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ORIGINAL ARTICLE

The Impact of Cataract Surgery on Health Related Quality of Life in Kenya, the Philippines, and Bangladesh

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ABSTRACT

Purpose: To assess the impact of cataract surgery on vision related quality of life (VRQoL) and generic health related quality of life (HRQoL) in Kenya, Bangladesh and the Philippines.

Methods: A multi-center intervention study was conducted. At baseline 651 cases aged ≥50 years with visually impairing cataract (corrected visual acuity (VA) <6/24) and 561 age- gender-matched controls with normal vision (VA>6/18) were interviewed about VRQoL (using the World Health Organization/ Prevention of Blindness and Deafness 20-item Visual Functioning Questionnaire [WHO/PBD VF20]) and generic HRQoL (EuroQol). Cases were offered free/subsidized cataract surgery. Approximately 1 year later participants were re-interviewed.

Results: Response rate at follow up was 84% for operated cases and 80% for controls. At baseline, cases had significantly poorer VRQoL scores, were more likely to report problems with the EuroQol 5D five descriptive (EQ–SD) domains (mobility, daily activities, self-care, pain, depression/anxiety) and had significantly poorer self-rated health compared to controls. At follow up VRQoL scores of operated cases improved significantly to approximately equal those of controls. Effect sizes were large (> 0.8) regardless of pre-operative VA. Poor outcome from surgery (VA < 6/60) was associated with smaller VRQoL gains. Among operated cases frequency of reported problems with all the EQ-5D reduced significantly compared to baseline in Kenya and the Philippines, and in mobility, daily activities and self-care in Bangladesh. Self-rated health scores increased significantly in each country. HRQoL of controls remained stable from baseline to follow up.

Conclusion: This study among adults undergoing cataract surgery in 3 different low-income settings found evidence of improved VRQoL and generic HRQoL to approximately equal that of controls with normal vision.

KEYWORDS: Bangladesh; Cataract surgery; Health related quality of life; Kenya; Low-income countries; Philippines; Vision related quality of life

INTRODUCTION

The assumption behind medical interventions for non life-threatening conditions, such as cataract surgery, is that it brings improvements to the quality of life (QoL) of the patient. However, the degree to which this occurs is not captured by clinical measures (e.g.,

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visual acuity, VA) that are typically used to assess outcome from interventions such as cataract surgery. Patient reported outcome measures, such as health related quality of life (HRQoL) instruments can be used alongside clinical evaluation to provide a more comprehensive outcome assessment.[1]

HRQoL measures include disease or organ specific instruments, which address issues relating to a specific condition of interest (e.g., visual impairment) and generic HRQoL instruments which are applicable to all health conditions. Some instruments focus on functional ability, addressing restrictions to basic daily activities (e.g., visual functioning, VF), while others are multi-dimensional and also include broader aspects of health such as psychological and social well-being.

Studies on the impact of cataract surgery on HRQoL in high-income countries are inconsistent. While a positive impact on VF and vision-related QoL (VRQoL) has been shown consistently in a range of settings, findings on generic HRQoL are mixed with some studies showing an improvement[2–3] and others finding no change. [4–6] In low-income settings, less is known. Studies in India have demonstrated improved VF and VRQoL after cataract surgery, but no information could be identified on the impact on generic HRQoL.

Different factors may influence the impact cataract surgery has on the patient including post-operative VA,[7–9] unilateral or bilateral surgery,[2,10,11] and socio-demographic characteristics.[7, 12,13] Identifying these may help guide policy decisions about where and how to allocate limited resources to improve services.[14,15] This has been relatively unexplored in the poorest parts of the world where the populations most commonly affected by blindness from cataract reside.[16]

The "Cataract Impact Study" was undertaken to explore the impact of cataract surgery on poverty and HRQoL among people aged ≥ 50 years in Kenya, Bangladesh and the Philippines. At baseline we found that persons visually impaired from cataract (cases) had substantially poorer VRQoL and generic HRQoL compared to controls with normal vision.[17–19] Cases were offered free/subsidized cataract surgery at baseline and study participants were followed up after 1 year. The aim of the current paper is to assess the impact of cataract surgery on change in VRQoL and generic HRQoL and to explore socio-demographic and ocular predictors of this change.

METHODS

Study Overview

The "Cataract Impact Study" was a longitudinal intervention study conducted in Kenya (Nakuru district), Bangladesh (Satkhira district) and the Philippines (Negros Island and Antique district). At baseline people aged ≥ 50 years with visual impairment from cataract (cases) and age- gender matched peers with normal vision (controls) were interviewed about poverty,[20] time-use,[21] and HRQoL. Cases were offered free or subsidized cataract surgery. Approximately 1 year later, participants were re-interviewed. This paper presents findings from the HRQoL data before and after cataract surgery.

Study Population

Sample size calculations were powered to detect a 30% improvement in VRQoL one year after cataract surgery based on previous study findings.[7, 22] To detect this improvement required 100 operated cases in each country examined at baseline and follow-up with an alpha of 0.05 and 80% power.

