



The ROYAL COLLEGE of
OPHTHALMOLOGISTS

National Ophthalmology Database Audit

Year 2 Annual Report – The First Prospective Report of
the National Ophthalmology Database Audit

2017



The ROYAL COLLEGE of
OPHTHALMOLOGISTS

NOD

NATIONAL OPHTHALMOLOGY DATABASE
AUDIT



HQIP

Healthcare Quality
Improvement Partnership

The Royal College of Ophthalmologists (RCOphth) is the professional body for eye doctors, who are medically qualified and have undergone or are undergoing specialist training in the treatment and management of eye disease, including surgery. As an independent charity, we pride ourselves on providing impartial and clinically based evidence, putting patient care and safety at the heart of everything we do. Ophthalmologists are at the forefront of eye health services because of their extensive training and experience. The Royal College of Ophthalmologists received its Royal Charter in 1988 and has a membership of over 4,000 consultants of all grades. We are not a regulatory body, but we work collaboratively with government, health and charity organisations to recommend and support improvements in the coordination and management of eye care both nationally and regionally.



Healthcare Quality Improvement Partnership (HQIP) is led by a consortium of the Academy of Medical Royal Colleges, the Royal College of Nursing and National Voices. Its aim is to promote quality improvement, and in particular to increase the impact that clinical audit has on healthcare quality in England and Wales. HQIP holds the contract to manage and develop the National Clinical Audit Programme, comprising more than 30 clinical audits that cover care provided to people with a wide range of medical, surgical and mental health conditions. The programme is funded by NHS England, the Welsh Government and, with some individual audits, also funded by the Health Department of the Scottish Government, DHSSPS Northern Ireland and the Channel Islands.



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We would like to acknowledge the support and guidance we have received from the National Audit Steering Committee which includes professional members, ophthalmologists and optometrists, and patient and public representatives with individual lay members as well as patient support groups being represented. We thank the steering committee for reviewing this report.

We also acknowledge the support of the hospitals that participated in the first year of the prospective audit and thank our medical and non-medical colleagues for the considerable time and effort devoted to data collection. All participating centres are acknowledged on the NOD audit website www.nodaudit.org.uk

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It is with deep regret that we note the death of our friend and colleague Robert Johnston, who sadly died in September 2016. Without his inspirational vision, determination and career long commitment to quality improvement in ophthalmology this work would not have been possible.



Foreword

The content of this report reflects the activity and outcomes of 120,722 cataract operations, representing nearly one third of all those carried out in England and Wales in 2015/2016. This is an impressive achievement and the team, led by Professor John Sparrow, are to be congratulated on this contribution to key data which are essential to the understanding of the real-life benefits, complications and variation in this high volume surgical field. This information is particularly relevant as it adjusts for patient and preoperative surgical risk and is therefore realistic and non-threatening. It is extremely reassuring to note that visual outcomes are good and adverse events infrequent.

A number of data sources are being used to submit the information and, while 47% of all Trusts have participated, NOD have been unable to audit the quality of cataract surgery in independent providers but this will be addressed in the next round of data collection. Those who have participated will be using the information positively and more Trusts are coming on board next year to add to the collective data which act to improve learning and contribute to patient safety.

It is recognised that further developments could be made to increase the completeness of the dataset and that commissioners and providers should be aware that all NCAPOP audits are a mandated requirement of the NHS Standard Contract.

Cataract surgery is the commonest surgical procedure performed in the UK and Worldwide. This rich source of accurate, high quality data is the envy of other health care systems and those involved should be rightly proud of both developing the mechanisms to collect it and finding ways to analyse and share it usefully and widely.

A handwritten signature in blue ink, appearing to read 'Carrie MacEwen'.

Professor Carrie MacEwen

President, The Royal College of Ophthalmologists

Executive Summary

Background and aims of the audit

Cataract surgery remains the most frequently undertaken NHS surgical procedure with approximately 390,000 cataract operations undertaken in England and 16,000 in Wales during 2015-2016. The Health Quality Improvement Partnership (HQIP) has commissioned the National Ophthalmology Database (NOD) Cataract Audit to report on all NHS funded cataract surgery in England and Wales. The quality of delivery of this high volume surgical activity nationally is unknown, previous reports have been based on data from self-selected centres and thus may not provide a comprehensive picture representative of NHS cataract surgery as a whole. Furthermore, there are ongoing reports of restrictions of access to surgery which may compromise certain population groups in relation to locality or deprivation. The current report documents prospectively collected cataract surgery data and reports results for named NHS centres. These include operations performed and recorded by all surgeons of all grades within centres. Results for named consultant surgeons will be separately published on the NHS Choices website through the Clinical Outcomes Publication (COP) programme.

Two primary indicators of surgical quality are audited. These are, firstly, the index surgical intraoperative complication of rupture of the posterior lens capsule or vitreous prolapse or both (PCR), and secondly Visual Acuity (VA) Loss related to surgery. As an adverse operative event PCR is relevant because it results in a significantly higher risk of harm to the eye and may impact recovery of vision. For example, there is an approximately 40 fold higher risk of a retinal detachment occurring following cataract surgery if PCR occurred. Retinal surgery imposes

additional risks, morbidity and cost. Since VA Loss from surgery is the opposite of the intended effect, these key primary outcomes together capture relevant safety elements of surgical quality. Here these outcomes are presented as risk adjusted rates for surgical centres, supported by relevant contextual information including surgical volumes, data completeness, access to surgery and deprivation. The benchmark values of 2.0% for PCR and 1.5% for VA Loss (doubling or worse of the visual angle) and the risk indicators for each of these adverse events were derived from earlier data collections. The audit is designed to avoid duplicate data collection through utilization of data which is collected as part of routine clinical practice. The vast majority of data were obtained through extraction from Electronic Medical Record (EMR) systems, with a small number of centres choosing to submit data from their pre-existing audit databases.

The audit is intended to quality assure NHS cataract surgical services for patients whose vision is adversely affected by cataract to the point where they seek surgical intervention. This will be achieved through assessing key indicators of cataract surgical quality within the frames of data completeness and access by centre and deprivation. Should performance fall short of what can reasonably be expected by NHS patients this will be highlighted.

Results

Included in this first prospective report are operations undertaken between 1st September 2015 and 31st August 2016. Reported operations were performed in 55 English and one Welsh NHS cataract surgical centres.



Approximately 47% of the 125 eligible NHS trusts in England and Wales are thus represented. Around 9% of cataract operations were excluded for a variety of reasons such as being done for indications other than

visual improvement, or being combined with other significant intra-ocular surgery. 120,722 eligible cataract operations were available for analysis which approximates to 30% of all NHS funded cataract surgery undertaken in England and Wales during the audit period. Data completeness was excellent (100%) for the PCR outcome as this is a compulsory operative field in the EMRs. Overall, 1.5% of operations were affected by PCR, slightly below the current benchmark of 2.0%. An eligible preoperative distance VA was recorded for 80.5% of eyes and a postoperative VA for 67.4% of eyes, 57.1% of eyes had both a preoperative and a postoperative

VA measurement. There was significant variation between centres for completeness of VA data, a reflection of variations in current modes of use of the data collection systems and diverse patient pathways. The median preoperative VA was 0.50 LogMAR units (6/19 Snellen Equivalent); the median postoperative VA was 0.10 LogMAR units (6/7.5 Snellen); and the median change in VA was a 0.38 LogMAR gain. A 'good' postoperative VA of 0.30 (=6/12) or better was achieved in 88.6% of eyes overall, 94.8% of eyes with no ocular co-pathology and 81.4% of eyes with a recorded co-pathology. Overall the VA Loss rate was 0.81%, considerably lower than previously reported and hence lower than the existing benchmark. If confirmed by results from wider centre participation the existing benchmark will require adjustment in future audit cycles.

Whilst the audit is able to report on encouragingly large numbers of procedures, there remain centres from which data for the current period are not available. Many centres have indicated that they wish to participate in future audit cycles and as the audit becomes further established increasing uptake will provide a more comprehensive picture of the quality of surgery being undertaken on the NHS.

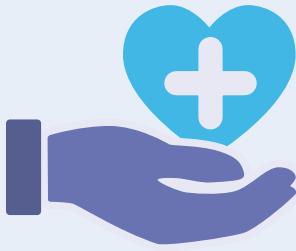
Recommendations for Patients



- Information should be made easily accessible to the general public
- Patients, carers and those with an interest in cataract surgery are encouraged to access and view data regarding their local services. Information about the quality of cataract surgery can be viewed online on the National Ophthalmology Audit Database website (www.nodaudit.org.uk) and the

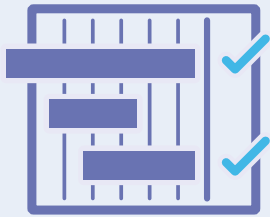
- www.nodaudit.org.uk) and the HQIP website (www.hqip.org.uk). In addition, data can be accessed on the NHS Choices website (www.nhs.uk/pages/home.aspx), Care Quality Commission website (www.cqc.org.uk) and <https://data.gov.uk/>
- Patients should ensure they discuss and understand the risks and outcomes of any eye surgery with their consultant

Recommendations for Providers and Surgeons



- Care providers and surgeons should be familiar with their performance
 - Centres and surgeons are encouraged to view their performance in regard to outcomes and data completeness
 - Where opportunities for quality improvements are found these should be acted upon to enhance the quality of the patient care being provided
 - Care providers should be open and transparent regarding their audit participation and outcomes and provide relevant information to their patients and the populations they serve
- Care providers and surgeons are encouraged to maximise quality improvement opportunities through making best use of the audit tools that allow real time tracking of adverse event rates locally
 - Monitoring of adverse events in real time is valuable for the early detection of a rising adverse event rate to ensure timely remedial action can be instituted. This will potentially avoid unnecessary harm to patients through avoidable surgical complications
 - An emphasis on continuous quality monitoring will, in addition, lessen the risk of a centre or surgeon being identified as an outlier in national reports.
- Care providers are reminded that all NCAPOP audits are mandated as a requirement of the NHS Standard Contract and a timely response to the audit providers and their sub-contractors is expected in regard to arrangements for participation in the audit.
 - Care providers are encouraged to adhere to the requirements of the NHS standard contract through participation in the national audit
- Surgeons and centres are encouraged to ensure accurate and complete data collection for each operation
 - Risk adjustment can only be successfully applied if the risk indicator data are recorded in the audit data collection tool
- With these data, surgeons and centres can be given appropriate credit for the complexity of their case mix using the risk adjustment models
- Without relevant risk adjustment information, operations are assumed to be low risk and, if this is not the case, the reported risk adjusted adverse event rate will be higher than the unadjusted rate
- Care providers and surgeons should review their patient pathways to maximise the recording of both pre- and postoperative VA data
 - Care providers are encouraged to implement pathways which collect these data items for every operation

Recommendations for Commissioners



- Commissioners should be familiar with the quality of services which they are commissioning on behalf of the populations they serve.
 - Commissioners are encouraged to view the performance of all providers of the care which they purchase in regard to outcomes and data completeness
- Commissioners should ensure all existing or new contracts with NHS funded providers including independent sector treatment centres include quality assurance for the well-being of the population they serve, through participation in the national audit
 - Commissioners are encouraged to incentivise in quality assurance through participation in the national audit via provider contracts
- Commissioners are in a key position to influence VA data returns through appropriate contracting and surgical providers should engage with commissioners and local optometrists to develop such 'enhanced community services'.
 - Commissioners are encouraged to commission services which reward quality assurance in regard to visual acuity outcome
- Where outcomes, data completeness or participation are not satisfactory providers should be asked to provide explanations together with their plans for improvements

Recommendations for the Regulator



- When inspecting NHS organisations, national audit commissioning, participation and performance should be routinely requested from commissioners and providers of cataract care
 - Regulators should expect participation in national audits with audit results made available to them when inspecting NHS organisations
- All providers of care should be expected to be in a position to provide quality assurance regardless of whether they are traditional NHS centres or independent providers

1. Introduction

In the 2015-2016 year, around 390,000 NHS cataract surgery procedures were undertaken in England and 16,000 in Wales, this being the most frequently performed surgical procedure in the UK. A widely accepted indicator of surgical quality is the frequency of rupture of the posterior capsule or the lens zonules with or without vitreous prolapse into the anterior chamber of the eye, abbreviated as PCR. This surgical event is emphasised in the NICE draft Cataract Surgery Guideline in the context of surgical risk and is similarly used as a clinical outcome (adverse event) by the International Consortium for Health Outcome Measurement www.ichom.org/medical-conditions/cataracts/. This operative complication arises on average in approximately one operation in 50 but the risk of this event varies by as much as 50-fold depending on preoperative risk factors associated with the patient and their eye. PCR is relevant as an adverse operative event because it results in a significantly higher risk of harm to the eye and may impact recovery of vision. For example, there is an approximately 40 fold higher risk of a retinal detachment occurring following cataract surgery if PCR occurred, and retinal surgery imposes additional risks, morbidity and cost. Importantly, when PCR occurs there is a six-fold higher chance of loss of vision from pre- to postoperatively in the eye undergoing surgery.

Some weeks following cataract surgery most patients attend their community optometrist (high-street optician) for updating of their glasses prescription and then only is the final 'best-corrected' visual acuity established. The results of this follow-up episode are currently inconsistently communicated back to the hospital to allow a definitive measure of visual acuity benefit from surgery. A web-based data return tool has been developed and offered as a free EMR software enhancement to centres to encourage and facilitate these data returns. Since VA Loss from surgery is the opposite of the intended effect, these key primary outcomes together capture relevant safety elements of surgical quality. VA Loss is emphasised in the NICE draft Cataract Surgery Guideline in the context of surgical risk.

Providing risk adjusted results for centres and surgeons will facilitate their ability to benchmark their own performance against that of their peers and act as a prompt to reviewing practice where outcomes are less good. Our past experience has indicated that showing individual surgeons their performance stimulates them to be more mindful of quality generally and to improve performance where needed. Since safety is a key domain for the NHS, embodied in the oft quoted phrase "do no harm", the audit is primarily focussed on these two chosen safety metrics. The audit tools we provide allow real time tracking of outcomes which empowers centres and surgeons to monitor their results and to detect adverse signals early with a view to minimising patient harm through prompt action. The contextual information presented provides centres and surgeons with secondary process outcomes in terms of access by centre, by deprivation and data completeness.

In this first prospective report of the National Ophthalmology Database Audit we will report the case complexity adjusted rates of PCR and monocular visual acuity (VA) loss for named centres (including all surgeons). On the RCOphth NOD website will be posted case complexity adjusted rates of PCR and VA Loss for participating centres and surgeons, and on the NHS choices website will be outcomes for named consultant surgeons for both PCR and VA Loss. Incomplete data will be highlighted and where <40% of outcome data are available for a particular centre (e.g. for VA Loss) the rate will not be reported as deemed too unreliable. Increasing participation is anticipated as the audit develops further and the data collection tools are 'rolled out' to all currently paper-based cataract surgical centres in England and Wales.

Five sources of data have been included in the prospective first year of the national cataract audit, 52 centres used the Medisoft EMR, one very large London eye hospital used the OpenEyes EMR and three centres used in-house data collection systems. The data for analysis were extracted in September/October

2016, with a further extraction of data from the Medisoft EMR and one in-house data collection system in January/February 2017 to address issues encountered in the Autumn 2016 data extractions. Case complexity adjustment for the reported period used risk adjustment models based on 287,000 cataract operations from 34 centres over a four-year time frame up to March 2015. Centres joining the audit towards the end of the data collection period would be expected to have reduced volumes of data. The date for the first submitted operation is included in the results to clarify which centres submitted data for less than the full one year period.

2. Audit Framework

The national cataract audit data in this report covers all adult phacoemulsification cataract surgical operations recorded on either the Medisoft EMR at 52 contributing centres, the OpenEyes EMR in use at Moorfields eye hospital (and a number of its satellite units) or in-house cataract data collection systems used in three of the contributing centres. For the PCR outcome the audit included all reported cataract operations performed in the period between 1st September 2015 and 31st August 2016. For the risk adjusted VA Loss outcome and postoperative complications and visual acuity results the reported period was between 1st September 2015 and 30th June 2016 in order to allow time for postoperative data to become available following recovery from surgery. Excluded were cataract operations which were not done by phacoemulsification, operations which were done as combined procedures along with another significant intra-ocular procedure (e.g. a trabeculectomy or a pars plana vitrectomy combined with other vitreoretinal procedures) and operations on individuals aged <18 years. Data on privately funded cataract surgery undertaken by participating surgeons in private hospitals were unavailable and are therefore not included in this report (see Appendix 3 for further details). Centres are identified by name.

3. Aims

The specific aims will be to report risk adjusted rates for two primary patient safety outcomes, PCR and VA Loss in cataract surgery. In this report prospectively collected data are used and applied to risk adjusted models developed from a four-year period of historical data from 34 centres. It is expected that data on PCR will have high levels of completeness for all participating centres as recording of the presence or absence of specified operative complications has always been mandatory in ophthalmology EMR systems but the preoperative risk indicator and follow up VA data are expected to be less complete.

The quality improvement aims of this report include

- Reporting of the intra-operative complication rates (risk adjusted), thus drawing attention to the need for careful risk profiling of cases in advance of surgery in order to minimise avoidable surgical complications
- Reporting the rates of VA Loss, thus drawing attention to potentially avoidable visual harm where rates are elevated

There will be a number of secondary aims developed throughout the life of the audit, in this annual report for example the contextual information includes access (preoperative VA) by centre and by deprivation.

4. NHS Trust / Health Board and Surgeon Participation

The audit brief is to include all NHS funded cataract surgery in England and Wales where Caldicott Guardians and Clinical Leads have given permission for extraction of their data. As part of the prospective audit the cataract module of an EMR has been made available to all currently paper-based, non-EMR enabled centres. In this report the majority of centres were in England with a single centre in Wales. This report includes currently EMR enabled centres and three centres using an in-house data collection system. Also available is a spreadsheet data entry option which has not to date been used to submit data (which would be inefficient as it would require duplicate data entry).

5. Methodology

5.1 Context of the data collection

The audit data derive from routine data collection in NHS hospital trust ophthalmology departments. Complications data depend on surgeons recording these faithfully, unlike mortality figures there is no external validation of the reported complications, although certain cross checks are possible within the extracted data. The EMR requires the surgeon recording the operation note to specifically indicate a Yes/No response to whether a surgical complication occurred and at all centres the EMR record (or its printed copy for the paper notes) constitutes the medico-legal document of the patient's operation record. Accurate follow up data on VA and refraction often depend on patients attending their optometrist for updating of spectacles following surgery and for this information to then be returned to the hospital electronic data collection system. Although some centres have good paper-based systems in place for optometrists to return this information and for staff at the hospital to enter the data electronically, it is anticipated that this outcome will be incomplete and the audit team have therefore taken steps to enhance returns from optometrists through encouraging proactive local engagement with community optometrists, an active programme of engagement with national optometric professional bodies, and provision of a web based data return tool for the National Ophthalmology Audit.

5.2 Limitations of the data

The RCOphth NOD includes data for cataract operations to the first treated eye, the second treated eye and in some cases simultaneous bilateral surgery, but for some patients the record for the first treated eye may be missing. This may arise for example if the first eye operation was performed prior to the centre adopting an electronic data collection system, or the first treated eye operation could have been performed in a different centre. At present the RCOphth NOD cannot link patients' data if collected at different centres; this will be possible if a section 251 exemption is granted, an information governance permission which would allow patient identifiable data to be used for purposes of linkage between care providers. Patient's age, and calculation of index of multiple deprivation (IMD) data¹⁰ rely on data entered directly onto the Hospital's Patient Administration System (PAS) which links into EMR systems, hence if this data is not recorded in the PAS it is not present in the data extract for EMR enabled centres with PAS connections. Centres opting for an EMR installation without a PAS connection would need to record this information along with the other audit data. IMD data was present for many operations recorded on the Medisoft EMR system, but not calculable for the other sources of data as the complete patient postcode would be needed to calculate the IMD data and The RCOphth NOD does not currently have permission to receive this. For future cycles of the national cataract audit the OpenEyes EMR will include IMD data calculated during extraction and transferred to the RCOphth NOD audit.

5.3 Case ascertainment

Exact estimation of the number of cataract operations submitted to the audit as a proportion of the number of cataract operations performed in each participating centre is not possible because:

1. Not all participating centres were collecting their cataract operations in an electronic format for the whole audit period.
2. The national cataract audit has exclusion criteria that would not be in place in other reported sources of the number of cataract operations performed in any centre i.e. surgery combined with another procedure.

