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Original Research Paper

Cataract Surgery Outcomes, Coverage, and Barriers in Tribal Areas of Gujarat and Maharashtra: A Comprehensive Analysis

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ABSTRACT:

This study was done to estimate cataract surgery outcomes, surgical coverage and Barriers to availing surgery in rural/tribal areas of south Gujarat and Maharashtra. In districts of Gujarat and Maharashtra, where most of the population is tribal, door-to-door surveys have been conducted with standardized, validated questionnaires that collected data on cataract surgery outcomes, coverage, and barriers to acceptance. Visual impairment, surgical coverage, surgical details of age at surgery, cost, type, place, causes of low outcome post-surgery and satisfaction level with surgery were assessed. Out of 4,850 adults aged ≥ 50 years, 66.4% of all grades of visual impairment are due to cataracts, out of which 44.8% faced some barrier in accessing surgical intervention. This study further delves into assessment of cataract surgery outcomes in tribal areas, including visual acuity improvement, postoperative complications and patient satisfaction. Analyzing the coverage of surgery involves factors such as the availability of surgical facilities quality of facilities along with place, type and cost of surgery will be explored to understand the extent of coverage. This study is useful in health policy planning for cataract blindness and improvement in availability of surgical services to tribal populations to improve targeted healthcare development, community engagement and policy adjustments to foster more inclusive and equitable healthcare system ultimately.

Keywords: Cataract, Tribal, Gujarat, Maharashtra, India.

INTRODUCTION:

With 66.2% of all occurrences of blindness being caused by cataracts, this condition is the most frequent cause of blindness globally. It constitutes a significant challenge regarding social expenses, economic loss, and human morbidity. [1]

- In most developing nations, including India, age-related cataracts continue to cause blindness (80.1%). In Gujarat state, prevalence of bilateral cataract blindness had been 0.44% or 82.6% of population ≥50years. [2]
- Government blindness control programmes in Gujarat are excellent. Still, for nearby red zone tribal areas in the south-tribal district and Maharashtra, there were barriers to surgery like fear of surgery, travel cost, considering the surgery unnecessary, lack of awareness, etc.

BACKGROUND:

- The study aims to evaluate surgical coverage (SC) as a measure of the presence or absence of high-quality surgical services effective cataract surgery coverage (eCSC).
- Additionally, cataract surgery outcomes to assess effectiveness of surgery, identifying barriers, compare with other regions, measure quality-of-life improvements, analyze healthcare interventions, and recommend better eye care strategies.
- Identifying barriers to undergoing surgery helps in understanding factors like lack of awareness, financial constraints, cultural beliefs, or accessibility issues.
- According to previous research, there is a significant

cataract backlog in rural/tribal communities. [3]

- To evaluate cataract surgery coverage, results, and barriers to accessing them in tribal areas of Gujarat and Maharashtra, we performed current research as part of Rapid Assessment of Avoidable Blindness (RAAB) [4].

MATERIALS AND METHODS:

- A "Door to door" survey has been conducted where patients were examined at their homes.
- Visual acuity (VA) measured through simplified tumbling 'E' optotype chart held at 6m distance determined by pre-measured rope piece.
- With patient's approval, a direct ophthalmoscope has been employed for examining lenses, either with or without dilatation as required. If pinhole vision failed to improve to >6/12 or retinal disease had been identified, short-acting mydriatic eye drops (Tropicamide 0.5%) had been employed.
- It had been reported if lens appeared normal, cataractous, aphakic, pseudophakic (with or without posterior capsule opacification), or no view of the lens.
- Total population of research area has been 11,10,095.
- We evaluated individuals aged ≥50y/o. Entire survey area has been classified as rural. Selected clusters were divided into segments, each containing 400 people, to yield segments with 50 individuals aged ≥50y/o. Based on, this has been projections that 17% of Gujarat's population would be aged 50+ by 2011 (i.e., 17% of 400 gives 68 people aged 50y/o and above).

(1) PVA or BCVA have been utilized for measuring prevalence of cataracts.