Study participants were identified primarily through population-based blindness surveys at baseline.[23–25] Clusters were selected using probability proportionate to size sampling and households within clusters were selected using compact segment sampling. All participants underwent a VA test using a Snellen tumbling "E" chart and clinical examinations by an ophthalmologist in their home. Cases were survey participants aged ≥ 50 years, with pinhole corrected VA < 6/24 in the better eye from cataract. For each case identified in the survey, one (up to two in Bangladesh) age-, gender- and cluster- matched controls without visual impairment (VA < 6/24) from cataract were selected. For the purposes of the present analyses, only controls with normal vision (presenting VA ≥ 6/18 in the better eye) were included. Due to logistical and time constraints, additional cases were identified in each setting through community-based case detection, using the same examination procedures and case definition. In Kenya, the first 50 patients (from a set date) attending the local hospital for cataract surgery and meeting the case definition, were also recruited.

Baseline and Follow Up

Baseline surveys were undertaken between January 2005 and May 2006. In Kenya and Bangladesh free surgery was offered which was funded by this study. In the Philippines a fee was requested but those who could not afford the fee were offered free surgery. The direct cost of cataract surgery to the patient in these settings is between US$40 and $60 (inclusive of follow up and medication). In each setting, however, systems are in place to provide free surgery for those unable to pay.

Follow up surveys were undertaken approximately 1 year later, during the same climatic season as the baseline. All traced participants were re-examined (using same VA assessment procedures as at baseline) and re-interviewed. Interviews were conducted in respondents' own homes (except for hospital cases in Kenya), by trained interviewers who were regularly observed by supervisors. The interviewers at baseline and follow up were the same with the exception of Bangladesh, where two additional people were trained at follow up.

Measuring HRQoL

VRQoL was assessed using the World Health Organization/ Prevention of Blindness and Deafness 20-item Visual Functioning Questionnaire (WHO/PBD VF20),[26] which was adapted from the Indian VF33 and proposed by the WHO as a tool for assessing VRQoL in low-income settings. The scale includes 20 items on overall eyesight, visual symptoms, visual functioning and psychosocial well-being, each with a 5-point response option. Evidence for reliability and validity of this scale was found at baseline, details of which are presented in previous publications.[17–19] Based on pilot testing and psychometric evaluation during baseline two items were removed: *"How much pain or discomfort do you have in your eyes*?" and *"How much difficulty do you have seeing because of glare from bright lights?"* The scale used in the current study therefore comprised 18 items, but will be referred to as the WHO/PBD VF20 for simplicity. Factor analysis showed that the items grouped into two subscales—general functioning (13 items about difficulty with daily activities) and psychosocial sub-scales (4 items) and there was one overall eyesight rating item.[17–19] The scale was translated into local languages (three in Kenya, three in the Philippines and one in Bangladesh) using standard forward and backward translation procedures.

Generic HRQoL was assessed using the European Quality of Life (Euroqol) questionnaire.[27] This instrument includes two components. The first consists of five descriptive domains (EQ-5D): mobility, self care, usual activity, pain/discomfort and anxiety/depression, each with three response options (no problem, some problem or extreme problem). The second measures self-rated health (SRH) using a Visual Analogue Scale (VAS), with scores ranging from 0 (representing *worst imaginable health state*) to 100 (*best imaginable health state*). The respondents are asked which EQ-5D response option or where on the VAS scale best describes them "today." The translation of this questionnaire was undertaken independently from the Euroqol group and the versions used in this study have therefore not been approved by the Euroqol group.

Covariates

Information was collected on standard socio-demographic variables including age, gender, education, literacy and marital status. Data were also collected on standard indicators of wealth (e.g., assets owned by the household, building materials of the house) and a socio-economic-status (SES) index was developed for each household using Principal Components Analysis, separately for each country.[28]

Statistical Analysis

All data analyses were restricted to participants with both baseline and follow-up data. To assess the potential impact of loss to follow up, we compared baseline socio-demographic characteristics, VRQoL and generic HRQoL for participants with and without follow-up data.

The VRQoL sub-scale scores were converted into scores out of 100, with 0 as the worst possible score and 100 as the best score. We compared VRQoL and generic HQRoL of operated and un-operated cases to controls at baseline and at follow up controlling for age, gender and SES using Analysis of Variance (ANOVA) (for VRQoL and SRH) and logitic regression (for EQ-5D). For the logistic regression analysis the EQ-5D the "some" and "extreme" response options were combined to create a binary outcome variable: "none" versus "any" problem. Change from baseline to follow up was assessed by comparing VRQoL and generic HRQoL responses at baseline and follow up, among operated cases, un-operated cases and controls separately. *P*-values were calculated through paired t-test for VRQoL and SRH and McNemars tests for EQ-5D responses. Effect sizes for longitudinal change in VRQoL and SRH were also calculated as the mean change in scores divided by the standard deviation of the baseline score (of the cases and controls). Effect sizes of 0.2–0.49 were considered "small," 0.5–0.79 medium and ≥ 0.8 large.[29]

To explore potential predictors of change in VRQoL and SRH among operated cases we compared the amount of change by socio-demographic (age, gender, SES, literacy, and marital status) and ocular factors (baseline and follow up VA in the better eye and unilateral/bilateral surgery) using analysis of covariance adjusted for baseline score. In addition, effect sizes for VRQoL among operated cases were stratified by the three ocular variables. For analyses VA categories (presenting VA in the better eye) were defined based on

WHO categories [30] as follows: Normal vision, VA6/6–6/18 (controls only); Moderate visual impairment, < 6/24–6/60; Severe visual impairment, < 6/60–3/60; Blind < 3/60 >Perception of light (PL); PL.

