculated by vector analysis.

Results

Median postoperative spherical equivalent was − 0.50D (interquartile range − 1.25 to 0.00) and median cylinder was − 1.50D (interquartile range − 2.00 to − 1.00); 92.2% had an astigmatic component. Median surgically induced astigmatism was 1.83D (interquartile range 1.14–2.74), and against-the-rule astigmatism increased from 63.2% to 81.9%. Median absolute prediction error was 0.75D (interquartile range 0.25–1.25); 46.1% were within ± 0.50D and 74.5% within ± 1.00D of target, below benchmark ($p = 0.011$ and $p < 0.001$). Refractive surprise occurred in 25.5%. No variable independently predicted refractive surprise; each additional 1.00D of preoperative corneal astigmatism was associated with a 0.12D increase in absolute prediction error (95% confidence interval 0.03–0.22; $p = 0.014$).

Conclusion

Postoperative outcomes showed substantial residual astigmatism, refractive accuracy below benchmark thresholds and systematic myopic bias. Facility-specific lens-constant optimisation, astigmatism-informed incision planning and improved completeness of postoperative refraction are practical quality-improvement targets.

Introduction

Cataract surgery is increasingly evaluated by both visual restoration and refractive predictability. Residual spherical error and surgically induced astigmatism may reduce uncorrected vision and increase spectacle dependence after manual small-incision cataract surgery (MSICS).[1–4] Commonly used audit benchmarks propose that 55% of eyes should fall within ± 0.50D and 85% within ± 1.00D of target refraction.[5] Facility-level evidence from sub-Saharan Africa remains limited. Because systematic refractive error may be identifiable and correctable using existing outcome data, this study audited five years of MSICS in Ghana to characterise refractive outcomes and identify demographic, biometric and surgeon-related determinants.

Methods

Study design and setting

This was a retrospective, hospital-based clinical audit of cataract surgeries performed between January 2021 and December 2025 at a faith-based district hospital in Ghana. In design terms it is a retrospective observational cohort study based on routinely collected clinical data, relating preoperative and operative characteristics to refractive status 4–6 weeks after surgery. The hospital serves predominantly rural and semi-urban communities and used a consistent MSICS and biometric protocol during the study period. Reporting follows the STROBE statement for cohort studies together with the RECORD extension for studies using routinely collected health data.

Participants

Patients aged 40 years or older who underwent MSICS with primary posterior chamber intraocular lens implantation were eligible. Records were required to contain complete preoperative biometric information, operative details, and subjective manifest refraction obtained 4–6 weeks after surgery.

Patients were excluded if they had traumatic, congenital, complicated or secondary cataract; underwent a combined ocular procedure; were left aphakic or received secondary intraocular lens implantation; had pre-existing corneal opacity, dystrophy, pterygium or previous corneal refractive surgery; or lacked complete preoperative biometry or postoperative refraction.

One eye per patient was analysed. Where both eyes were eligible, the eye with the more complete record was selected; where both records were complete, the right eye was selected according to the prespecified protocol.

Of 640 cataract operations during the review period, 40 involved patients younger than 40 years, leaving 600 age-eligible records. Further exclusions were traumatic cataract (n = 20), complicated cataract (n = 15), pre-existing corneal opacity, dystrophy or pterygium (n = 25), incomplete preoperative biometry or

missing postoperative refraction (n = 296), and a second cataract surgery in the same patient (n = 40). The final analytic sample comprised 204 patients, with one eye per patient (Fig. 1).

Surgical and biometric protocol

All eyes underwent MSICS through a superior scleral tunnel incision. Axial length was measured using immersion ultrasound biometry, and keratometry was performed preoperatively. The Holladay formula was used for intraocular lens power calculation throughout the study period; the biometry system was configured with an A-constant of 118. The intended target refraction was − 0.25D in all eyes. Because incision site, intraocular lens formula, A-constant, target refraction and biometry modality were constant throughout the study period, these variables could not be examined as predictors.