Given the above limitations, estimates of the proportion of cataract operations performed in each participating centre that are included in the audit analysis are provided in Table 1. For centres joining the audit during the audit period, the NHS Digital data for the full audit period was adjusted by the proportion of time a centre had recorded data to provide a pro-rata estimate of the number of operations a centre could have recorded. From this adjusted number an estimate of case-ascertainment was calculated where the range in the percentage of eligible cases submitted to the audit was 7.7% to 99.9% and for 33 centres this estimate was >80%.

5.4 Data quality and completeness

Among the advantages of EMR data collection are compulsory collection of key data items (e.g. operative complications) and automatic range checking of variables (e.g. axial length) at the time of data entry improving data completeness and accuracy. In addition, the richness of EMR data provides a more complete picture of the patient and their state of health making it possible to infer important information through cross checking. (e.g. An undetected breach of the capsule may have occurred at the time of surgery which later became apparent at an outpatient visit. If vitreous was detected in the anterior chamber at the outpatient visit then it can be inferred that a complication must have occurred at the time of surgery and the operation can accordingly be correctly classified).

Completeness of preoperative VA and postoperative VA outcome remain variable and an area for improvement in many centres. The Audit tools include a web based data return tool for use by community optometrists which is intended to facilitate return of postoperative data. This works best when optometrists are commissioned to undertake postoperative follow up in the community as contracting can make payment contingent upon data having been received by the surgical centre.

5.5 Small numbers policy

Centres with <50 operations have not been included in this report and the COP report for individual surgeon results will likewise not report results for surgeons who have undertaken <50 procedures. (This is done for statistical reasons as the estimates would be unreliable and meaningless.) Issues related to reporting on small numbers are therefore not relevant to this audit.

5.6 Outliers policy

The audit outliers' policy has been developed directly from the HQIP outliers' policy and is available on the NOD Audit website at www.nodaudit.org.uk/resources/policies. An outlying centre or surgeon is identified where the risk adjusted adverse event rate (i.e. case complexity taken into account) is above the national threshold set by the mean rate plus three Standard Deviations (3SD). The method takes into account statistical uncertainty related to sample size and there is a one in 1,000 chance that a surgeon or centre would fall above this threshold purely due to 'bad luck'. Where initial analysis suggests a potential outlier may have been identified the centre or surgeon or both are notified and invited to check the accuracy and completeness of the data which has been received by the audit. Where corrections are relevant these are made prior to any results being released into the public domain.

6. Data Extraction, Cleaning and Statistical Methods

There are five sources of data included in the prospective first year of the national cataract audit, where 52 centres used the Medisoft EMR (Medisoft Ophthalmology, Medisoft Limited, Leeds, UK, (www.medisoft.co.uk/), one very large London eye hospital (and a number of its satellites) used the OpenEyes EMR (www.openeyes.org.uk/) and three centres used in-house data collection systems. The audit data extractions were performed in September/October 2016, with a further extraction in January/February 2017 of data from the Medisoft EMR and one in-house data collection system to address problems encountered in the Autumn 2016 data extractions. Late in the analysis it was discovered that data for one trust had become corrupted during the extraction period and these data were excluded from reporting.

All analysis was conducted using STATA version 14, (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP). Centre participation was affirmed by agreement from the Trust Caldicott Guardian and Clinical Lead for Ophthalmology.

Full details regarding eligibility and analysis criteria can be found on the NOD audit website following registration www.nodaudit.org.uk

7. Definitions

7.1 Dataset

A minimum cataract dataset has been defined for purposes of the audit www.nodaudit.org.uk. These variables include those required for case complexity adjustment of outcomes.

7.2 Surgeon grade

The grade of surgeon was categorised as consultant surgeons, career grade non-consultant surgeons (associate specialists, staff grade and trust doctors), experienced trainee surgeons (fellows, registrars, speciality registrars years 3 – 7 and specialty trainees years 3 – 7) and less experienced trainee surgeons (SHO, speciality registrars years 1 – 2, specialty trainees years 1 – 2 and foundation doctors years 1 – 2).

7.3 Posterior Capsular Rupture (PCR)

PCR included posterior capsule rupture or vitreous prolapse or both and was intended to capture significant breach of the lens-zonule barrier. Detailed criteria for case definitions are in Appendix 3.

7.4 Visual Acuity (VA)

VA definitions used were designed to maximise the usefulness of the available data with specified 'time windows' for pre- and postoperative measurements and criteria for preferred choices in terms of corrected VA, unaided VA and pin hole corrected VA. The detailed criteria are given in Appendix 3 along with interpretations for levels of VA.

7.5 Mixed effects modelling of PCR and visual loss

The categorisation of each covariate under investigation in the PCR and VA Loss mixed effects logistic regression models are detailed for registered users on The RCOphth NOD Audit website www.nodaudit.org.uk, with operations performed in the four-year period 2011-12 to 2014-15 NHS years used to develop the current models.

The risk adjustment model equations for PCR and Visual Acuity Loss respectively were applied to the audit data for the respective results in this report where the case mix adjusted graphs have 99.8% error lines displayed which are created from benchmark means of 2.0% for PCR and 1.5% for Visual Acuity Loss. The audit stipulates that at least 40% of operations with both pre- and postoperative VA data are required in order to report a result for VA Loss. On the centre level case mix adjusted funnel plots, data for all surgeons is included (i.e. including trainee surgeons).

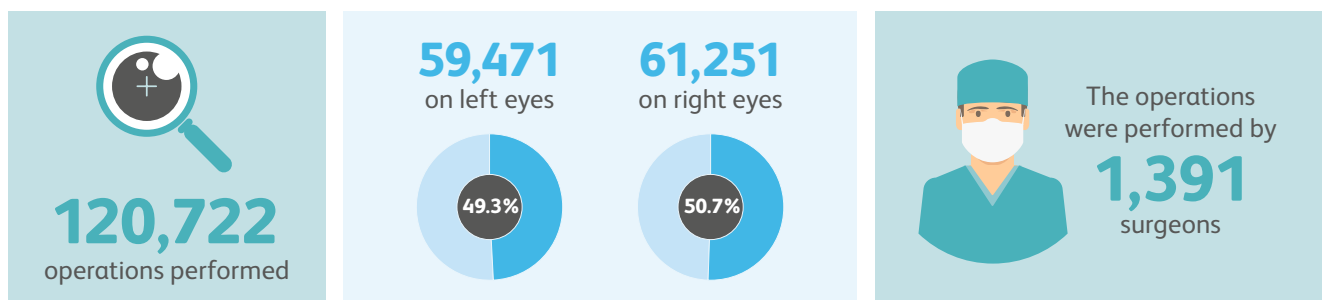
8. Results

8.1 Cataract procedures reported to the audit

In total 132,678 operations were submitted during the audit period (01 September 2015 to 31 August 2016), of these 11,956 (9.0%) operations are excluded from analysis; the reasons for exclusion were as follows:

- 183 operations were performed on patients <18 years old.
- 1,189 operations had no record of phacoemulsification \pm IOL.
- 6,667 operations had a non-cataract indication for surgery.
- 3,878 operations included ineligible combined operative procedures.
- Six operations were performed under general anaesthesia and also had examination under anaesthetic recorded.
- One operation had an operative note stating “Cataract surgery previously”
- 32 operations from four centres were excluded as these centres were recent joiners and had submitted <50 eligible operations (two further centres joined just after the audit time window had closed, therefore of the 62 centres from which data were extracted six centres were excluded).

This left 120,722 operations performed in 56 participating centres eligible for analysis. The operations were performed on 59,471 (49.3%) left eyes and 61,251 (50.7%) right eyes from 97,908 patients. These operations were performed by 1,391 surgeons where 85 surgeons had performed surgery at more than one grade. Whilst these are encouragingly large numbers of procedures, there remain many centres from which data for the current period are not available. As the audit becomes further established increasing uptake will provide a more comprehensive picture of the quality of surgery being undertaken on the NHS.



The number of surgeons and operations at each surgeon grade were:

- 660 consultant surgeons performed 74,228 (61.5%) operations.
- 167 career grade non-consultant surgeons performed 13,219 (10.9%) operations.
- 540 experienced trainee surgeons performed 28,927 (24.0%) operations.
- 109 less experienced trainee surgeons performed 4,348 (3.6%) operations.

The percentage of operations performed by each grade of surgeon within each centre varied reflecting catchment area, NHS trust differences and training opportunities for junior surgeons within England and Wales, Table 1 and Figure 1.

The median number of operations each surgeon had performed was 50 operations (range; 1 – 805), and 696 (49.6%) surgeons had performed >50 operations within the time window, Figure 2.

Of the 1,391 surgeons, 914 (65.7%) surgeons were male, 447 (32.1%) surgeons were female and the surgeon's gender was unknown for 30 (2.2%) surgeon's. 124 (8.8%) surgeons had data for operations performed in 2 participating centres, and 3 (0.4%) surgeons had data for operations performed in 3 participating centres.

Table 1: The number of eligible operations with the percentage performed by each grade of surgeon for the participating centre

Centre name	Centre number	Date of first cataract operation during the audit period	Number of eligible operations	Estimate of cases submitted to the audit (%)*	Number of surgeons	The percentage of operations performed by			
						Consultant surgeons	Career grade non-consultant surgeons	Experienced trainee surgeons	Less experienced trainee surgeons
Moorfields Eye Hospital NHS Foundation Trust (Open Eyes Centre)	1	01/09/2015	10,626	55.7	169	43.5	3.6	52.8	0.0
The Newcastle upon Tyne Hospitals NHS Foundation Trust	2	07/09/2015	7,560	96.7	62	68.1	9.5	19.4	3.0
Norfolk and Norwich University Hospitals NHS Foundation Trust	3	01/09/2015	4,639	96.9	31	63.7	19.1	12.7	4.5
Leeds Teaching Hospitals NHS Trust	4	01/09/2015	4,371	94.8	45	56.5	2.8	32.5	8.1
York Teaching Hospital NHS Foundation Trust (In-house database)	5	01/09/2015	4,212	89.0	29	82.0	0.0	14.7	3.3
Oxford University Hospitals NHS Foundation Trust	6	01/09/2015	4,182	97.4	44	13.5	28.2	58.1	0.2
University Hospitals Bristol NHS Foundation Trust	7	01/09/2015	4,154	96.2	49	54.4	0.0	45.6	0.0
Gloucestershire Hospitals NHS Foundation Trust	8	01/09/2015	4,085	98.9	37	51.0	24.3	21.8	2.9
Sheffield Teaching Hospitals NHS Foundation Trust	9	01/09/2015	3,829	76.9	37	78.4	3.0	10.3	8.3
Sandwell and West Birmingham Hospitals NHS Trust	10	01/09/2015	3,332	81.1	80	51.7	9.6	31.9	6.8
University Hospital Southampton NHS Foundation Trust	11	01/09/2015	3,128	All	47	63.8	0.1	34.0	2.1
Royal Berkshire NHS Foundation Trust	12	01/09/2015	3,109	59.8	31	57.5	1.9	35.8	4.9

*The estimate of the proportion of cases submitted to the audit is derived from the number of completed cataract operations supplied to NHS digital for the audit period. This estimation uses a pro-rata calculation for a centre's denominator where the proportion of time during the audit cycle that a centre had been recording cataract operations was multiplied by the number of cataract operations supplied to NHS digital. The numerator was the number of eligible operations a centre had in the audit analysis. Centre's that had more operations submitted to the national audit than in the NHS digital data were all assumed to have a complete submission rate (All) as the actual rate was not possible to estimate. **3 centres had no data in the NHS digital data.

Table 1 continued: The number of eligible operations with the percentage performed by each grade of surgeon for the participating centre

Centre name	Centre number	Date of first cataract operation during the audit period	Number of eligible operations	Estimate of cases submitted to the audit (%)*	Number of surgeons	The percentage of operations performed by			
						Consultant surgeons	Career grade non-consultant surgeons	Experienced trainee surgeons	Less experienced trainee surgeons
Calderdale and Huddersfield NHS Foundation Trust	13	01/09/2015	2,864	97.9	26	88.9	7.3	3.9	0.0
Mid Cheshire Hospitals NHS Foundation Trust	14	01/09/2015	2,637	97.2	22	47.1	34.8	13.7	4.5
The Mid Yorkshire Hospitals NHS Trust	15	02/09/2015	2,615	98.5	17	78.5	15.4	0.0	6.0
Cardiff & Vale University LHB	16	01/09/2015	2,414	NPE**	41	64.9	1.3	33.8	0.0
Epsom and St Helier University Hospitals NHS Trust	17	01/09/2015	2,406	100.0	22	76.5	0.0	14.2	9.3
Barts Health NHS Trust	18	01/09/2015	2,376	85.7	44	43.5	11.5	38.3	6.6
Frimley Health NHS Foundation Trust	19	01/09/2015	2,290	88.1	28	41.5	36.8	10.8	10.9
Bradford Teaching Hospitals NHS Foundation Trust	20	01/09/2015	2,268	96.4	34	78.0	0.0	19.0	3.0
Moorfields Eye Centre at Bedford Hospital NHS Trust	21	01/09/2015	2,257	All	15	76.8	18.7	4.5	0.0
Plymouth Hospitals NHS Trust	22	02/09/2015	2,223	82.3	24	39.8	31.6	26.9	1.7
University Hospitals Birmingham NHS Foundation Trust	23	01/09/2015	1,977	98.7	39	57.5	0.0	41.1	1.5
Hampshire Hospitals NHS Foundation Trust	24	01/09/2015	1,975	60.3	17	89.4	1.6	8.1	1.0
Royal Cornwall Hospitals NHS Trust	25	01/09/2015	1,969	96.0	20	68.9	22.9	6.9	1.3
Central Manchester University Hospitals NHS Foundation Trust	26	01/09/2015	1,952	46.0	46	48.3	9.4	39.7	2.7
King's College Hospital NHS Foundation Trust	27	01/09/2015	1,924	30.0	45	59.1	0.5	37.0	3.4
Shrewsbury and Telford Hospital NHS Trust	28	01/09/2015	1,920	100.0	22	85.3	6.0	3.3	5.4
Moorfields Eye Centre at Croydon Health Services NHS Trust	29	04/09/2015	1,824	NPE**	26	37.3	37.1	22.2	3.4
The Hillingdon Hospitals NHS Foundation Trust	30	01/09/2015	1,693	99.2	23	36.9	6.6	49.5	7.0

*The estimate of the proportion of cases submitted to the audit is derived from the number of completed cataract operations supplied to NHS digital for the audit period. This estimation uses a pro-rata calculation for a centre's denominator where the proportion of time during the audit cycle that a centre had been recording cataract operations was multiplied by the number of cataract operations supplied to NHS digital. The numerator was the number of eligible operations a centre had in the audit analysis. Centre's that had more operations submitted to the national audit than in the NHS digital data were all assumed to have a complete submission rate (All) as the actual rate was not possible to estimate. **3 centres had no data in the NHS digital data.

Table 1 continued: The number of eligible operations with the percentage performed by each grade of surgeon for the participating centre

Centre name	Centre number	Date of first cataract operation during the audit period	Number of eligible operations	Estimate of cases submitted to the audit (%)*	Number of surgeons	The percentage of operations performed by			
						Consultant surgeons	Career grade non-consultant surgeons	Experienced trainee surgeons	Less experienced trainee surgeons
Aintree University Hospital NHS Foundation Trust	31	01/09/2015	1,626	93.9	29	57.8	10.8	27.5	3.9
Royal United Hospitals Bath NHS Foundation Trust	32	01/09/2015	1,597	94.5	16	66.8	3.7	14.7	14.8
Chesterfield Royal Hospital NHS Foundation Trust	33	01/09/2015	1,472	98.6	13	100.0	0.0	0.0	0.0
Mid Essex Hospital Services NHS Trust	34	01/09/2015	1,462	93.5	16	76.9	7.9	13.4	1.7
Harrogate and District NHS Foundation Trust	35	02/09/2015	1,461	99.8	11	66.7	16.4	6.2	10.7
Hinchingbrooke Health Care NHS Trust	36	01/09/2015	1,458	98.1	9	87.2	0.0	12.8	0.0
Northern Devon Healthcare NHS Trust	37	01/09/2015	1,431	99.6	13	49.9	23.4	26.7	0.0
Peterborough and Stamford Hospitals NHS Foundation Trust	38	02/09/2015	1,402	99.6	14	65.9	21.7	6.5	5.9
Wirral University Teaching Hospital NHS Foundation Trust	39	01/09/2015	1,351	94.7	20	75.4	0.0	20.7	4.0
South Warwickshire NHS Foundation Trust	40	01/09/2015	1,286	99.0	8	71.7	28.3	0.0	0.0
Isle of Wight NHS Trust	41	01/09/2015	1,222	94.9	10	66.9	24.5	8.6	0.0
St Helens and Knowsley Teaching Hospitals NHS Trust	42	01/09/2015	1,135	61.9	13	83.9	11.0	5.1	0.0
Wrightington, Wigan and Leigh NHS Foundation Trust	43	29/10/2015	993	64.3	7	85.8	14.2	0.0	0.0
Warrington and Halton Hospitals NHS Foundation Trust	44	29/01/2016	855	64.0	14	75.2	1.4	3.9	19.5
South Tees Hospitals NHS Foundation Trust	45	18/09/2015	687	25.1	22	81.1	7.1	11.8	0.0
The Royal Bournemouth and Christchurch Hospitals NHS Foundation Trust	46	08/03/2016	574	32.7	15	75.8	24.2	0.0	0.0
Barking, Havering and Redbridge University Hospitals NHS Trust	47	03/09/2015	568	36.8	14	78.9	9.3	3.2	8.6
Royal Free London NHS Foundation Trust	48	09/02/2016	552	17.3	28	52.7	7.8	19.6	19.9

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Table 1 continued: The number of eligible operations with the percentage performed by each grade of surgeon for the participating centre

Centre name	Centre number	Date of first cataract operation during the audit period	Number of eligible operations	Estimate of cases submitted to the audit (%)*	Number of surgeons	The percentage of operations performed by			
						Consultant surgeons	Career grade non-consultant surgeons	Experienced trainee surgeons	Less experienced trainee surgeons
University Hospitals Coventry and Warwickshire NHS Trust	49	09/11/2015	551	25.4	22	43.9	42.5	4.7	8.9
Barnsley Hospital NHS Foundation Trust (In-house database)	50	24/03/2016	458	NPE**	5	76.9	23.1	0.0	0.0
Salisbury NHS Foundation Trust	51	13/01/2016	453	47.4	9	87.0	3.3	7.3	2.4
London North West Healthcare NHS Trust (In-house database)	52	02/09/2015	325	44.8	14	36.3	35.4	28.3	0.0
Blackpool Teaching Hospitals NHS Foundation Trust	53	01/09/2015	297	11.3	12	54.5	32.7	0.0	12.8
University Hospitals of Morecambe Bay NHS Foundation Trust	54	19/10/2015	288	11.1	7	88.9	11.1	0.0	0.0
Nottingham University Hospitals NHS Trust	55	02/09/2015	250	7.7	14	62.0	0.0	38.0	0.0
Yeovil District Hospital NHS Foundation Trust	56	18/04/2016	157	54.7	2	100.0	0.0	0.0	0.0

*The estimate of the proportion of cases submitted to the audit is derived from the number of completed cataract operations supplied to NHS digital for the audit period. This estimation uses a pro-rata calculation for a centre's denominator where the proportion of time during the audit cycle that a centre had been recording cataract operations was multiplied by the number of cataract operations supplied to NHS digital. The numerator was the number of eligible operations a centre had in the audit analysis. Centre's that had more operations submitted to the national audit than in the NHS digital data were all assumed to have a complete submission rate (All) as the actual rate was not possible to estimate. **3 centres had no data in the NHS digital data.