Cases identified in the hospital in Kenya were younger and more likely to be in the higher SES group than the population-based cases and both these factors could be associated with HRQoL. Further, they were interviewed in the hospital at baseline rather than their homes which may have influenced their responses, although it is unclear in what direction. To assess the potential impact of inclusion of hospital cases on the results we compared the baseline, follow-up and change in HRQoL scores between hospital and population based cases and found no significant differences. Further, the analyses described above were repeated without the hospital cases and results were similar. Data are therefore presented for these two groups combined.

Ethical Considerations

Informed signed/thumb-printed consent was obtained from all study participants. Ethical approval was granted by the London School of Hygiene &Tropical Medicine, Kenya Medical Research Institute, Bangladesh Medical Research Council and the University of St. La Salle, Bacolod, The Philippines.

RESULTS

At baseline we included 196, 217 and 238 cases visually impaired from cataract and 128, 280 and 163 controls with normal vision in Kenya, Bangladesh and the Philippines respectively. Sixty percent of cases were identified through the survey, 37% through case finding and 8% from the hospital (Kenya only). All controls were recruited through the survey. Uptake of surgery among cases identified through surveys and case detection was low (88%, n = 85 in Kenya, 46% n = 117 in Bangladesh, 47% n = 112 in the Philippines).

Response rates at follow-up were generally high: 80% for operated cases, 65% for un-operated cases and 75% for controls in Kenya; 85%, 71%, 80% respectively in Bangladesh and 88%, 73%, 86% in the Philippines (Table 1). The dominant causes of non-response were person not available (moved away and untraceable or not present in the household after three visits by the survey team) or death. Refusals to participate at follow up were rare (< 3 in each country). Socio-demographic characteristics and baseline HRQoL of operated cases, un-operated and controls lost to follow-up and included at follow-up were similar (data not presented). The exception was that in the Philippines cases lost to follow up were significantly younger than those included. Among the operated cases at follow up, 71% in Kenya and 72% in the Philippines had presenting VA ≥ 6/18 in the better eye while this was higher in Bangladesh (84%).[31]

Operated cases and controls were broadly similar in age, gender and marital status in the three countries, but un-operated cases were older, and more likely to be female and unmarried (Table 2). Controls were more likely than cases to be in the highest SES quartile and have a formal education in Kenya and Bangladesh.

TABLE 1 Loss to follow up by country for operated cases, un-operated cases and controls

			Lost to follow up	
	Total at baseline N	Examined at follow up N (%)	Known mortality N (%)	Not available (moved home/not found) N (%)
Kenya				
Cases				
Operated	132	106 (80%)	9 (7%)	17 (13%)
Un-operated	62	40 (65%)	7 (11%)	15 (24%)
Controls	128	96 (75%)	5 (4%)	27 (21%)
Bangladesh				
Cases				
Operated	117	99 (85%)	6 (5%)	12 (10%)
Un-operated	100	71 (71%)	7 (7%)	22 (22%)
Controls	280	223 (80%)	10 (4%)	47 (16%)
Philippines				
Cases				
Operated	112	98 (88%)	7 (6%)	7 (6%)
Un-operated	126	92 (73%)	20 (16%)	14 (11%)
Controls	163	140 (86%)	5 (3%)	18 (11%)

TABLE 2 Baseline demographic characteristics of cases (operated and un-operated) and controls examined at baseline and follow-up

	Kenya				Bangladesh				Philippines			
	Operated cases (n=106)	Un-operated cases (n=40)	Controls (n=96)	*P*-value*	Operated cases (n=99)	Un-operated cases (n=71)	Controls (n=223)	*P*-value*	Operated cases (n=98)	Un-operated cases (n=92)	Controls (n=140)	*P*-value*
Mean age(95% CI)	74 (72–76)	80 (78–83)	73 (71–75)	<0.001	70 (68–72)	74 (71–76)	68 (67–69)	<0.001	71 (69–73)	76 (74–77)	70 (69–72)	<0.001
Female	56%	62%	56%	0.74	53%	71%	57%	0.05	61%	69%	54%	0.07
Married	52%	32%	58%	0.03	49%	33%	58%	0.001	44%	46%	57%	0.08
Education	25%	28%	45%	0.009	18%	17%	34%	0.002	90%	89%	92%	0.71
Highest SES	18%	10%	38%	0.002	16%	18%	29%	0.03	18%	21%	29%	0.64
Pre op VA												
≥6/18	0%	0%	100%	0.001**	0%	0%	100%	0.84**	0%	0%	100%	0.20**
< 6/24-6/60	39%	60%			29%	23%			23%	27%		
<6/60-3/60	17%	30%			16%	20%			22%	16%		
<3/60>PL	21%	3%			12%	14%			28%	35%		
PL	24%	8%			42%	43%			28%	22%		
Unilateral /bilateral surgery												
Unilateral	57%				74%				71%			
Bilateral	43%				26%				29%			
VA outcome†												
Good	71%				84%				72%			
Borderline	21%				6%				20%			
Poor	8%				10%				8%			