Data collection and outcome definitions

Demographic, clinical, biometric, surgical and postoperative data were abstracted from archived patient records and operating-room registers using a standardised data-abstraction form. Variables included age, sex, documented systemic disease, operated eye, axial length, keratometry, preoperative corneal astigmatism magnitude and axis, implanted intraocular lens power, surgeon, year of surgery, postoperative manifest refraction, postoperative keratometry and corrected distance visual acuity. Systemic disease was classified from chart documentation as present when a diagnosis was recorded, or as none documented when no systemic diagnosis was recorded. The latter category should not be interpreted as confirmed absence of systemic disease. Snellen acuities were converted to logMAR, with low-vision categories converted using published methods.[6,7]

Target-based prediction error was calculated as the achieved postoperative spherical equivalent minus the intended target spherical equivalent, so that a negative prediction error indicated a myopic result relative to target and a positive prediction error a hyperopic result. Prediction error was therefore referenced to the nominal clinical target rather than to the formula-predicted refraction of the specific implanted lens; because intraocular lens powers were available only in discrete steps, predicted and nominal target refraction may differ slightly in individual eyes. Absolute prediction error (APE) was defined as the absolute value of the prediction error, and refractive surprise as an APE greater than 1.00D. Secondary outcomes included mean and median APE, the proportions within ± 0.50D and ± 1.00D of target, postoperative refractive astigmatism, surgically induced astigmatism and corrected distance visual acuity. Surgically induced astigmatism was calculated from paired preoperative and postoperative keratometric magnitude and axis using the Alpins vector method, and is summarised as a scalar magnitude.[8]

Statistical analysis

Data were managed in IBM SPSS Statistics version 27 (IBM Corp., Armonk, NY, USA). Continuous variables were summarised as mean with standard deviation and median with interquartile range, as appropriate, and categorical variables as frequencies and percentages.

APE was right-skewed and departed significantly from normality. Mann–Whitney U and Kruskal–Wallis tests were therefore used for primary group comparisons, and Spearman rank correlation assessed associations between continuous predictors and APE. Exact binomial tests compared the proportions achieving ± 0.50D and ± 1.00D with the prespecified benchmarks. Signed prediction error was tested against zero using the Wilcoxon signed-rank test. Proportions are reported with 95% Wilson confidence intervals.

Multivariable logistic regression was used to evaluate predictors of refractive surprise. Because only 52 refractive-surprise events occurred, a reduced prespecified model was used for primary reporting. It comprised age, sex, preoperative corneal astigmatism, axial length, average keratometry and surgeon, chosen to limit model complexity while retaining the most clinically relevant candidate predictors. The full model was examined only as an exploratory check. For continuous APE, ordinary least-squares diagnostics showed non-normal residuals but no evidence of important heteroscedasticity or influential observations; the final secondary model therefore retained untransformed APE and used HC3 robust standard errors. An alpha level of 0.05 was used throughout.

Ethical considerations

Ethical approval

was obtained from the University of Cape Coast Institutional Review Board (UCCIRB/CHAS/2026/042), with institutional permission from St Mary Catholic Hospital, Drobo. The study adhered to the Declaration of Helsinki as revised in 2013. The requirement for individual informed consent was waived because the study involved retrospective review of archived clinical records, with data de-identified at the point of abstraction.

Results

Participant characteristics

The 204 patients had a median age of 66.0 years (interquartile range 60.0–75.3; range 40–98 years), and 127 (62.3%) were female. Systemic disease was documented in 105 patients (51.5%), most commonly hypertension (86 patients). The right eye was operated in 109 patients (53.4%). Three surgeons (A, B and C) performed 83, 68 and 53 procedures, respectively.

Median axial length was 23.19 mm (interquartile range 22.69–23.81), and 186 eyes (91.2%) had axial lengths within the moderate range. Median average keratometry was 43.59D (interquartile range 42.55–44.52), and median preoperative corneal astigmatism was 1.00D (interquartile range 0.63–1.63). Against-the-rule astigmatism was present preoperatively in 129 eyes (63.2%). Median implanted

intraocular lens power was 21.50D (interquartile range 20.50–22.50). Participant characteristics are presented in Table 1.