Figure 1: The number of eligible operations supplied to the national cataract audit by surgeon grade and participating centre (N= 120,722 operations from 56 centres)

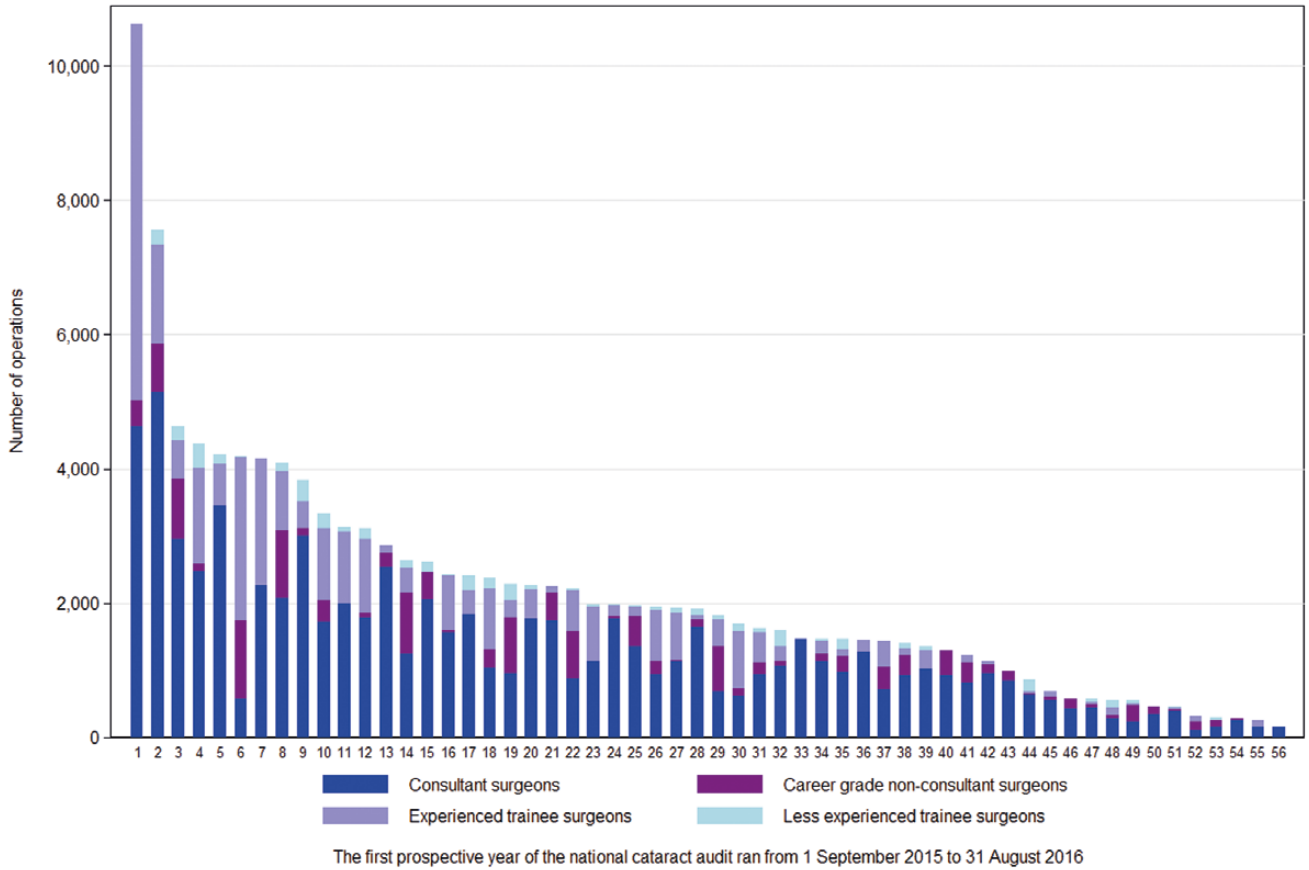
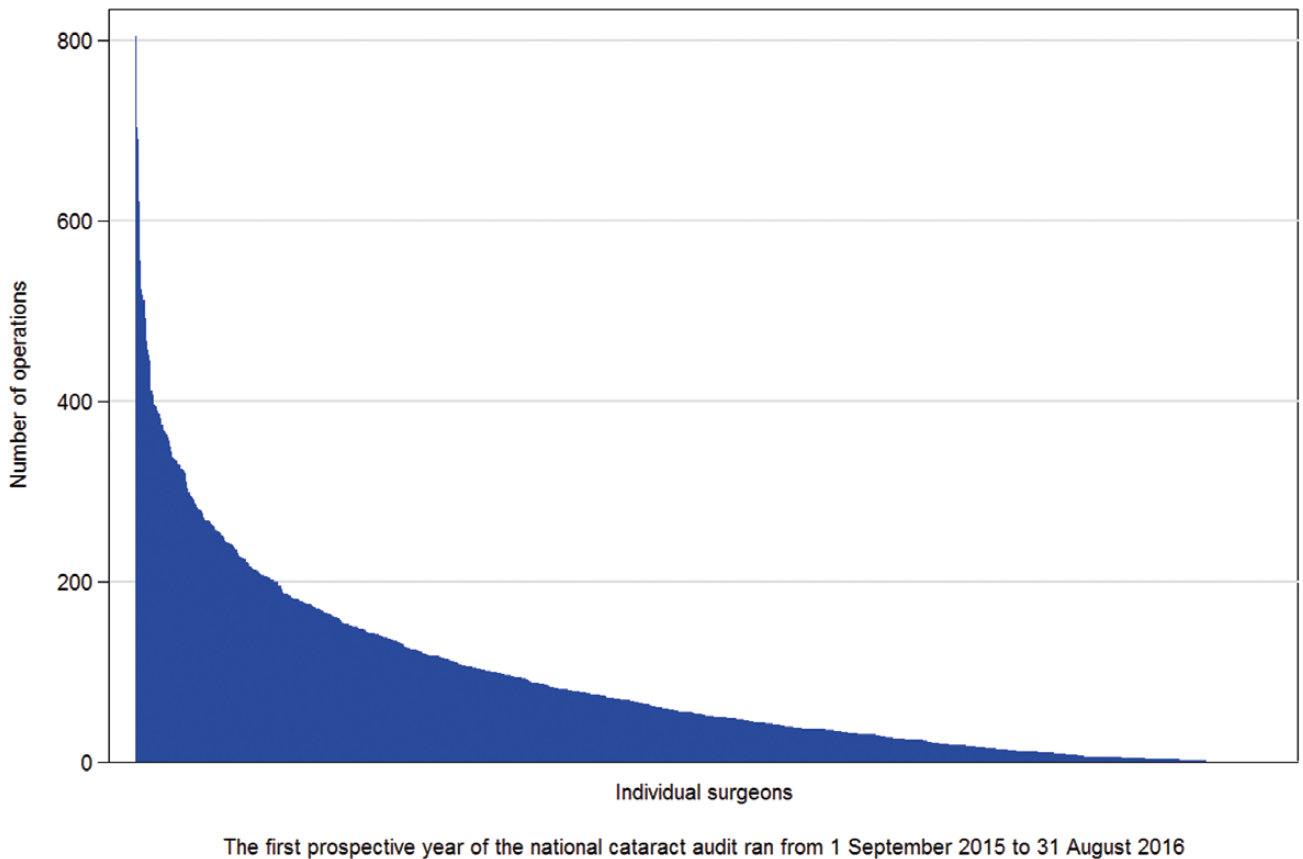


Figure 2: The number of eligible operations supplied to the national cataract audit for each individual surgeon. (N= 120,722 operations performed by 1,391 surgeons from 56 centres)



8.2 Patient characteristics – Age and Gender

Summary details of the 97,908 patients undergoing cataract surgery in the first year of the prospective audit were as follows:



- 97,908 patients with median age 76.6 years
- 41,830 (42.7%) patients were men with median age 76.1 years.
- 55,895 (57.1%) patients were women with median age 77.0 years.
- The gender was not recorded for 183 (0.2%) patients with median age 77.0 years.
- The ethnicity was not recorded for 45,158 (46.1%) patients.

8.3 First eye, second eye and simultaneous bilateral surgery

All cataract operations performed during the audit cycle would be in either the patient's first or second treated eye unless simultaneous bilateral surgery was performed. The RCOphth NOD Audit may not have the record for both operations or the first treated eye could have had the operation at another centre or prior to electronic data collection within the centre. For these reasons, no results on time between operations are provided in this report.

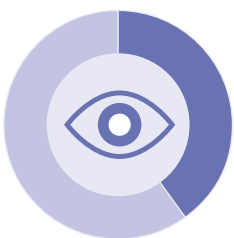
Results for first and second treated eye operations are reported for the 120,428 operations performed that were not simultaneous bilateral operations.

First treated eye cataract surgery;



- First eye cataract surgery was performed for 71,970 (59.8%) operations.
- The median age at first treated eye surgery was 76.1 years (range; 18.1 – 114.9).
- 19,935 (27.7%) patients were recorded as having diabetes mellitus at the time of their first cataract operation.
- 935 (1.3%) patients were recorded to be unable to lie flat.
- 833 (1.2%) patients were recorded to be unable to cooperate during the operation.

Second treated eye cataract surgery;



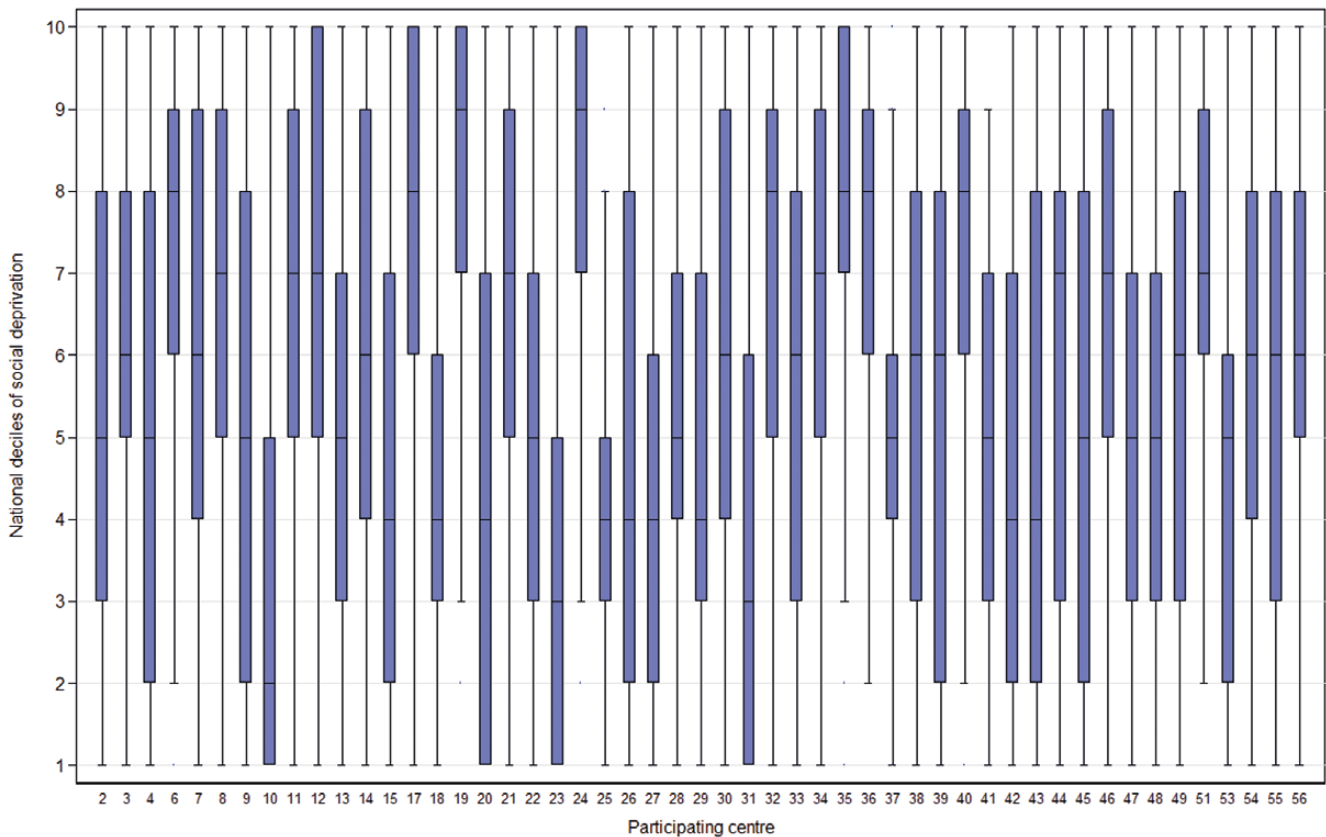
- Second eye cataract surgery was performed for 48,458 (40.2%) operations.
- The median age at second treated eye surgery was 77.2 years (range; 18.3 – 103.7).
- 13,968 (28.8%) patients were recorded as having diabetes mellitus at the time of their second treated eye surgery.
- 494 (1.0%) patients were recorded as being unable to lie flat.
- 431 (0.9%) patients were recorded as being unable to cooperate during the operation.

8.4 Index of multiple deprivation

The index of multiple deprivation (IMD) was calculated for 82,477 (96.7%) patients with cataract surgery data recorded on the Medisoft EMR. All but four centres performed cataract surgery on patients in the least deprived national decile of social deprivation (decile 1) and all but two centres performed cataract

surgery on patients in the most deprived national decile of social deprivation (decile 10). The median national decile of social deprivation for patients undergoing cataract surgery varied significantly between centres, confirming that there was variation between the participating centres in the social deprivation of patients undergoing cataract surgery during the first year of the prospective national cataract audit, Figure 3. The IMD was not calculable for operations from the OpenEyes EMR or the centres using the in-house data collection systems.

Figure 3: Box and whisker plots of the national deciles of social deprivation for patients undergoing cataract surgery during the audit period by participating centre. (N= 82,477 patients from 51 participating centres)



The first prospective year of the national cataract audit ran from 1 September 2015 to 31 August 2016

8.5 Preoperative Visual Acuity (VA)

A preoperative visual acuity was recorded for 97,196 (80.5%) eyes and missing for 23,526 (19.5%) eyes, of which 1,182 (1.0% of operations) had a Pin Hole Visual Acuity (PHVA) measured but no Corrected Distance Visual Acuity (CDVA) or Uncorrected Distance Visual Acuity (UDVA) measurement.

There was wide variation in the percentage of eyes with missing preoperative VA by contributing centre, Figure 4.

For the 97,196 eyes with a preoperative VA measurement, the measurement was CDVA in 67,911 (69.9%) eyes, UDVA in 27,832 (28.6%) eyes and in 1,453 (1.5%) eyes the CDVA measurement was the same as the UDVA measurement.

The median preoperative VA was 0.50 LogMAR units (range; -0.30 – NPL) (6/19 Snellen Equivalent); where 3,472 (3.6%) eyes were CF, 1,888 (1.9%) eyes were HM, 465 (0.5%) eyes were PL and 37 (<0.1%) eyes were NPL.

The preoperative VA was 0.30 LogMAR units (6/12) or better for 31,783 (32.7%) eyes, 0.60 LogMAR units (6/24) or better for 67,426 (69.4%) eyes and 1.0 LogMAR units (6/60) or better for 86,379 (88.9%) eyes.


The median preoperative VA was 0.50 LogMAR units for each grade of surgeon.

There was variability in the preoperative VA between contributing centres, although for the majority of centres the median preoperative VA was approximately 0.50 LogMAR units, Figure 5.

Access to surgery, judged by preoperative VA was uniform regardless of IMD national decile, Figure 6. Preoperative VA is used as a proxy metric for access because where access to surgery is significantly limited the average preoperative VA would be expected to be worse and vice versa.

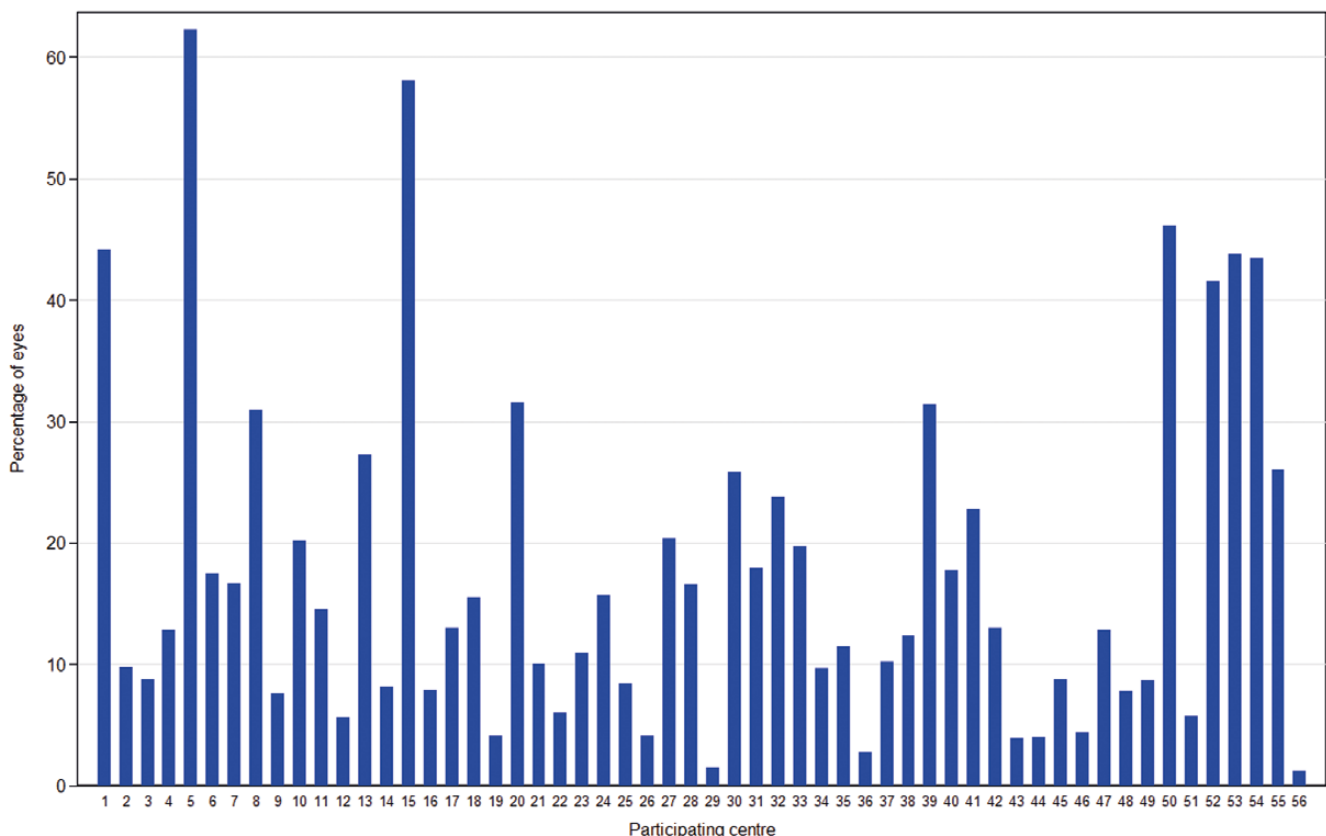
For 15,703 patients who had both eyes undergo cataract surgery during the audit period and had a preoperative VA measurement for both eyes (excluding simultaneous bilateral surgery), the mean presenting VA was worse for the first treated eye than for the second treated eye (means = 0.60 (6/24) and 0.50 LogMAR (6/19) respectively, $p < 0.001$).

