

Cataract surgery in the United Kingdom: patient characteristics, surgical patterns, and clinical outcomes in the National Health Service and a private-sector provider

Stephen J. Hannan  · Jan A. Venter · David Teenan · Colin W. Berry · Noelle C. Hannan · Dasi Raju · Huba J. Kiss · Manu Mathew · Sharone V. Suthaharan · David R. Cooper · Mirna Belovari · Julie M. Schallhorn · Steven C. Schallhorn

Received: 12 June 2026 / Accepted: 17 September 2026

© The Author(s) 2026

Abstract

Purpose To describe differences in patient population, practice patterns and outcomes between private and public setting cataract surgery.

Methods Preoperative population and clinical outcomes from the Royal College of Ophthalmologists National Ophthalmology Dataset study (2010 NOD; surgeries August 2006 to November 2010), the latest annual audit (2025 NOD; surgeries April 2023 to March 2024), and consecutive cataract surgeries performed at a United Kingdom-based network of private surgical centres (Optical Express) between April 2023 and March 2024 were reviewed.

Results The number of treated eyes was 180,144, 550,519, and 4,969 in the 2010 NOD, 2025 NOD, and private centres, respectively. Private patients were on average one decade younger and had better preoperative visual acuities. Vision loss (≥ 0.3 logMAR) was recorded in 1.5% of eyes in the 2010 NOD, 0.46% in 2025 NOD, and 0.26% in the private cohort. The incidence of posterior capsule rupture decreased from 1.95% in 2010 to 0.69% in 2025 in the NOD; the rate in the private cohort was 0.18%. As the cohorts differed in baseline characteristics, the observed differences should be interpreted cautiously. In the private cohort, implanted IOLs were monofocal (24.8%), enhanced monofocal (54.0%), or multifocal (21.2%), whereas NOD patients typically received conventional monofocal IOLs. Among private patients, immediate sequential bilateral cataract surgery was performed in 57.4%, while its uptake in NOD cohorts was negligible.

Conclusion Private patients underwent surgery at a younger age and with better preoperative visual acuity, consistent with less advanced cataract. Outcome metrics improved markedly between the 2010 and 2025 NOD cohorts.

Keywords Cataract surgery · Complication rates · Posterior capsule rupture · Vision loss · Patient characteristics

This Article in Press is shared early to give you faster access to new research. It is citable and carries a permanent DOI. The final edited version will replace it automatically.



Introduction

Cataract surgery remains the most frequently performed surgical procedure in the United Kingdom [1]. The Royal College of Ophthalmologists (RCOphth) established the National Ophthalmology Database (NOD) in 2010 to collate data on cataract surgeries for audit and research purposes [2]. In 2014, the RCOphth was commissioned by the Healthcare Quality Improvement Partnership to build on the work of the NOD and deliver a national audit programme for ophthalmology. The outcomes of these audits have become an important benchmark for the comparison of cataract surgery standards.

For intraocular lens (IOL) surgeries in the United Kingdom, patients have a choice between government-funded National Health Service (NHS) care pathways and pathways of a variety of private providers, depending on their personal preference, the significance of cataract, the reason for IOL surgery (cataract, presbyopia correction, refractive error correction) and the preference for the type of an intraocular lens. The NHS increasingly utilises the services of private providers in order to deliver patient care and attempt to meet demands on accessibility to care in line with their constitution.

Differences between patient populations seeking care within the NHS and those receiving care in the private system form the basis of this study. The purpose of this study was to examine baseline population characteristics and clinical outcomes of surgery performed within the NHS system (using National Ophthalmology Database audit data) and within a large private multi-centre provider of intraocular lens surgery, with a particular focus on surgical patterns, differences in preoperative characteristics, visual acuity outcomes, vision loss, and the most commonly reported adverse events.

Patients and methods

This study reviewed the outcomes of the first RCOphth NOD study (“2010 NOD”) [2], covering NHS cataract surgeries performed between August 2006 and November 2010; the latest 2025 RCOphth NOD annual audit (“2025 NOD”) [1], which includes surgery dates between April 2023 and March 2024, and a retrospective analysis of consecutive cataract surgeries performed by a large private multi-centre refractive and cataract surgery provider (Optical Express, United Kingdom) between April 2023 and March 2024 (“private”).

This study did not require Research Ethics Committee approval per NHS Health Research authority guidelines [3]. For the Optical Express data, Institutional Review Board at the University of California, San Francisco deemed the study an exempt from full review because it only involved collection of de-identified and retrospective patient data. All Optical Express patients signed an informed consent to undergo cataract surgery and, as a part of that informed consent, agreed to use their de-identified data for statistical analysis and research purposes. The study was conducted in accordance with the tenets of the Declaration of Helsinki.

For the private review, records meeting the inclusion/exclusion criteria of the RCOphth NOD audits [1, 2] were extracted in anonymized fashion from the electronic medical record. The three studies included only adult patients (18 years or older) with cataracts and procedures performed by phacoemulsification. Surgeries performed as combined procedures along with another significant intraocular procedure, or those performed on eyes with previous ocular trauma, significant congenital or developmental abnormalities were excluded from this analysis. The time period for surgeries in the OE audit was matched to cover the same date range as the 2025 NOD audit. The initial 2010 NOD report was included in this review to demonstrate the change in outcomes in NHS-funded cataract surgeries over the recent years and to review some outcome metrics that were not included in the 2025 NOD audit.

