

## Survey of Blindness in Saki East, Oyo State, Nigeria

### Abstract

**Background:** This survey was undertaken in a rural local government area (LGA) where eye care services recently commenced, with no known previous data on blindness or visual impairment. **Aim and Objectives:** The aim was to generate evidence for further planning and monitoring of the on-going eye care program. The objectives included determination of the prevalence of blindness and visual impairment, causes of blindness and visual impairment, and assessment of cataract services and barriers to cataract surgery uptake. **Materials and Methods:** This was a cross-sectional observational study. A population-based rapid assessment of avoidable blindness (RAAB) was undertaken among eligible individuals, aged 50 years and above, who were residents of Saki East LGA. A three-stage cluster sampling technique with probability proportional to size was employed to recruit 1100 respondents. Field data were analysed using the RAAB 5 computer software package. **Results:** The age- and sex-adjusted prevalence of blindness was 1.7% (95% confidence interval: 0.1–3.3). Cataract was the commonest cause of blindness (37.8%) and severe visual impairment (56.3%), whereas refractive error was the leading cause of moderate visual impairment (68.3%). The prevalence of blindness significantly increased with age ( $\chi^2=38.01$ ,  $P=0.000$ ). Avoidable conditions were responsible for 94.6% of the blindness. **Conclusion:** The burden of blindness and visual impairment in the survey area is significant, with more than 90% due to avoidable causes. Cataract, glaucoma, and uncorrected refractive error were important causes needing urgent attention.

**Keywords:** Barriers, blindness, cataract surgical coverage, prevalence, Saki East

### Introduction

Good vision is required for almost every human endeavour. However, in spite of worldwide efforts, the magnitude of blindness and visual impairment keeps increasing globally.<sup>[1,2]</sup>

Four of every five blind or visually impaired persons in the world are aged 50 years and above.<sup>[3]</sup> With increasing longevity, worldwide occurrence of age-related vision impairment rises as well. This is more so in developing countries in which equitable access to health services tends to be a challenge.<sup>[4]</sup> Similarly, the prevalence of distance visual impairment is four times higher in low- to middle-income countries, compared with high-income countries.<sup>[5]</sup> It has been shown that, at least, 80% of all global vision losses could be prevented or cured from cost-effective public health measures, surgical intervention, or early medical therapy.<sup>[3]</sup>

The World Health Organization (WHO), through the Global Action Plan for Eye Health (2014–2019), proposed district level planning of services towards achieving universal access

to eye care, especially in developing countries such as Nigeria.<sup>[6]</sup> Population-based surveys were advocated as a district level tool for generating important eye health indices by which eye care programs can be planned and/or monitored objectively.<sup>[6]</sup>

To this end, the Ophthalmology Department of the University College Hospital (UCH), Ibadan, Nigeria established a rural secondary eye facility in Sepeteri, a town located within Saki East Local Government Area (LGA), Oyo State, Nigeria, with the aim of improving access to eye care by ensuring proximity of services to the people of this vast region and by increasing their eye health awareness. It was hoped that possible barriers to the uptake of eye health services such as distance of travel, with its attendant direct and indirect cost implications, would be eliminated as well. General eye care services started from December 2016, whereas on-site cataract surgical services began in July 2018.

This survey was undertaken to determine the extent to which eye care services being rendered were addressing the specific needs of this area and provide data on the prevalence

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and causes of vision impairment, crucial for monitoring/ planning on-going services and for advocacy.

Saki East LGA is located within the mainly rural, northern zone of Oke-Ogun in Oyo State, Nigeria. Oyo State has 33 LGAs. The Oke-Ogun zone (03°35'–04°13' N, 008° 05'–009° 08' E)<sup>[7]</sup> is a major food crop-producing area, constituted by 10 different LGAs of Oyo State. Saki East LGA had an estimated population of 153,100 according to the updated 2016 population figures.<sup>[8]</sup> The LGA is located in the savanna vegetation belt of the northernmost part of Oyo State.

## Materials and Methods

### Study design

This was a population-based, cross-sectional blindness prevalence survey.

### Inclusion criteria

The criteria included inhabitants of the LGA who were 50 years or older and had been resident for, at least, 6 months prior to the survey.

### Exclusion criteria

Inhabitants of the LGA who were <50 years of age and inhabitants who were 50 years of age or older but had been living in the survey area for <6 months as at the time of the survey were excluded.

### Sample size

The sample size for the survey was calculated with the RAAB5 software.<sup>[9]</sup> A minimum sample size of 1054 participants was obtained using the following parameters: a blindness prevalence of 6.3%<sup>[10]</sup> in persons 50 years old and above, a

precision of 30%, and a design effect of 1.5 at 95% confidence interval (CI) with a cluster size of 50.