147
patients had simultaneous
bilateral cataract surgery



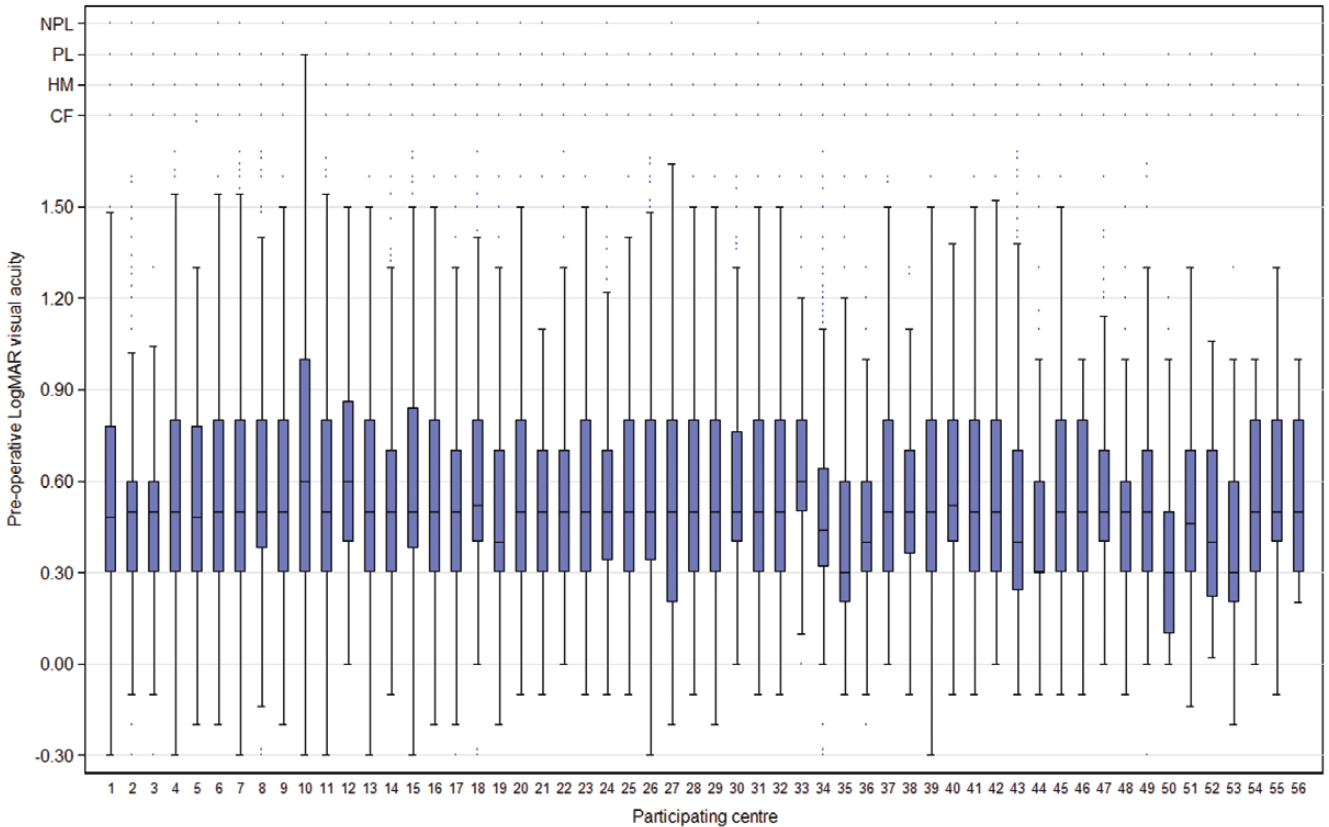
Of the 147 patients who had simultaneous bilateral surgery, 107 (72.8%) had presenting VA data for both eyes where the median difference in the VA between the right and left eyes was 0.00 LogMAR units and the inter quartile range was -0.10 – +0.10 LogMAR units.

Figure 4: The percentage of cataract operations supplied to the audit with a missing preoperative VA by participating centre. (N= 120,722 operations from 56 participating centres)



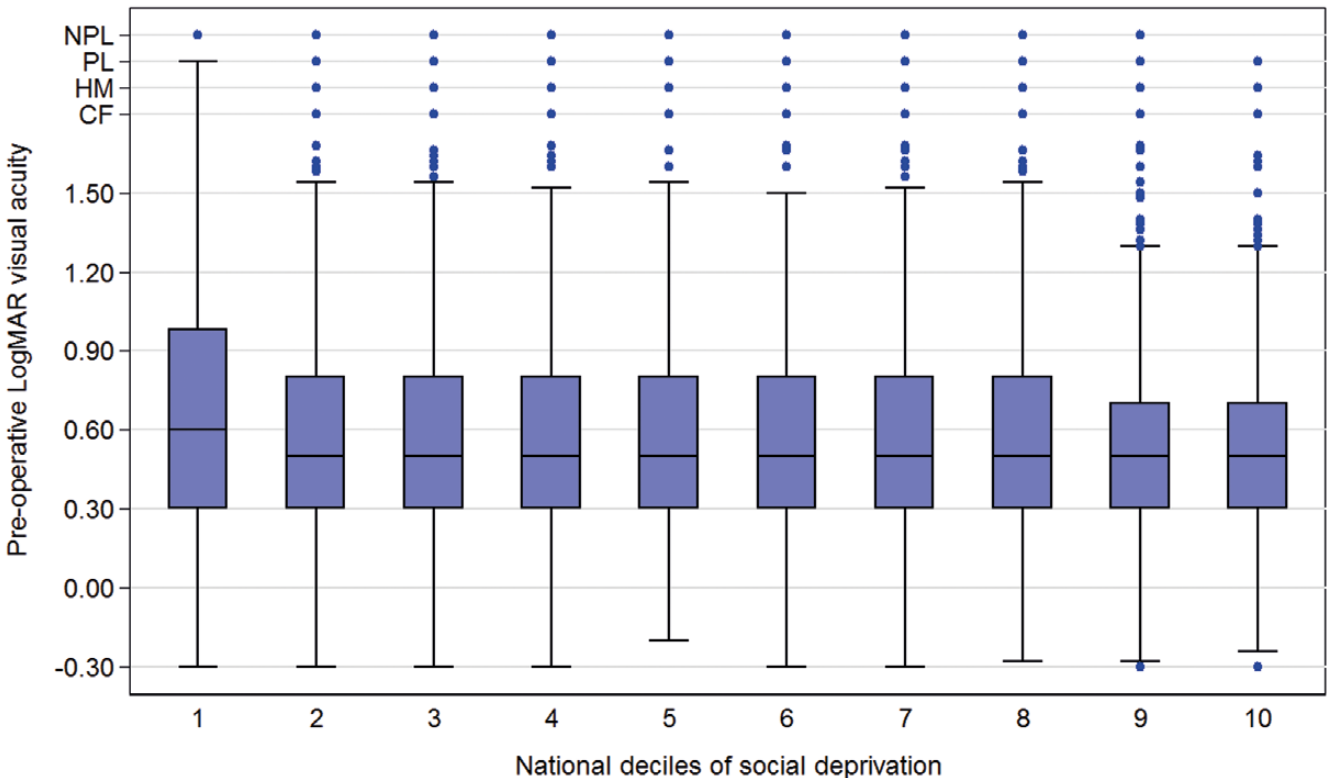
The first prospective year of the national cataract audit ran from 1 September 2015 to 31 August 2016

Figure 5: Box and whisker plots of preoperative LogMAR VA for eligible cataract operations supplied to the national cataract audit by participating centre (N=97,196 operations from 56 participating centres)



The first prospective year of the national cataract audit ran from 1 September 2015 to 31 August 2016

Figure 6: Box and whisker plots of preoperative VA by national deciles of social deprivation for patients undergoing cataract surgery (N= 72,031 patients from 51 participating centres)



The first prospective year of the national cataract audit ran from 1 September 2015 to 31 August 2016

8.6 Ocular co-pathology

The presence or absence of ocular co-pathology was recorded for 100% of operated eyes and was recorded as absent for 64,349 (53.3%) eyes, at least one ocular co-pathology was recorded for 56,373 (46.7%) eyes. The percentage of eyes reported to have an ocular co-pathology varied between participating centres, ranging from 14% to 96% and 10 centres had >50% of operated eyes with an ocular co-pathology, Figure 7.

The centre with 96% of eyes with an ocular co-pathology utilises SNOMED-CT diagnosis coding which is more granular and hierarchical than The RCOphth NOD coding for ocular co-pathology. The RCOphth NOD is in communication with this centre with the aim of better matching the ocular co-pathology coding to SNOMED-CT diagnosis coding in future data extractions.

The most commonly recorded ocular co-pathologies were ‘unspecified other’, age related macular degeneration, glaucoma and diabetic retinopathy which were recorded for 12.0%, 9.4%, 9.0% and 6.0% of operations respectively, Figure 8.

A higher proportion of operations were performed by consultant surgeons for each individual ocular co-pathology, except for ‘unspecified other’ where a high proportion of these operations were performed by experienced trainee surgeons, although this result is heavily influenced by the centre with 96% of operations with ‘unspecified other’ as this centre also had a higher proportion of operations performed by experienced trainee surgeons, Figure 9.

For the prospective data collection changes to the recording of ocular co-pathology were implemented, details about the impact of the changes on the ocular co-pathology results can be found in appendix 4.

Figure 7: The percentage of cataract operations supplied to the audit with an ocular co-pathology by participating centre. (N= 120,722 operations from 56 participating centres)

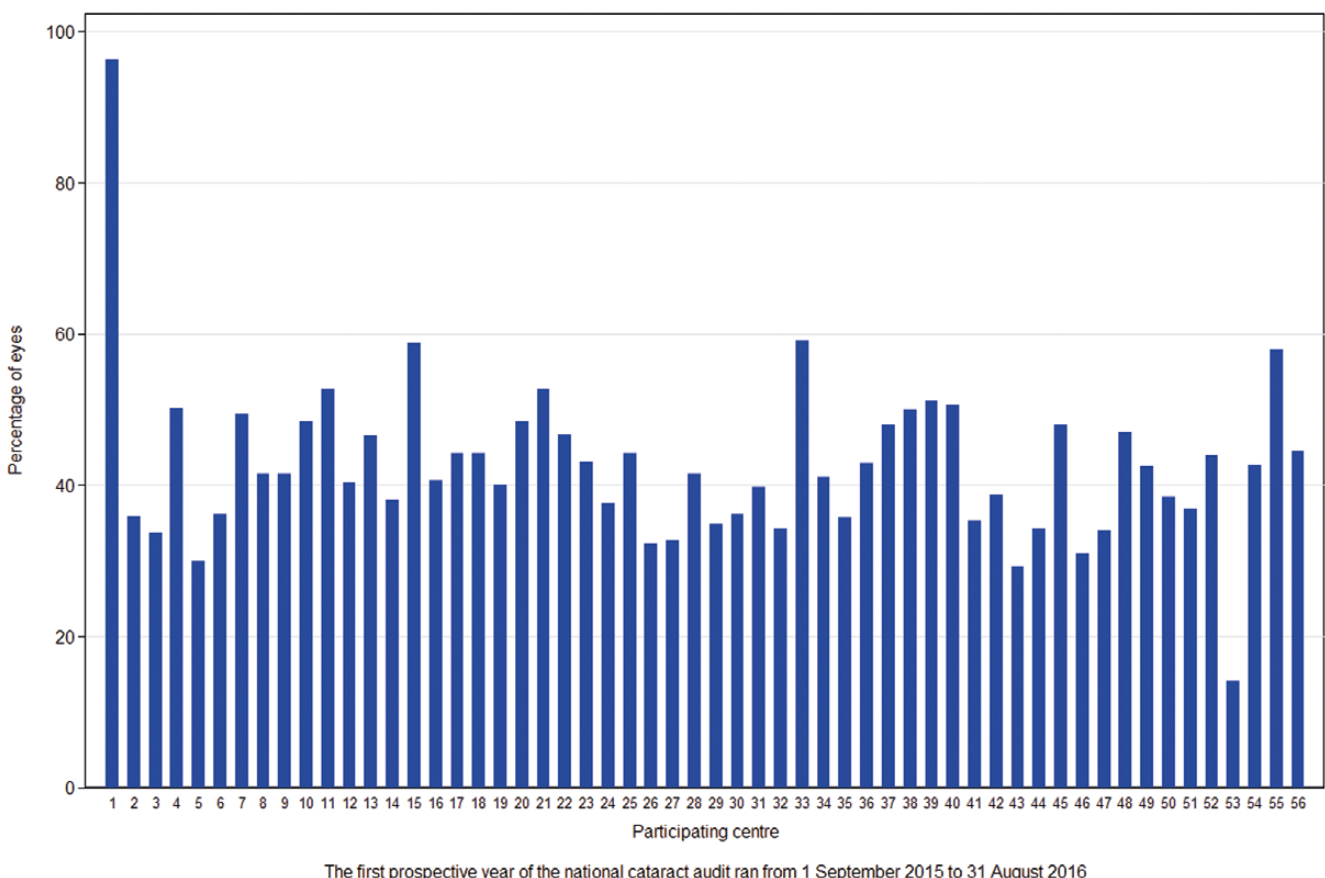
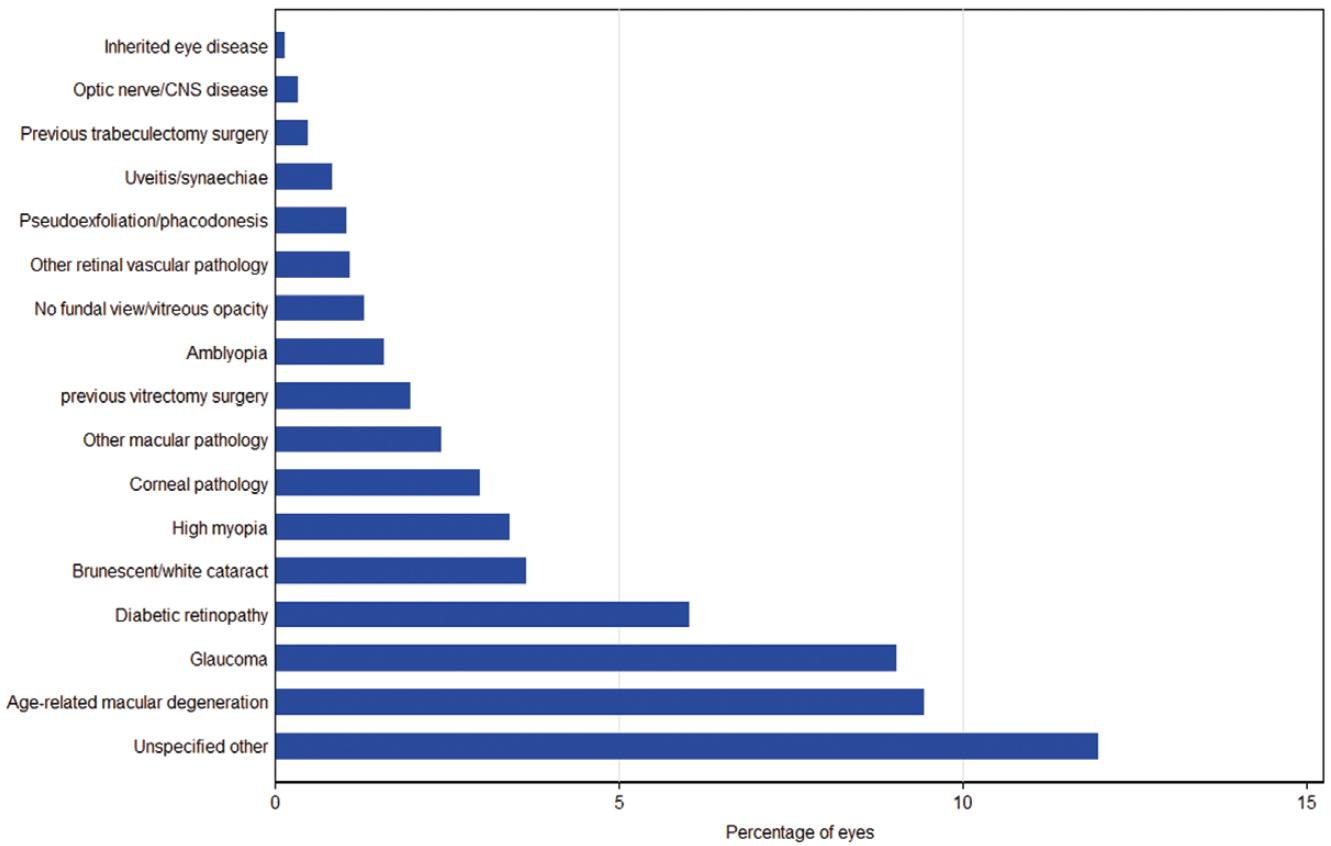
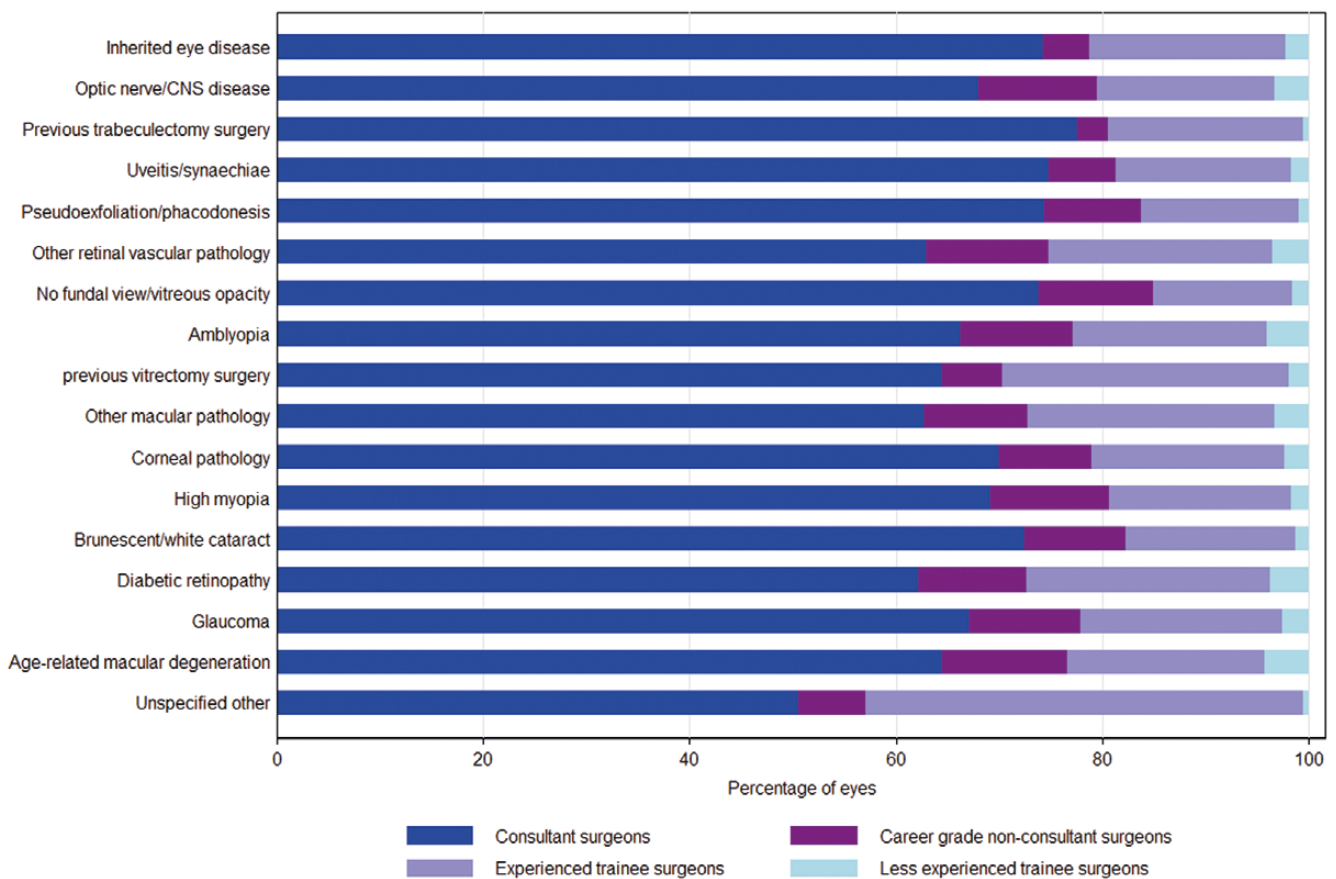


Figure 8: The percentage of cataract operations supplied to the audit with each individual ocular co-pathology. (N= 120,722 operations from 56 participating centres)



The first prospective year of the national cataract audit ran from 1 September 2015 to 31 August 2016

Figure 9: The percentage of cataract operations supplied to the audit for each individual ocular co-pathology by grade of surgeon.



The first prospective year of the national cataract audit ran from 1 September 2015 to 31 August 2016

8.7 Operation characteristics

Phacoemulsification ± IOL was performed in all eligible cataract operations and for 116,612 (96.6%) operations was the only operative procedure performed. Phacoemulsification ± IOL was combined with one other procedure in 3,771 (3.1%) operations, with ≥2 other procedures in 339 (0.3%) operations.

The most frequently performed operative procedures that were combined with phacoemulsification ± IOL were anterior vitrectomy and limbal relaxing incisions / Opposite Clear Corneal Incision (OCCI), which were performed in 0.8% and 0.5% of operations respectively. A full list of operative procedures combined with phacoemulsification ± IOL can be found in Appendix 5.

8.8 Operative complications

One or more intra-operative complication was recorded for 3,924 (3.3%) operations, with the most frequently recorded being PCR which was reported for 1,821 (1.5%) operations. The ‘any’ intra-operative complication rates were higher for the less experienced grade of surgeons, while the rates for individual intra-operative complications were similar across the grades of surgeon except for PCR which was higher for the less experienced grades, Table 2.

