PEER REVIEW HISTORY

BMJ Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form (**http://bmjopen.bmj.com/site/about/resources/checklist.pdf**) and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below.

This paper was submitted to another journal from BMJ but declined for publication following peer review. The authors addressed the reviewers' comments and submitted the revised paper to BMJOpen. The paper was subsequently accepted for publication at BMJ Open. As BMJ Open operates using open peer review, we sought the consent of the reviewers for the other journal to include their reviews as part of the peer review history of the article in BMJ Open. We have included the reviews only when consent was obtained.

ARTICLE DETAILS

TITLE (PROVISIONAL)	Impact of practicing internal benchmarking on continuous improvement of cataract surgery outcomes: a retrospective observational study at Aravind Eye Hospitals, India
AUTHORS	Balu, Ganesh-Babu; Gupta, Sachin; Ravilla, Ravindran; Ravilla, Thulasiraj; Mertens, Helen; Webers, C; Vasudeva Rao, Shyam; van Merode, Frits

VERSION 1 - REVIEW

REVIEWER	***Soh, Yu Qiang*** ***Singapore National Eye Centre, Ophthalmology***
REVIEW RETURNED	19-Sep-2022

GENERAL COMMENTS	This represents an important piece of work. The concepts are sound however the lack of formal statistical analysis, despite access to a large volume of data which should expectedly be readily amenable to that, precludes publication of the manuscript in its current state. I am hopeful, however, that this manuscript should be acceptable for publication with further work. Other minor comments: Page 7 Line 11: What is the exact name of the EMR and automated processes used for data storage and extraction? Is this a commercially available EMR with data inbuilt data extraction algorithms? Or is it an Aravind self-built EMR / data storage + extraction facility? Page 8 lines 10-14: The authors should include all inclusion and exclusion criteria. Simply stating 'database contained information about patient over the age of 15' and 'included all patients who had phacoemulsification surgery' is inadequate. What about SICS / ECCE? Combined phaco/PPV? Or combined phaco/MIGS? What about high risk phaco? - small pupils, shaky zonules, posterior polar, white or hypermature brunescent cataracts? Were they all included in the analysis? If so, not only must this be stated, but results should also ideally be stratified based on high-risk vs low-

	risk phacos. Page 8 line 20 - I presume 'post-op follow-up visit' refers to post-op week 8? Or is it week 1? (Im guessing based on what was described in the earlier sections). Whatever it is, it should be stated clearly.

VERSION 1 – AUTHOR RESPONSE

Reviewers' comments

Reviewer: 1

This represents an important piece of work. The concepts are sound however the lack of formal statistical analysis, despite access to a large volume of data which should expectedly be readily amenable to that, precludes publication of the manuscript in its current state. I am hopeful, however, that this manuscript should be acceptable for publication with further work.

Response: Our research focus on demonstrating impact of using quality improvement method: Internal benchmarking for continuous quality improvement. So, the statistical analysis of outcome differences due to various attributes are not discussed.

Other minor comments:

Page 7 Line 11: What is the exact name of the EMR and automated processes used for data storage and extraction? Is this a commercially available EMR with data inbuilt data extraction algorithms? Or is it an Aravind self-built EMR / data storage + extraction facility?

Response: a few additional lines added about the software in the method

Page 8 lines 10-14: The authors should include all inclusion and exclusion criteria. Simply stating 'database contained information about patient over the age of 15' and 'included all patients who had phacoemulsification surgery' is inadequate. What about SICS / ECCE? Combined phaco/PPV? Or combined phaco/MIGS? What about high risk phaco? - small pupils, shaky zonules, posterior polar, white or hypermature brunescent cataracts? Were they all included in the analysis? If so, not only must this be stated, but results should also ideally be stratified based on high-risk vs low-risk phacos.

Response: We have not addressed this comment as the focus of the study is not describing association of outcome.

Page 8 line 20 - I presume 'post-op follow-up visit' refers to post-op week 8? Or is it week 1? (I'm guessing based on what was described in the earlier sections). Whatever it is, it should be stated clearly.

Response: This suggestion is addressed in the revised format under measures section.

VERSION 2 – REVIEW

REVIEWER	***Ionides, Alexander*** ***Moorfields Eye Hospital NHS Foundation Trust***
REVIEW RETURNED	10-Mar-2023

GENERAL COMMENTS	Huge data with clear parameters and this adds to the pool of data on cataract outcomes.

