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The challenges in improving outcome of cataract surgery in low and middle income countries

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Cataract is the leading cause of blindness globally and surgery is the only known measure to deal with it effectively. Providing high quality cataract surgical services is critical if patients with cataract are to have their sight restored. A key focus of surgery is the outcome of the procedure. In cataract surgery this is measured predominantly, using visual acuity. Population- and hospital-based studies have revealed that the visual outcome of cataract surgery in many low and middle income settings is frequently sub-optimal, often failing to reach the recommended standards set by the World Health Organization (WHO). Another way of measuring outcome of cataract surgery is to ask patients for their views on whether surgery has changed the functioning of their eyes and their quality of life. There are different tools available to capture patient views and now, these patient-reported outcomes are becoming more widely used. This paper discusses the visual outcome of cataract surgery and frames the outcome of surgery within the context of the surgical service, suggesting that the process and outcome of care cannot be separated. It also discusses the components of patient-reported outcome tools and describes some available tools in more detail. Finally, it describes a hierarchy of challenges that need to be addressed before a high quality cataract surgical service can be achieved.

Key words: Cataract surgery, clinical outcome, patient-reported outcome, quality improvement, quality

Cataract is the leading cause of blindness (visual acuity worse than 20/400 in the better eye with best correction) worldwide with an estimated 18 million people thought to be affected.^[1] Approximately 90% of cataract blindness occurs in low and middle income countries (LMICs).

Cataract is closely associated with aging, with exogenous (UV radiation, trauma) and endogenous (genetics, diabetes, and others) risk factors being less important.

There are no known preventive strategies for cataract and the mainstay of treatment is cataract surgery. Cataract surgery is one of the most common surgical procedures performed worldwide and the numbers are on the rise. It is also has been shown to be one of the most cost-effective surgical interventions.^[2]

There is evidence that the cataract surgical outcomes (CSOs) in many LMICs are suboptimal. To improve poor outcome and avoid converting 'curable' to 'incurable' blindness, it is recognized that it is important to understand that outcomes are influenced by the whole cataract surgical service and implement a quality improvement program. This paper explores the challenges in trying to improve outcome.

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What is 'Outcome' of Cataract Surgery?

There are two methods of measuring outcome of cataract surgery; using a clinical indicator such as visual acuity or contrast sensitivity, or using a patient report of function or quality of life (or other types of subjective outcome).

There is a relationship between the two types of outcome [Fig. 1].

A patient can report a good outcome without an improvement in clinically assessed indicator (i.e., improved vision) and conversely vision can improve without the patient reporting an improvement in quality of life. However, most usually there is an association between good clinical outcome and good patient reports.^[3]

Outcome in most studies has been solely defined using clinical outcomes, usually based on visual acuity.

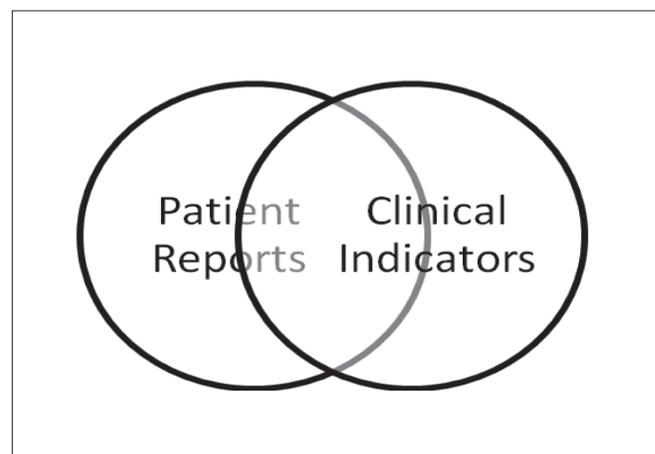


Figure 1: Relationship between types of outcome of cataract surgery

Outcome of Cataract Surgery

Both population- and hospital-based studies have shown that cataract surgical visual outcomes (CSVOs) in LMICs are variable. Table 1 shows visual outcomes in a range of different low and middle income settings.