Prevalence of cataract =Number of people having cataract ÷Total number of people examined

(2) Following formula calculates CSC(cataract surgical coverage) for eyes and persons: CSC(eyes)(%)=x/(x+y),

In the equation,

x=No. of eyes with pseudo(aphakia).

y=No. eyes with operable cataracts.

CSC(persons) (%)=(a+b)/(a+b+c)

In the above equation,

a=No. of persons with unilateral pseudo(aphakia) and operable cataracts in other eyes

b=No. of persons with bilateral pseudo(aphakia) c=No. of persons with bilateral operable cataracts

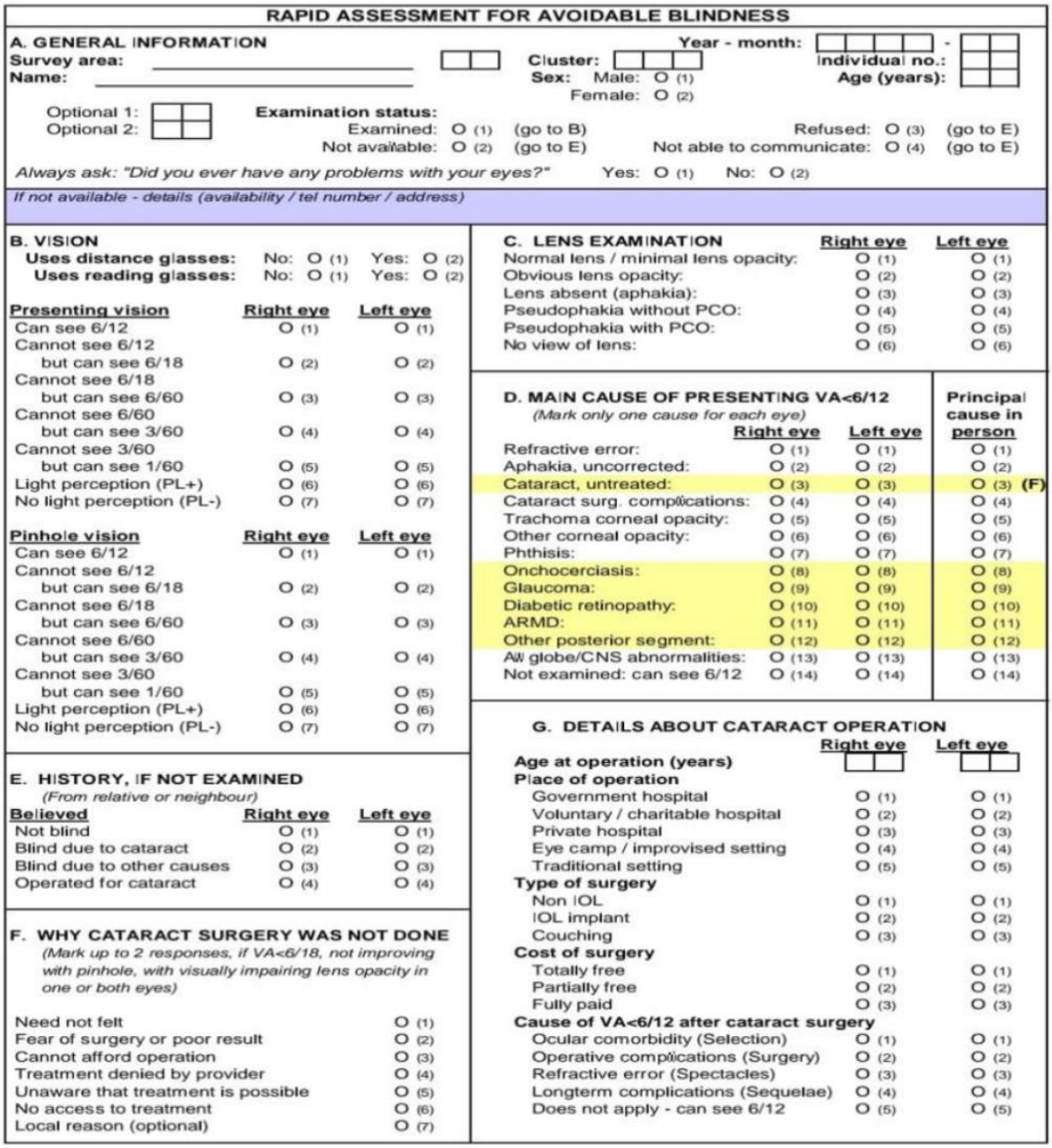
(3) Barriers for getting cataract surgery is calculated in percentage.