Data collection and analysis

The primary outcome measures in this study were monocular visual acuity (VA), the degree of vision loss from preoperative to postoperative assessments, and the incidence of some operative and postoperative adverse events. Definitions of VA used in each study are summarized in Table 1. While the NOD used the best-measured visual acuity (corrected distance visual acuity [CDVA], uncorrected distance visual acuity [UDVA] or pinhole visual acuity, whichever was available), the best-measured visual acuity in the private cohort was consistently measured as CDVA following subjective refraction (Table 1). Where records were available, VA analyses were stratified by the presence or absence of pre-existing ocular co-pathology.

Vision loss was defined as a deterioration of ≥ 0.30 logMAR units between preoperative and postoperative examinations (Table 1), corresponding to a doubling or worse of the visual angle [1]. Severe vision loss was defined as a deterioration of ≥ 0.60 logMAR units, representing a quadrupling of the visual angle [1].

Adverse events evaluated included posterior capsule rupture (PCR), postoperative endophthalmitis, retinal detachment, and cystoid macular oedema (CMO). Due to differences in baseline characteristics across the three study cohorts, outcomes were not compared using inferential statistical tests. Instead, the findings are presented as a descriptive analysis of independently collected datasets, highlighting trends, improvements and surgical patterns observed across the cohorts. Unless otherwise specified, all percentages and adverse event incidences are reported on a per-eye basis.

Results

The 2010 NOD report included outcomes of 28 NHS Trusts (27 in England and 1 in Scotland) performed by 995 surgeons. The 2025 NOD audit contained data from 199 centers and 2,361 treating surgeons. Of the 199 centers, 71 were traditional NHS providers, and the remaining were independent sector treatment providers of NHS-funded services, private providers, or combined NHS and privately-funded cataract surgery data. The OE audit included treatments from 21 centers in the United Kingdom performed by 20 surgeons. Of all surgeries, 58.4% in the NOD 2010 audit, 86.3% in the NOD 2025 audit, and all surgeries in the private audit were performed by consultant-grade surgeons.

Table 2 summarizes the preoperative characteristics across the three datasets. The number of eyes (patients) included was 180,144 (127,685) in the 2010 NOD, 550,519 (409,107) in the 2025 NOD, and 4,969 (3,031) in the private dataset. Median age in the 2010 NOD cohort was approximately a decade higher than in the private cohort, while age was not reported for the 2025 NOD audit. Preoperative visual acuity was poorer in both NOD

Table 1 Visual acuity definitions used in analyses

	2010 NOD (years 2006–2010)	2025 NOD (years 2023–2024)	Private (years 2023–2024)
Preoperative visual acuity definition	• The better value of UDVA or CDVA • Eligible VA measurements were recorded within 3 months prior to surgery and the VA measurement closest to the date of surgery was used in the analysis.	• The better value of CDVA or UDVA that is closest to the day of surgery (including the day of surgery) and measured within 6 months prior to surgery.	• Corrected distance visual acuity recorded within 3 months prior to surgery. • If more than one measurement of CDVA was present on the electronic medical record, the measurement closest to the day of surgery was used in the analysis
Postoperative best-measured visual acuity definition	• The best CDVA measurement within 2 weeks and 4 months of cataract surgery when present and the best measurement of UDVA or pinhole VA within the time period when CDVA was absent.	• The best measurement of CDVA, UDVA, or pin hole visual acuity between eight days and 6 months (inclusive) post-cataract surgery.	• The best measurement of CDVA between eight days and 6 months (inclusive) post-cataract surgery.

NOD - National Ophthalmology Database, VA – visual acuity, CDVA – corrected distance visual acuity, UDVA uncorrected distance visual acuity

Table 2 Preoperative characteristics

	2010 NOD (years 2006–2010)	2025 NOD (years 2023–2024)	Private (years 2023–2024)
Number of eyes in the original cohort	180,114	550,519	4,969
Number of eyes without pre-existing ocular co-pathology	113,610	373,023	3,207
Treatment time period	August 2006 to November 2010	April 2023 to March 2024	April 2023 to March 2024
Age at surgery [years]		---	
(median)	77.1		68.0
IQR	(IQR: 69.7, 82.8)		(IQR: 62, 75)
Number of eligible eyes with recorded preop visual acuity	147,962	490,052	4,969
Preop visual acuity			
Median [logMAR]	0.50	0.40	0.22
IQR	(IQR: 0.30, 0.80)	---	(IQR: 0.00, 0.40)
Mean (SD)	0.63 (---)	---	0.31 (0.50)
Percentage of eyes with preop visual acuity			
20/40 or better	36.2%	---	71.6%
20/20 or better	3.2%	---	29.5%

NOD - National Ophthalmology Database

logMAR – logarithm of the minimum angle of resolution

IQR – interquartile range

SD – standard deviation

--- records not available

Preop visual acuity –the better of corrected or uncorrected distance visual acuity measurement (whichever was available) in NOD reports, corrected distance visual acuity in the private dataset

audits compared with the private cohort (median best measured visual acuity: 0.50 logMAR [20/63] for 2010 NOD, 0.40 logMAR [20/50] for 2025 NOD, and 0.22 logMAR [20/32⁻¹] for private). This trend is consistent with the private sector's tendency to operate at earlier stages of cataract development. However, the preoperative best measured visual acuity in the 2025 NOD was approximately one Snellen line better than in the 2010 NOD, indicating that NHS surgeries are now also being performed at earlier stages of the disease.