The World Health Organization (WHO) recommends that

Table 1: Percentage of poor outcome (BCVA<20/200) following cataract surgery in low and middle income countries

Country	District/Town	Year of Publication	% with poor outcome despite IOL being inserted (with best correction)
Population-based Studies			
Eritrea ^[4]	All	2011	19
Malawi ^[5]	Southern	2011	28
Tanzania ^[6]	Kilimanjaro Region	2010	17
Kenya ^[7]	Nakuru	2007	17
Rwanda ^[8]	Western Province	2007	22
Cameroon ^[9]	Limbe	2007	44
China ^[10]	Gao'an	2010	13
	Xin'gan		13
	Wan'zai		3
China ^[11]	Nine Provinces	2010	10
China ^[12]	Beijing	2009	4
China ^[13]	Tibet	2005	19
Nepal ^[14]	Lumbini Zone	2010	6
Turkmenistan ^[15]	All	2002	8
Pakistan ^[16]	All	2007	11
Pakistan ^[17]	Chakwal Province	2003	12
Bangladesh ^[18]	Satkhira	2006	5
Brazil ^[19]	Campinas	2009	15
Guatemala ^[20]	Four Regions	2007	29
Philippines ^[21]	Negros	2007	12
	Antique		6
Hospital-based Studies			
Nepal ^[22]	Eye Camps (Pokhara)	1997	7
Nepal ^[23]	Morang	2009	4.5
South Africa ^[24]	Umtata	2001	7.6
Pakistan ^[25]	Lahore	2003	7
India ^[26]	Vellore	2003	0.7
India ^[27]	Madurai	2005	1.6
Bangladesh ^[28]	Mymensingh	2009	15
Nigeria ^[29]	Abak	2009	14.6
Nigeria ^[30]	Ibadan	2009	32.2

Gray shading shows studies that report a poor outcome in $\leq 5\%$ of cases

less than 5% of patients should have a visual outcome of worse than 20/200 with best correction.^[31] Table 1 shows that visual outcomes in many countries failed to reach this level. The information must be interpreted with care because it includes hospital-based studies that do not necessarily represent standard outcomes achieved across all centers and surgeries from different providers at different times. However, it shows that poor outcomes are common in many different LMICs.

Causes of Poor Outcome after Cataract Surgery

Poor visual outcome can be due to patient-related factors and/or service-related factors [Table 2].

'Patient-reasons' are those that are specific to each patient and not related to the service provided. The service can do little to alter the visual outcome in these cases. However, in certain instances, for example, posterior capsule opacification, the visual outcome can be improved with treatment.

'Service-reasons' are related to the service provided to the patient and are directly preventable by the altering the service. Poor visual outcome as a result of service factors, such as surgical complications, are unavoidable and are frequently due to human error or equipment malfunction. However, the service should have, in place, systems to reduce the likeliness of these errors.

Why is Poor Outcome after Cataract Surgery an Important Issue?

It has been established that those with poor vision, following cataract surgery in LMICs, are less likely to have an improved quality of life.^[32]

In addition, it has been found that rumors about poor outcome within communities decrease the demand for surgery.^[33] While this is only one of several reasons for refusing surgery it is important for service providers to maximize good outcomes so rumors such as this are minimized.

Addressing Poor Outcome Following Cataract Surgery

Several studies, shown in Table 1, suggest further training or changing surgical techniques to improve outcome but none have tested these suggestions.

A study in Kenya assessed whether outcomes could be improved using outcome indicators.^[34] Surgical teams received outcome data over a year and it was seen that good (VA better than 20/70) outcomes increased from 77% to 89%. The authors

Table 2: Description of causes of poor outcome after cataract surgery

Patient-related factors	Service-related factors
Preoperative ocular morbidity other than cataract resulting in poor vision despite successful surgery.	Intra-operative surgical complications
Long-term postoperative complications that affect visual acuity such as posterior capsule opacification	Postoperative uncorrected refractive error.

explained that complication rates had decreased but they did not explore why these changes had occurred. Patients with preexisting eye diseases were not included in this study.

Outcome as Part of Quality

Donabedian described the outcome of health care as being related to both structure (the characteristics of the health care provider including human, physical, and financial resources) and process (the interaction between clinician and patient both technical and interpersonal).^[35]

Donabedian suggested that structure, process, and outcome of care should be considered when defining a high quality service.^[35] This means that it is not appropriate to focus only on one aspect of care to improve outcomes; all components of the 'care pathway' should be addressed, from consent to surgical technique. This holistic view of the factors affecting outcome of surgery complicates the process of addressing poor outcomes but suggests that the only way to effectively improve outcome is to consider the whole care pathway.