Table 1
Demographic, clinical and preoperative biometric characteristics (n = 204)

Characteristic	**n (%) or median (IQR)**
Age, years	66.0 (60.0–75.3)
<60	48 (23.5)
60–75	105 (51.5)
>75	51 (25.0)
Female sex	127 (62.3)
Documented systemic disease	105 (51.5)
Hypertension	86 (42.2)
Diabetes mellitus	16 (7.8)
Other	3 (1.5)
Right eye operated	109 (53.4)
Surgeon A / B / C	83 (40.7) / 68 (33.3) / 53 (26.0)
Year 2021 / 2022 / 2023 / 2024 / 2025	20 / 40 / 54 / 46 / 44
Axial length, mm	23.19 (22.69–23.81)
Short (< 22.0 mm)	11 (5.4)
Moderate (22.0–24.5 mm)	186 (91.2)
Long (> 24.5 mm)	7 (3.4)
Average keratometry, D	43.59 (42.55–44.52)
Preoperative corneal astigmatism, D	1.00 (0.63–1.63)
Against-the-rule	129 (63.2)
With-the-rule	40 (19.6)
Oblique	35 (17.2)
Implanted intraocular lens power, D	21.50 (20.50–22.50)
Preoperative uncorrected acuity, logMAR	1.98 (1.00–2.30)

IQR, interquartile range. Target refraction was − 0.25D in all eyes. Surgeon identities are coded A–C in descending order of case volume.

Postoperative refractive profile

Residual refractive error was present in 203 of 204 eyes, and an astigmatic component was present in 188 eyes (92.2%). Mixed astigmatism was the most common postoperative refractive state, occurring in 62 eyes (30.4%), followed by compound myopic astigmatism in 55 (27.0%) and simple myopic astigmatism in 43 (21.1%).

Median postoperative spherical equivalent was − 0.50D (interquartile range − 1.25 to 0.00), and median manifest cylinder was − 1.50D (interquartile range − 2.00 to − 1.00). More than 1.00D of refractive astigmatism remained in 106 eyes (52.0%).

Corneal astigmatism increased substantially following surgery. Median keratometric cylinder rose from 1.00D preoperatively to 2.24D postoperatively, with a median paired increase of 1.13D (interquartile range 0.20–1.80; Wilcoxon signed-rank $p < 0.001$). Median surgically induced astigmatism was 1.83D (interquartile range 1.14–2.74; mean 2.09D, standard deviation 1.36), and the proportion of eyes with against-the-rule corneal astigmatism increased from 63.2% before surgery to 81.9% afterwards.

Refractive accuracy

Median APE was 0.75D (interquartile range 0.25–1.25), and mean APE was 0.76D (standard deviation 0.60). Ninety-four eyes (46.1%; 95% confidence interval 39.4–52.9) were within ± 0.50D of target, significantly below the prespecified 55% benchmark ($p = 0.011$). One hundred and fifty-two eyes (74.5%; 95% confidence interval 68.1–80.0) were within ± 1.00D, compared with the 85% benchmark ($p < 0.001$). Refractive surprise occurred in 52 eyes (25.5%; 95% confidence interval 20.0–31.9).

The error was directional rather than symmetric. Median signed prediction error was − 0.25D (interquartile range − 1.00 to 0.25) and mean signed prediction error − 0.38D (standard deviation 0.89). The distribution was significantly displaced from zero ($p < 0.001$), demonstrating a systematic myopic rather than symmetric refractive error. Refractive and accuracy outcomes are summarised in Table 2.

Table 2
Postoperative refractive, corneal and accuracy outcomes (n = 204)

Outcome	Value
Spherical equivalent, D, median (IQR)	−0.50 (− 1.25 to 0.00)
Manifest cylinder, D, median (IQR)	−1.50 (− 2.00 to − 1.00)
Astigmatic component present, n (%)	188 (92.2)
Residual cylinder > 1.00D, n (%)	106 (52.0)
Preoperative keratometric cylinder, D, median (IQR)	1.00 (0.63–1.63)
Postoperative keratometric cylinder, D, median (IQR)	2.24 (1.50–3.21)
Median paired increase in keratometric cylinder, D	1.13 (IQR 0.20–1.80); p < 0.001
Surgically induced astigmatism, D, median (IQR); mean (SD)	1.83 (1.14–2.74); 2.09 (1.36)
Against-the-rule astigmatism, preoperative → postoperative	63.2% → 81.9%
Signed prediction error, D, median (IQR)	−0.25 (− 1.00 to 0.25)
Absolute prediction error, D, median (IQR)	0.75 (0.25–1.25)
Absolute prediction error, D, mean (SD)	0.76 (0.60)
Within ± 0.50D of target, n (%)	94 (46.1); p = 0.011*
Within ± 1.00D of target, n (%)	152 (74.5); p < 0.001*
Refractive surprise (absolute prediction error > 1.00D), n (%)	52 (25.5)
Corrected distance visual acuity, logMAR, median (IQR)	0.18 (0.00–0.18)

IQR, interquartile range; SD, standard deviation.