### Survey teams

There were two survey teams, each headed by a senior ophthalmology resident. Both teams were trained by a certified RAAB trainer (CDM). Inter-observer variability tests were done to assess the level of agreement between both teams in visual acuity (VA) estimation, lens assessment, and determination of the main cause of visual impairment or blindness. Kappa scores of 0.9, 0.9, 0.8, and 0.7 were achieved for presenting VA, pinhole VA, lens assessment, and main cause of visual impairment, respectively. A pilot field survey in two full clusters was subsequently conducted under the supervision of a trainer.

### Sampling technique

A three-stage cluster sampling technique was employed to recruit 1100 respondents. In the first stage, 22 clusters were randomly selected from a sampling frame of all villages across Saki East LGA, using probability proportional to size. In the second stage, the compact segment sampling technique was employed. Each cluster was divided into equal segments to contain at least 50 persons, 50 years and above. Landmarks such as prominent structures and roads were used to denote boundaries between the segments and sketched on paper, numbering each segment appropriately. The segment to begin recruitment from was determined by simple balloting. In the third stage, respondents 50 years of age and above and residents in households [see Table 1] within the selected segments were examined through house-to-house visits until 50 participants had been enrolled/examined. Survey teams returned on the same day to examine persons not at home at first visit and

**Table 1: Definition of Terms**

Term	Definition
Household	One or more people who live under the same roof, eating from the same kitchen
Resident	An individual who had lived in the study area for the preceding six or more months
Presenting Visual Acuity (PVA)	Distance visual acuity in each eye (with available refractive correction where applicable)
Blindness	Presenting VA of <3/60 in the better eye
Severe Visual Impairment	Presenting VA of <6/60 to ≥3/60 in the better eye
Moderate Visual Impairment	Presenting VA of <6/18 to ≥6/60 in the better eye
Cataract	Presence of visually significant lens opacity
Trichomatous Corneal Opacity	The presence of corneal opacification in an eye with evidence of corrected or uncorrected entropion and/or trichiasis
Non-Trichomatous Corneal Opacity	The presence of corneal opacity not attributable to trachoma
Glaucoma	The presence of a pale and cupped disc with a vertical cup-to-disc ratio ≥0.8, with/ without relative afferent pupillary defect and/ or stony hard eye on digital palpation
Aphakia	Absence of the crystalline lens in the pupillary axis
Uncorrected Aphakia	An aphakic eye whose vision improves with +10D lens or pinhole
Surgical Complication	The finding of a blind or visually impaired eye that had undergone cataract surgery or couching, in the absence of other causes of blindness or visual impairment
Cataract Surgical Coverage (CSC)	A measure of the number of people (or eyes) in a defined population with operated cataract as a proportion of those (or eyes) having operable cataract plus operated cataract

thereafter were listed as absentees. Subjects who declined examination were marked as refusals.

### Clinical examination

At the household level, individual consent was obtained from each participant before proceeding with examination. Demographic data of each eligible respondent were entered into the RAAB5 survey form. VA estimation was done with a simplified tumbling E chart, and lens examination was done according to the RAAB survey protocol.<sup>[11]</sup> The main cause of visual impairment (presenting VA worse than 6/18) was determined on the basis of the coding instructions for WHO/PBL eye examination record.<sup>[9]</sup> All examination findings were marked in the corresponding sections of the survey form.

### Data handling

At the end of daily field data collection, data in the survey forms from each cluster were independently entered into the RAAB5 software database by two research assistants. A consistency check was then run by the Principal Investigator, and inconsistencies flagged by the software were corrected by referring to the corresponding survey form(s). After covering all clusters, data were cleaned, and generation of reports was done via the RAAB5 software package. Additional statistical analysis was undertaken using Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA) software version 22.

### Ethical considerations

Ethical approval was obtained from the Ethics Committee of the UCH/University of Ibadan, as well as the Oyo State Ethical Review Committee, Ministry of Health, Oyo State, Nigeria. Written informed consent was obtained from all respondents, and information obtained from all respondents was treated with utmost confidentiality. Data safety was ensured by storing in a password-secured laptop handled by the Principal Investigator.

Respondents seen with ocular complaints benefitted from free medications for the treatment of minor conditions and/

or referral to the UCH as necessary. Relatives of respondents who were not necessarily enumerated but brought forward with ocular complaints also benefitted from free medications and/or referrals. Free reading spectacles were given to all respondents diagnosed with presbyopia. Persons diagnosed with cataract requiring surgery were offered the same at subsidized rates at a hospital in Sepeteri.