Table 2: Recorded Intra-operative complications for cataract operations for the first year of the national audit by grade of surgeon

Intra-operative complications n (column %)	Consultant surgeons (N = 74,228)	Career grade non-consultant surgeons (N = 13,219)	Experienced trainee surgeons (N = 28,927)	Less experienced trainee surgeons (N = 4,348)	Total (N = 120,722)
Eyes with no complications	72,194 (97.3)	12,828 (97.0)	27,665 (95.6)	4,111 (94.5)	116,798 (96.7)
Eyes with ≥1 complication	2,034 (2.7)	391 (3.0)	1,262 (4.4)	237 (5.5)	3,924 (3.3)
Recorded intra-operative complications*					
Posterior capsular rupture	900 (1.2)	170 (1.3)	634 (2.2)	117 (2.7)	1,821 (1.5)
Zonule rupture – no vitreous loss	275 (0.4)	31 (0.2)	142 (0.5)	13 (0.3)	461 (0.4)
Corneal epithelial abrasion	203 (0.3)	58 (0.4)	83 (0.3)	29 (0.7)	373 (0.3)
Torn iris / damage from the phaco	138 (0.2)	24 (0.2)	74 (0.3)	17 (0.4)	253 (0.2)
Lens exchange required / other IOL problems	78 (0.1)	9 (<0.1)	41 (0.1)	17 (0.4)	145 (0.1)
Endothelial damage / Descemet's tear	70 (0.1)	18 (0.1)	43 (0.1)	13 (0.3)	144 (0.1)
Anterior capsular tear	45 (<0.1)	3 (<0.1)	86 (0.3)	0 (0.0)	134 (0.1)
Corneal oedema	74 (0.1)	13 (0.1)	30 (0.1)	7 (0.2)	124 (0.1)
Iris trauma	22 (<0.1)	9 (<0.1)	38 (0.1)	1 (<0.1)	70 (<0.1)
Hyphaema	34 (<0.1)	5 (<0.1)	17 (<0.1)	4 (0.1)	60 (<0.1)
Iris prolapse	22 (<0.1)	3 (<0.1)	32 (0.1)	1 (<0.1)	58 (<0.1)
Phaco burn / wound problems	20 (<0.1)	4 (<0.1)	21 (<0.1)	3 (<0.1)	48 (<0.1)
Choroidal / suprachoroidal haemorrhage	32 (<0.1)	4 (<0.1)	7 (<0.1)	0 (0.0)	43 (<0.1)
Unspecified other**	279 (0.4)	65 (0.5)	121 (0.4)	33 (0.8)	498 (0.4)

*Each operation can have more than one intra-operative complication recorded.

**The unspecified other included one vitreous haemorrhages and nine instances when the operation was cancelled.

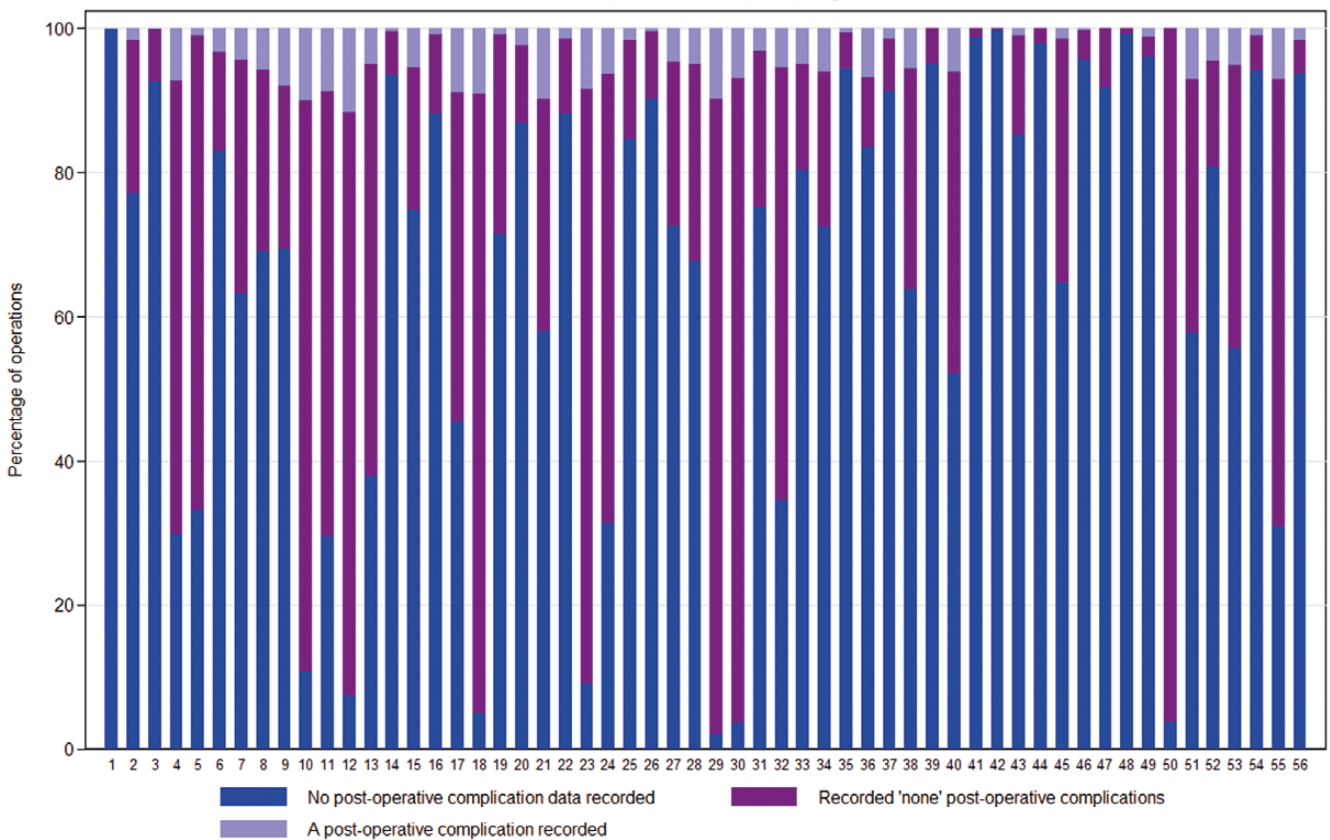
8.9 Postoperative complications

Of the 120,722 eligible cataract operations submitted to the audit, 99,087 (82.1%) operations were performed before 30th June 2016 and had the potential for two months follow up. Of these 63,806 (64.4%) operations had no postoperative complication data recorded, 31,246 (31.5%) had 'none' recorded as the postoperative complication and 4,035 (4.1%) had at least one postoperative complication recorded.

The percentage of operations with a postoperative complication record (none or a complication) or no postoperative complication record varied significantly between the participating centres, with seven centres having no records of any specific postoperative complications, Figure 10.

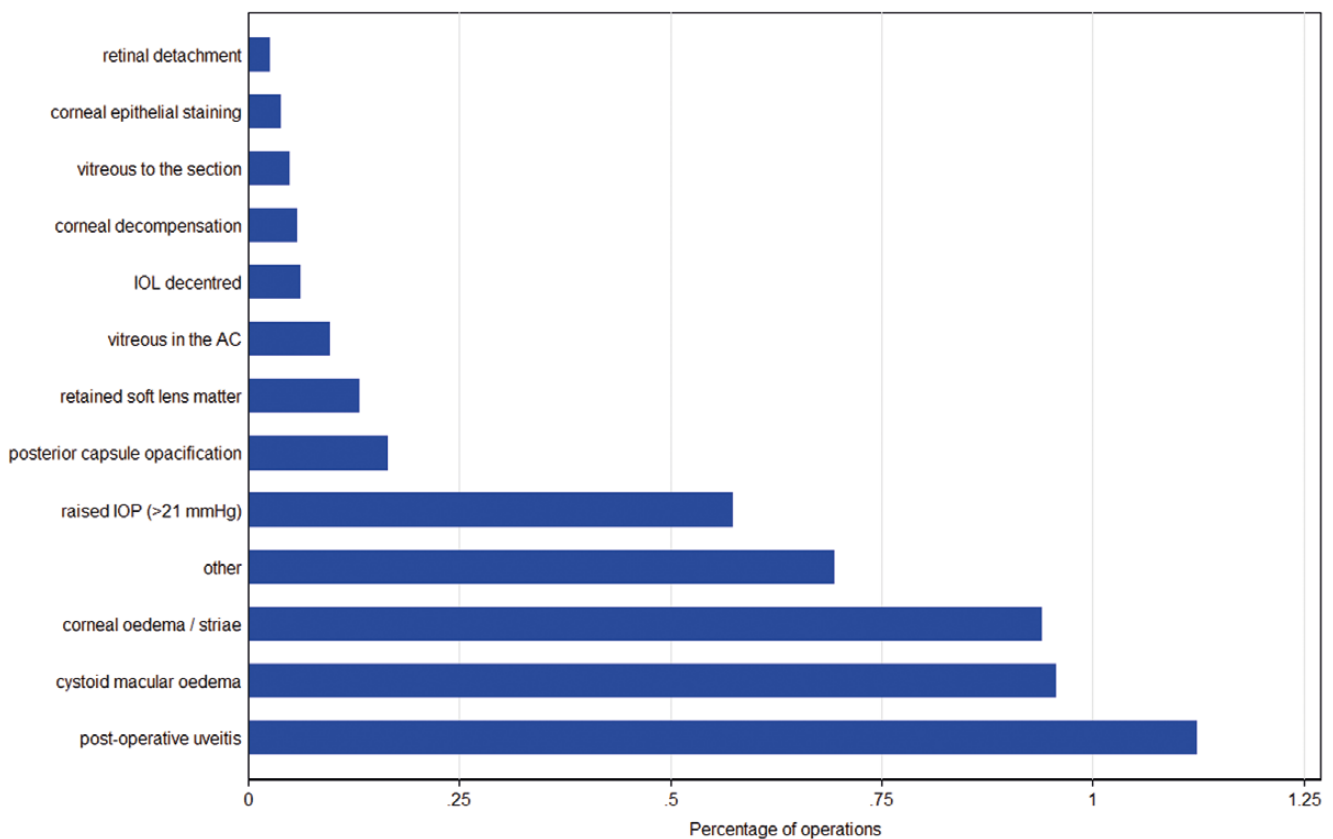
The most frequently recorded postoperative complication was postoperative uveitis which was the only individual postoperative complication recorded for >1.0% of operations, Figure 11.

Figure 10: The percentage of eligible cataract operations supplied to the audit by postoperative complication status and participating centre. (N= 99,087 operations from 56 participating centres)



The first prospective year of the national cataract audit ran from 1 September 2015 to 31 August 2016

Figure 11: The percentage of eligible cataract operations supplied to the audit with each individual postoperative complication. (N= 99,087 operations from 56 participating centres)



The first prospective year of the national cataract audit ran from 1 September 2015 to 31 August 2016

8.10 Postoperative visual acuity

Of the 120,722 eligible cataract operations submitted to the audit, 99,087 (82.1%) operations were performed before 30th June 2016 and had the potential for two months follow up. Of these a postoperative visual acuity was recorded for 66,769 (67.4%) eyes and missing for 32,318 (32.6%) eyes.

There was wide variation in the percentage of eyes with missing postoperative VA by contributing centre, Figure 12, although influencing this result are operations performed in the latter part of the audit period where follow up times may have been too brief for all post op results to be available.

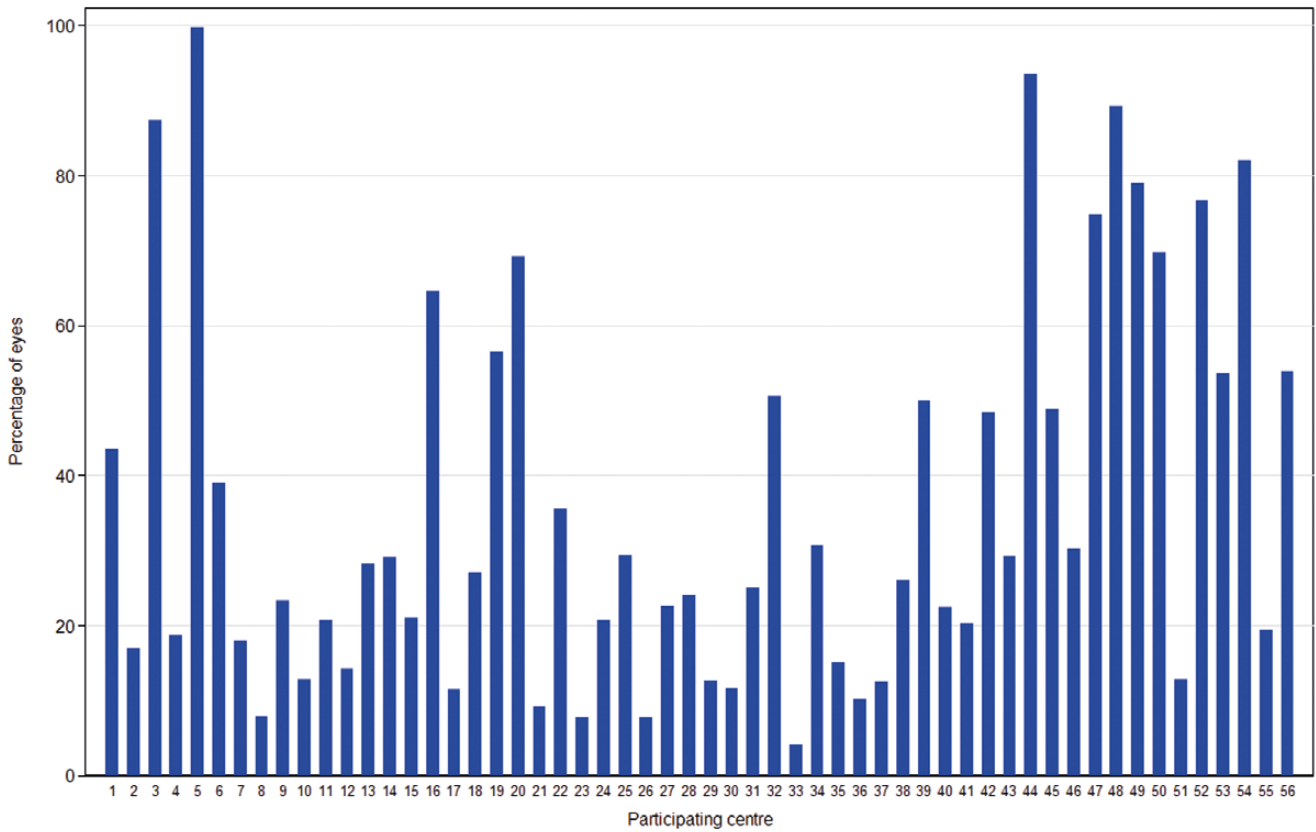
For the 66,769 eyes with a postoperative VA measurement, the best measurement was CDVA in 21,752 (32.6%) eyes, UDVA in 18,978 (28.4%) eyes, PHVA in 14,338 (21.5%) eyes; the best measurement was the same for two of the assessment methods for 10,768 (16.1%) eyes and the same for all three methods in 933 (1.4%) eyes.

The median postoperative VA was 0.10 LogMAR units (range; -0.30 – NPL) (6/7.5 Snellen equivalent); where 217 (0.3%) eyes were CF, 136 (0.2%) eyes were HM, 35 (<0.1%) eyes were PL and 13 (<0.1%) eyes were NPL.

The postoperative VA was 0.30 LogMAR units (6/12) or better for 59,047 (88.4%) eyes, 0.60 LogMAR units (6/24) or better for 64,007 (95.9%) eyes and 1.0 LogMAR units (6/60) or better for 65,773 (98.5%) eyes.

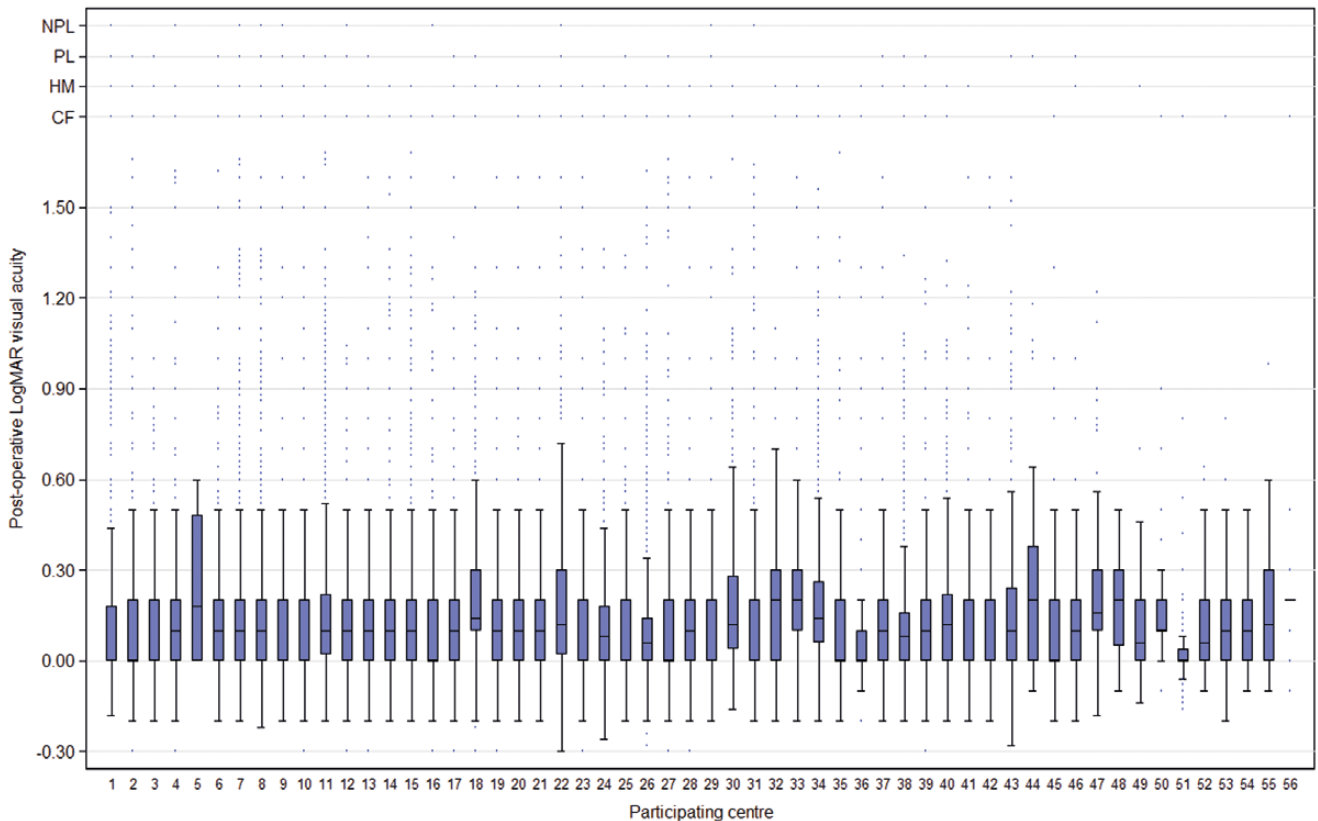
The postoperative VA was fairly stable across participating centres, Figure 13.