CI – Confidence Interval; PL – Perception of Light; SES – Socioeconomic Status; VA – Visual Acuity (presenting, in the better eye).
**P*-value from ANOVA for continuous variable (age) and chi-square for categorical variables.
**Comparison of operated versus un-operated cases.
† Presenting VA in the better eye among operated cases classified by WHO cataract surgical outcome categories (Good = VA 6/6–6/18; Borderline VA <6/18–6/60; Poor = VA <6/60).

VRQoL- WHO/PBD VF20

At baseline in each country, cases had considerably poorer general functioning, psychosocial and overall eyesight scores compared to controls with normal vision ($P<0.001$, Table 3). At follow up, among operated cases, all scores had improved substantially (by between 31 and 61 points, $P<0.001$, Table 3). In contrast, scores among the controls remained relatively stable between baseline and follow-up, with the exception of a small but significant improvement in overall eyesight rating among controls in Bangladesh.

TABLE 3 Baseline and follow-up VRQoL scores and effect sizes among operated cases and controls

	Baseline mean (95% CI)	Follow up mean (95% CI)	Change from baseline to follow up Mean (95% CI)	*P*-value* for change	Effect size (95% CI)
KENYA					
Overall eyesight					
Operated cases	24 (21–28)	72 (68–76)	47 (42–53)	<0.001	1.5 (1.3–1.7)
Controls	73 (68–78)	75 (70–79)	2 (-4–7)	0.8	0.05 (-0.3–0.2)
P-value vs control**	<0.001	0.2			
General functioning					
Operated cases	42 (36–48)	89 (85–92)	47 (41–52)	<0.001	1.4 (1.2–1.5)
Controls	92 (90–95)	91 (88–94)	-1 (-4–2)	0.8	-0.03 (-0.1–0.1)
P-value vs control**	<0.001	0.3			
Psychosocial					
Operated cases	55 (48–61)	91 (88–95)	37 (29–44)	<0.001	1.1 (0.9–1.3)
Controls	92 (89–95)	91 (88–95)	-1 (-5–3)	0.9	-0.02 (-0.1–0.1)
P-value vs control**	<0.001	0.9			
BANGLADESH					
Overall eyesight					
Operated cases	12 (11–18)	70 (65–75)	58 (52–63)	<0.001	1.9 (1.7–2.1)
Controls	64 (62–67)	72 (69–75)	8 (5–11)	<0.001	0.2 (0.1–0.4)
P-value vs control**		0.4			
General functioning					
Operated cases	15 (1–18)	76 (71–81)	61 (55–67)	<0.001	1.6 (0.5–1.8)
Controls	85 (83–88)	80 (78–83)	-5 (-7– -3)	<0.001	-0.1 (-0.2–0.1)
P-value vs control**	<0.001	0.8			
Psychosocial					
Operated cases	30 (25–34)	82 (79–85)	50 (44–57)	<0.001	1.4 (1.3–1.6)
Controls	89 (87–91)	82 (79–85)	-7 (-9– -4)	<0.001	-0.02 (-0.3–1.1)
P-value vs control**	<0.001	0.7			
THE PHILIPPINES					
Overall eyesight					
Operated cases	18 (14–22)	76 (71–80)	57 (51–64)	<0.001	1.7 (1.5–1.9)
Controls	67 (63–71)	74 (70–78)	7 (2–12)	0.02	0.2 (0.1–0.4)
P-value vs control**	<0.001	0.7			
General functioning					
Operated cases	28 (24–33)	85 (81–88)	56 (51–62)	<0.001	1.6 (1.4–1.7)
Controls	88 (86–91)	85 (83–88)	-3 (-5– -1)	0.02	–0.1 (–0.2–0.0)
P-value vs control**	<0.001	0.8			
Psychosocial					
Operated cases	42 (38–47)	82 (78–86)	40 (34–46)	<0.001	1.3 (1.1–1.5)
Controls	87 (84–89)	86 (83–89)	-1 (-4–3)	0.9	0.2 (-0.1–0.1)
P-value vs control**	<0.001	0.2			

CI – Confidence Interval.

*P-values from paired t-test comparing scores at baseline and follow up separately for operated cases and controls.

** P-values from ANOVA (controlling for age and gender) comparing operated cases to controls at follow up.

Some data were missing: Kenya: Baseline 1 operated case, psychosocial. Follow up 1 operated case, overall eyesight. Bangladesh: follow up 1 operated case and 1 control, psychosocial. Philippines: baseline, 1 control psychosocial. Follow up 1 control, general functioning and 1 control psychosocial.