### Results

A total of 1095 respondents were examined out of 1100 enrolled. A coverage of 99.5% was thus achieved. Overall, there were more female participants (52.5%) than males (47.5%) [Table 2].

The modal age bracket was 50–59 years. Male participants were more in this age group, unlike females in all older age groups. The mean age was 66 years (SD = ±12.85 years) [Table 3].

Based on the presenting visual acuity (PVA), the overall age- and sex-adjusted blindness prevalence was 1.7% (95% CI: 0.1–3.3). The prevalence of blindness significantly increased with age ( $\chi^2 = 38.005$ ,  $P = 0.000$ ) [Table 4].

Cataract and glaucoma were the leading causes of blindness and visual impairment [Table 5].

Cataract surgical coverage, analysis of cataract surgical outcome, and barriers to the uptake of cataract surgery are presented in Tables 6-8 respectively.

Further analysis of respondents who had borderline-to-poor outcomes after cataract surgery [Table 6] revealed refractive error (41.9%), surgical sequelae (25.8%), surgical complications (12.9%), and poor patient selection (19.4%) as the reasons.

### Discussion

The coverage of 99.5% attained in this survey could be attributed to pre-visits done to engage the various community

**Table 2: Summary of enrollees**

	Examined		Not available		Refused		Not capable		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Males	518	47.0	1	0.1	1	0.1	0	0.0	520	47.3
Females	577	52.5	0	0.0	2	0.2	1	0.1	580	52.7
<b>Total</b>	<b>1,095</b>	<b>99.5</b>	<b>1</b>	<b>0.1</b>	<b>3</b>	<b>0.3</b>	<b>1</b>	<b>0.1</b>	<b>1,100</b>	<b>100.0</b>

**Table 3: Age and sex distribution of survey respondents**

Age class	Male		Female		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
50–59	210	40.5	200	34.7	410	37.5
60–69	104	20.1	144	25.0	248	22.7
70–79	113	21.8	124	21.5	237	21.7
80–99	91	17.6	109	18.8	200	18.2
<b>Total</b>	<b>518</b>	<b>100.0</b>	<b>577</b>	<b>100.0</b>	<b>1095</b>	<b>100.0</b>

**Table 4: Age–sex-adjusted prevalence of blindness, SVI, and MVI, based on bilateral PVA**

	Males		Females		Total	
	<i>n</i>	% (95% CI)	<i>n</i>	% (95% CI)	<i>n</i>	% (95% CI)
Blindness	101	1.5 (0.0–3.0)	85	1.8 (–0.3 to 4.0)	186	1.7 (0.1–3.3)
Severe VI	142	2.2 (–0.1 to 4.5)	115	2.5 (–0.3 to 5.3)	257	2.3 (0.2–4.4)
Moderate VI	401	6.1 (2.5–9.7)	287	6.2 (2.8–9.7)	688	6.2 (3.5–8.8)

**Table 5: Principal cause of blindness, SVI, and MVI in persons (based on PVA)**

Principal cause	Blindness	%	Severe VI	%	Moderate VI	%
1. Untreated cataract	14	37.8	9	56.3	9	14.3
2. Glaucoma	12	32.4	5	31.1	5	7.9
3. Uncorrected aphakia	4	10.8	0	0.0	0	0.0
4. Non-trachomatous CO	3	8.2	0	0.0	0	0.0
5. Cataract surgical complications	2	5.4	0	0.0	1	1.6
6. Other posterior segment diseases	2	5.4	1	6.3	5	7.9
7. Refractive error	0	0.0	1	6.3	43	68.3
Total	37	100.0	16	100.0	63	100.0

\*Total proportion of blindness, SVI, and MVI from avoidable causes (1–5 and 7) = 94.6%, 93.8%, and 92.1%, respectively

**Table 6: Cataract surgical coverage (persons)**

	Males	Females	Total
VA <3/60	100.0	56.0	76.1%
VA <6/60	100.0	48.3	70.0%
VA <6/18	75.0	37.8	55.1%
Overall CSC			67.0%

heads ahead of the survey. The provision of local guides by each community head, avoidance of field work on local market days, and the fact that the survey was conducted in the dry season also contributed to the high coverage. This excellent coverage achieved implies that data collected in this survey could reliably represent the situation in Saki East LGA.

More than half of the respondents were aged 60 years and above. This proportion is similar to that observed by Kolawole *et al.*<sup>[10]</sup> in a survey conducted in Egbedore LGA of neighbouring Osun State in 2005, highlighting the demographic similarity of both survey populations.