Table 3 presents postoperative best measured visual acuity stratified by the presence or absence of ocular co-pathology, where available. Overall, a higher proportion of eyes in the private cohort achieved postoperative visual acuity of both 20/40 (driving standard) and 20/20 than in the NOD cohorts. However, these findings should be interpreted cautiously because the private cohort had more favourable baseline characteristics, including younger age and better preoperative visual acuity, and postoperative visual acuity was defined differently between the datasets. The NOD datasets also demonstrated improved outcomes over time, with better postoperative results in 2025 compared with 2010, although differences in patient characteristics and audit methodology should also be considered. Across all eyes, irrespective of ocular co-pathology, the mean postoperative best measured visual acuity was 0.10 logMAR (20/25) in the 2010 NOD cohort, 0.02 logMAR (20/20⁻¹) in the 2025 NOD cohort, and 0.00 logMAR (20/20) in the private cohort.

Postoperative uncorrected distance visual acuity (UDVA) for eyes with an intended postoperative target manifest spherical equivalent (MSE) within ± 0.50 D is provided in Table 4. Equivalent data were not reported in the 2025 NOD audit, likely reflecting changes in audit reporting; consequently, UDVA summary is limited to the 2010 NOD and private cohorts, and no conclusions can be drawn regarding temporal changes in UDVA outcomes within the NHS. Among eligible eyes, 75.3% in the 2010 NOD audit and 95.5% in the private audit had postoperative unaided vision 20/40 or better. For unaided vision of 20/20 or better, the corresponding proportions were

Table 3 Postoperative best measured visual acuity

	2010 NOD (years 2006–2010)	2025 NOD (years 2023–2024)	Private (years 2023–2024)
Number of eyes in the original cohort	180,114	550,519	4,969
Number of eligible eyes with available records	95,561	372,300	4,576
Eyes with co-pathology			
20/40 or better	79.9%	86.6%	95.9%
20/20 or better	32.5%	---	72.0%
Eyes without co-pathology			
20/40 or better	94.6%	96.4%	99.4%
20/20 or better	50.8%	---	88.9%
All eyes			
20/40 or better	89.6%	93.0%	98.2%
20/20 or better	44.5%	---	83.1%
Postop best measured visual acuity (All eyes)			
Median [logMAR]	0.10	0.02	0.00
IQR	(IQR: 0.0,0.20)	---	(IQR: -0.08,0)
Mean (SD)	0.16 (0.30)	---	-0.01 (0.14)
Postoperative best measured visual acuity (Eyes with no ocular co-pathology)			
Median [logMAR]	0.00	---	-0.08
IQR	(IQR: 0.0,0.20)	---	(IQR: -0.08,0.00)
Mean (SD)	0.10 (0.21)	---	-0.03 (0.10)

NOD - National Ophthalmology Database

logMAR – logarithm of the minimum angle of resolution

IQR – interquartile range

SD – standard deviation

--- records not available

Postoperative best measured visual acuity – corrected distance visual acuity, uncorrected distance visual acuity, or pinhole visual acuity in the NOD audits, corrected distance visual acuity in the private dataset

Table 4 Postoperative uncorrected distance visual acuity in eyes with predicted postoperative manifest spherical equivalent $\pm 0.50D$

	2010 NOD (years 2006–2010)	2025 NOD (years 2023–2024)	Private (years 2023–2024)
Number of eyes in the original cohort	180,114	550,519	4,969
Number of eligible eyes with available records	63,669	---	4,256
Eyes with co-pathology			
20/40 or better	63.2%	---	91.7%
20/20 or better	16.2%	---	43.0%
Eyes without co-pathology			
20/40 or better	80.9%	---	97.5%
20/20 or better	27.3%	---	61.2%
All eyes			
20/40 or better	75.3%	---	95.5%
20/20 or better	23.8%	---	54.9%

NOD –National Ophthalmology Database

--- records not available

23.8% in the 2010 NOD cohort and 54.9% in the private cohort. These differences should be interpreted in the context of the baseline characteristics of the study populations.

Table 5 presents the change from preoperative to postoperative vision, stratified by the presence or absence of ocular co-pathology, where available. Although overall vision loss was lowest in the private cohort, both the 2010 NOD and the private datasets demonstrated greater vision loss among eyes with ocular co-pathology

Table 5 Pre to postoperative loss of best measured visual acuity

	2010 NOD (years 2006–2010)	2025 NOD (years 2023–2024)	Private (years 2023–2024)
Number of eyes in the original cohort	180,114	550,519	4,969
Number of eligible eyes with available records	94,106	265,854	4,576
Vision Loss ≥ 0.3 logMAR			
<i>Eyes with preop best measured visual acuity 20/20 or better</i>			
No ocular co-pathology	5.7%	---	0.17%
With ocular co- pathology	10.2%	---	0.58%
<i>Eyes with pre-operative best measured visual acuity 20/40 or better</i>			
No ocular co- pathology	2.4%	---	0.20%
With ocular co- pathology	4.2%	---	0.34%
<i>All eyes (regardless of the level of preoperative best measured visual acuity)</i>			
No ocular co- pathology	1.0%	---	0.20%
With ocular co- pathology	2.5%	---	0.38%
All eyes (with and without ocular co- pathology)	1.5%	0.46%	0.26%
Severe Vision Loss ≥ 0.6 logMAR			
All eyes (with and without ocular co- pathology)	---	0.17%	0.02%

NOD –National Ophthalmology Database

logMAR – logarithm of the minimum angle of resolution

Table 6 Adverse events

	2010 NOD (years 2006–2010)	2025 NOD (years 2023–2024)	Private (years 2023–2024)
Number of eyes in the original cohort	180,114	550,519	4,969
Posterior capsule rupture events %	1.95%, 3,514/180,114 eyes	0.69%, 3,822/550,519 eyes	0.18%, 9/4,969 eyes
Endophthalmitis %	0.03%, 43/145,868 eyes	0.02%, (n/a)/222,547 eyes	0.00%, 0/4,576 eyes
Retinal Detachment %	0.03%, 45/139,537 eyes	0.05%, (n/a)/222,547 eyes	0.02%, 1/4,576 eyes
Cystoid macular oedema %	(n/a)	1.58%, (n/a)/222,547 eyes	0.96%, 44/4,576 eyes

