

## WORLD VIEW

## Prevalence and causes of blindness and visual impairment in Limbe urban area, South West Province, Cameroon

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**Aim:** To conduct a rapid assessment of cataract surgical services to estimate the prevalence and causes of blindness and visual impairment in members of the population aged  $\geq 40$  years in the Limbe urban area, Cameroon.

**Methods:** Clusters of 50 people aged  $\geq 40$  years were sampled with probability proportionate to size. Compact segment sampling was used to select households within clusters. All eligible people had their visual acuity (VA) measured by an ophthalmic nurse. An ophthalmologist examined people with VA  $< 6/18$ .

**Results:** 2215 people were examined (response rate = 92.3%). The prevalence of bilateral blindness was 1.1% (95% CI: 0.7–1.5%), 0.3% (0.1–0.6%) for severe visual impairment and 3.0% (2.0–4.0%) for visual impairment. Posterior-segment disease was the leading cause of blindness (29%), followed by cataracts (21%) and optic atrophy (21%). Cataracts were the most common cause of severe visual impairment (43%) and visual impairment (48%). Most cases of blindness (50%), severe visual impairment (57%) and visual impairment (78%) were avoidable (that is, they were caused by cataracts, refractive error, corneal scar, onchocerciasis or phthisis/no globe). The cataract surgical coverage was relatively high, although 57% of eyes operated upon had a poor outcome (presenting VA  $< 6/60$ ).

**Conclusions:** Although the prevalence of blindness was relatively low, most of the cases were avoidable. The implementation of an effective eye-care programme remains a priority in the Limbe urban area.

In 2002, there were approximately 161 million people in the world with visual impairments, of whom around 37 million were blind.<sup>1</sup> At least three-quarters of cases of blindness are preventable or treatable, and this proportion is thought to be even higher in low-income countries. VISION 2020—The Right to Sight programme was launched in 1999 as a joint initiative of the World Health Organisation (WHO) and the International Agency for Prevention of Blindness. It aims to eliminate avoidable blindness by 2020.<sup>2</sup> The VISION 2020 initiative is put into action through disease control, human-resource and infrastructure development, and these strategies are implemented through national and district plans. Baseline data on the prevalence and causes of visual impairment are needed to design and monitor VISION 2020 programmes. Unfortunately, reliable data are often not available, particularly in Africa.

No national survey of blindness has been undertaken in Cameroon. Estimates from the WHO suggest that approximately 1% of the population of Cameroon, and 9% of people aged  $\geq 50$  years, are blind.<sup>1</sup> On the basis of these estimates, a comprehensive eye-care programme that was VISION 2020 compliant was set up in the South West Province in 2001, building up from the community-directed treatment with Ivermectin programme initiated in 1999. A survey carried out in Muyuka Health District, a rural area in the South West Province of Cameroon, reported a prevalence of blindness in people aged  $\geq 40$  years of 1.6% (0.8–2.4%),<sup>3</sup> which was far lower than expected on the basis of the WHO figures.<sup>1</sup> For evidence-based planning and monitoring of the ongoing VISION 2020 plan for this province, data are needed on the prevalence and causes of blindness in urban areas.

The aim of our study was to conduct a rapid assessment of cataract surgical services to estimate the prevalence and causes of blindness and visual impairment and the availability of cataract surgical services for people aged  $\geq 40$  years in the Limbe urban area.<sup>4,5</sup> This information will be used to guide

planning for the existing South West Province eye-care programme.

## METHODS

## Sample-size calculation

The expected prevalence of blindness in people aged  $\geq 40$  years was 1.6%.<sup>3</sup> Assuming a worst acceptable result of 1%, a design effect of 1.3,<sup>6</sup> confidence of 95%, a population of 18 000 aged  $\geq 40$  years,<sup>7</sup> and a 20% non-response rate, then a minimum sample size of 2398 was required (using Epi Info 6.04). In total, 48 clusters of 50 people aged  $\geq 40$  years were required for the survey.