Based on the PVA, the age- and sex-adjusted blindness prevalence was 1.7%. Despite the similarity in demographics, our findings contrast with that reported by Kolawole *et al.*,<sup>[10]</sup> who observed an age–sex-adjusted blindness prevalence of 5.4% in Egbedore LGA of neighbouring Osun State. This higher prevalence might be related to the finding of a predominant belief system that “blindness was part of aging and nothing should be done about it” in Egbedore LGA.<sup>[10]</sup> Furthermore, our findings suggested a better acceptance of eye care services in Saki East compared with Egbedore LGA, as our interviews revealed that some survey respondents in Saki East LGA had to travel as far as Parakou, a town in neighbouring Republic of Benin and Bobo-Dioulasso in Burkina Faso to access eye surgery in the past. The study in Egbedore LGA documented existing eye care services in the community.<sup>[10]</sup>

In similar surveys done elsewhere in Nigeria, a higher overall blindness prevalence of 4.5%, 4.2%, and 5.4% was reported in Birnin-Kebbi,<sup>[12]</sup> Plateau,<sup>[13]</sup> and Katsina,<sup>[14]</sup> respectively. In other regions of Sub-Saharan Africa, blindness prevalence from similar population-based surveys varied from 3.3% in Southern Malawi<sup>[15]</sup> to 1.8% in Western Rwanda.<sup>[16]</sup> The prevalence from our survey of 1.7% is similar to the prevalence from Western Rwanda.

From recent population-based surveys among individuals aged 50 years and above in other developing countries, Isipradit *et al.*<sup>[17]</sup> reported a blindness prevalence of 0.6% in Thailand, whereas Thoufeeq *et al.*<sup>[18]</sup> found a prevalence of 2.0% in the Maldives. In the Pune region of Western India, an overall blindness prevalence of 1.3% was observed.<sup>[19]</sup> The lower prevalence of blindness observed in regions of these countries could be due to better developed and longstanding eye care programmes.

The overall age–sex-adjusted prevalence of bilateral severe visual impairment (SVI) was found to be much lower at 2.3% compared with 6.7% reported in Plateau State, North Central Nigeria.<sup>[13]</sup> This can be attributed to the higher poverty index in Plateau State,<sup>[20]</sup> as there is an established causal relationship between low socio-economic status and visual impairment/blindness.<sup>[21,22]</sup> The age–sex-adjusted prevalence of SVI found in northern Burundi was also much less at 0.6%.<sup>[23]</sup> Also contrary to our findings, lower age–sex-adjusted prevalence of SVI was reported from Northern Burundi (0.6%), Thailand (1.3%), and the Maldives (1.9%).<sup>[17,18,23]</sup>

Females had a higher burden of blindness compared with males in this survey. This finding is similar to reports from previous surveys.<sup>[12,13,18,24–26]</sup> Such gender gap could be due to cultural factors such as the need for permission from the male head of the home before females can seek care and the fact that resources are controlled by the men in most households. In line with the target of the sustainable development goals to

**Table 7: Cataract surgical outcome with available correction (eyes) [n = 74]**

	Males		Females		Total	
	n	%	n	%	n	%
Good: can see $\geq$ 6/18	24	57.1	19	59.4	43	58.1
Borderline: can see $\geq$ 6/60	2	4.8	5	15.6	7	9.5
Poor: cannot see 6/60	16	38.1	8	25.0	24	32.4
Total	42	100.0	32	100.0	74	100.0

**Table 8: Barriers to cataract surgery**

	Males		Females		Total	
	n	%	n	%	n	%
Unaware treatment is possible	16	39.0	28	46.7	44	43.6
Cost	16	39.0	13	21.7	29	28.7
Need not felt	6	14.6	13	21.7	19	18.8
Cannot access treatment	2	4.9	2	3.3	4	4.0
Fear	1	2.5	4	6.6	5	4.9
Total	41	100.0	60	100.0	101	100.0

eliminate gender inequity,<sup>[27]</sup> it is important to use this evidence to advocate, through collaboration with relevant stakeholders, for increased awareness and commitment to gender equity in access to eye health care in Saki East LGA.