*Exact binomial tests against reference values of 55% and 85%. Keratometric cylinder magnitudes are unsigned. Surgically induced astigmatism is reported as a scalar magnitude derived by the Alpins vector method.

Factors associated with refractive error

No demographic variable was significantly associated with APE. Median APE did not differ significantly by sex, age group or documented systemic disease, and age as a continuous variable was not significantly correlated with APE.

Among the biometric variables, preoperative corneal astigmatism was the only parameter associated with APE on bivariate analysis (Spearman ρ = 0.203; p = 0.004). Axial length (ρ = −0.116; p = 0.098), average keratometry (ρ = 0.095; p = 0.175), implanted intraocular lens power (ρ = 0.105; p = 0.136) and surgically induced astigmatism (ρ = −0.063; p = 0.369) were not significantly associated with APE

(Table 3). Refractive accuracy did not differ significantly by surgeon or year of surgery; refractive-surprise rates were 21.7%, 30.9% and 24.5% for surgeons A, B and C, respectively.

Table 3
Bivariate associations with absolute prediction error (n = 204)

Variable	Test	p
Sex	Mann–Whitney U	0.495
Age group	Kruskal–Wallis H	0.237
Age, continuous	ρ = 0.121	0.086
Documented systemic disease: present vs none documented	Mann–Whitney U	0.560
Axial length	ρ = −0.116	0.098
Average keratometry	ρ = 0.095	0.175
Preoperative corneal astigmatism	ρ = 0.203	0.004
Implanted intraocular lens power	ρ = 0.105	0.136
Surgically induced astigmatism	ρ = −0.063	0.369
Surgeon	Kruskal–Wallis H	0.230
Year of surgery	Kruskal–Wallis H	0.316

ρ, Spearman rank correlation coefficient. Correlations with preoperative corneal astigmatism use the unsigned cylinder magnitude.

In the reduced multivariable logistic regression model, no predictor independently predicted refractive surprise. Preoperative corneal astigmatism showed the largest biometric association but did not reach statistical significance (odds ratio 1.28 per 1.00D; 95% confidence interval 0.96–1.70; p = 0.089). The reduced model was not significant overall (likelihood-ratio $\chi^2 = 10.85$, df = 7; p = 0.145; Nagelkerke $R^2 = 0.076$), and the exploratory full model was also non-significant (Table 4).

Table 4
Reduced multivariable logistic regression for refractive surprise (52 events, n = 204)

Predictor	Odds ratio (95% CI)	p
Age, per year	1.02 (0.99–1.05)	0.222
Male sex	1.92 (0.93–3.96)	0.077
Preoperative corneal astigmatism, per 1.00D	1.28 (0.96–1.70)	0.089
Axial length, per mm	0.76 (0.45–1.28)	0.304
Average keratometry, per 1.00D	1.02 (0.77–1.35)	0.877
Surgeon B vs A	1.70 (0.79–3.66)	0.172
Surgeon C vs A	1.06 (0.45–2.48)	0.899

CI, confidence interval. Model likelihood-ratio $\chi^2 = 10.85$, df = 7; p = 0.145; Nagelkerke $R^2 = 0.076$; area under the receiver operating characteristic curve = 0.653; Hosmer–Lemeshow p = 0.523. No predictor reached statistical significance.

In the secondary continuous model, preoperative corneal astigmatism was the only significant independent predictor: each additional 1.00D of preoperative cylinder was associated with a 0.12D increase in APE (95% confidence interval 0.03–0.22; p = 0.014).

Visual acuity outcomes

Median postoperative corrected distance visual acuity was 0.18 logMAR (interquartile range 0.00–0.18); because acuity was recorded in discrete Snellen steps, the median coincides with the upper quartile. A corrected distance visual acuity of 6/12 or better was achieved in 191 eyes (93.6%), and 193 eyes (94.6%) achieved 6/18 or better.