## Sampling procedures

The survey was performed on people aged  $\geq 40$  years in the Limbe urban area in the South West Province of Cameroon. The sampling frame consisted of all the villages, quarters and health areas in the Limbe urban area. Their respective population sizes were obtained from the Ministry of Health in South West Province. Clusters were sampled from the sampling frame with probability proportionate to size.

Individuals within clusters were selected through compact segment sampling.<sup>8</sup> The selected village or quarter was divided into equal segments by trained community-directed distributors (CDDs) of Ivermectin using community-directed treatment with Ivermectin registers, so that each segment contained approximately 50 people aged  $\geq 40$  years. One of the segments was selected at random by drawing lots, and all eligible people living in the selected segment were included in the survey until the cluster size of 50 was achieved. If the segment did not include 50 people aged  $\geq 40$  years then another segment was chosen at random and sampling continued. The survey team visited households door-to-door. Absentees were re-visited, once on the same day in the evening and then the following day, early in the morning.

## Ocular examination

A standardised protocol was used for the rapid assessment of cataract surgical services. A survey record was completed for each eligible person. Information recorded included general demographic information, results of the vision and pinhole examination and of the lens examination, the principal cause of visual impairment, the history of visual impairment, and why a cataract operation had not been carried out and details about the cataract operation if it had.<sup>4 5</sup>

People were examined in their houses. VA was measured by the ophthalmic nurse using a 6-metre illiterate Snellen's acuity chart. All measurements were taken in full daylight with available eyesight correction. Pinhole vision was measured for those with VA <6/18 in either eye. A +10 dioptres pair of glasses was used for aphakic cases. If VA was <6/18 in either eye, an ocular and fundus examination was performed by the ophthalmologist using a torch and a direct ophthalmoscope. Fundus examination was performed with a non-dilated pupil if VA improved to  $\geq 6/18$  aided (by a pinhole or +10 glasses) and after dilation of the pupil if VA did not improve to 6/18 after correction. The principal cause of blindness or visual impairment was recorded, according to the WHO convention where the major cause is assigned to the primary disorder, or if there are two existing primary disorders, to the one that is easiest to treat.<sup>9</sup>

People who had undergone cataract surgery were asked about the details of their surgery. Cases with an operable cataract (<6/60 vision owing to cataracts) were asked why they had not gone for cataract surgery. A maximum of four reasons were allowed.

## Study definitions

The following definitions were used for this survey:

- **Blindness:** Presenting VA <3/60 in the better eye with available correction.
- **Severe visual impairment:** Presenting VA <6/60 to  $\geq 3/60$  in the better eye with available correction.
- **Visual impairment:** Presenting VA <6/18 to  $\geq 6/60$  in the better eye with available correction.
- **Cataract:** Lens opacity obscuring at least half of red reflex.<sup>10</sup>
- **Refractive error:** Improvement of unaided VA <6/18 to VA  $\geq 6/18$  using pinhole or +10 dioptres glasses
- **Onchocerciasis:** Characteristic onchocercal sclerosing keratitis; presence of characteristic onchocercal chorioretinitis with or without optic atrophy or optic atrophy with pigmentary lesions around the disc.
- **Glaucoma:** Visual impairment with a cup-disc ratio >0.7 in the absence of a cataract, refractive error or corneal scar.

## Survey team

There was one survey team, consisting of one ophthalmologist, three ophthalmic nurses, three field assistants and three CDDs

who served as guides. A three-day training course, including a pilot survey, was organised to prepare the team members for use of the survey questionnaire and procedures. The accuracy of VA screening by the nurses was compared with that of the ophthalmologist to ensure that it was satisfactory (i.e. it had a kappa value of  $\geq 0.6$ ).

## Statistical analysis

Data analysis consisted of frequency analysis, bivariate analysis using tables and  $\chi^2$  for statistical significance, stratified analysis using the Mantel-Haenszel test and multivariate logistic regression. Analyses were undertaken using STATA.