Untreated cataract, followed by glaucoma and uncorrected aphakia, were the commonest causes of blindness in this survey, as was also observed in Plateau State.<sup>[13]</sup> Likewise, cataract, followed by glaucoma, was the leading cause of blindness in Egbedore LGA of neighbouring Osun State, followed by posterior segment disorders.<sup>[10]</sup>

The main causes of SVI in this survey were untreated cataract and glaucoma, which is similar to findings in Plateau State where cataract, glaucoma, and uncorrected aphakia were the leading causes of SVI.<sup>[13]</sup>

Moderate visual impairment (MVI) was mostly due to uncorrected refractive errors and untreated cataract in this survey. This compares with findings in Plateau State, which also showed untreated cataract and refractive error as the two leading causes of MVI. Trachoma, which was also an important cause of vision impairment and blindness reported in Plateau State, was not found in this survey. This is likely due to the fact that Saki East LGA does not lie within the trachoma belt of Nigeria, whereas Plateau state lies within the fringes of the trachoma belt of West Africa.<sup>[28]</sup>

Over 90% of all blindness in this survey were avoidable, so also were the causes of all SVI and MVI. Similarly, over 80% of all blindness, SVI, and MVI seen in Plateau State, were from avoidable causes.<sup>[13]</sup> This pattern closely mirrors observations from the Nigerian National Blindness and Low Vision Survey,<sup>[29]</sup> which reported that 84% of all blindness, 84.3% of SVI, and 91.6% of MVI were due to avoidable causes, respectively.

There was an overall cataract surgical coverage of 67% in the survey area, with particularly poor coverage in the female gender. This might be partly due to gender-related

inequity already discussed earlier. The observed barriers of 'unawareness of availability of treatment' among other barriers to cataract surgery may also contribute to this inadequate coverage. In addition, all routine eye outreaches that had been done as at the time of the survey were to major and fairly easily accessible settlements of the survey area. Coverage of the most remote villages could be guaranteed by training and equipping, at least a community health extension worker or any suitable volunteer in each village on VA estimation to identify cases of visual impairment and refer to the base hospital.

Concerning cataract surgical outcomes, the WHO recommends that district cataract programs should aim for good outcomes (VA  $\geq$ 6/18) in at least 80%, whereas poor outcomes should not exceed 5%.<sup>[30]</sup> Our finding is such that outcomes of cataract surgeries in the survey area so far fell short of this recommendation, and the majority of poor outcomes observed were due to refractive error and other surgical sequelae. This means going forward, adequate attention must be paid to ensuring long-term follow-up of individuals who have undergone cataract surgery in order to attend to all medium- to long-term sequelae of cataract surgery that may contribute to visual impairment. Even though post-operative follow-up rates are reportedly poor in developing countries due to several factors,<sup>[31]</sup> its role in achieving better visual outcomes of surgery is crucial to improving effective cataract surgical coverage.<sup>[32]</sup>

The barriers to cataract surgery observed in this survey are mostly surmountable by an intensive awareness campaign, across the survey area, on the causes of visual impairment observed in this survey, what can be done to treat, and the importance of follow-up clinic visits. This can be achieved through the existing eye outreach team. The use of audio-visual aids and pseudophakic motivators during health talks at routine outreaches as well as periodic information dissemination via the local radio station could help to reinforce the message and reverse the trend of ignorance, poor attitude to eye health, and fear of surgery. Interestingly,

over half of all the individuals identified with visually significant cataracts during this survey did not show up to take up the highly subsidized cataract surgery they were offered in the immediate week following the field work. Follow-up revealed fear of surgery and cost as the main reasons for this. We saw that highly subsidized cost of surgery does not necessarily mean that the local populace will utilize surgical services if the aforementioned barriers are not addressed first. It will be informative if further studies can reveal what participants who are blind or visually impaired with cataract, identified in the survey area, are willing to pay for cataract surgery. This could provide information to address the issue of affordability of cataract surgery among the people of this community.

Recognizing the huge magnitude of global blindness from cataract and refractive errors alone, the WHO Global Action Plan for Eye Health (2014–2019) suggested that provision of effective cataract and refraction services alone could reduce the burden of visual impairment by up to two-thirds in any world district.<sup>[6]</sup> More recently, the 74th World Health Assembly took a step further by recommending new global targets for effective coverage of refractive errors and cataract surgery by year 2030.<sup>[33]</sup> It is hoped that these targets will guide Member States towards stemming the tide of avoidable vision loss.

## Conclusion

There is a need to re-plan on-going services in Saki East LGA to further reduce the burden of blindness from avoidable causes identified in this survey. Service delivery through the Sepeteri eye facility is currently being tailored towards addressing these issues, the impact of which will be assessed in the near future. These include provision of high quality, affordable cataract surgery, optical services as well as on-going community engagement via advocacy for general eye health promotion/utilization in Saki East LGA and environs. Furthermore, the data provided by this survey could help to streamline district eye care service planning in South-Western Nigeria at large.

## Limitations

Limited posterior segment examination, by design of the RAAB methodology, implied that we could have underestimated some posterior segment causes of avoidable blindness such as early glaucoma.

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## Conflicts of interest

The authors declare no conflicts of interest whatsoever in this work.

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