NOD – National Ophthalmology Dataset

(n/a) - records not available

Values are presented as incidence (%), followed by the number of events and the number of eligible eyes (denominator) used for that calculation. Denominators vary between adverse events because outcome data were not available for all eyes in the original cohort

Endophthalmitis – adverse event recorded within 3 months of surgery in the 2010 NOD, and within 42 days in the 2025 NOD and private dataset

Retinal Detachment – adverse event recorded within 3 months of surgery in the 2010 NOD, and within 2 months in the 2025 NOD and private dataset

Cystoid macular oedema – adverse event recorded within 2 months of surgery in both 2025 NOD and private dataset

(stratification by co-pathology was not provided in the 2025 NOD cohort). Vision loss of ≥ 0.3 logMAR occurred in 1.5% of eyes in the 2010 NOD, 0.46% in the 2025 NOD, and 0.26% in the private cohort. Severe vision loss (≥ 0.6 logMAR) was not reported in the 2010 NOD audit, precluding comparison across all three cohorts. It was reported in 0.17% of eyes in the 2025 NOD cohort and 0.02% in the private cohort. Given the absence of complete subgroup data and the differences in baseline case mix, these findings should be regarded as descriptive rather than evidence of comparative effectiveness.

The incidence of posterior capsule rupture (PCR) improved in the NOD reports between 2010 and 2025, decreasing from 1.95% to 0.69% (Table 6). The private cohort had a PCR rate of 0.18%, but the differences in baseline case mix should be considered when interpreting these findings. Rates of endophthalmitis and retinal detachment were low in both the NOD datasets and the private cohort; however, follow-up for adverse event

reporting differed between datasets, with the 2010 NOD recording both events within 3 months of surgery, compared with 42 days for endophthalmitis and 2 months for retinal detachment in both the 2025 NOD and private datasets (Table 6). Cystoid macular oedema was not reported in the 2010 NOD but was recorded at 1.58% in the 2025 NOD and 0.96% in the private cohort.

Surgical patterns

Of all eyes in the private cohort dataset, 24.8% (1,231) had a monofocal IOL, 54.0% (2,681) had an enhanced monofocal IOL, and 21.2% (1,056) had a multifocal IOL. The cataract procedure was performed as immediate sequential bilateral cataract surgery (ISBCS) in 57.4% (1,741) of patients, delayed sequential bilateral cataract surgery (DSBCS) in 6.5% (197) of patients, and the remaining 36.1% (1,093) patients had unilateral cataract surgery. For patients undergoing DSBCS, the median time between first and second eye surgery was 38 days (interquartile range, 16–69 days).

Of the 127,685 patients in the 2010 NOD report, only 0.3% (436 patients) had ISBCS. For patients who had DSBCS, the median time between first and second eye surgery was 3.7 months (interquartile range: 2.4–6.6 months).

In the 2025 NOD audit 3,983 of 409,107 patients underwent ISBCS (0.97%), while the time interval between first and second eye surgery in patients with delayed sequential surgery was not reported.

Discussion

The publicly funded National Health Service has observed a significant reduction in IOL surgery-related complications and vision loss between 2010 and 2025 with improved best-measured vision after surgery during the same time period [1]. This demonstrates how large-scale national auditing enables continuous quality improvement by allowing both trainee and consultant surgeons to benchmark their surgical outcomes and complication rates against national standards, identify areas for improvement, and iteratively refine their clinical practice. Beyond monitoring standard cataract surgery outcomes, the National Ophthalmology Database has also supported numerous studies and analyses of risk factors [4–8]. These have significantly enriched the ophthalmic community both nationally and worldwide. In contrast, private providers typically use internal audit systems in which surgeons' outcomes are benchmarked against both their peers and organisational standards. A proprietary electronic medical record is designed to highlight major complications, facilitating timely review of outcome trends by the Medical Advisory Board and supporting continuous quality improvement. Given the high expectations of patients who self-fund their surgery, ongoing monitoring of surgical outcomes is an essential component of quality assurance.

In this study, we found differences in the baseline characteristics of population of patients that seek care within the private system in the UK versus the NHS. Private-sector patients are generally younger, present with better preoperative visual acuity, and have a lower incidence of ocular co-pathology. Compared with outcomes reported in NOD, the incidence of vision loss in the private cohort was lower. However, these findings should be interpreted cautiously because the cohorts differed in baseline characteristics and outcome definitions. The observed differences may partly reflect the greater complexity of cases treated within the NHS. In particular, patients treated under the NHS typically present with a higher prevalence of known risk factors for vision loss—such as older age, more severe cataracts, co-existing ocular pathology, and a higher incidence of PCR complications [9].