At follow up, average VRQoL scores among operated cases were approximately equal to those of control subjects with normal vision. Effect sizes were consistently large (> 1.1) for operated cases and very small among controls (< 0.2).

Generic HRQoL - Euroqol

At baseline, in each setting, more than 70% of the operated cases reported "some" or "extreme" problem with mobility, daily activities, pain/discomfort and anxiety/depression, while at least half reported problems with self-care (Table 4). At follow up, the proportion of operated cases reporting any problem reduced significantly by between 10–44% compared to baseline in all domains in Kenya and the Philippines and in mobility, daily activities and self-care in Bangladesh (Table 4). In contrast, baseline and follow up response distributions for controls remained broadly similar. At follow up, the proportion of operated cases reporting "any problem" was similar to that of the controls in each country.

At baseline, cases had significantly poorer SRH scores compared to controls. Among operated cases mean SRH scores increased significantly at follow up in each country, from 47.7 (95% Confidence Interval [CI] 44.3–51.1) to 58.0 (95% CI 54.9–61.0) in Kenya (P <0.001), from 49.8 (44.9–54.6) to 65.3 (95% CI 61.2–69.3) in Bangladesh (P < 0.001) and from 53.3 (50.4–56.3) to 57.7 (54.3–60.9) (P = 0.05) in the Philippines. Among controls, mean SRH did not change significantly in Kenya (60.2 to 61.3,P = 0.5) or the Philippines (62.3 to 59.0, P = 0.09), while in Bangladesh scores increased by 3.7 points (59.1–62.8, P = 0.01). Medium effect sizes for SRH were seen among operated cases in Kenya (0.6) and Bangladesh (0.7) and they were small in the Philippines (0.3). Among controls effect sizes were all less than 0.2. At follow up, SRH scores among operated cases were broadly equal to those of controls.

Un-operated Cases

Among un-operated cases VRQoL and generic HRQoL remained relatively stable between the two time points and continued to be significantly poorer compared to controls at follow up (data not presented). The exceptions were improvements in overall eyesight in Kenya (30.6 to 45.0, P < 0.001) and psychosocial score in the Philippines (42.9 to 49.2, P = 0.001), although the magnitude of these improvements were small. There was also some reduction in the proportion of un-operated cases reporting problems with pain/discomfort (80% to 57%, P = 0.04) and anxiety/depression (72% to 53%, P = 0.02) in Kenya and mobility (93% to 80%, P = 0.01) in Bangladesh. In the Philippines reporting of problems *increased* for self care (48% to 67%, p = 0.006) and usual activities (71% to 86%, P = 0.01). Effect sizes for VRQoL and SRH among un-operated cases were < 0.3 in each country.

Predictors of Change in HRQoL Among Operated Cases

VRQoL

A good VA outcome (VA > 6/18) from surgery was consistently associated with greater improvements in overall eyesight, general functioning and psychosocial scores after adjustment for baseline score (Table 5). There was no significant association between change in VRQoL and baseline VA. Average scores for cases who were operated in both eyes were consistently higher compared to those with unilateral surgery, although this was not always statistically significant. There were few consistent trends or significant associations between socio-demographic variables and change in VRQoL (Table 5).

Table 6 shows effect sizes stratified by the ocular variables. Noteworthy is that effect sizes were large (> 0.8) regardless of level of pre-operative VA. Cases with poor VA outcome had consistently smaller effect sizes (< 0.8, except general functioning in Kenya which was 1.1) compared to those with good or borderline outcome in each setting (≥ 0.8). Effect sizes were consistently large (> 0.9) for cases with one or both eyes operated, however a general trend of greater effect sizes for cases with bilateral compared to unilateral surgery was observed.

Self-rated Health

In all countries increase in SRH was smallest for those with poor VA outcome (Kenya 3.3, Bangladesh 5.5, Philippines -4.4) compared to good outcome (10.1, 23.9 and 5.8 respectively), although this was only statistically significant for Kenya. There were no associations between changes in SRH scores with other ocular or socio-demographic variables (data not shown).

DISCUSSION

This multi-center study found that 1 year after cataract surgery there were large, significant improvements in perception of own eyesight, reduced difficulty undertaking everyday activities (general functioning) and reduced frequency of negative psychosocial experiences associated with vision. There were also significant improvements in aspects of generic HRQoL:

TABLE 4 Responses to the EQ-5D at baseline and follow up among operated cases and controls