Measuring Outcome of Cataract Surgery

Patient reports

A patient reported outcome (PRO) has been defined as

Table 3: Domains of the 14 item Visual Function Questionnaire

- Reading small print such as labels on medicine bottles, or a telephone book
- Reading a newspaper or book
- Reading a large print book or large print newspaper or numbers on a telephone
- Recognizing people when they are close to you
- Seeing steps, stairs, or curbs
- Reading traffic, street, or store signs
- Doing fine handwork like sewing, knitting, crocheting, or carpentry
- Writing cheques or filling out forms
- Playing games such as bingo, dominoes, card games, or mahjong
- Taking part in sports like bowling, handball, tennis, or golf
- Cooking
- Watching television
- Daytime driving
- Night-time driving

'measurement of any aspect of a patient's health status that is reported directly by the patient, free of interpretation by a physician, researcher, or other person. It is an account of how the patient functions or feels relative to a health condition or therapy.'^[36]

There are many different methods of assessing the outcome of cataract surgery from a patient perspective. These include measures of satisfaction, symptom scores, and quality of life taking into consideration vision and health.

PROs tend to be questionnaires that patients complete by rating aspects of their health, usually by giving a score. The score from each question is combined to provide an overall score. Analyses of PRO results tend to focus on a change in scores after an episode of care.

PROs have been developed and validated in many clinical settings including eye care. A common PRO used in eye care is the 14 item visual function index (VF-14) – a questionnaire with 14 questions related to eye health.^[37] Table 3 lists the main questions in the VF-14. The VF-14 has been widely used and validated in different populations.

It is also possible to combine different PROs in the same questionnaire. A questionnaire originally developed in India combined visual function and quality of life measures (VF-QoL).^[38] It has been used widely in different LMICs.^[39-43]

Despite widespread use of PROs in studies from LMICs, very few studies in these settings have examined visual function or vision-related quality of life for the same individuals before and after cataract surgery. Table 4 describes some of the studies that have explored this. Only a single vision-related quality of life or visual function domain is presented in the table despite the studies using several different domains. Every domain showed a significant improvement after surgery.

Issues with PROs

There are several factors that affect the use of PROs. A PRO has to be carefully validated before being used. Table 5 describes the features of a validated PRO that should be considered prior to selecting it.^[47]

If a PRO has not been validated for a specific population then care must be taken when using it as the results may not be reliable. Table 6 describes a PRO developed in India.

Another issue with the use of PROs in clinical practice is that they do not provide any information about the service. This means that, if patients are not reporting an improvement in function or quality of life following cataract surgery, it is

Table 4: Studies from low and middle income countries that explored visual function and/or vision-related quality of life in the same patients pre- and postcataract surgery

Study	Country	Tool	Domain	Pre-Op	Post-OP	Time scale
Polack ^[32]	Bangladesh	WHO/PBD/VF20	Overall Eyesight	12 (95% CI 11–18)	70 (95% CI 65–75)	1 year
	Kenya	WHO/PBD/VF20	Overall Eyesight	24 (95% CI 21–28)	72 (95% CI 68–76)	1 year
	Philippines	WHO/PBD/VF20	Overall Eyesight	18 (95% CI 14–22)	76 (95% CI 71–80)	1 year
Maki ^{*[44]}	Thailand	WHO/PBD/VF20	Weighted Overall VF Mean Score	2.88 (95% CI 2.75–3.02)	1.91 (95% CI 1.74–2.02)	3 months
Fletcher ^[45]	India	VF-QoL (Elwein)	VF General	8.71 (SD 14.74)	57.37 (SD 27.85)	6 months
Mamidipudi ^[46]	India	VF-QoL (Elwein)	VF General	39.6 (SD 27.4)	82.6 (SD 21.1)	3 months

*Note: The study by Maki shows a decrease in postoperative weighted overall VF mean score, however, this reflects an increase in visual functioning

not possible to establish where the problem lies in the service. PROs need to obtain more information to be more effective.

Clinical Outcome

Good clinical outcomes are an integral part of a high quality service.

The Importance of Clinical Outcome in Cataract Surgery

There are many ways of measuring clinical outcome after cataract surgery. These include visual acuity, contrast sensitivity, complication rates, among others.

Unlike other health conditions, clinical outcomes, such as visual acuity, in cataract surgery, are relatively simple to measure. They are easily quantified and can be used to show pre- and postoperative changes. They can also be standardized across hospitals making it convenient to compare the proportion of patients with a certain postoperative visual acuity with that in a different hospital.

However, poor visual outcome postsurgery cannot be used in isolation. It needs to take into consideration the patient's situation and is not necessarily a marker of poor surgery. To understand the context of the outcome, it is important to capture information on preoperative morbidity (patient-related reason for poor outcome). Capturing markers of preoperative morbidity and visual loss in a group of patients is called the 'case mix'.^[50,51]

It is also critical to collect information about intra-operative complications as a high complication rate can be associated with poor surgical technique or patient management.