In the RCOphth NOD audits, posterior capsule rupture is considered as one of the most important safety metrics. Reducing PCR rates is critical, as these events can prolong visual recovery and predispose patients to sight-threatening complications, such as endophthalmitis and retinal detachment [1, 2]. The incidence of PCR within the NHS has shown a marked improvement over recent years, decreasing from 1.95% in the 2010 audit to 0.69% in the 2025 audit [1, 2]. These findings align with data from the European Registry of Quality Outcomes for Cataract and Refractive Surgery (EUREQUO), which reported a PCR rate of 1.1% (range 0.60%–1.65%) and

similarly documented a downward trend [10]. The NOD data suggest that increased use of surgical simulators among trainee surgeons may have contributed to the gradual reduction in complication rates across the NHS over the years [7]. In the private cohort, the PCR incidence was 0.18% and comparable to PCR rates reported in previous Optical Express dataset reviews [11–13]. Commonly recognised risk factors for PCR include advanced patient age, cataract maturity and type, small pupils, coexisting ocular pathology, and surgeon experience level [10, 14–16]. Given these factors, a higher PCR incidence rate is expected within the NHS, where patients typically present with greater clinical complexity. On the other hand, cataract surgery in the private sector is performed exclusively by consultant-grade surgeons, which may also have contributed to the lower PCR incidence observed in the private cohort. Nevertheless, differences in baseline case mix between the NHS and private cohorts should also be considered when interpreting differences in PCR rates.

Endophthalmitis, although rare, remains a devastating complication of intraocular surgery and is associated with poor visual outcomes. Its management also places a substantial cost burden on healthcare services. The incidence of endophthalmitis has declined markedly following the widespread adoption of intracameral cefuroxime prophylaxis [17–20]. Even though there were some differences in postoperative time window definitions of this serious adverse event (3 months for 2010 NOD and 42 days for 2025 NOD), reported rates within the National Health Service are favourable and fall at the lower end of those described in other large national studies (0.023%–0.15% [21–25]). The shorter follow-up period used in the more recent datasets may have reduced the opportunity to identify a small number of later-presenting cases and should therefore be considered when interpreting these findings. Previous population-based studies of Optical Express [11–13] have shown that endophthalmitis is extremely rare in this patient population, and no cases were identified in the cohort analysed in the present study.

Estimating the incidence of retinal detachment (RD) is more challenging than for acute endophthalmitis. In contrast to endophthalmitis, RD can develop months to years after intraocular surgery and is not always linked to the procedure. Multiple factors can contribute to its development. The 10-year incidence of pseudophakic RD after phacoemulsification is estimated to range from 0.36% to 2.9%, with the postoperative risk remaining approximately ten times higher than that of the general population without intraocular lens surgery [26]. This review includes only cases occurring within the first few postoperative months (2–3 months, depending on the dataset), when RD is most likely surgery-related. However, the shorter follow-up period used in the 2025 NOD audit and the private cohort provided less opportunity to identify later-presenting retinal detachments than the 3-month follow-up used in the 2010 NOD report. Consequently, the reported RD rates should be interpreted with caution, as they may underestimate the true incidence, particularly in the more recent datasets, and should not be considered directly comparable across the three cohorts. Both the NHS and Optical Express demonstrated very low rates of this complication (0.03% in the 2010 NOD cohort, 0.05% in the 2025 cohort, and 0.02% in the private cohort). However, in an NOD sub-analysis from a different year that was restricted to cases with at least three months of potential follow-up and in which cataract and vitreoretinal procedures were recorded within the same electronic medical record, the incidence reached 0.21% [5]. Posterior capsular rupture and surgeon grade emerged as the main risk factors, and RD also occurred earlier in cases where cataract surgery was complicated by PCR [5]. These findings underscore the importance of continuously reducing intraoperative complications, particularly PCR, to minimize the risk of this sight-threatening adverse outcome.

Immediate sequential bilateral cataract surgery, while historically contentious, experienced a marked increase in adoption in some clinical practices around the world during the COVID-19 pandemic due to its potential to reduce patient visits and streamline care pathways. Large population-based studies conducted within Optical Express have shown excellent safety profiles and low adverse-event rates when all recommended precautions for performing same-day bilateral surgery are followed [11, 13]. The rate of ISBCS in the NOD dataset continues to grow (0.3% in the 2010 NOD report to 0.97% in the 2025 NOD report) [1, 2], however it remains significantly behind the rate in private practice. This disparity is likely multifactorial. Despite favourable guidance from the National Institute for Health and Care Excellence (NICE), which recommends offering ISBCS to appropriately selected low-risk patients and those requiring general anaesthesia [27], widespread implementation within the NHS has been limited. The reasons may potentially include historical concerns regarding bilateral

sight-threatening complications, medico-legal and clinical governance considerations, logistical challenges associated with delivering two independent sterile procedures during a single operating session, and established referral and surgical pathways that have traditionally favoured delayed sequential surgery [28]. At the same time, cataract surgery waiting list pressures have renewed interest in ISBCS as a strategy to improve theatre efficiency and patient access [29]. The higher proportion of ISBCS in the private cohort likely reflects differences in patient selection, organisational pathways, and provider-specific service models that facilitate delivery of ISBCS, in addition to the established safety and efficacy of the procedure.

Patients in the private cohort underwent cataract surgery at a younger age and with better preoperative visual acuity than those represented in the National Ophthalmology Database and experienced favourable postoperative outcomes. However, these findings are descriptive and should not be interpreted as evidence of an effect of earlier surgical intervention on visual outcomes. The study cohorts differed substantially in baseline characteristics, case complexity, and other clinical factors that may independently influence postoperative outcomes. These differences provide plausible alternative explanations for the observed outcomes, and the present study was not designed to determine the independent effect of surgical timing.