Discussion

This five-year audit shows that good visual rehabilitation after MSICS does not necessarily translate into good refractive predictability. Most eyes achieved useful corrected vision, yet accuracy fell below the prespecified ± 0.50D and ± 1.00D benchmarks. Postoperative error was predominantly astigmatic, showed a systematic myopic bias, and was independently associated with preoperative corneal astigmatism in the continuous APE model.

The predominance of postoperative astigmatism is consistent with the MSICS literature.[3,9–11] In this study, 92.2% of eyes had an astigmatic component, with a median refractive cylinder of − 1.50D. The accompanying corneal change is more relevant. Median surgically induced astigmatism was 1.83D, and the prevalence of against-the-rule astigmatism increased from 63.2% before surgery to 81.9% afterwards.

A superior MSICS incision flattens the vertical corneal meridian.[9,12] In an eye already against-the-rule, further vertical flattening may increase rather than neutralise existing astigmatism. This plausibly explains the postoperative shift observed here and argues against a fixed incision site regardless of preoperative corneal astigmatism. Recent evidence supports tailoring incision location to the pre-existing cylinder, including temporal or on-axis approaches where appropriate.[10,13] Ghanaian data also show that wound geometry influences postoperative corneal astigmatism after MSICS.[14] Such modification may reduce astigmatism without additional equipment.

The observed surgically induced astigmatism is high. A meta-analysis of 28 studies reported a pooled mean surgically induced astigmatism of 1.10D (95% confidence interval 0.94–1.26) for superior-incision MSICS and 0.82D (95% confidence interval 0.68–0.96) for temporal incisions,[10] so the present median is roughly 1.7 times the pooled estimate for the same incision site. The distribution was right-skewed (mean 2.09D versus median 1.83D), so the median is the more reliable summary. Surgically induced astigmatism was also calculated from keratometric rather than refractive cylinder and is sensitive to keratometer calibration and axis recording. Contemporary standards emphasise vector-based analysis with reporting of astigmatic centroids and double-angle plots rather than scalar magnitudes alone.[15] The high value warrants prospective confirmation, and the present data cannot establish that incision site alone caused the change.

Refractive accuracy also fell short of the audit benchmark. Only 46.1% of eyes were within ± 0.50D and 74.5% within ± 1.00D of target, compared with reference values of 55% and 85%.[5] These benchmarks derive from phacoemulsification with partial coherence biometry and are a stringent comparator for district-level MSICS, although the present figures are broadly comparable with those from other sub-Saharan African settings.[2,16–18] These findings indicate a refractive quality gap despite generally good visual outcomes.

An important finding was the systematic direction of the refractive error. Median signed prediction error was − 0.25D and mean signed prediction error − 0.38D, showing that eyes were systematically left more myopic than intended. Unlike purely random error, systematic bias may be correctable at facility level. Immersion ultrasound was used consistently, making corneal compression from contact biometry an unlikely explanation. A locally unoptimised lens constant is one plausible contributor and should be formally evaluated.[19,20]

However, the fixed A-constant could not be evaluated directly because it did not vary between eyes. What the data justify is a practical next step: optimise the lens constant using the postoperative outcomes of the facility itself and then repeat the audit. If the signed bias narrows, the hypothesis will have been supported.

Preoperative corneal astigmatism was the only measured variable independently associated with continuous APE. Each additional 1.00D of preoperative cylinder was associated with approximately 0.12D greater absolute error. Although the effect size was small, the direction of association was

clinically plausible. Eyes with greater preoperative cylinder present both a more complex optical starting point and a greater opportunity for the fixed superior incision to interact adversely with the existing astigmatism.

Axial length was not significantly associated with APE, but only 18 eyes were short or long, so the analysis had limited power to detect the axial-length dependence reported in larger series.[1,21]

Age, sex, systemic disease, surgeon and year of surgery were also not independently associated with refractive outcome. With only 52 events, these null results mean that an association was not demonstrated, not that the groups were equivalent.

The multivariable models explained only a small proportion of the variation in APE. The unexplained variation may reflect factors not available in the records, including effective lens position, anterior chamber depth, lens thickness, keratometer calibration and examiner-related variation in postoperative refraction.