A. Sampling strategy:

1. Compact cluster sampling (CSS) has been employed
2. A sampling frame has been created for the entire survey area.

Clusters have been selected via PPS(probability proportional to size) approach for systematic sampling from this sample frame.

B. Questionnaire:



RAPID ASSESSMENT FOR AVOIDABLE BLINDNESS

A. GENERAL INFORMATION
Survey area: _____ Cluster: ☐☐☐ Year - month: ☐☐☐☐ - ☐☐
Name: _____ Sex: Male: O (1) Female: O (2) Individual no.: ☐☐☐ Age (years): ☐☐☐
Optional 1: ☐☐ Optional 2: ☐☐
Examination status:
Examined: O (1) (go to B) Refused: O (3) (go to E)
Not available: O (2) (go to E) Not able to communicate: O (4) (go to E)
Always ask: "Did you ever have any problems with your eyes?" Yes: O (1) No: O (2)
If not available - details (availability / tel number / address)

B. VISION
Uses distance glasses: No: O (1) Yes: O (2)
Uses reading glasses: No: O (1) Yes: O (2)

Presenting vision	Right eye	Left eye
Can see 6/12	O (1)	O (1)
Cannot see 6/12 but can see 6/18	O (2)	O (2)
Cannot see 6/18 but can see 6/60	O (3)	O (3)
Cannot see 6/60 but can see 3/60	O (4)	O (4)
Cannot see 3/60 but can see 1/60	O (5)	O (5)
Light perception (PL+)	O (6)	O (6)
No light perception (PL-)	O (7)	O (7)

Pinhole vision	Right eye	Left eye
Can see 6/12	O (1)	O (1)
Cannot see 6/12 but can see 6/18	O (2)	O (2)
Cannot see 6/18 but can see 6/60	O (3)	O (3)
Cannot see 6/60 but can see 3/60	O (4)	O (4)
Cannot see 3/60 but can see 1/60	O (5)	O (5)
Light perception (PL+)	O (6)	O (6)
No light perception (PL-)	O (7)	O (7)

E. HISTORY, IF NOT EXAMINED
(From relative or neighbour)

Believed	Right eye	Left eye
Not blind	O (1)	O (1)
Blind due to cataract	O (2)	O (2)
Blind due to other causes	O (3)	O (3)
Operated for cataract	O (4)	O (4)

F. WHY CATARACT SURGERY WAS NOT DONE
(Mark up to 2 responses, if VA<6/18, not improving with pinhole, with visually impairing lens opacity in one or both eyes)

Need not felt	O (1)
Fear of surgery or poor result	O (2)
Cannot afford operation	O (3)
Treatment denied by provider	O (4)
Unaware that treatment is possible	O (5)
No access to treatment	O (6)
Local reason (optional)	O (7)

C. LENS EXAMINATION

	Right eye	Left eye
Normal lens / minimal lens opacity:	O (1)	O (1)
Obvious lens opacity:	O (2)	O (2)
Lens absent (aphakia):	O (3)	O (3)
Pseudophakia without PCO:	O (4)	O (4)
Pseudophakia with PCO:	O (5)	O (5)
No view of lens:	O (6)	O (6)

D. MAIN CAUSE OF PRESENTING VA<6/12
(Mark only one cause for each eye)

	Right eye	Left eye	Principal cause in person
Refractive error:	O (1)	O (1)	O (1)
Aphakia, uncorrected:	O (2)	O (2)	O (2)
Cataract, untreated:	O (3)	O (3)	O (3) (F)
Cataract surg. complications:	O (4)	O (4)	O (4)
Trachoma corneal opacity:	O (5)	O (5)	O (5)
Other corneal opacity:	O (6)	O (6)	O (6)
Phthisis:	O (7)	O (7)	O (7)
Onchocerciasis:	O (8)	O (8)	O (8)
Glaucoma:	O (9)	O (9)	O (9)
Diabetic retinopathy:	O (10)	O (10)	O (10)
ARMD:	O (11)	O (11)	O (11)
Other posterior segment:	O (12)	O (12)	O (12)
Ant globe/CNS abnormalities:	O (13)	O (13)	O (13)
Not examined: can see 6/12	O (14)	O (14)	O (14)