The potential implications of surgical timing have been examined in the wider literature. Previous studies have reported associations between cataract surgery performed before visual impairment becomes advanced and improvements in visual function and quality of life, perioperative advantages such as more accurate biometry and better fundus visibility, as well as reductions in the risk of falls and accidents [30–35]. Nevertheless, these findings should be considered independently of the present descriptive analysis, which was not designed to establish causal relationships between the timing of intervention and postoperative outcomes. At the same time, decisions regarding the timing of cataract surgery must also consider healthcare resource allocation, surgical capacity, and patient prioritisation within publicly funded healthcare systems, where earlier intervention for some patients may have implications for waiting times and access to care for others. Expanding access to earlier surgery for patients with relatively mild visual impairment could increase demand for cataract surgery and, unless accompanied by additional surgical capacity, may prolong waiting times or reduce timely access for patients with more advanced cataracts or greater functional impairment. Achieving an appropriate balance between maximising individual patient benefit, ensuring equitable access to care, and making efficient use of finite healthcare resources remains an important challenge for publicly funded healthcare systems.

Several limitations of this study should be acknowledged. This study was not designed as a direct comparative effectiveness analysis between National Health Service and private cataract surgery providers. The datasets differed in patient selection, data collection and outcome definitions, and the findings should therefore be interpreted as descriptive rather than evidence of superiority or equivalence. Standardised risk adjustment was not possible because important clinical variables, including age, cataract severity, ocular comorbidities, pupil size, and case complexity, were not consistently available across the datasets. Consequently, residual confounding may have influenced the observed differences in surgical and visual outcomes. A further limitation relates to differences in visual acuity assessment. All Optical Express patients underwent subjective refraction, ensuring corrected distance visual acuity was available for every case. In contrast, the National Ophthalmology Database reports the best available visual acuity, which may comprise CDVA, UDVA or pinhole visual acuity. Although both datasets used the best measurement within predefined follow-up periods, differences in measurement methodology may have influenced interpretation of visual outcomes. A further limitation relates to differences in postoperative follow-up periods for adverse event reporting. Endophthalmitis and retinal detachment were recorded over different follow-up windows across the datasets, providing unequal opportunities to identify postoperative complications. Consequently, complication rates, particularly for retinal detachment, may be underestimated in datasets with shorter follow-up periods, limiting direct comparison between the cohorts.

Despite the limitations, we believe that patients treated within both the National Health Service and private providers receive high-quality care appropriate to their clinical setting. Private care may offer greater access to intraocular lens options, shorter waiting times, and a higher proportion of consultant-grade surgeons. In the United Kingdom, patients can choose treatment options based on their preferences and circumstances. Ultimately,

the differences observed between the cohorts reflect distinct patient populations and models of care and should be interpreted within their respective clinical contexts.

Abbreviations

NOD	National Ophthalmology Dataset
logMAR	Logarithm of the minimum angle of resolution
IOL	Intraocular lens
RCOphth	Royal College of Ophthalmologists
NHS	National Health Service
VA	Visual acuity
PCR	Posterior capsule rupture
CMO	Cystoid macular oedema
OE	Optical Express
UDVA	Uncorrected distance visual acuity
CDVA	Corrected distance visual acuity
MSE	Manifest spherical equivalent
ISBCS	Immediate sequential bilateral cataract surgery
DSBCS	Delayed sequential bilateral cataract surgery
UK	United Kingdom
EUREQUO	European Registry of Quality Outcomes for Cataract and Refractive Surgery
RD	Retinal detachment
NICE	National Institute for Health and Care Excellence

Acknowledgements Not applicable.

Author contributions Conception and design: SJH, JAV, DT, CWB, NCH, DR, HJK, MM, SVS, DRC, MB, JMS, SCS; Data acquisition and analysis: SJH, CWB, SVS; Interpretation of data: SJH, JAV, DT, JMS, SCS; Drafting the manuscript and critical revision: SJH, JAV, DT, CWB, NCH, DR, HJK, MM, SVS, DRC, MB, JMS, SCS.

Funding No funding was received for this study.

Data availability The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate This study did not require Research Ethics Committee approval per NHS Health Research authority guidelines [3]. For the Optical Express data, Institutional Review Board at the University of California, San Francisco deemed the study an exempt from full review because it only involved collection of de-identified and retrospective patient data. All Optical Express patients signed an informed consent to undergo cataract surgery and, as a part of that informed consent, agreed to use their de-identified data for statistical analysis and research purposes. The study was conducted in accordance with the tenets of the Declaration of Helsinki.

Consent for publication Not applicable.

Competing interests Jan Venter and Manu Mathew are consultants to Optical Express. Stephen Hannan, Colin Berry, Noelle Hannan, Dasi Raju, Huba Kiss, Sharone Suthaharan, David Cooper, David Teenan, and Mirna Belovari are employees of Optical Express. Steven Schallhorn is a chief medical officer for Carl Zeiss Meditec and a chairman of the international medical advisory board for Optical Express. Jan Venter, Stephen Hannan, David Teenan, and Julie Schallhorn are members of the international medical advisory board for Optical Express. Julie Schallhorn received personal fees from Carl Zeiss Meditec, Allergan, Elios, Long Bridge, ViaLase, Vanda, and Forsight V6 and has a financial interest in Journey 1, Neurotrigger, and Novus Vision.

Open Access This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/>.