## Ethical considerations

Ethical approval for the survey was obtained from the Provincial Delegation for Public Health in the South West Province. Oral consent was obtained from participants for the examination. All cases with eye problems were either treated on the spot with free eye medications or were referred for free further consultation or free/subsidised eye surgery, as appropriate. Reading glasses were sold in the community at subsidised hospital prices.

## RESULTS

2215 out of the 2400 selected subjects were examined (response rate = 92.3%). 117 subjects were absent, 52 refused to participate, and 16 could not be examined. Non-respondents were of similar age, sex and occupation to respondents. The age and sex distribution of the sample were broadly similar to that expected on the basis of the updated census estimates (Table 1).<sup>7</sup> The younger age groups were slightly over-represented, as expected for an urban area.

## Presenting visual acuity

The prevalence of blindness was 1.1% (95% CI: 0.7%–1.5%), 0.3% (0.1%–0.6%) for severe visual impairment and 3.0% (2.0%–4.0%) for visual impairment (Table 2). Monocular blindness was three times as common as binocular blindness (3.3%, 2.5%–4.2%). The age- and sex-standardised prevalence of blindness was slightly higher at 1.4% (95% CI: 0.9%–2.0%). The prevalence of blindness and severe visual impairment was similar in men and women, but women were significantly more likely to be visually impaired ( $p < 0.01$ ). Six people had bilateral aphakia/pseudophakia, and 14 had unilateral aphakia/pseudophakia.

## Causes of blindness and visual impairment

Posterior-segment disease (29%), cataract (21%) and optic atrophy (21%) were the most important causes of blindness (Table 3). Lack of detailed examination made diagnosis difficult, but it seemed that glaucoma (defined by CDR > 0.7) was the most common form of posterior-segment disease. Cataracts were an important cause of severe visual impairment (43%) and visual impairment (48%), and refractive error was a leading cause of visual impairment (22%). Overall, avoidable

**Table 1** Age and sex distribution of sample and district population

Age (years)	Male		Female	
	Sample	Census estimates	Sample	Census estimates
40–49	600 (54%)	3855 (44%)	649 (59%)	3963 (43%)
50–59	302 (27%)	2528 (29%)	226 (20%)	2711 (29%)
60–69	139 (12%)	1496 (17%)	132 (12%)	1657 (18%)
$\geq 70$	75 (7%)	817 (9%)	92 (8%)	973 (10%)
Total	1116	8696	1099	9304

**Table 2** Distribution of survey VA results by VA category and gender in Muyuka District

	Men		Women		Total	
	(n = 1116)		(n = 1099)		(n = 2215)	
VA with available correction	No.	Prevalence (95% CI) (%)	No.	Prevalence (95% CI) (%)	No.	Prevalence (95% CI) (%)
VA <3/60						
Bilateral blindness	12	1.1 (0.5–1.7)		1.1 (0.5–1.7)	24	1.1 (0.7–1.5)
Unilateral blindness	30	3.6 (2.4–4.8)	12	3.1 (1.9–4.2)	74	3.3 (2.5–4.2)
VA <6/60 – ≥3/60						
Bilateral severe visual impairment	6	0.5 (0.1–0.9)	1	0.1 (0–0.3)	7	0.3 (0.1–0.6)
Unilateral severe visual impairment	11	1.0 (0.3–1.6)	7	0.6 (0.2–1.1)	18	0.8 (0.4–1.2)
VA <6/18 to ≥6/60						
Bilateral visual impairment	24	2.1 (1.2–3.0)	43	4.0 (2.3–5.5)	67	3.0 (2.0–4.0)
Unilateral visual impairment	16	1.4 (1.7–2.2)	27	2.4 (1.3–3.6)	43	2.0 (1.2–2.7)