Despite the refractive shortfall, corrected visual acuity was good: more than 93% of eyes achieved 6/12 or better, so cataract removal was visually effective for most patients. Many nonetheless carried clinically meaningful residual refractive error. Ghanaian data similarly show that visual recovery does not necessarily translate into spectacle independence.[22] Corrected visual acuity and refractive predictability should therefore be viewed as complementary rather than interchangeable indicators of cataract surgical quality.

Completeness of postoperative outcome data was a second problem. Incomplete biometry or missing 4–6-week refraction accounted for 296 of the 396 exclusions, so the final sample may differ from the broader operated population. Refractive audit works only when postoperative refraction is routinely completed and recorded, so completeness is itself a quality indicator.[23]

These findings support several practical quality-improvement measures. Lens-constant optimisation should be evaluated using the existing outcome dataset. Incision location should take preoperative corneal astigmatism into account rather than remaining uniformly superior, and wound construction should be standardised, because incision geometry and depth can influence postoperative astigmatism.[14,24] Keratometer calibration should be verified, postoperative subjective refraction should follow a standardised protocol, and postoperative follow-up should be strengthened. Several of these measures require better use of existing data and processes rather than major capital investment.

Limitations

The principal limitation is selection: only 204 of 600 age-eligible records met all clinical eligibility and data-completeness requirements, and the analysed cohort may therefore not represent the entire cataract surgical population of the facility. Because excluded records were by definition incomplete, formal comparison of included and excluded patients on biometric and refractive variables was not

possible. Completion of postoperative refraction may have been related to visual symptoms, access to follow-up or other patient characteristics, so the direction of this selection bias is uncertain, and the observed refractive accuracy may either overstate or understate outcomes in the whole operated population.

The retrospective design restricted the analysis to information already documented in clinical records, with the possibility of measurement and transcription error. Incision site, intraocular lens formula, A-constant, biometry modality and target refraction were invariant and could not be evaluated as predictors. Anterior chamber depth, lens thickness and intraoperative complications were not available.

Prediction error was referenced to the nominal target rather than to the formula-predicted refraction of the implanted lens. Because intraocular lens powers are discrete, this convention carries a small rounding component, and the reported bias is a deviation from the intended clinical target rather than a formal test of formula accuracy. Surgically induced astigmatism is likewise reported as a scalar magnitude rather than as a centroid with double-angle plots.

The multivariable logistic model was underpowered at 52 events, so non-significant estimates are inconclusive rather than evidence of no association.

Finally, refraction was assessed at a single visit 4–6 weeks after surgery at one district hospital using one operative protocol, so generalisation beyond similar settings should be cautious.

Conclusion

Postoperative refractive outcomes following MSICS at this Ghanaian district hospital were characterised by substantial residual astigmatism, a marked shift toward against-the-rule corneal astigmatism, refractive accuracy below benchmark thresholds and a systematic myopic prediction bias. Preoperative corneal astigmatism was the only measured variable independently associated with the magnitude of continuous refractive error.

Corrected visual outcomes were good, but refractive predictability remained suboptimal and may be amenable to quality improvement. The immediate priorities are therefore to evaluate facility-specific lens-constant optimisation, incorporate preoperative corneal astigmatism into incision planning, verify keratometer calibration, standardise postoperative refraction and improve follow-up completion. A prospective re-audit after these changes would determine whether refractive accuracy improves.

Declarations

Disclosure statement: Enoch Yelzaala Dagoe is one of the three surgeons whose operations are included in this audit, and both he and Joachim Boadi Amponim are employed at St Mary Catholic Hospital, Drobo, where the study was conducted. To limit the influence of these roles, surgeon identities were

coded (A, B and C) and are not reported. Data abstraction and statistical analysis were performed by authors not involved in the surgical procedures. The authors report no financial conflict of interest.

Declaration of generative artificial intelligence use

OpenAI ChatGPT (GPT-5.6 Sol) was used during manuscript preparation to assist with language refinement, structural editing and synthesis of author-supplied material. Claude Opus 5.5 (Anthropic) was used to assist with formatting the manuscript to journal style. The tools were used to improve clarity, organisation and consistency. All material produced with the assistance of these tools was critically reviewed, independently verified where appropriate, revised and approved by the authors. The authors take full responsibility for the accuracy, originality, interpretation and final content of the manuscript.