References

1. National Ophthalmology Database. National cataract audit: eighth annual report 2025. London: National Ophthalmology Database. 2025. Available from: <https://nodaudit.org.uk/sites/default/files/2025-07/NOD%20Cataract%20Audit%208th%20Annual%20Report%202025%20Final.pdf>. Accessed July 4, 2026.
2. Day AC, Donachie PH, Sparrow JM, Johnston RL. The Royal College of Ophthalmologists' National Ophthalmology Database study of cataract surgery: report 1, visual outcomes and complications. *Eye (Lond)*. 2015;29(4):552–60. <https://doi.org/10.1038/eye.2015.3>.
3. Health Research Authority. What approvals do I need? Available from: <https://www.hra.nhs.uk/approvals-amendments/what-approvals-do-i-need/>. Accessed July 4, 2026.
4. Day AC, Donachie PH, Sparrow JM, Johnston RL. The Royal College of Ophthalmologists' National Ophthalmology Database study of cataract surgery: report 2, relationships of axial length with ocular comorbidity, preoperative visual acuity, and posterior capsule rupture. *Eye (Lond)*. 2015;29(12):1528–37. <https://doi.org/10.1038/eye.2015.198>.
5. Day AC, Donachie PHJ, Sparrow JM, Johnston RL. United Kingdom National Ophthalmology Database Study of cataract surgery: report 3: pseudophakic retinal detachment. *Ophthalmology*. 2016;123(8):1711–5. <https://doi.org/10.1016/j.ophtha.2016.04.002>.
6. Theodoropoulou S, Grzeda MT, Donachie PHJ, Johnston RL, Sparrow JM, Tole DM. The Royal College of Ophthalmologists' National Ophthalmology Database study of cataract surgery. Report 5: clinical outcome and risk factors for posterior capsule rupture and visual acuity loss following cataract surgery in patients aged 90 years and older. *Eye (Lond)*. 2019;33(7):1161–70. <https://doi.org/10.1038/s41433-019-0389-z>.
7. Ferris JD, Donachie PH, Johnston RL, Barnes B, Olaitan M, Sparrow JM. Royal College of Ophthalmologists' National Ophthalmology Database study of cataract surgery: report 6. The impact of EyeSi virtual reality training on complication rates of cataract surgery performed by first and second year trainees. *Br J Ophthalmol*. 2020;104(3):324–9. <https://doi.org/10.1136/bjophthalmol-2018-313817>.
8. Johnston RL, Day AC, Donachie PHJ, Sparrow JM. The Royal College of Ophthalmologists' National Ophthalmology Database study of cataract surgery: report 4, equity of access to cataract surgery. *Eye (Lond)*. 2020;34(3):530–6. <https://doi.org/10.1038/s41433-019-0524-x>.
9. Sparrow JM, Taylor H, Qureshi K, Smith R, Birnie K, Johnston RL. The Cataract National Dataset electronic multi-centre audit of 55,567 operations: risk indicators for monocular visual acuity outcomes. *Eye (Lond)*. 2012;26(6):821–6. <https://doi.org/10.1038/eye.2012.51>.
10. Segers MHM, Behndig A, van den Biggelaar F, Brocato L, Henry YP, Nuijts R, et al. Risk factors for posterior capsule rupture in cataract surgery as reflected in the European Registry of Quality Outcomes for Cataract and Refractive Surgery. *J Cataract Refract Surg*. 2022;48(1):51–5. <https://doi.org/10.1097/j.jcrs.0000000000000708>.
11. Hannan SJ, Schallhorn SC, Venter JA, Teenan D, Schallhorn JM. Immediate sequential bilateral surgery in refractive lens exchange patients: clinical outcomes and adverse events. *Ophthalmology*. 2023;130(9):924–36. <https://doi.org/10.1016/j.ophtha.2023.04.013>.
12. Schallhorn JM, Schallhorn SC, Teenan D, Hannan SJ, Pelouskova M, Venter JA. Incidence of intraoperative and early postoperative adverse events in a large cohort of consecutive refractive lens exchange procedures. *Am J Ophthalmol*. 2019;208:406–14. <https://doi.org/10.1016/j.ajo.2019.08.025>.
13. Raju D, Hannan SJ, Belovari M, Hannan NC, Berry CW, Venter JA, et al. Immediate sequential bilateral cataract surgery in patients with bilateral visually significant cataracts. *Clin Ophthalmol*. 2024;18:1515–23. <https://doi.org/10.2147/OPT.H.S459266>.
14. Zare M, Javadi MA, Einollahi B, Baradaran-Rafii AR, Feizi S, Kiavash V. Risk factors for posterior capsule rupture and vitreous loss during phacoemulsification. *J Ophthalmic Vis Res*. 2009;4(4):208–12.
15. Ergun SB, Kocamis SI, Cakmak HB, Cagil N. The evaluation of the risk factors for capsular complications in phacoemulsification. *Int Ophthalmol*. 2018;38(5):1851–61. <https://doi.org/10.1007/s10792-017-0667-3>.