	Kenya				Bangladesh				The Philippines			
	Operated cases		Controls		Operated cases		Controls		Operated cases		Controls	
EQ-5D Domains	Baseline	Followup	Baseline	Follow up	Baseline	Follow up	Baseline	Follow up	Baseline	Follow up	Baseline	Follow up
MOBILITY	N=106		N=96		N=99		N=223		N=98		N=140	
No problem	31%	64%	70%	76%	11%	54%	53%	52%	17%	35%	44%	44%
Some problem	65%	34%	30%	24%	85%	45%	47%	44%	74%	56%	54%	51%
Confined to bed	4%	2%	0%	0%	4%	1%	0%	4%	8%	9%	2%	5%
*P-value case vs controls**	<0.001	0.7			<0.001	0.8			<0.001	0.2		
*P-value for change***	<0.001		0.3		<0.001		0.2		0.005		0.9	
SELF-CARE												
No problems	54%	85%	89%	87%	38%	65%	80%	71%	46%	67%	86%	74%
Some problems	42%	13%	12%	12%	60%	34%	20%	24%	46%	23%	12%	22%
Unable	5	2%	0%	2%	1%	1%	0%	5%	8%	9%	1%	4%
*P-value case vs controls**	<0.001	0.8			<0.001	0.3			<0.001	0.2		
*P-value for change***	<0.001		0.8		<0.001		0.002		0.002		0.003	
USUAL ACTIVITIES												
No problems	21%	67%	72%	71%	12%	47%	56%	57%	26%	51%	73%	64%
Some problems	57%	26%	26%	25%	56%	45%	39%	35%	59%	40%	24%	29%
Unable	23%	8%	2%	4%	31%	7%	5%	7%	15%	9%	3%	6%
*P-value case vs controls**	<0.001	0.6			<0.001	0.1			<0.001	0.1		
*P-value for change***	<0.001		0.2		<0.001		0.9		0.002		0.09	
PAIN/DISCOMFORT												
None	16%	43%	38%	50%	18%	19%	19%	16%	10%	20%	31%	25%
Moderate	73%	50%	58%	45%	55%	70%	68%	57%	81%	63%	62%	66%
Extreme	11%	8%	4%	5%	26%	11%	13%	26%	9%	14%	7%	9%
*P-value case vs controls**	0.001	0.3			0.02	0.5			0.001	0.4		
*P-value for change***	<0.001		0.1		0.8		0.04		0.04		0.2	
ANXIETY/DEPRESSION												
None	20%	64%	51%	72%	8%	14%	24%	9%	31%	46%	50%	55%
Moderate	56%	27%	46%	23%	53%	69%	59%	59%	44%	42%	43%	35%
Extreme	25%	9%	3%	5%	38%	17%	17%	31%	26%	12%	7%	10%
*P-value case vs controls**	<0.001	0.2			<0.001	0.2			<0.001	0.4		
*P-value for change***	<0.001		0.004		0.2		<0.001		0.02		0.4	

*P-value from chi squared analysis comparing response distribution of cases and controls.
**P-value from McNemars test of difference between proportion reporting 'none' or 'any' ('some' and 'extreme' combined) problem at baseline and follow up.

TABLE 5 Association between socio-demographic and ocular variables and change in VRQoL from baseline to follow-up among operated cases, adjusted for baseline score

	Kenya			Bangladesh			The Philippines		
	Overall eyesight	General functioning	Psycho-social	Overall eyesight	General functioning	Psycho-social	Overall eyesight	General functioning	Psycho-social
	Mean change (95% CI)			Mean change (95% CI)			Mean change (95% CI)		
Age									
50–59	61 (31–90)	56 (26–86)	43 (7–78)	60 (39–81)	69 (48–89)	61 (42–79)	64 (45–82)	61 (51–72)	37 (23–52)
69–69	46 (29–62)	44 (27–60)	33 (15–51)	58 (48–67)	60 (49–71)	47 (33–60)	59 (43–74)	53 (41–65)	41 (29–53)
70–79	46 (38–55)	48 (38–55)	43 (31–56)	63 (55–71)	63 (54–71)	51 (42–59)	57 (47–66)	61 (52–69)	43 (33–54)
≥80	47 (39–54)	46 (37–56)	31 (19–44)	46 (31–60)	56 (41–70)	50 (34–66)	52 (34–69)	47 (32–62)	31 (17–45)
P-value*	0.3	0.3	0.6	0.2	0.3	0.2	0.5	0.6	0.9
Gender									
Male	42 (34–50)	43 (34–52)	30 (17–42)	57 (48–65)	61 (52–69)	50 (40–59)	63 (53–72)	61 (54–68)	43 (32–53)
Female	51 (44–58)	49 (41–57)	42 (34–51)	59 (52–66)	62 (53–70)	51 (42–49)	54 (45–63)	53 (46–61)	38 (30–45)
P-value*	0.1	0.03	0.3	0.3	0.5	0.6	0.1	0.3	0.9
Literacy									
Can't read	46 (39–52)	45 (38–52)	36 (28–45)	56 (50–62)	60 (54–66)	50 (43–56)	58 (40–77)	56 (38–73)	31 (14–49)
Can read	51 (39–63)	50 (37–63)	37 (21–53)	65 (50–80)	66 (52–80)	52 (32–71)	57 (50–64)	56 (51–62)	41 (35–48)
P-value*	0.5	0.7	0.6	0.2	0.4	0.5	0.07	0.6	0.002
Baseline VA									
<6/24–6/60	42 (35–49)	34 (26–42)	31 (22–40)	54 (44–64)	51 (42–61)	45 (34–56)	41 (25–57)	37 (25–49)	31 (19–44)
<6/60–3/60	42 (27–56)	39 (22–56)	26 (5–48)	61 (48–74)	62 (50–74)	43 (26–59)	69 (58–80)	63 (56–71)	43 (35–54)
<3/60>PL	43 (29–57)	45 (35–56)	40 (24–57)	46 (31–61)	54 (38–69)	47 (30–65)	57 (44–71)	59 (48–70)	44 (35–55)
PL	64 (53–74)	73 (62–84)	51 (32–70)	62 (53–71)	70 (60–79)	58 (47–68)	59 (48–71)	63 (53–74)	41 (37–56)
P-value*	0.8	0.4	0.08	0.5	0.8	0.8	0.1	0.06	0.1
VA outcome**									
Good	56 (47–64)	56 (47–65)	47 (37–57)	56 (45–67)	58 (47–70)	50 (34–65)	60 (46–74)	61 (50–72)	38 (25–52)
Borderline	39 (25–53)	38 (27–52)	19 (3–35)	29 (0–60)	35 (2–69)	21 (-0.8–49)	50 (35–65)	51 (37–65)	36 (53–50)
Poor	25 (14–36)	38 (16–60)	27 (-17–71)	23 (1–44)	13 (-9–35)	13 (-5.2–32)	19 (02–37.3)	16 (-5–38)	7 (-16–30)
P-value*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Surgery									
Unilateral	43 (35–51)	41 (33–49)	40 (32–47)	55 (49–61)	58 (51–65)	48 (41–56)	55 (47–63)	54 (47–60)	34 (26–41)
Bilateral	53 (46–60)	54 (46–62)	21 (-4.2–46)	65 (54–77)	70 (61–79)	56 (44–68)	63 (50–75)	64 (54–73)	55 (44–65)
P-value*	0.1	0.1	0.04	0.08	0.03	0.07	0.002	0.06	0.01
	Correlation coefficient			Correlation coefficient			Correlation coefficient		
Baseline score	-0.71	-0.78	-0.91	-0.58	-0.65	-0.67	-0.67	-0745	-0.79
P-value*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