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Figures

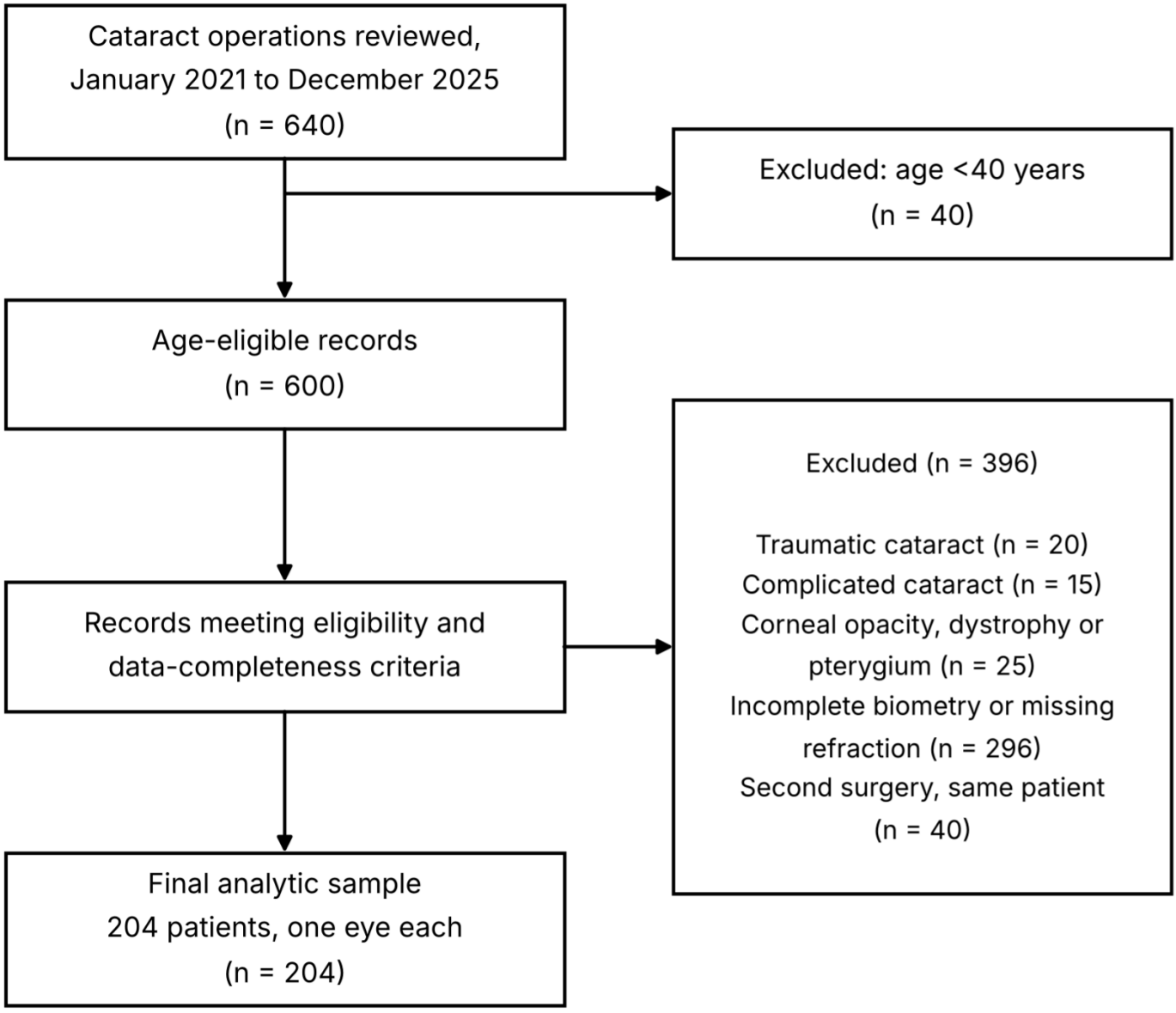


Figure 1

Flow diagram of record selection. Of 640 cataract operations, 204 eyes of 204 patients met the eligibility and data-completeness criteria.