Tools to Collect Information on Clinical Outcomes

Various tools are used to collect information on patient demography, pre- and postoperative visual acuity, preoperative ocular morbidity, type of surgery, and complications.

Open-access computer software specifically for use in LMICs is available.

Challenges to Improving the Outcome of Cataract Surgery

Challenges to improve outcome of cataract surgery vary depending on the location where surgery is conducted. The complexity of assuring a good outcome means that all the basic building blocks of providing cataract surgery have to be in place (e.g., equipment/consumables, infrastructure, and staffing) before monitoring and follow up can begin. These need to be present before patient-centered care can occur (defined as providing care that is respectful of and responsive to individual patient preferences, needs, and values and ensuring that patient values guide all clinical decisions).^[52]

The level of development of the health system and hospital determines the level at which the challenge in assuring optimal outcomes is faced [Table 7].

For example, a basic hospital in a low income country might struggle to provide biometry before cataract surgery. This will

Table 5: Features of a validated patient reported outcome tool

Appropriateness	The PRO content is appropriate to the content in which it is being used.
Acceptable	The PRO acceptable to patients.
Feasible	The PRO easy to administer and collect.
Interpretable	The results of the PRO are easy to interpret.
Precise	The scores of the PRO are precise.
Reliable	The results of the PRO are reproducible and internally consistent.
Valid	The PRO measures what it purports to measure.
Responsive	The PRO detects differences over time that matter to patients.

Table 6: Example of a patient-reported outcome tool developed for low and middle income settings

The VF-14 domains are useful for literate and urban communities but may not be appropriate for many LMIC settings.

Recognition of the limitations of the VF-14 led to the development of the Indian Visual Function Questionnaire (IND-VFQ). A wide variety of socio-economic groups took part in the development process including 61.3% of participants who were illiterate.^[48]

18 broad domains and 33 questions were developed from 46 focus group discussions and the collection of 5000 problem statements. These domains encompass visual, functional, and psychological components.^[49]

The IND-VFQ has been used in several settings and has been shown to be a useful tool to measure patient-reported outcome.

Table 7: Hierarchy of Challenges in improving outcome

Level of Development	Challenges	Comment
Low	Equipment Consumables Skills Human resources Financing Leadership and Governance	Challenges at this level include procurement and maintenance of equipment, procurement of consumables, and having adequate numbers of appropriately trained staff.
Middle	Follow up Monitoring outcomes	Challenges include following up patients to ensure they receive optimal refractive correction, and monitoring patient and visual outcomes.
High	Patient-centered care	Challenges include collecting and understanding information about patient experience, patient satisfaction and patient-reported outcomes and identifying service development required to address these issues.

compromise outcome despite the availability of well trained, competent surgeons, and the use of intraocular lenses. A hospital in a middle income country might have the necessary

equipment, consumables, staffing, skills, and infrastructure but might struggle with following up on patients (ensuring that their refractive error is corrected) or monitoring outcomes.

Addressing these challenges depends on the functioning of the hospital and its operations. A low income setting will require different approaches to improve quality when compared with those taken by a high income hospital. This makes understanding the context of the hospital critical before making any changes to improve outcome.

Monitoring

A critical component in improving outcome is monitoring. In the absence of monitoring, it is not possible to assess what needs to change and difficult to determine the impact of any interventions designed to change the service.

A regular clinical (medical) audit by the service provider is a good way of monitoring clinical outcome.

Monitoring is time consuming and expensive. Often there is resistance from medical staff as they feel that monitoring outcome is also a measure of their performance. However, without an effective monitoring system it is not possible to assess whether the service being provided is effective.

Monitoring clinical outcomes is usually simpler than monitoring patient reports. Patient reports add a further level of complexity into the monitoring system as they require a different approach to collect, comprehend, and disseminate.

Summary

Evidence suggests that the clinical outcome of surgery in many LMICs is sub-optimal. However, outcome of cataract surgery is integrally linked to every aspect of the cataract surgical service and as a result the process of improving outcome is complicated.

When addressing poor outcome the relative development of the cataract surgical service must be assessed and any planned interventions must reflect this development. For example, there is no point in investing in patient-centered care when there is no surgeon.

The complexity of measuring outcome must be tempered by the necessity to collect outcome, both clinical and patient reports. Without outcome data it is not possible to assess the effectiveness of the service, or address issues in the service.

Conclusion

Collecting information on clinical and patient reported outcome is critical for every cataract surgical service to continue to improve. Monitoring outcome should be as integral to the service as performing the surgery.

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