G. DETAILS ABOUT CATARACT OPERATION

	Right eye	Left eye
Age at operation (years)	☐☐	☐☐
Place of operation		
Government hospital	O (1)	O (1)
Voluntary / charitable hospital	O (2)	O (2)
Private hospital	O (3)	O (3)
Eye camp / improvised setting	O (4)	O (4)
Traditional setting	O (5)	O (5)
Type of surgery		
Non IOL	O (1)	O (1)
IOL implant	O (2)	O (2)
Couching	O (3)	O (3)
Cost of surgery		
Totally free	O (1)	O (1)
Partially free	O (2)	O (2)
Fully paid	O (3)	O (3)
Cause of VA<6/12 after cataract surgery		
Ocular comorbidity (Selection)	O (1)	O (1)
Operative complications (Surgery)	O (2)	O (2)
Refractive error (Spectacles)	O (3)	O (3)
Longterm complications (Sequelae)	O (4)	O (4)
Does not apply - can see 6/12	O (5)	O (5)

DISCUSSION:

A. Cataract Surgical Coverage:

Cataract surgical coverage varied based on visual acuity (VA) levels:

- For **VA < 3/60**, **84.9% of males** and **77.7% of females** received surgery, with an overall coverage of **80.8%**.
- For **VA < 6/60**, **74.5% of males** and **66.0% of females** were covered, totalling **69.5%**.
- For **VA < 6/18**, **52.0% of males** and **43.8% of females** underwent surgery, with overall coverage at **47.1%**.

Surgical coverage was higher in males across all categories but decreased as the vision threshold became less severe. [1]

TABLE I: CATARACT SURGERY COVERAGE

VA Level	Males (%)	Females (%)	Total (%)
VA < 3/60	84.9	77.7	80.8
VA < 6/60	74.5	66.0	69.5
VA < 6/18	52.0	47.1	43.8

B. Outcomes After Cataract Surgery with Available Correction:

After cataract surgery, **66.1%** achieved **very good vision (6/12)**, while **19.8%** had **good vision (6/18)**. **6.8%** had **borderline vision (6/60)**, and **7.3%** had **poor vision (worse than 6/60)**.

Females had better outcomes, with **73.2%** attaining **very good vision**, compared to **58.2%** of males. Poor vision was slightly higher in males (**8.8%**) than in females (**6.0%**).

Most patients experienced successful vision restoration, but a small percentage remained with suboptimal outcomes.

TABLE II: OUTCOMES AFTER CATARACT SURGERY WITH AVAILABLE CORRECTION (GENDER WISE DISTRIBUTION)

Outcome	Males (N=273)	%	Females (N=302)	%	Total (N=575)	%
Very Good: Can see 6/12	159	58.2%	221	73.2%	380	66.1%
Good: Can See 6/18	63	23.1%	51	16.9%	114	19.8%
Borderline: Can see 6/60	27	9.9%	12	4.0%	39	6.8%
Poor: Cannot see 6/60	24	8.8%	18	6.0%	42	7.3%
Total	**273**	**100**	**302**	**100**	**575**	**100**

C. Causes of Poor Vision (PVA <6/12) After Cataract Surgery:

Poor vision outcomes after cataract surgery were linked to several factors:

- **Selection Issues**: **61.1%** had poor vision due to pre-existing conditions, **13.9%** had good vision, and **25.0%** had borderline vision.
- **Surgical Factors**: **75.0%** of borderline cases were due to surgical complications, though no cases resulted in poor vision.
- **Need for Spectacles**: **92.2%** of good vision cases and **6.3%** of borderline cases were due to uncorrected refractive errors.
- **Post-Surgical Complications**: **53.8%** of good vision and **25.3%** of borderline cases were affected, while **20.9%** experienced poor vision.