**Table 3** Distribution of main causes of binocular blindness, severe visual impairment and visual impairment

Cause	Blindness (VA<3/60)	Severe visual impairment (VA<6/60 to 3/60)	Visual impairment (VA<6/18 to 6/60)
	n = 24 (%)	n = 7 (%)	n = 67 (%)
Refractive error	0	0	15 (22)
Cataract	5 (21)	3 (43)	32 (48)
Surgery related	1 (4)	0	1 (2)
Uncorrected aphakia	1 (4)	0	0
Corneal scar	0	1 (14)	0
Phthisis/no globe	1 (4)	0	0
Onchocerciasis	4 (17)	0	4 (6)
Posterior segment diseases	7 (29)	2 (29)	9 (13)
Optic atrophy	5 (21)	1 (14)	6 (9)
Avoidable*	12 (50)	4 (57)	52 (78)

\*Cataract (corrected and uncorrected), refractive error, onchocerciasis, corneal scar and phthisis/no globe.

causes of blindness (that is, uncorrected and corrected cataracts, refractive error, onchocerciasis, corneal scars and phthisis/no globe) made up 50% of blindness, 57% of severe visual impairment and 78% of visual impairment.

### Cataract surgery

The cataract surgical coverage (CSC) is calculated as the number of people who had received surgery (that is, aphakic/pseudophakic people) divided by the number who had operable cataracts (that is, the number of aphakic/pseudophakic cases plus the number of people visually impaired from cataracts). If we assume that people were operated upon when their VA was <3/60, then 20 people were operated upon out of the 25 people needing surgery (20 who had been operated upon plus five people with VA<3/60 owing to a cataract) to give a CSC of 80%. The CSC for people at the <6/60 level was 71% (20/[8+ 20]). The most common reasons for not going for surgery among the 48 responders were inability to pay (40%), lack of awareness of cataracts (17%), a feeling they could cope with the cataract (10%) and that they were waiting for the cataract to mature (8%).

The majority of people operated upon (68%) had received an intra-ocular lens (IOL) implant. Only 23% of eyes operated upon for cataract had good post-operative outcome (VA≥6/18), 19% had a borderline outcome (VA<6/18 and ≥6/60) and 57% had a poor outcome (VA<6/60) (Table 4). Outcomes were better for people who had surgery with an IOL than those who were aphakic. Patients with good outcome were on average younger (mean = 61 years) than those with a borderline (72 years) or poor outcome (68 years).

The South West Province has a total population of 1.4 million people, of whom approximately 259 600 people are aged ≥40 years (77 300 urban and 182 300 rural) (Table 6). Extrapolating the results for the Limbe survey to the urban regions in the South West Province, and for the Muyuka survey to the rural areas,<sup>3</sup> among those aged ≥40 years there are a total of 3532 blind people in the province, 3913 severely visually impaired and 14 421 visually impaired. Assuming that 21% of blindness in the urban area is caused by cataracts and 62% of blindness in the rural area,<sup>3</sup> then there are expected to be 211 people blind from cataracts in the urban area and 1566 in the rural area. Assuming that 43% of severe visual impairment is caused by cataracts in the urban area and 65% in the rural area, there are a further 126 severely visually impaired people because of cataracts in the urban area and 2352 in the rural area. In total there are approximately 4255 people requiring surgery for cataracts at VA<6/60 in the South West Province.

**Table 4** Presenting visual outcome of eyes after cataract surgery

Procedure	Visual outcome		
	Good (n = 6)	Borderline (n = 5)	Poor (n = 15)
ICCE	1 (17%)	0	7 (47%)
IOL	5 (83%)	5 (100%)	8 (53%)
Total	6	5	15

**Table 5** Extrapolated estimates of the number of blind, severely visually impaired (SVI) and visually impaired (VI) people in the South West Province

	Approximate population size	Sex-adjusted prevalence of blindness (%)	Estimated number that are blind	Sex-adjusted prevalence of SVI (%)	Estimated number SVI	Sex-adjusted prevalence of VI (%)	Estimated number VI
<b>URBAN</b>							
Age							
40–49	33 556	0.2	67	0	0	0.3	101
50–59	22 487	0.6	135	0.1	22	1.4	315
60–69	13 532	2.2	298	0.3	41	7.9	1069
70+	7 686	6.6	507	3.0	231	20.3	1560
Total	77 261		1007		294		3045
<b>RURAL</b>							
Age							
40–49	79 191	0.4	317	0.1	79	1.8	1425
50–59	53 068	0.4	212	0.7	371	3.9	2070
60–69	31 935	1.2	383	3.9	1245	14.0	4471
70+	18 139	8.8	1596	10.6	1923	18.8	3410
Total	182 333		2525		3619		11 376