CI – confidence interval; VA – Visual Acuity (presenting, in the better eye).
* p-value from ANCOVA adjusting for the corresponding baseline VRQoL score.
**Presenting VA in the better eye among operated cases classified by WHO cataract surgical outcome categories (Good VA 6/6–6/18; Borderline VA <6/18–6/60; Poor VA <6/60).

TABLE 6 Effect sizes among operated cases stratified by baseline and follow up visual acuity and unilateral/bilateral surgery

	Kenya			Bangladesh			Philippines		
	Overall eyesight	General function	Psychosocial	Overall eyesight	General function	Psychosocial	Overall eyesight	General function	Psychosocial
	Effect Sizes (95% CI)			Effect Sizes (95% CI)			Effect Sizes (95% CI)		
Baseline VA									
<6/24–6/60	1.4 (1.1–1.6)	1.0 (0.8–1.2)	0.9 (0.6–1.2)	1.8 (1.5–2.1)	1.4 (1.1–1.6)	1.3 (1.0–1.6)	1.2 (0.8–1.7)	1.0 (0.7–1.4)	1.0 (0.6–1.5)
<6/60–3/60	1.3 (0.9–1.8)	1.2 (0.7–1.6)	0.8 (0.2–1.4)	2.0 (1.6–2.4)	1.6 (1.3–1.9)	1.2 (0.8–1.7)	2.1 (1.8–2.4)	1.8 (1.6–2.0)	1.4 (1.0–1.8)
<3/60>PL	1.4 (0.9–1.8)	1.3 (1.0–1.6)	1.2 (0.7–1.7)	1.5 (1.0–2.0)	1.4 (1.0–1.8)	1.4 (0.8–1.9)	1.8 (1.3–2.2)	1.7 (1.4–2.0)	1.4 (0.1–1.8)
PL	2.0 (1.7–2.4)	2.2 (1.8–2.5)	1.5 (1.0–2.8)	2.0 (1.7–2.3)	1.8 (1.6–2.1)	1.7 (1.3–2.0)	1.8 (1.5–2.2)	1.8 (1.5–2.1)	1.4 (0.9–1.9)
VA outcome*									
6/6–6/18	1.7 (0.5–1.9)	1.5 (1.3–1.7)	1.3 (1.0–1.5)	2.1 (2.0–2.2)	1.8 (1.7–1.9)	1.6 (1.4–1.8)	1.9 (1.7–2.2)	1.8 (1.6–1.9)	1.5 (1.2–1.7)
<6/18–6/60	1.2 (0.8–1.7)	1.1 (0.7–1.5)	0.6 (0.1–1.0)	1.0 (-0.3–2.2)	0.9 (0.0–1.8)	0.6 (-0.2–1.4)	1.5 (1.0–1.9)	1.4 (1.1–1.8)	1.2 (0.8–1.7)
<6/60	0.7 (0.4–1.1)	1.1 (0.4–1.7)	0.7(-0.5–2.1)	0.7 (0.3–1.4)	0.3 (0.0–0.9)	0.4 (-0.1–0.9)	0.6 (0.0–1.1)	0.5 (-0.1–1.1)	0.2 (-0.5–1.0)
Surgery									
Unilateral	1.3 (1.1–1.6)	1.2 (1.0–1.4)	0.9 (0.6–1.1)	1.8 (1.6–2.0)	1.5 (1.4–1.7)	1.4 (1.2–1.6)	1.7 (1.4–1.9)	1.5 (1.3–1.7)	1.1 (0.9–1.4)
Bilateral	1.7 (1.5–1.9)	1.6 (1.4–1.8)	1.4 (1.1–1.7)	2.1 (1.7–2.5)	1.8 (1.6–2.1)	1.6 (1.3–1.9)	1.9 (1.5–2.3)	1.8 (1.5–2.1)	1.8 (1.5–2.2)