Pre-existing conditions, uncorrected refractive errors, and post-surgical complications were the main causes of poor vision. However, 100% of those with very good vision (6/12 or better) had no issues from these factors.

TABLE III: CAUSES OF POOR VISION OUTCOME (PVA <6/12) AFTER CATARACT SURGERY

Cause	Selection (N)	%	Surgery (N)	%	Spectacles (N)	%	Sequelae (N)	%	Can See 6/12 (N)	%
Very Good: Can see 6/12	0	0.0	0	0.0	0	0.0	0	0.0	380	100.0
Good: Can See 6/18	5	13.9	1	25.0	59	92.2	49	53.8	0	0.0
Borderline: Can see 6/60	9	25.0	3	75.0	4	6.3	23	25.3	0	0.0
Poor: Cannot see 6/60	22	61.1	0	0.0	1	1.6	19	20.9	0	0.0
Total	**36**	**100**	**4**	**100**	**64**	**100**	**91**	**100**	**380**	**100**

D. Barriers to Cataract Surgery (Bilateral BCVA <6/60):

- **22%** of individuals did not feel the need for surgery.
- **16.5%** cited fear as a reason for not undergoing surgery.
- **14.3%** mentioned cost as a barrier.
- **2.2%** were denied treatment by the provider.
- **15.9%** were unaware treatment was possible.
- **29.1%** could not access treatment.

TABLE IV. BARRIERS TO CATARACT SURGERY (BILATERAL BCVA <6/60)

Barrier	Males (N)	%	Females (N)	%	Total (N)	%
Need not felt	19	29.2	21	17.9	40	22.0
Fear	7	10.8	23	19.7	30	16.5
Cost of travel	8	12.3	18	15.4	26	14.3
Treatment denied by provider	0	0.0	4	3.4	4	2.2
Unaware treatment is possible	11	16.9	18	15.4	29	15.9
Cannot access treatment	20	30.8	33	28.2	53	29.1
Total	**65**	**100**	**117**	**100**	**182**	**100**

E. Barriers to Cataract Surgery (Unilateral BCVA <6/60)

- **41.6%** did not perceive the need for surgery.
- **14.2%** avoided surgery due to fear.
- **14.7%** reported cost as a limiting factor.
- **2.1%** were denied treatment by the provider.
- **10.9%** were unaware of treatment options.
- **16.5%** could not access treatment.

TABLE V. BARRIERS TO CATARACT SURGERY (UNILATERAL BCVA <6/60)

Barrier	Males (N)	%	Females (N)	%	Total (N)	%
Need not felt	50	43.9	91	40.4	141	41.6
Fear	16	14.0	32	14.2	48	14.2
Cost of travel	17	14.9	33	14.7	50	14.7
Treatment denied by provider	3	2.6	4	1.7	7	2.1
Unaware treatment is possible	11	9.6	26	11.6	37	10.9
Cannot access treatment	17	14.9	39	17.3	56	16.5
Total	**114**	**100**	**225**	**100**	**339**	**100**

CONCLUSION:

The National Rural Blindness Survey (2007-08) estimates that the prevalence of blindness is five times higher in the tribal areas of Gujarat and Maharashtra. [2]

However, the leading cause of blindness remains cataracts. [2] This study provides an important perspective on cataract surgery coverage, surgical outcomes, and barriers.

81% of blindness can be treated through cataract surgeries at secondary or tertiary levels, 8% require rehabilitation or low vision services, 7% require primary eye care services, and 4% require ophthalmic services at tertiary levels. [3]

ETHICS APPROVAL AND CONSENT TO PARTICIPATE: N/A.

LIST OF ABBREVIATIONS:

1. BCVA: Best corrected visual acuity
2. VA: Visual acuity
3. CSS: Compact cluster sampling
4. Sc: Surgical coverage
5. PPS: Probability proportional to size
6. Ecsc: Effective cataract surgical coverage
7. PVA: Presenting visual acuity

DATA AVAILABILITY STATEMENT:

No additional source data is required since all of the data supporting the results has been included in the article.

CONFLICTS OF INTEREST: N/A.

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