Figure 12: The percentage of eligible cataract operations supplied to the audit with a missing postoperative VA by participating centre. (N= 99,087 operations from 56 participating centres)



The first prospective year of the national cataract audit ran from 1 September 2015 to 31 August 2016

Figure 13: Box and whisker plots of postoperative VA by participating centre. Postoperative LogMAR VA for eligible cataract operations supplied to the audit by participating centre (N= 66,769 operations from 56 participating centres)



The first prospective year of the national cataract audit ran from 1 September 2015 to 31 August 2016

8.11 Change in visual acuity

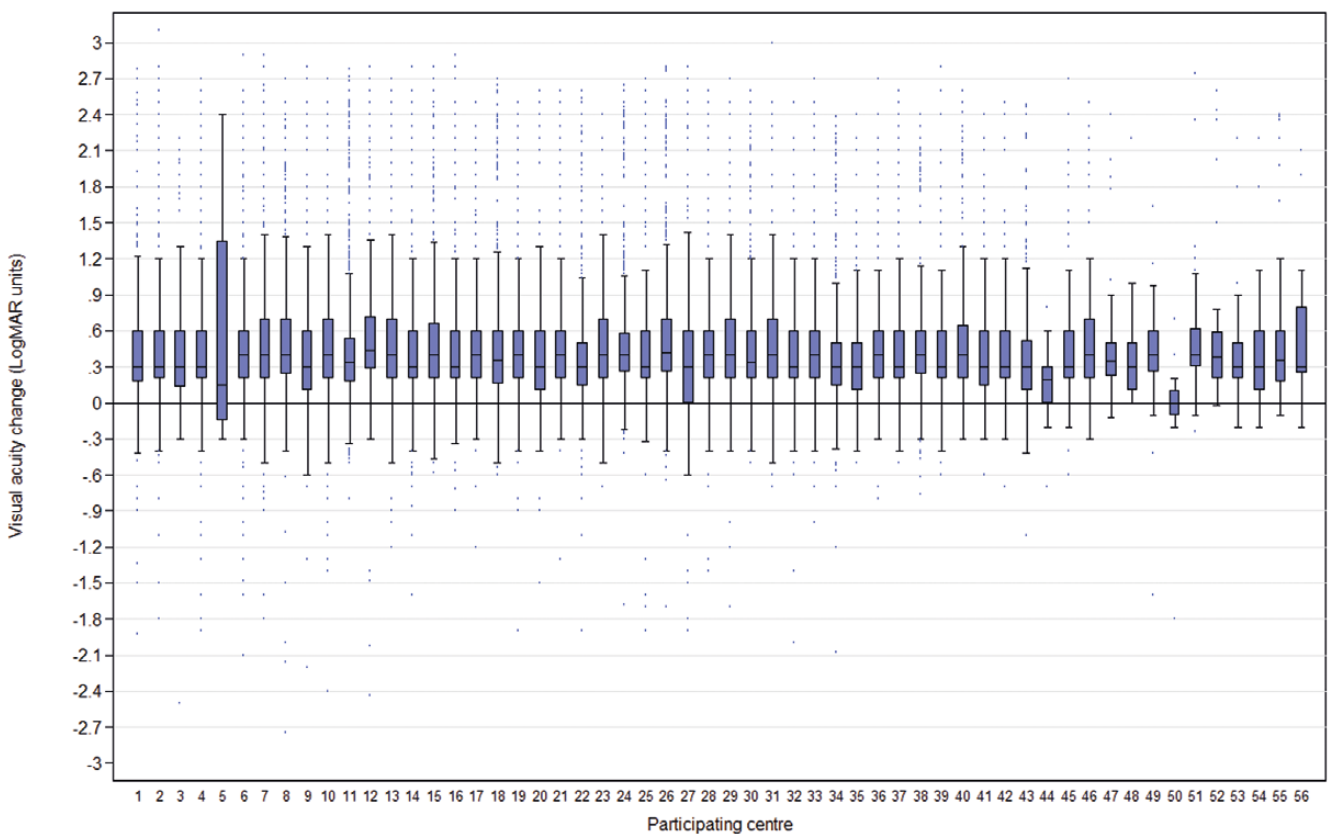
Of the 99,087 eligible cataract operations submitted to the audit performed before 30th June 2016, 56,588 (57.1%) eyes had both a preoperative VA and a postoperative VA measurement. The median change in VA from baseline was a 0.38 LogMAR gain (IQR; 0.20 – 0.60 gain). The change in VA was fairly stable between the participating centres, Figure 14.

74% of eyes with a presenting VA of 0.00 LogMAR or better had a postoperative VA of 0.00 LogMAR or better and 97% of eyes with a presenting VA of 0.30 LogMAR or better had a postoperative VA of 0.30 LogMAR or better.

Eyes that had an ocular co-pathology or experienced an intra-operative complication or PCR during surgery had worse postoperative VA than eyes that did not have any of these problems. >88% of eyes without these problems had a postoperative VA of 0.30 LogMAR (6/12 Snellen) or better, Table 3.

The percentage of operations from each participating centre with preoperative VA, postoperative VA and both pre- and postoperative VA data varied between participating centres, Table 4.

Figure 14: Box and whisker plots of change in VA by participating centre. VA change from baseline for eligible cataract operations supplied to the audit by participating centre (N= 56,588 from 56 participating centres)



The first prospective year of the national cataract audit ran from 1 September 2015 to 31 August 2016; Below the horizontal line is VA loss and above the line VA gain

Table 3: Postoperative VA by preoperative VA, ocular co-pathology and intra-operative complications.

	Post-operative LogMAR visual acuity				
Percentages are row % (Approximate Snellen)	≤0.00 (6/6 or better)	≤0.18 (6/9 or better)	≤0.30 (6/12 or better)	≤0.60 (6/24 or better)	≤1.00 (6/60 or better)
All eyes (N = 56,588)	39.0	59.0	88.6	95.9	98.5
Presenting LogMAR VA (Snellen)					
≤0.00 (N = 1,068)	74.3	84.6	98.6	99.6	99.9
≤0.18 (N = 2,486)	62.6	85.5	97.9	99.6	99.9
≤0.30 (N = 17,870)	49.6	69.2	96.7	99.5	99.9
≤0.60 (N = 38,886)	41.9	63.0	93.4	99.1	99.9
≤1.00 (N = 50,283)	40.2	60.8	90.8	97.7	99.6
Ocular co-pathology					
No (N = 30,296)	45.9	65.4	94.8	98.9	99.7
Yes (N = 26,292)	31.0	51.6	81.4	92.3	97.1
Intra-operative complications					
No (N = 54,880)	39.4	59.5	88.9	96.1	98.6
Yes (N = 1,708)	25.2	43.5	76.9	89.3	95.5
PCR					
No (N = 55,791)	39.2	59.3	88.8	96.0	98.6
Yes (N = 797)	19.9	37.8	70.9	84.2	92.3

Table 4: The percentage of eyes with preoperative VA, postoperative VA and change in VA data for participating centres in the audit.

Centre name	Centre number	Number of operations	% with preoperative VA data	Number of operations eligible for postoperative VA results	% with postoperative VA data	% with change in VA data
Moorfields Eye Hospital NHS Foundation Trust (Open Eyes Centre)	1	10,626	55.87	8,713	56.51	45.33
The Newcastle upon Tyne Hospitals NHS Foundation Trust	2	7,560	90.25	6,136	82.97	75.70
Norfolk and Norwich University Hospitals NHS Foundation Trust	3	4,639	91.21	3,786	12.60	11.52
Leeds Teaching Hospitals NHS Trust	4	4,371	87.19	3,582	81.24	72.19
York Teaching Hospital NHS Foundation Trust (In-house database)	5	4,212	37.77	3,630	0.19	0.11
Oxford University Hospitals NHS Foundation Trust	6	4,182	82.47	3,507	60.99	51.98
University Hospitals Bristol NHS Foundation Trust	7	4,154	83.32	3,471	81.96	70.61
Gloucestershire Hospitals NHS Foundation Trust	8	4,085	69.08	3,415	92.12	63.48
Sheffield Teaching Hospitals NHS Foundation Trust	9	3,829	92.37	3,439	76.59	70.92
Sandwell and West Birmingham Hospitals NHS Trust	10	3,332	79.83	2,848	87.18	69.91
University Hospital Southampton NHS Foundation Trust	11	3,128	85.49	2,563	79.24	67.19
Royal Berkshire NHS Foundation Trust	12	3,109	94.40	2,559	85.81	80.70
Calderdale and Huddersfield NHS Foundation Trust	13	2,864	72.73	2,299	71.77	53.41
Mid Cheshire Hospitals NHS Foundation Trust	14	2,637	91.81	2,209	70.85	64.78
The Mid Yorkshire Hospitals NHS Trust	15	2,615	41.91	2,217	78.98	33.51
Cardiff & Vale University LHB	16	2,414	92.13	2,014	35.40	31.73
Epsom and St Helier University Hospitals NHS Trust	17	2,406	87.03	2,065	88.43	77.24

Table 4 continued: The percentage of eyes with preoperative VA, postoperative VA and change in VA data for participating centres in the audit.

Centre name	Centre number	Number of operations	% with preoperative VA data	Number of operations eligible for postoperative VA results	% with postoperative VA data	% with change in VA data
Barts Health NHS Trust	18	2,376	84.47	1,965	72.88	60.97
Frimley Health NHS Foundation Trust	19	2,290	95.85	1,875	43.47	42.19
Bradford Teaching Hospitals NHS Foundation Trust	20	2,268	68.39	1,907	30.83	21.97
Moorfields Eye Centre at Bedford Hospital NHS Trust	21	2,257	89.94	1,877	90.84	81.14
Plymouth Hospitals NHS Trust	22	2,223	93.97	1,866	64.42	61.84
University Hospitals Birmingham NHS Foundation Trust	23	1,977	89.02	1,629	92.27	82.07
Hampshire Hospitals NHS Foundation Trust	24	1,975	84.30	1,632	79.29	65.50
Royal Cornwall Hospitals NHS Trust	25	1,969	91.62	1,629	70.60	65.93
Central Manchester University Hospitals NHS Foundation Trust	26	1,952	95.85	1,601	92.25	88.26
King's College Hospital NHS Foundation Trust	27	1,924	79.68	1,489	77.43	59.57
Shrewsbury and Telford Hospital NHS Trust	28	1,920	83.44	1,585	75.96	65.30
Moorfields Eye Centre at Croydon Health Services NHS Trust	29	1,824	98.52	1,534	87.35	86.18
The Hillingdon Hospitals NHS Foundation Trust	30	1,693	74.19	1,358	88.37	63.92
Aintree University Hospital NHS Foundation Trust	31	1,626	82.04	1,366	74.89	60.18
Royal United Hospitals Bath NHS Foundation Trust	32	1,597	76.21	1,304	49.39	37.88
Chesterfield Royal Hospital NHS Foundation Trust	33	1,472	80.30	1,190	95.88	80.84
Mid Essex Hospital Services NHS Trust	34	1,462	90.29	1,203	69.33	63.01

Table 4 continued: The percentage of eyes with preoperative VA, postoperative VA and change in VA data for participating centres in the audit.

Centre name	Centre number	Number of operations	% with preoperative VA data	Number of operations eligible for postoperative VA results	% with postoperative VA data	% with change in VA data
Harrogate and District NHS Foundation Trust	35	1,461	88.57	1,194	84.92	74.54
Hinchingbrooke Health Care NHS Trust	36	1,458	97.26	1,232	89.77	87.58
Northern Devon Healthcare NHS Trust	37	1,431	89.80	1,225	87.43	78.78
Peterborough and Stamford Hospitals NHS Foundation Trust	38	1,402	87.66	1,212	73.93	65.18
Wirral University Teaching Hospital NHS Foundation Trust	39	1,351	68.62	1,221	49.96	35.30
South Warwickshire NHS Foundation Trust	40	1,286	82.27	1,080	77.50	64.81
Isle of Wight NHS Trust	41	1,222	77.25	1,055	79.62	61.61
St Helens and Knowsley Teaching Hospitals NHS Trust	42	1,135	86.96	896	51.56	44.75
Wrightington, Wigan and Leigh NHS Foundation Trust	43	993	96.07	731	70.73	68.81
Warrington and Halton Hospitals NHS Foundation Trust	44	855	96.02	533	6.38	6.00
South Tees Hospitals NHS Foundation Trust	45	687	91.27	555	51.17	46.31
The Royal Bournemouth and Christchurch Hospitals NHS Foundation Trust	46	574	95.64	343	69.68	67.93
Barking, Havering and Redbridge University Hospitals NHS Trust	47	568	87.15	452	25.22	23.01
Royal Free London NHS Foundation Trust	48	552	92.21	262	10.69	9.54
University Hospitals Coventry and Warwickshire NHS Trust	49	551	91.29	338	21.01	20.41
Barnsley Hospital NHS Foundation Trust (In-house database)	50	458	53.93	212	30.19	22.17

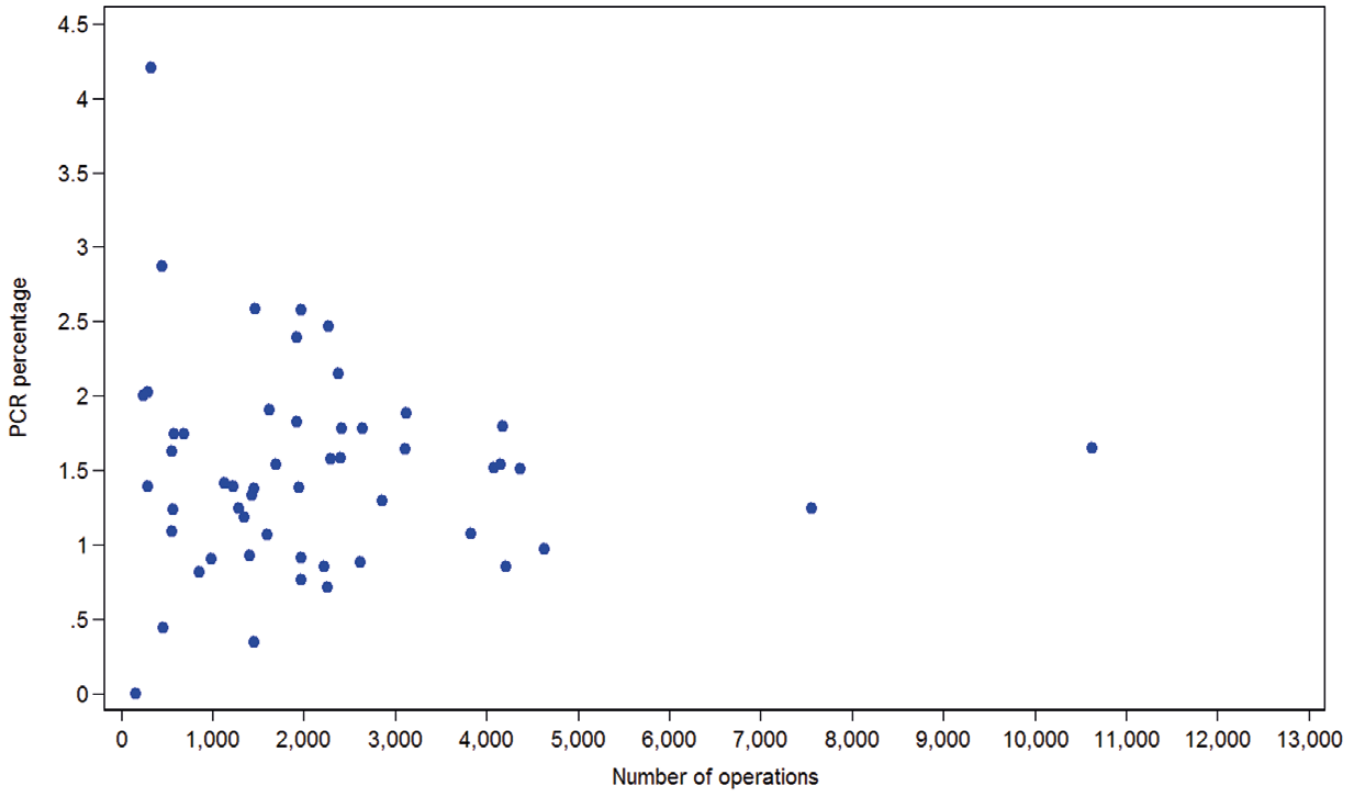
Table 4 continued: The percentage of eyes with preoperative VA, postoperative VA and change in VA data for participating centres in the audit.

Centre name	Centre number	Number of operations	% with preoperative VA data	Number of operations eligible for postoperative VA results	% with postoperative VA data	% with change in VA data
Salisbury NHS Foundation Trust	51	453	94.26	156	87.18	82.05
London North West Healthcare NHS Trust (In-house database)	52	325	58.46	266	23.31	15.04
Blackpool Teaching Hospitals NHS Foundation Trust	53	297	56.23	295	46.44	27.46
University Hospitals of Morecambe Bay NHS Foundation Trust	54	288	56.60	190	17.89	14.21
Nottingham University Hospitals NHS Trust	55	250	74.00	113	80.53	58.41
Yeovil District Hospital NHS Foundation Trust	56	157	98.73	63	46.03	44.44

8.12 Case complexity adjusted PCR results

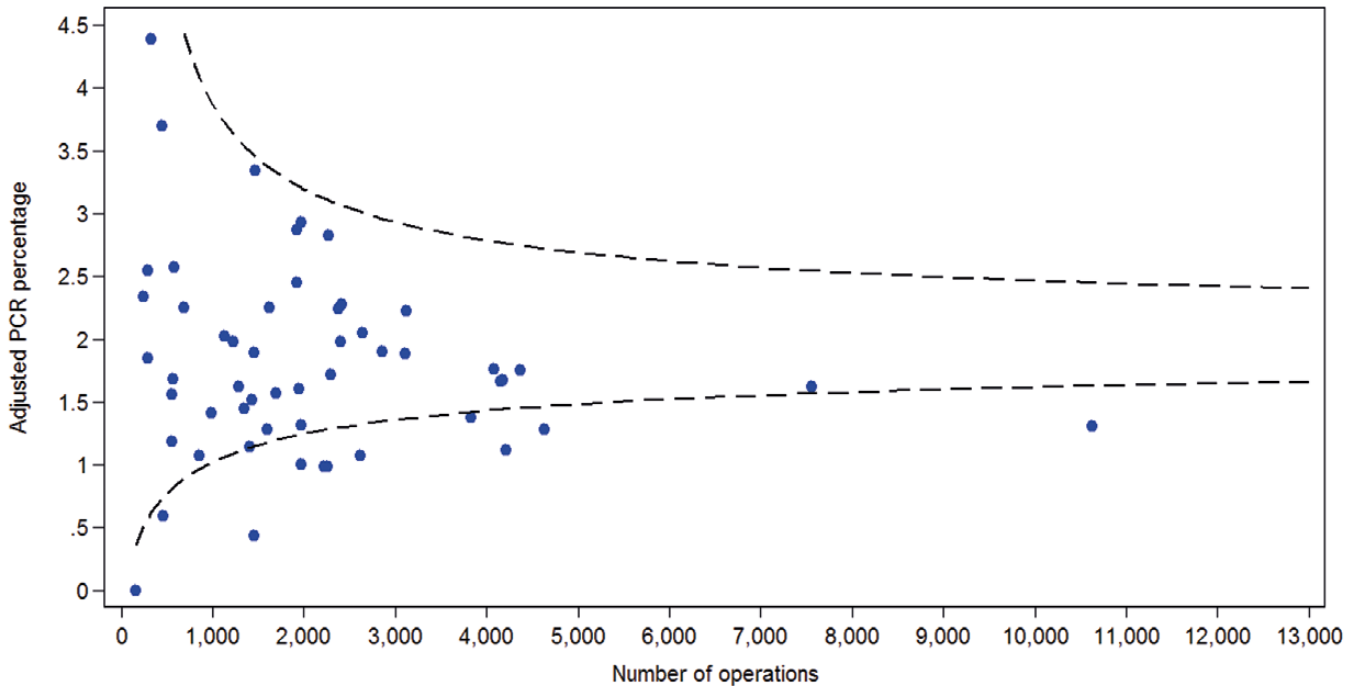
Unadjusted for case complexity PCR rates for 54 of the 56 participating centres are shown on Figure 15 and an adjusted for case complexity graph in Figure 16. Two centres data is not reported as they have requested that their data is not published while they carry out internal investigations into the data collection at their sites. Details of the unadjusted and adjusted for case complexity PCR results for 54 participating centres can be found in Table 5.

Figure 15: Unadjusted for case complexity PCR funnel plot for participating centres. (N= 115,928 operations from 54 centres)



The first prospective year of the national cataract audit ran from 1 September 2015 to 31 August 2016

Figure 16: Adjusted for case complexity PCR funnel plot for participating centres. (N= 115,928 operations from 54 centres)



● Participating centres adjusted PCR rate ▲ Centres above the 99.8% confidence interval
 - - - - 99.8% confidence interval

The first prospective year of the national cataract audit ran from 1 September 2015 to 31 August 2016

Table 5: Posterior capsular rupture and VA Loss results for participating centres in the audit.