REVIEWER	***Boland, Michael*** ***Massachusetts Eye and Ear, Ophthalmology***
REVIEW RETURNED	29-Mar-2023

GENERAL COMMENTS	General - Consider supplementary material including how some of the key measures aside from visual acuity are collected in the electronic medical record (complications, refractive target, etc.) Please also describe any major changes to the EMR in this time period that might have impacted results (changes in clinical data collection forms and the like). Rationale - Please define the CATQA before using it here. Discusion - Can any of the process changes (refraction, IOL selection, biometry) be linked to changes in outcomes based on timing? This work would be of more interest if you could link specific interventions (benchmarking, process changes) to changes in outcomes. - Similarly, in terms of your discussion points, how do we know that the process changes are not what improved outcomes? Perhaps better IOLs and better biometry improved the refractive outcomes, for example. Figures - Figures 2-4 could be improved by removing the table of data at the bottom and creating a legend indicating for the colors.

VERSION 2 – AUTHOR RESPONSE

Reviewer: 1
Dr. Alexander Ionides, Moorfields Eye Hospital NHS Foundation Trust Comments to the Author:
Huge data with clear parameters and this adds to the pool of data on cataract outcomes.

Thank you.

Reviewer: 2
Dr. Michael Boland, Massachusetts Eye and Ear Comments to the Author:

General
- Consider supplementary material including how some of the key measures aside from visual acuity are collected in the electronic medical record (complications, refractive target, etc.) Please also

describe any major changes to the EMR in this time period that might have impacted results (changes in clinical data collection forms and the like).

Response:
Thank you. Following sentences are added in Methods (Setting) to provide more detail about EMR.

“Using eyeNotes all the findings of clinical examinations and investigations are recorded in a structured way as part of examination processes. A/Scan, B/Scan, and other investigation reports from the equipment are inserted into eyeNotes in real-time. Surgery notes, including any intraoperative complications, are entered immediately after the surgery. Immediate postoperative findings are recorded by the examining doctor. eyeNotes has been undergoing regular upgrades based on feedback from the users. During the study period CATQA database was not changed much except that source data was changed from IHMS to eyeNotes.”

Rationale
- Please define the CATQA before using it here.

Response:
Thank you. Full form of CATQA – “Cataract Surgical Quality Assurance” is added now.

Discussion
- Can any of the process changes (refraction, IOL selection, biometry) be linked to changes in outcomes based on timing? This work would be of more interest if you could link specific interventions (benchmarking, process changes) to changes in outcomes.

Response:
Thank you. Following paragraph is added and also a reference is given from recent publication.
A benchmarking process based on evidence-based outcome monitoring gives an opportunity to evaluate variations and take appropriate measures to achieve better outcomes, such as changing processes and upgrade inputs, e.g., standardizing equipment across the system, choosing right intraocular lens (IOL), training, etc. Specific interventions at Aravind and their results are as follows. Because of the introduction of immersion biometry in 2013 and its implementation in all centres in the following years, prediction error declined significantly in the immediately following year and thereafter.(34) Since 2012, LED-illuminated vision charts have been introduced in eye camps, and vision drum charts were replaced with digital vision charts at base hospitals. These changes have led to improvement in refraction quality. Similarly, the analysis of outcome based on residual spherical equivalent with individual IOLs prompted changing of the A-constant of Aurovue IOL (hydrophobic acrylic IOL) from 118.4 to 118.7. This change helped to improve the refractive outcome and those within ±0.5D residual spherical equivalent increased from 81.5% in 2014 to 95% in the following years. Following chart is included as Supplementary figure-4.

- Similarly, in terms of your discussion points, how do we know that the process changes are not what improved outcomes? Perhaps better IOLs and better biometry improved the refractive outcomes, for example.

Response:
Thank you. Following sentences are included to highlight this limitation and note that benchmarking itself will not lead to actual improvement.

“We recognize that to conclusively establish the impact of benchmarking, a randomized control study would be required. The retrospective, observational design in the current study relies on time trends to assess the impact and therefore cannot fully rule out alternative explanations. As a result, our findings are suggestive rather than conclusive. Furthermore, while benchmarking shows opportunities for improvement, but actual improvement can only occur when the causes of deficiencies are identified and addressed”.

- Figures
- Figures 2-4 could be improved by removing the table of data at the bottom and creating a legend indicating for the colours.

Response:
Thank you. Tables at the bottom are removed now. Tables are shown as supplementary tables.

VERSION 3 – REVIEW

REVIEWER	***Boland, Michael*** ***Massachusetts Eye and Ear, Ophthalmology***
REVIEW RETURNED	18-May-2023

GENERAL COMMENTS	Thank you to the authors for their responses to my comments. I hope they found them helpful in revising the manuscript.