16. Narendran N, Jaycock P, Johnston RL, Taylor H, Adams M, Tole DM, et al. The Cataract National Dataset electronic multicentre audit of 55,567 operations: risk stratification for posterior capsule rupture and vitreous loss. *Eye (Lond)*. 2009;23(1):31–7. <https://doi.org/10.1038/sj.eye.6703049>.
17. Endophthalmitis Study Group. Prophylaxis of postoperative endophthalmitis following cataract surgery: results of the ESCRS multicenter study and identification of risk factors. *J Cataract Refract Surg*. 2007;33(6):978–88. <https://doi.org/10.1016/j.jcrs.2007.02.032>.
18. Barry P, Seal DV, Gettinby G, Lees F, Peterson M, Revie CW. ESCRS study of prophylaxis of postoperative endophthalmitis after cataract surgery: preliminary report of principal results from a European multicenter study. *J Cataract Refract Surg*. 2006;32(3):407–10. <https://doi.org/10.1016/j.jcrs.2006.02.021>.
19. Beselga D, Campos A, Castro M, Fernandes C, Carvalheira F, Campos S, et al. Postcataract surgery endophthalmitis after introduction of the ESCRS protocol: a 5-year study. *Eur J Ophthalmol*. 2014;24(4):516–9. <https://doi.org/10.5301/ejo.5000417>.
20. Garcia-Saenz MC, Arias-Puente A, Rodriguez-Caravaca G, Banuelos JB. Effectiveness of intracameral cefuroxime in preventing endophthalmitis after cataract surgery: Ten-year comparative study. *J Cataract Refract Surg*. 2010;36(2):203–7. <https://doi.org/10.1016/j.jcrs.2009.08.023>.
21. Freeman EE, Roy-Gagnon MH, Fortin E, Gauthier D, Popescu M, Boisjoly H. Rate of endophthalmitis after cataract surgery in Quebec, Canada, 1996–2005. *Arch Ophthalmol*. 2010;128(2):230–4. <https://doi.org/10.1001/archophthalmol.2009.380>.
22. Friling E, Lundstrom M, Stenevi U, Montan P. Six-year incidence of endophthalmitis after cataract surgery: Swedish national study. *J Cataract Refract Surg*. 2013;39(1):15–21. <https://doi.org/10.1016/j.jcrs.2012.10.037>.
23. Hatch WV, Cernat G, Wong D, Devenyi R, Bell CM. Risk factors for acute endophthalmitis after cataract surgery: a population-based study. *Ophthalmology*. 2009;116(3):425–30. <https://doi.org/10.1016/j.ophtha.2008.09.039>.
24. Mollan SP, Gao A, Lockwood A, Durrani OM, Butler L. Postcataract endophthalmitis: incidence and microbial isolates in a United Kingdom region from 1996 through 2004. *J Cataract Refract Surg*. 2007;33(2):265–8. <https://doi.org/10.1016/j.jcrs.2006.10.022>.
25. Sheng Y, Sun W, Gu Y, Lou J, Liu W. Endophthalmitis after cataract surgery in China, 1995–2009. *J Cataract Refract Surg*. 2011;37(9):1715–22. <https://doi.org/10.1016/j.jcrs.2011.06.019>.
26. Qureshi MH, Steel DHW. Retinal detachment following cataract phacoemulsification—a review of the literature. *Eye (Lond)*. 2019. <https://doi.org/10.1038/s41433-019-0575-z>.
27. National Institute for Health and Care Excellence. Cataracts in adults: management (NG77). Published October 26. 2017. Available from: <https://www.nice.org.uk/guidance/ng77>. Accessed July 4, 2026.
28. Lee E, Balasingam B, Mills EC, Zarei-Ghanavati M, Liu C. A survey exploring ophthalmologists' attitudes and beliefs in performing immediately sequential bilateral cataract surgery in the United Kingdom. *BMC Ophthalmol*. 2020;20(1):210. <https://doi.org/10.1186/s12886-020-01475-0>.
29. Alsusa M, Ahmad S, Smith Z, Evans S, Wilkinson E, Roberts H. High patient acceptance of immediately sequential bilateral cataract surgery (ISBCS) as part of a one-stop see-and-treat pathway within an innovative NHS cataract unit. *Eye (Lond)*. 2025;39(6):1165–9. <https://doi.org/10.1038/s41433-024-03567-3>.
30. Lamoureux EL, Fenwick E, Pesudovs K, Tan D. The impact of cataract surgery on quality of life. *Curr Opin Ophthalmol*. 2011;22(1):19–27. <https://doi.org/10.1097/ICU.0b013e3283414284>.
31. Farquhar E, Harley U, Rotchford A, Ramaesh K. Should we perform early cataract surgery? A patient reported outcome study. *Clin Ophthalmol*. 2021;15:4707–14. <https://doi.org/10.2147/OPTH.S323348>.
32. Keay L, Ho KC, Rogers K, McCluskey P, White AJ, Morlet N, et al. The incidence of falls after first and second eye cataract surgery: a longitudinal cohort study. *Med J Aust*. 2022;217(2):94–9. <https://doi.org/10.5694/mja2.51611>.
33. Meuleners LB, Fraser ML, Ng J, Morlet N. The impact of first- and second-eye cataract surgery on injurious falls that require hospitalisation: a whole-population study. *Age Ageing*. 2014;43(3):341–6. <https://doi.org/10.1093/ageing/agt177>.
34. Conner-Spady B, Sanmartin C, Sanmugasunderam S, De Coster C, Lorenzetti D, McLaren L, et al. A systematic literature review of the evidence on benchmarks for cataract surgery waiting time. *Can J Ophthalmol J canadien d'ophtalmologie*. 2007;42(4):543–51.
35. Hodge W, Horsley T, Albiani D, Baryla J, Belliveau M, Buhrmann R, et al. The consequences of waiting for cataract surgery: a systematic review. *CMAJ*. 2007;176(9):1285–90. <https://doi.org/10.1503/cmaj.060962>.

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Authors and Affiliations

Stephen J. Hannan¹  · Jan A. Venter¹ · David Teenan¹ · Colin W. Berry¹ · Noelle C. Hannan¹ · Dasi Raju¹ · Huba J. Kiss¹ · Manu Mathew¹ · Sharone V. Suthaharan¹ · David R. Cooper¹ · Mirna Belovari¹ · Julie M. Schallhorn^{2,3} · Steven C. Schallhorn^{2,4}

✉ Stephen J. Hannan
StephenHannan@opticaexpress.com

¹ Optical Express, 200 St Vincent St, Glasgow G2 5SG, UK

² Department of Ophthalmology, University of California, San Francisco, CA, USA

³ F.I. Proctor Foundation, University of California, San Francisco, CA, USA

⁴ Carl Zeiss Meditec, Dublin, CA, USA