Centre name	Posterior Capsular rupture					Visual Acuity loss			
	Centre number	Number of operations	Unadjusted PCR rate (%)	Adjusted PCR rate (%)	Outlier	Number of operations	Unadjusted VA Loss rate (%)	Adjusted VA Loss rate (%)	Outlier
Moorfields Eye Hospital NHS Foundation Trust (OE)	1	10,626	1.65	1.31	No				
The Newcastle upon Tyne Hospitals NHS Foundation Trust	2	7,560	1.24	1.62	No	4,645	0.47	0.94	No
Norfolk and Norwich University Hospitals NHS Foundation Trust	3	4,639	0.97	1.28	No				
Leeds Teaching Hospitals NHS Trust	4	4,371	1.51	1.75	No	2,586	1.28	1.86	No
York Teaching Hospital NHS Foundation Trust	5	4,212	0.85	1.12	No				
Oxford University Hospitals NHS Foundation Trust	6	4,182	1.79	1.68	No				
University Hospitals Bristol NHS Foundation Trust	7	4,154	1.54	1.67	No	2,451	0.86	1.38	No
Gloucestershire Hospitals NHS Foundation Trust	8	4,085	1.52	1.76	No	2,168	0.55	0.99	No
Sheffield Teaching Hospitals NHS Foundation Trust	9	3,829	1.07	1.38	No	2,439	1.15	2.06	No
University Hospital Southampton NHS Foundation Trust	11	3,128	1.89	2.23	No	1,722	0.99	1.51	No
Royal Berkshire NHS Foundation Trust	12	3,109	1.64	1.89	No	2,065	0.29	0.61	No
Calderdale and Huddersfield NHS Foundation Trust	13	2,864	1.29	1.90	No				
Mid Cheshire Hospitals NHS Foundation Trust	14	2,637	1.78	2.05	No	1,431	1.33	2.37	No
The Mid Yorkshire Hospitals NHS Trust	15	2,615	0.88	1.07	No				
Cardiff & Vale University LHB	16	2,414	1.78	2.28	No				
Epsom and St Helier University Hospitals NHS Trust	17	2,406	1.58	1.98	No	1,595	0.56	0.99	No
Barts Health NHS Trust	18	2,376	2.15	2.24	No	1,198	0.83	1.77	No
Frimley Health NHS Foundation Trust	19	2,290	1.57	1.72	No				
Bradford Teaching Hospitals NHS Foundation Trust	20	2,268	2.47	2.82	No				
Moorfields Eye Centre at Bedford Hospital NHS Trust	21	2,257	0.71	0.98	No	1,523	0.39	0.62	No

Table 5: Posterior capsular rupture and VA Loss results for participating centres in the audit continued

Posterior Capsular rupture						Visual Acuity loss			
Centre name	Centre number	Number of operations	Unadjusted PCR rate (%)	Adjusted PCR rate (%)	Outlier	Number of operations	Unadjusted VA Loss rate (%)	Adjusted VA Loss rate (%)	Outlier
Plymouth Hospitals NHS Trust	22	2,223	0.85	0.99	No	1,154	1.39	2.32	No
University Hospitals Birmingham NHS Foundation Trust	23	1,977	2.58	2.93	No	1,337	0.60	1.11	No
Hampshire Hospitals NHS Foundation Trust	24	1,975	0.91	1.31	No	1,069	0.28	0.54	No
Royal Cornwall Hospitals NHS Trust	25	1,969	0.76	1.00	No	1,074	1.12	2.15	No
Central Manchester University Hospitals NHS Foundation Trust	26	1,952	1.38	1.61	No	1,413	0.64	1.25	No
King's College Hospital NHS Foundation Trust	27	1,924	2.39	2.87	No				
Shrewsbury and Telford Hospital NHS Trust	28	1,920	1.82	2.45	No	1,035	0.77	1.45	No
Moorfields Eye Centre at Croydon Health Services NHS Trust	29	1,824	1.26	1.44	No	1,322	0.68	1.25	No
The Hillingdon Hospitals NHS Foundation Trust	30	1,693	1.54	1.56	No	868	0.92	1.98	No
Aintree University Hospital NHS Foundation Trust	31	1,626	1.91	2.25	No	822	0.73	1.26	No
Royal United Hospitals Bath NHS Foundation Trust	32	1,597	1.06	1.28	No				
Chesterfield Royal Hospital NHS Foundation Trust	33	1,472	2.58	3.34	No	962	0.73	1.16	No
Harrogate and District NHS Foundation Trust	35	1,461	0.34	0.43	No	890	0.56	0.95	No
Hinchingbrooke Health Care NHS Trust	36	1,458	1.37	1.89	No	1,079	0.19	0.37	No
Northern Devon Healthcare NHS Trust	37	1,431	1.33	1.51	No	965	0.52	0.84	No
Peterborough and Stamford Hospitals NHS Foundation Trust	38	1,402	0.93	1.14	No	790	1.01	1.65	No
Wirral University Teaching Hospital NHS Foundation Trust	39	1,351	1.18	1.44	No				
South Warwickshire NHS Foundation Trust	40	1,286	1.24	1.63	No	700	0.14	0.23	No
Isle of Wight NHS Trust	41	1,222	1.39	1.97	No	650	0.62	1.13	No
St Helens and Knowsley Teaching Hospitals NHS Trust	42	1,135	1.41	2.03	No				

Table 5: Posterior capsular rupture and VA Loss results for participating centres in the audit continued

Posterior Capsular rupture						Visual Acuity loss			
Centre name	Centre number	Number of operations	Unadjusted PCR rate (%)	Adjusted PCR rate (%)	Outlier	Number of operations	Unadjusted VA Loss rate (%)	Adjusted VA Loss rate (%)	Outlier
Wrightington, Wigan and Leigh NHS Foundation Trust	43	993	0.91	1.41	No	503	0.80	1.61	No
Warrington and Halton Hospitals NHS Foundation Trust	44	855	0.82	1.07	No				
South Tees Hospitals NHS Foundation Trust	45	687	1.75	2.25	No				
The Royal Bournemouth and Christchurch Hospitals NHS Foundation Trust	46	574	1.74	2.57	No	233	0.86	1.82	No
Barking, Havering and Redbridge University Hospitals NHS Trust	47	568	1.23	1.68	No				
Royal Free London NHS Foundation Trust	48	552	1.63	1.56	No				
University Hospitals Coventry and Warwickshire NHS Trust	49	551	1.09	1.19	No				
Barnsley Hospital NHS Foundation Trust	50	458	0.44	0.59	No				
Salisbury NHS Foundation Trust	51	453	2.87	3.70	No	128	0.00	0.00	No
London North West Healthcare NHS Trust	52	325	4.00	4.14	No				
Blackpool Teaching Hospitals NHS Foundation Trust	53	297	2.02	2.55	No				
University Hospitals of Morecambe Bay NHS Foundation Trust	54	288	1.39	1.85	No				
Nottingham University Hospitals NHS Trust	55	250	2.00	2.34	No				
Yeovil District Hospital NHS Foundation Trust	56	157	0.00	0.00	No				

8.13 Case complexity adjusted visual loss results

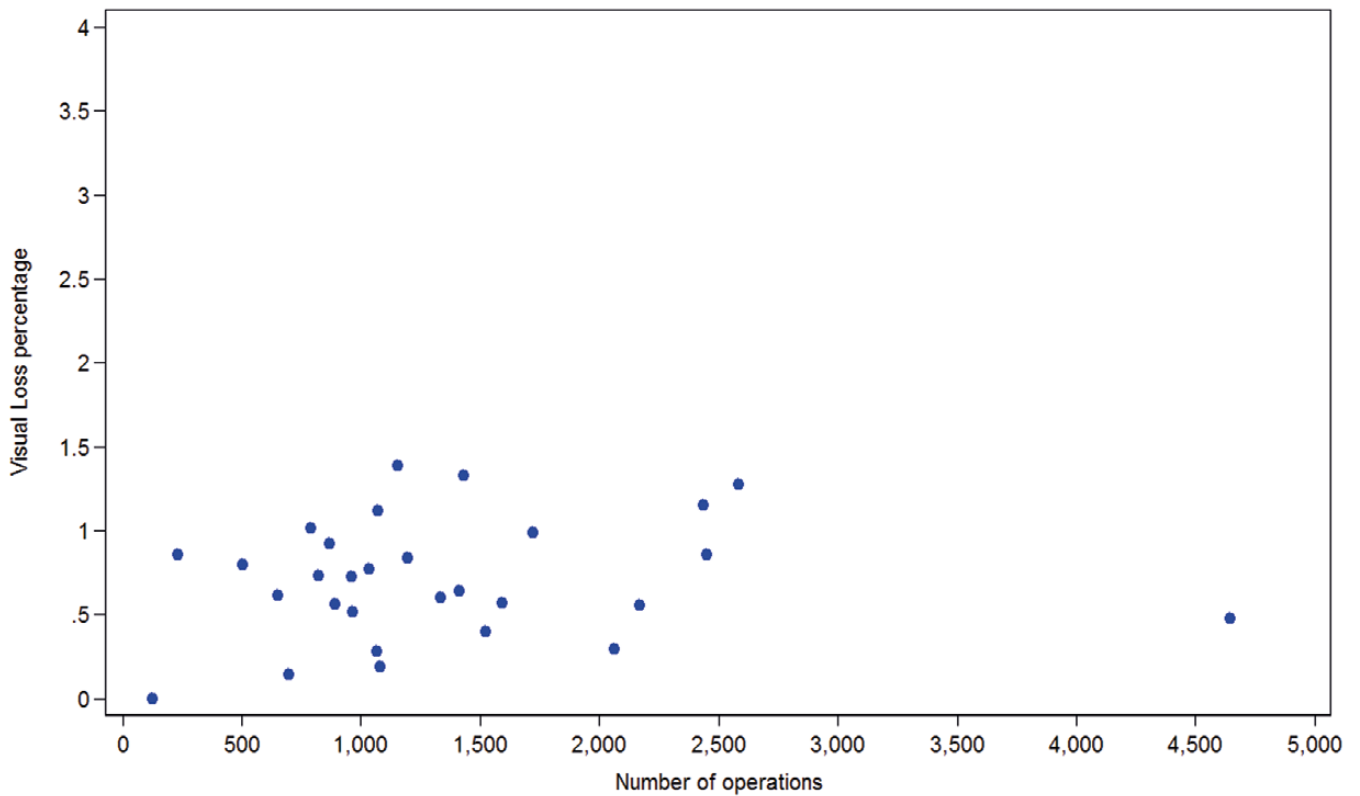
Of the 120,722 operations supplied to the audit, 99,087 operations were performed up to 30th June 2016 and had the potential for two months follow up. Of these, 43,566 (44.0%) operations from 32 centres were performed in centres where a preoperative and postoperative VA was recorded for at least 40% of the operations.

An unadjusted for case complexity funnel plot of VA Loss is shown in Figure 17 and an adjusted for case complexity funnel plot in Figure 18 for 30 of the 32 centres with VA Loss data. Two centres data is not reported as they have requested that their data is not published while they carry out internal investigations into the data collection at their sites. Details of the unadjusted and adjusted for case complexity VA Loss results for the 30 participating centres can be found in Table 5.

For 19 of the 30 centres, the case complexity adjusted VA rate was below the benchmark mean of 1.5% derived from earlier sets of data. There are likely to be many reasons for this result. The actual observed overall visual loss rate was 0.81% for this sample which is lower than the benchmark used, and there is variation in the number of operations and the number/experience of surgeons between centres. Some centres will have fewer surgeons than others and if these surgeons are very experienced this will contrast with a teaching hospital that is likely to have more operations performed by relatively less experienced surgeons. Another influence is the variation in the recording of follow up data which is necessary for visual loss estimation. In light of this apparent reduction in the rate of Visual Acuity Loss the benchmark rate will need to be reconsidered for future audit cycles although until fuller data return completeness is achieved caution should be exercised.

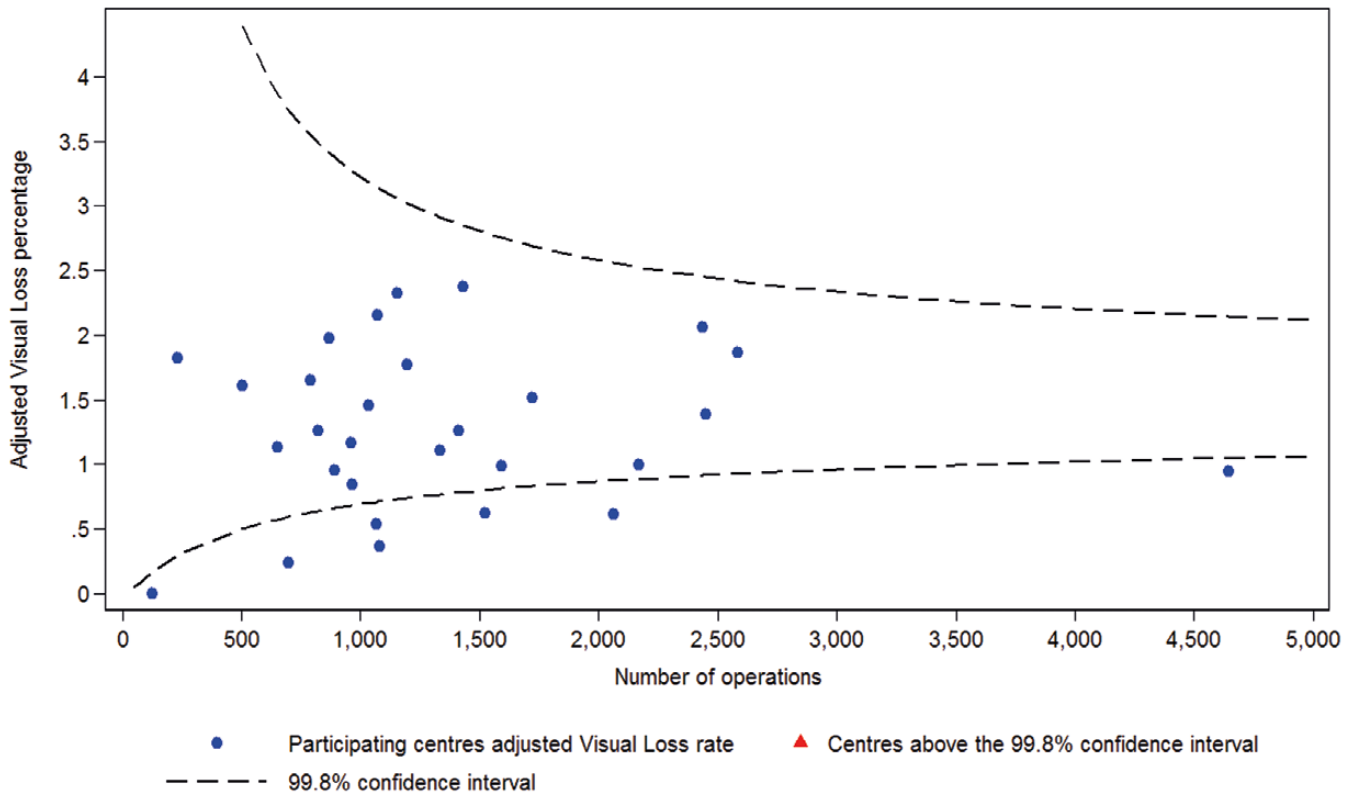
It should also be noted that the samples used for the VA Loss results are smaller than those used for the PCR results due to missing presenting and/or postoperative VA measurements. Any improvements in the number of operations with a recorded presenting and postoperative VA would increase the sample for future re-fitting of the Visual Loss model, this in turn would decrease parameter estimation errors due to the increased sample size.

Figure 17: Unadjusted for case complexity VA Loss funnel plot for participating centres. (N= 40,817 from 30 centres)



The first prospective year of the national cataract audit ran from 1 September 2015 to 31 August 2016

Figure 18: Adjusted for case complexity VA Loss funnel plot for participating centres. (N= 40,817 from 30 centres)



The first prospective year of the national cataract audit ran from 1 September 2015 to 31 August 2016

9. Summary of Key Points

This second annual report from the National Ophthalmology Database Cataract Audit is the first to report prospectively collected data for a one year period.

- Good progress has been made in terms of expanding the number of centres from 34 in the first annual report to 56 in the current report and looking ahead 112 of 125 traditional NHS cataract providers have indicated that they wish to participate in the future cycles of the audit.
- Established markers of surgical quality – PCR and VA Loss – are used as metrics for risk adjusted outcomes. PCR is the most frequent intra-operative complication and is associated with postoperative loss of vision. VA Loss is intended to capture all eyes where outcome has been adverse whether or not associated with PCR.
- This is the first cataract audit report which includes the reporting of named centre results for all submitted operations with results for named consultant surgeons shortly to be published as part of the Consultants Outcomes Programme (COP). For the 56 centres included in this report outcomes generally have been found to be within the standard HQIP expectation, i.e. risk adjusted outcomes within 3SD of the benchmark.
- Data completeness of reported surgery is excellent (100%) for PCR though less so for VA, particularly for postoperative VA, an area where many centres could do better, some centres in particular having poor VA data returns following surgery.
- Quality improvement drivers in this audit take the form of risk adjusted results for surgical complications and vision loss from before to after surgery. These key measures are risk adjusted to acknowledge case complexity and provide credit to surgeons and centres undertaking complex work. Without conscious completion of risk indicator data surgeons and centres run the risk of not being given credit for the complexity of the work undertaken, an important message for participants to take on board.
- The audit tools provided allow for real time tracking of adverse surgical events which facilitates local monitoring of complications by centres and surgeons. In the event of an adverse signal becoming apparent, timely corrective action would avoid unnecessary harm to patients and avoid centres or surgeons being identified as outliers in national audit reports going forward.

The coming period of the audit will look to extending the coverage to include all traditional NHS centres as well as the ‘independent sector treatment centres’, all of which are accountable to the public for the quality of services they provide. In addition, further outcomes will be considered in order to provide a broader and more balanced assessment of service quality in cataract care.

10. Glossary

Abbreviation	Description
CDVA	Corrected distance visual acuity
CF	The ability to count fingers
EMR	Electronic Medical Record
HM	The ability to distinguish hand movements
HQIP	Healthcare Quality Improvement Partnership
HSCIC	Health and Social Care Information Centre
IMD	Index of multiple deprivation is the measure of relative deprivation for small areas in England
IOL	Intra-ocular lens is an artificial lens generally inserted into the capsule of the lens after cataract removal
IQR	Inter Quartile Range
OCCI	Opposite Clear Corneal Incision
NCAPOP	National Clinical Audit and Patient Outcomes Programme
NICOR	National Institute for Cardiovascular Outcomes Research
NHS	National Health Service
NOD	National Ophthalmology Database
NPL	No perception of light
PAS	Patient Administration System keeps track of all patients' admissions and appointments.
PCR	Posterior capsule rupture is a break in the posterior capsule of the lens, usually as a complication of cataract surgery. It may allow vitreous to move forward into the anterior chamber of the eye.
PHVA	Pin hole visual acuity - The pinhole is an eye shield with several small holes which allow light rays to reach the retina without the interference of optical problems of the eye. It is used to test visual acuity.
PL	Perception light
RCOphth	The Royal College of Ophthalmologists
S251 exemption	Approval for exemption from section 251 of the NHS Health and Social Care Act 2006 which allows for certain uses of patient identifiable data such as linkage of data from more than one data source e.g. a national audit and NHS Digital
SES	Socio-economic status is the social standing or class of an individual or group. It is often measured as a combination of education, income and occupation
UDVA	Uncorrected distance visual acuity

10. Glossary continued

Abbreviation	Description
UK	United Kingdom
VA	Visual acuity is the sharpness of vision, measured by the ability to distinguish letters or numbers at a given distance according to a fixed standard. We have reported VA using the LogMAR scale (base 10 Log of the reciprocal of the visual angle). A normal LogMAR VA is 0.0 and the number increases as vision gets worse. LogMAR=0.3 would be at the boundary for driving a car and 1.0 would be at the level of registrable severe sight impairment. A postoperative VA of 0.3 or better is often used as a measure of a favourable outcome from surgery.
WHO	World Health Organisation
Yes/No	Yes or No

11. Graphs and Tables

Interpreting the Graphs

Among the results there are three types of graphs. The labelling of centres is a ranking of the total number of operations contributed by each centre so that centre 1 is the centre that contributed the highest number of operations and centre 56 the least.