CI – confidence interval; VA – Visual Acuity (presenting, in the better eye).
*Presenting VA in the better eye among operated cases classified by WHO cataract surgical outcome categories (Good VA 6/6–6/18; Borderline VA <6/18–6/60; Poor VA <6/60).

operated cases were less likely to report problems with mobility, self-care, usual activities and anxiety/depression and had higher overall SRH at follow up, indicating improvements in the perception of their own health associated with cataract surgery beyond vision specific experiences alone. After cataract surgery, VRQoL and generic HRQoL were approximately equal to those of age and gender matched controls with normal vision.

The improvements in VRQoL (measured through WHO/PBD VF20) observed in this study are consistent with a previous study in India which found similarly large effect sizes for VRQoL following cataract surgery.[7] To the best of our knowledge, the impact of cataract surgery on generic HRQoL in different low-income settings has not been previously reported.

Findings on the impact of cataract surgery on generic health measures in high income countries are inconsistent. Our study concurs with that of Jayamanne et al. in England which found significant improvement with each EQ-5D domain after cataract surgery.[3] Other studies using the SF-36 instrument have found improvements in some,[9] but not all, domains.[6,32] In contrast, several studies have found no evidence of significant change in generic HRQoL,[4,5,33,34] including self-rated health[6] following cataract surgery. The lack of change has been attributed either to lack of sensitivity of the HRQoL instrument used or to a lack of importance of vision in the overall perception of health.[5,6] Neither of these interpretations are supported in the current study, where improvements in perception of health were observed using a brief and simple instrument (Euroqol). The severe levels of pre-operative bilateral vision loss, more common in low compared to high income settings, may partially explain this difference. Differences in standards of living and availability of vision aids may also contribute.

This study explored factors associated with the amount of change in VRQoL scores from baseline to follow-up. Effect sizes for overall eyesight, general functioning and psychosocial sub-scales were consistently large for each level of pre-operative VA and this variable was not independently associated with the amount of change in scores indicating that operating at levels of bilateral VA < 6/24 is beneficial in terms of VRQoL. Improvements in VRQoL were consistently larger for people with bilateral compared to unilateral surgery. This result is in accordance with findings in high income settings, including a large randomized controlled trial that suggests second eye surgery provides additional benefits to the individual in terms of their VRQoL and, where possible, should be advocated.[10] Poor VA at follow up was associated with smaller increases in VRQoL. VA outcomes from cataract surgery did not meet the WHO recommended targets for outcome in any country and this study highlights the need for improvements in surgery outcomes to assure optimal gain in VRQoL.[31] Monitoring of cataract outcomes needs to be a priority for cataract services to assess the causes and determine appropriate interventions.

This study had a number of limitations. At follow up cases were revisited by the same survey team who had identified them and referred them for cataract surgery at baseline. A tendency among operated cases to provide answers that would "please" the interviewers or ophthalmologists by overstating satisfaction with health related quality of life therefore cannot be ruled out. It was not possible to mask interviewers as to the case/control status at baseline or follow up. Improvements in overall eyesight were observed among un-operated cases in Kenya and controls in Bangladesh from baseline to follow up. However the magnitude of these changes was small in comparison to the operated cases. The instruments used in this study focus predominately on physical functioning and mental health aspects of QoL associated with cataract vision loss and did not explore other factors important in quality of life such as relationships, environment, spirituality and finances. The sample size was not powered to analyze predictors of change in HRQoL and therefore, some caution in interpreting the statistical significance of these analyses is needed. Lastly, uptake of surgery was lower than expected and bias arising from differences between cases who did and did not attend for surgery cannot be ruled out.

There were also strengths. This was a large multi-country longitudinal study using validated tools and examining cases before and after cataract surgery. Similar trends in HRQoL change were seen across three countries. The relative stability of HRQoL among controls provides support to the reliability of the questionnaires used and to cataract surgery being a major factor in the HRQoL changes observed among operated cases.

SUMMARY

In summary, this study showed substantial improvements in VRQoL following cataract surgery among adults aged ≥ 50 years in three different low-income settings. Improvements were large regardless of pre-operative VA and were smallest for those with a poor outcome after cataract surgery. Operated cases also showed improvements in generic HRQoL indicating a wider positive impact of cataract surgery on perceptions of health.

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