## DISCUSSION

The estimated prevalence of bilateral blindness in people aged  $\geq 40$  years in the Limbe urban area was relatively low at 1.1% (0.7–1.5%). This was slightly lower than the prevalence of blindness detected in the neighbouring rural Muyuka Health Province (1.6%, 0.8–2.4%),<sup>3</sup> which is not surprising because ophthalmic services are often more available in urban than rural areas. A recent survey of blindness in Kenya also showed an unexpectedly low prevalence of blindness in people aged  $\geq 50$  years (2.0%, 1.5–2.4%).<sup>6</sup> A consistent pattern of surveys showing a low prevalence of blindness in Africa would suggest that the WHO blindness estimates for Africa are too high.<sup>1</sup> This would have implications for the current high targets for Africa of a cataract surgical rate of 2000 per million people per year.<sup>11–12</sup> In addition to the need for further surveys of blindness in Africa, the development of models to estimate the cataract surgical rate required (given the prevalence of cataract blindness and age distribution of the population)<sup>13</sup> would be a very useful undertaking to help with programme planning in Africa.

The two surveys in the South West Province of Cameroon show that cataracts were an important cause of blindness and severe visual impairment. This implies that the prevalence of blindness can be substantially reduced from its already low level. Furthermore, both surveys show that outcome after cataract surgery was relatively poor. These data suggest that the South West Province comprehensive eye-care project should focus on the provision of high-quality cataract surgery, particularly in the rural areas. Implementing a monitoring system of the results of cataract surgery could sensitise surgeons to quality control, thereby improving outcomes after surgery.<sup>14–17</sup>

Posterior-segment disease, particularly glaucoma, was an important cause of blindness in Limbe urban area, perhaps as a consequence of the high cataract surgical coverage and consequent low prevalence of cataract blindness. This is consistent with the findings from Nakuru district in Kenya, another area with a well-established eye-care programme.<sup>6</sup> Unfortunately there is no agreed control strategy that can be applied at the population level in low-income countries for glaucoma, and in Africa posterior-segment diseases are not targeted during the first phase of VISION 2020.<sup>2</sup> Glaucoma may become an urgent challenge for the prevention of global blindness once cataracts and other easily avoidable or treatable causes of blindness are brought under control. Diabetic retinopathy and age-related macular degeneration are also

likely to make up a greater proportion of blindness in low-income countries in the future (as they do in high income countries),<sup>1</sup> and these diseases are also currently difficult to treat.

There were a number of limitations to the study. As a result of the practical difficulties of diagnosing glaucoma, diabetic retinopathy and ARMD under field conditions, these diseases were classified together as a 'posterior-segment disease'. Many old people did not know their age and did not have identification cards. The age distribution of the sample was slightly younger than the age distribution for the district, although the population data for the district may not be reliable as they were extrapolated from the 1987 census data.

The study's strengths include the high response rate (92%) and high inter-observer agreement. In addition, there was only one team with one ophthalmologist and experienced nurses who applied standardised procedures to collect data. Compact segment sampling was used to select individuals within clusters, rather than the random-walk method, and this may have reduced selection bias.<sup>11</sup>

In conclusion, the prevalence of blindness is relatively low in both the urban and rural areas in the South West Province of Cameroon. Despite the low prevalence, most of the cases of blindness and visual impairment were avoidable suggesting that the burden of disease can be reduced still further. These survey data will help the South West Province comprehensive eye-care project to develop strategies to make high quality cataract services accessible to the population to reduce the prevalence of visual impairment from cataract.

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