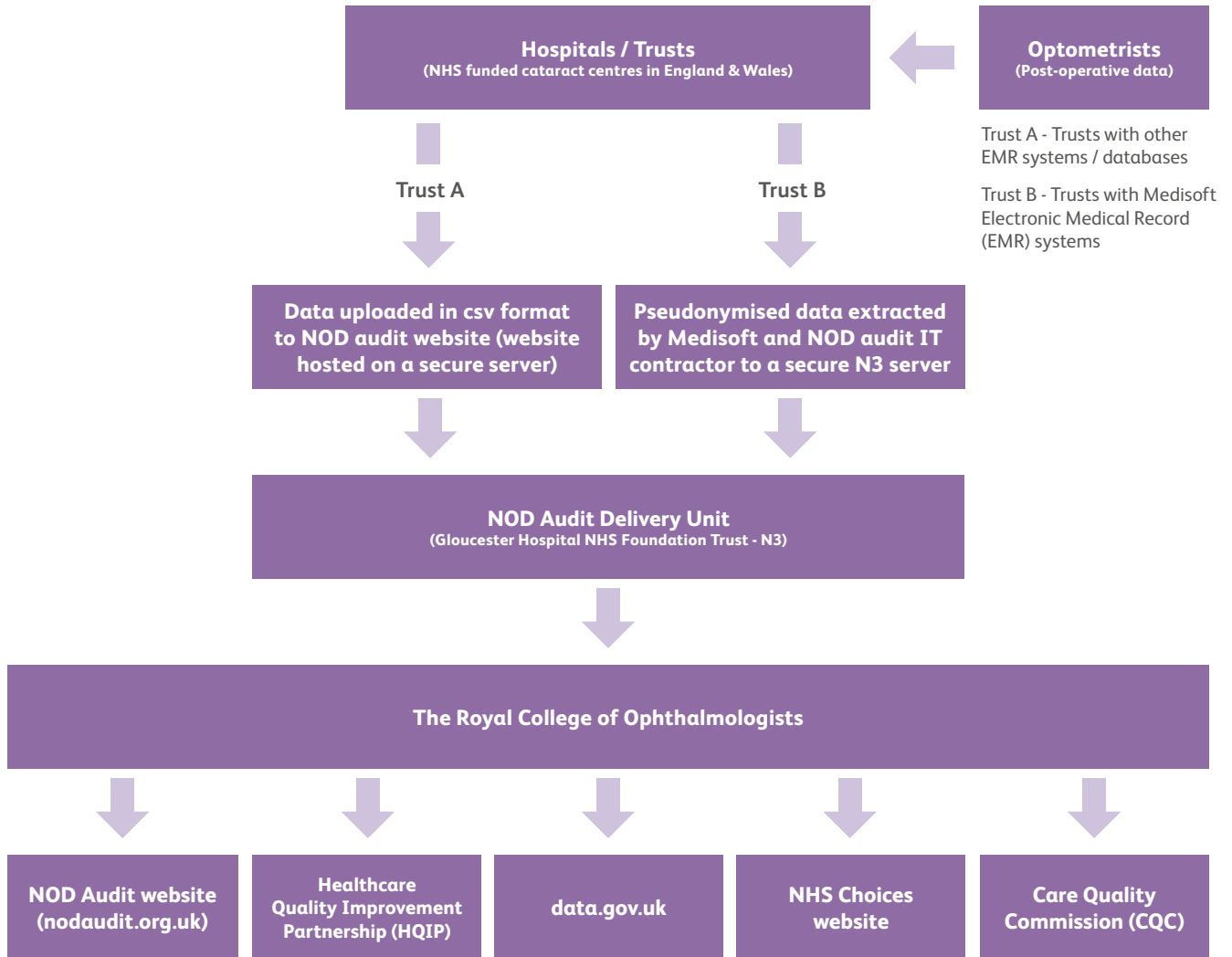
1. Bar charts – the horizontal axis consists of the categorical element, usually contributing centre. When bar charts are sub-divided by another category, the vertical height of each bar indicates the quantity of interest for that bar chart as read from the vertical axis.
2. Box and Whisker plots – the spread for the variable of interest is shown for each of the contributing centres. The central line is the median or ‘middle’ value. The box outlines the inter quartile range (25% and 75% centiles), and the horizontal lines above and below the inter quartile range display either the position of the furthest value or a value at a ‘reasonable’ stretch from the middle. Extreme values are the dots beyond that.
3. Funnel plots – The spread of dots on these look like a funnel going from left to right. Each dot represents a result for a centre as read off the vertical axis (proportion or rate). The funnel effect results from increasing statistical precision as the numbers get higher going along the horizontal axis. Some of the plots have lines on them showing what is expected. A result above the top line (three standard deviations) would be deemed unacceptably high.

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Appendix 1: Governance Structure

National Ophthalmology Database (NOD) Audit Project Data Flow



Appendix 2: National Ophthalmology Database Audit Project Steering Group Membership

Name	Designation
Andrew Frost	Cataract Representative The Royal College of Ophthalmologists
Anthony King	Glaucoma Representative The Royal College of Ophthalmologists
Beth Barnes	Head of the Professional Standards Department The Royal College of Ophthalmologists
Cathy Yelf	Chief Executive Macular Society
Chris Rogers	Independent Statistician The University of Bristol
David Parkins	Immediate Past President The College of Optometrists
David Yorston	Retinal Detachment Representative The Royal College of Ophthalmologists
Helen Doe	Ophthalmic Nurse and Support Groups Manager International Glaucoma Association
Jessica Hall	Acting Eye Health Campaigns Manager Royal National Institute of Blind People
John Sparrow	Chairman Clinical Lead for RCOphth National Ophthalmology Database Audit
Kathy Evans	Chief Executive The Royal College of Ophthalmologists
Martin McKibbin	AMD Representative The Royal College of Ophthalmologists
Matt Broom	Lay Group Representative The Royal College of Ophthalmologists and Vision 2020 UK
Melanie Hingorani	Cataract Representative The Royal College of Ophthalmologists
Raghu Ram	Wales Representative The Royal College of Ophthalmologists
Sasha Hewitt	Associate Director of Quality and Development Healthcare Quality Improvement Partnership (HQIP)
Sophia Olatunde	Project Manager Healthcare Quality Improvement Partnership (HQIP)
Wendy Newsom	Practicing Optometrist The College of Optometrists

Appendix 3: Case Definitions

Eligible Cataract Surgery Criteria

- Operation performed between 01 September 2015 – 31 August 2016
- Operation performed in an NHS hospital in England or Wales
- Operation performed in adults (aged 18 or above)
- Operation included a phacoemulsification procedure
- Operative data includes a surgeon identifier and valid surgeon grade
- Operation included a “cataract” indication for surgery (see the NOD audit website for details)
- Operation did not include certain operative procedures (see the NOD audit website for details)
- Operations that included a pars plana vitrectomy without any other vitreoretinal procedures
- A minimum of 50 eligible cataract operations for each participated centre

PCR - Posterior Capsule Rupture or Vitreous Prolapse or both

PCR was deemed to have occurred if any of the following intra-operative complications are recorded during surgery; Zonule rupture – vitreous loss, PC rupture ± vitreous loss, Vitreous to the section at end of surgery, Vitreous loss, Nuclear/ epinuclear fragment into vitreous, intra-ocular lens (IOL) into the vitreous, or if any of the following occurred.

- The operation includes any of ‘Sponge and scissors vitrectomy’, ‘Secondary IOL’, ‘Automated anterior vitrectomy’ or ‘Scleral fixed IOL’
- The operative procedure includes ‘Fragmatome lensectomy ± IOL’ with a previous or concurrent phacoemulsification procedure
- The operative procedure includes ‘Removal of retained lens fragments’ combined with a pars plana vitrectomy
- If either of ‘vitreous to the section’ or ‘vitreous in the anterior chamber’ were recorded within eight weeks of cataract surgery, this includes the day of cataract surgery in the time frame
- If there is a record of a dropped nucleus operation with 90 days of cataract surgery, this includes the day of cataract surgery in the time frame

Visual Acuity (VA) criteria

Visual acuity measurements were extracted from the EMR on the LogMAR scale and numeric substitutions of 2.10, 2.40, 2.70 and 3.00 were used for the ability to count fingers (CF), the ability to distinguish hand movements (HM), perception of light (PL) and no perception of light (NPL) respectively.

Pre-operative VA was defined as the better of corrected distance visual acuity (CDVA) and the uncorrected distance visual acuity (UDVA) recorded within a 90 day ‘time window’ prior to surgery. Where there are multiple occasions of measurement the VA measurement closest to the date of surgery is used and measurements recorded on the same day as cataract surgery are considered as pre-operative measurements.

Postoperative VA was defined as the best measurement of CDVA or UDVA or pinhole visual acuity (PHVA) within the ‘time window’ of between 14 days and four months of cataract surgery (inclusive).

Appendix 3: Case Definitions continued

Postoperative VA results were restricted to operations performed up to 30th June 2016 to allow for at least two months potential follow up. A further restriction was applied to the VA Loss results where only centres and surgeons with <40% missing pre and postoperative VA data were included.

Visual loss was defined as a loss of ≥ 0.30 LogMAR (doubling or worse of the visual angle) between the preoperative and postoperative VA measurements.

LogMAR VA is a continuous scale which allows arithmetic operations and parametric statistical methods to be employed in the analysis. Conversion between LogMAR and approximate Snellen scores, and their interpretations, are as follows:

Approximate Snellen to LogMAR Conversion		
LogMAR	Snellen	VA Interpretation
-0.1	6/5	Excellent
0.0	6/6	Very Good
0.2	6/9	Good
0.3	6/12	Reasonably Good
0.5	6/18	Moderate
0.6	6/24	Moderate Sight Impairment
0.8	6/36	Sight Impairment
0.9	6/48	Sight Impairment
1.0	6/60	UK Severe Sight Impairment
1.1	5/60	UK Severe Sight Impairment
1.2	4/60	UK Severe Sight Impairment
	3/60	WHO Severe Sight Impairment
2.1	Count Fingers (CF)	WHO Severe Sight Impairment
2.4	Hand Movements (HM)	WHO Severe Sight Impairment
2.7	Perception of Light (PL)	WHO Severe Sight Impairment
3.0	No Perception of Light (NPL)	WHO Severe Sight Impairment

WHO is World Health Organisation

Appendix 4: Ocular co-pathology changes

For the prospective data collection changes to the recording of ocular co-pathology were implemented. The intention is that in the future when sufficient operations have the individual components recorded separately this information could be investigated in the risk adjustment models.

The new options were as follows;

- AMD could be specified as either 'dry AMD' or 'wet AMD'
- No fundal view / vitreous opacities could be recorded separately as either 'no fundal view' or 'vitreous opacities'
- Psuedoexfoliation / phacodonesis could be recorded separately as either 'psuedoexfoliation' or 'phacodonesis'
- Uveitis / synechia could be recorded separately as either 'uveitis' or 'synechia'
- When either 'macular hole' or 'epiretinal membrane peel' were recorded it was possible to record if with or without a prior pars plana vitrectomy (PPV).

For the full results in this report these co-pathologies are not tabulated separately, but for interest overall figures for certain splits are summarised below.

- Of the 11,398 operations recorded in eyes with AMD, 3,506 (30.8%) were recorded as 'dry' AMD, 1,538 (13.5%) as 'wet' AMD and 6,354 (55.8%) as AMD without the specification of 'dry' or 'wet'.
- Of the 1,560 operations recorded in eyes with no fundal view / vitreous opacities, 812 (52.1%) were recorded as 'no fundal view', 66 (4.2%) as 'vitreous opacities' and 682 (43.7%) as combined.
- Of the 1,254 operations recorded in eyes with psuedoexfoliation / phacodonesis, 510 (40.7%) were recorded as 'psuedoexfoliation', 81 (6.5%) as 'phacodonesis' and 663 (52.9%) as combined.
- Of the 1,007 operations recorded in eyes with uveitis / synechia, 827 (82.1%) were recorded as 'uveitis', none as 'synechia' and 180 (17.9%) as combined.
- Of the 510 operations recorded in eyes with macular hole, 168 (32.9%) were recorded with a previous PPV and of the 1,319 operations recorded in eyes with epiretinal membrane peel, 107 (8.1%) were recorded with a previous PPV.

Appendix 5: Operative procedures combined with phacoemulsification ± IOL

Operative procedure	Frequency
Automated anterior vitrectomy	995
Limbal relaxing incisions / Opposite clear corneal incisions	578
Intravitreal injection	556
Insertion of Iris hooks	520
Insertion of pupil ring expander	469
Capsular tension ring	367
Synaechiolysis	176
Stretching of the Iris	158
Injection of bleb (antimetabolite)	151
Pars plana vitrectomy	116
Sphincterotomy	89
Capsulectomy	83
Intraoperative phenylephrine	51
Incision of Cornea	33
Removal of retained lens fragments	25
Suture of Cornea	18
Washout of anterior chamber	15
IOL removal	12
Secondary IOL	11
Examination under anaesthesia	10
Other specified operation on the Iris	9
Perfect capsule	7
IOL exchange	6
Fragmatone lensectomy	5
Removal Cornea sutures	5
Sub-conjunctival injection	5
Broad iridectomy	4
I/C Miochol	4

Appendix 5: Operative procedures combined with phacoemulsification ± IOL continued

Operative procedure	Frequency
Injection into anterior chamber	4
Removal of stent suture from Baerveldt	4
Implantation of intravitreal device	3
Intravenous steroid injection	3
Peripheral iridectomy	3
Healon GV	2
Surgical anterior capsulotomy	2
Diathermy	1
IOL polish	1
Orbital floor injection	1
Other specified excision of the Iris	1
Reformation of anterior chamber of eye	1
Scleral-fixed IOL	1

Appendix 6: Eligible cataract surgical centres in England and Wales

Category	Organisation name
Signed up and contributed data	Aintree University Hospital NHS Foundation Trust
	Barking, Havering and Redbridge University Hospitals NHS Trust
	Barnsley Hospital NHS Foundation Trust
	Barts Health NHS Trust
	Bedford Hospital NHS Trust - Moorfields
	Blackpool Teaching Hospitals NHS Foundation Trust
	Bradford Teaching Hospitals NHS Foundation Trust
	Calderdale and Huddersfield NHS Foundation Trust
	Cardiff and Vale University Health Board
	Central Manchester University Hospitals NHS Foundation Trust
	Chesterfield Royal Hospital NHS Foundation Trust
	Croydon Health Services NHS Trust – Moorfields
	East Sussex Healthcare NHS Trust*
	Epsom and St Helier University Hospitals NHS Trust
	Frimley Health NHS Foundation Trust
	Gloucestershire Hospitals NHS Foundation Trust
	Hampshire Hospitals NHS Foundation Trust
	Harrogate and District NHS Foundation Trust
	Hinchingbrooke Health Care NHS Trust
	Isle of Wight NHS Trust
	King's College Hospital NHS Foundation Trust
	Leeds Teaching Hospitals NHS Trust
	London North West Healthcare NHS Trust
	Mid Cheshire Hospitals NHS Foundation Trust
	Mid Essex Hospital Services NHS Trust
	Mid Yorkshire Hospitals NHS Trust
	Moorfields Eye Hospital NHS Foundation Trust
	Norfolk and Norwich University Hospitals NHS Foundation Trust
	Northern Devon Healthcare NHS Trust

Appendix 6: Eligible cataract surgical centres in England and Wales continued

Category	Organisation name
Signed up and contributed data	Nottingham University Hospitals NHS Trust
	Oxford University Hospitals NHS Trust
	Peterborough and Stamford Hospitals NHS Foundation Trust
	Plymouth Hospitals NHS Trust
	Royal Berkshire NHS Foundation Trust
	Royal Cornwall Hospitals NHS Trust
	Royal Free London NHS Foundation Trust
	Royal United Hospital Bath NHS Trust
	Salisbury NHS Foundation Trust
	Sandwell and West Birmingham Hospitals NHS Trust
	Sheffield Teaching Hospitals NHS Foundation Trust
	Shrewsbury and Telford Hospital NHS Trust
	South Tees Hospitals NHS Foundation Trust
	South Warwickshire NHS Foundation Trust
	St Helens and Knowsley Hospitals NHS Trust
	The Hillingdon Hospitals NHS Foundation Trust
	The Newcastle Upon Tyne Hospitals NHS Foundation Trust
	The Royal Bournemouth and Christchurch Hospitals NHS Foundation Trust
	University Hospital Southampton NHS Foundation Trust
	University Hospitals Birmingham NHS Foundation Trust
	University Hospitals Bristol NHS Foundation Trust
	University Hospitals Coventry and Warwickshire NHS Trust
	University Hospitals of Morecambe Bay NHS Foundation Trust
	Warrington and Halton Hospitals NHS Foundation Trust
	Wirral University Teaching Hospital NHS Foundation Trust
	Wrightington, Wigan and Leigh NHS Foundation Trust
	Yeovil District Hospital NHS Foundation Trust
	York Teaching Hospital NHS Foundation Trust

Appendix 6: Eligible cataract surgical centres in England and Wales continued

Category	Organisation name
Signed up but not in time for submission of (sufficient) data for 1st prospective report	Abertawe Bro Morgannwg University Health Board
	Ashford and St Peter's Hospitals NHS Foundation Trust
	Bolton NHS Foundation Trust
	Brighton and Sussex University Hospitals NHS Trust
	Buckinghamshire Healthcare NHS Trust
	Burton Hospitals NHS Foundation Trust
	Cambridge University Hospitals NHS Foundation Trust
	City Hospitals Sunderland NHS Foundation Trust
	Colchester Hospital University NHS Foundation Trust
	County Durham and Darlington NHS Foundation Trust
	Cwm Taf University Health Board
	Dorset County Hospital NHS Foundation Trust
	East Cheshire NHS Trust
	East Kent Hospitals University NHS Foundation Trust
	East Lancashire Hospitals NHS Trust
	George Eliot Hospital NHS Trust
	Great Western Hospitals NHS Foundation Trust
	Guy's and St Thomas' NHS Foundation Trust
	Heart of England NHS Foundation Trust
	Hull and East Yorkshire Hospitals NHS Trust
	Hywel Dda University Health Board
	Imperial College Healthcare NHS Trust
	James Paget University Hospitals NHS Foundation Trust
	Kettering General Hospital NHS Foundation Trust
	Kingston Hospital NHS Trust
	Luton and Dunstable Hospital NHS Foundation Trust
	Maidstone and Tunbridge Wells NHS Trust
Milton Keynes Hospital NHS Foundation Trust	
North Cumbria University Hospitals NHS Trust	

Appendix 6: Eligible cataract surgical centres in England and Wales continued

Category	Organisation name
Signed up but not in time for submission of (sufficient) data for 1st prospective report	North Middlesex University Hospital NHS Trust
	Northampton General Hospital NHS Trust
	Northern Lincolnshire and Goole Hospitals NHS Foundation Trust
	Pennine Acute Hospitals NHS Trust
	Portsmouth Hospitals NHS Trust
	Powys Teaching Health Board
	Queen Victoria Hospital NHS Foundation Trust
	Royal Devon and Exeter NHS Foundation Trust
	Royal Liverpool and Broadgreen University Hospitals NHS Trust
	Royal Surrey County Hospital NHS Foundation Trust
	Sherwood Forest Hospitals NHS Foundation Trust
	Southend University Hospital NHS Foundation Trust
	Southport and Ormskirk Hospital NHS Trust
	Stockport NHS Foundation Trust
	Surrey and Sussex Healthcare NHS Trust
	Taunton and Somerset NHS Foundation Trust
	The Dudley Group NHS Foundation Trust
	The Ipswich Hospital NHS Trust
	The Princess Alexandra Hospital NHS Trust
	The Queen Elizabeth Hospital King's Lynn NHS Foundation Trust
	The Rotherham NHS Foundation Trust
	The Royal Wolverhampton NHS Trust
	Torbay and South Devon NHS Foundation Trust
	United Lincolnshire Hospitals NHS Trust
	University Hospitals of Leicester NHS Trust
	University Hospitals of North Midlands NHS Trust
West Hertfordshire Hospitals NHS Trust	
Wye Valley NHS Trust	

Appendix 6: Eligible cataract surgical centres in England and Wales continued

Category	Organisation name
Yet to sign up or declined participation	Aneurin Bevan University Health Board
	Betsi Cadwaladr University Health Board
	Chelsea and Westminster Hospital NHS Foundation Trust
	Countess of Chester Hospital NHS Foundation Trust
	Derby Teaching Hospitals NHS Foundation Trust
	Doncaster and Bassetlaw Hospitals NHS Foundation Trust
	East and North Hertfordshire NHS Trust
	Lancashire Teaching Hospitals NHS Foundation Trust
	West Suffolk NHS Foundation Trust
	Worcestershire Acute Hospitals NHS Trust
	Western Sussex Hospitals NHS Trust

* Data were excluded from reporting due to corrupt file

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