

WORLD VIEW

Survey of blindness and visual impairment in Bioko, Equatorial Guinea

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6 November 2001**Aims:** This study was designed to estimate the prevalence of blindness and its main aetiologies in Bioko, an onchocerciasis endemic zone of Equatorial Guinea.**Methods:** Random sampling was applied, proportionally to population distribution into urban or rural areas. All the subjects underwent a basic eye examination by trained nurses. In the presence of any ocular affection or a visual acuity of less than 0.3, the subject was visited by the ophthalmologist. This visit included direct and indirect ophthalmoscopy, anterior segment examination with a slit lamp, and intraocular pressure recording. Blindness and visual impairment were defined by using the WHO criteria.**Results:** 3218 subjects were screened, with a mean age of 34.1 (SD 21.6) years, ranging from 1 month to 102 years (median 34 years). The overall prevalence of blindness was 3.2% (95% CI: 2.6% to 3.9%). Unilateral blindness was present in 4.2%. Visual impairment was diagnosed in 200 patients (6.8%). More than 20% of the acuities inferior to 0.7 improved when explored with a pinhole. The main causes of blindness were cataracts (61.3%); macular affection (25.3%), optic atrophy (16%), and glaucoma (13.3%). Ocular onchocerciasis was detected in 12 cases (0.4%).**Conclusion:** Ocular onchocerciasis was very uncommon in an area of high endemicity. Results also pointed at the lack of basic ophthalmologist eye care and optician resources in the island.

Equatorial Guinea, in west central Africa, comprises a continental territory, located between Cameroon and Gabon, and five inhabited islands. As a part of Equatorial Guinea, Bioko is a 2017 km² volcanic island in the Gulf of Guinea, roughly rectangular in shape, measuring 72 km from north to south, and 35 km from east to west, crossed over by about 200 rivers with fast streams. The island of Bioko is divided into four administrative districts (Malabo, Baney, Luba, and Riaba). The republic's capital, the city of Malabo, belongs to the district of Malabo and stands in the north of Bioko, by the sea. Bioko has an estimated population of about 62 000 inhabitants, approximately half of them living in rural areas. There is a tropical rain forest climate with temperatures near sea level varying between 17°C and 34°C and a single dry season running from November to the end of March. According to an epidemiological survey conducted between 1987 and 1989, onchocerciasis is hyperendemic and widespread all around the island, the overall prevalence of onchocerciasis (skin snips positive for *Onchocerca volvulus*) being 75.2%.¹ The present study was designed to estimate the prevalence of blindness and its main aetiologies in Bioko, which has not been determined to date.

SUBJECTS AND METHODS

From February to September 1999, a cross sectional study was conducted to assess the prevalence of blindness in Bioko (Equatorial Guinea).

Sample size and sampling method

In the design phase of the study, a sample size of 3012 was calculated to estimate an expected prevalence of blindness of 2%, with a precision of 0.5% and a confidence level of 95%.

The sampling frame was based on the 1998 census figures obtained through the onchocerciasis and other filariasis control programme. Random sampling was applied, proportionally to the population distribution in urban or rural areas. Three strata were considered: the urban area, large villages

(>400 inhabitants) from the rural area, and small villages from the rural area. The urban area, which is limited to the city of Malabo, includes approximately half of the total population of the island. The city of Malabo is divided in five quarters, from which a number of subjects, proportional to the quarter's population, were selected. Simple random sampling was applied in Malabo as individual records were available for the distribution of ivermectin. The remaining half of the study subjects were selected from the rural area of Bioko, which comprises 54 villages. Four of the villages, with more than 400 inhabitants, are rather bigger than the rest and represent 40% of the rural population. Twenty per cent of the total sample were then obtained from those villages, by household cluster sampling. From the 50 villages remaining, 21 clusters were selected and all the inhabitants of such villages were included.

Data collection

A questionnaire based on the World Health Organization (WHO) report on methods of assessment of avoidable blindness² was applied. The survey team consisted of two previously trained nurses, several eye auxiliaries, and one ophthalmologist. The protocol of the study, that was presented to and discussed with the field team members to ensure homogeneity, is available from the authors. Demographic data were collected, including age, sex, ethnicity, religion, country of origin, and previous treatment with ivermectin. Visual acuity was measured using an illiterate Snellen E-chart. Acuities of less than 0.7 were checked for improvement with a pinhole. Whenever the subject was not cooperating, visual acuity was estimated through the ability to fix a light source and follow it when moving. This was frequently the case with babies or little children. Eyes with acuities less than 0.3 were further tested for the capacity of counting fingers at progressively shorter distances (6 metres, 3 metres, and 1 metre).

All the subjects underwent a basic eye examination. In the presence of any ocular affection detected during the basic examination or a visual acuity of less than 0.3, the subject was visited by the ophthalmologist. This visit included direct and

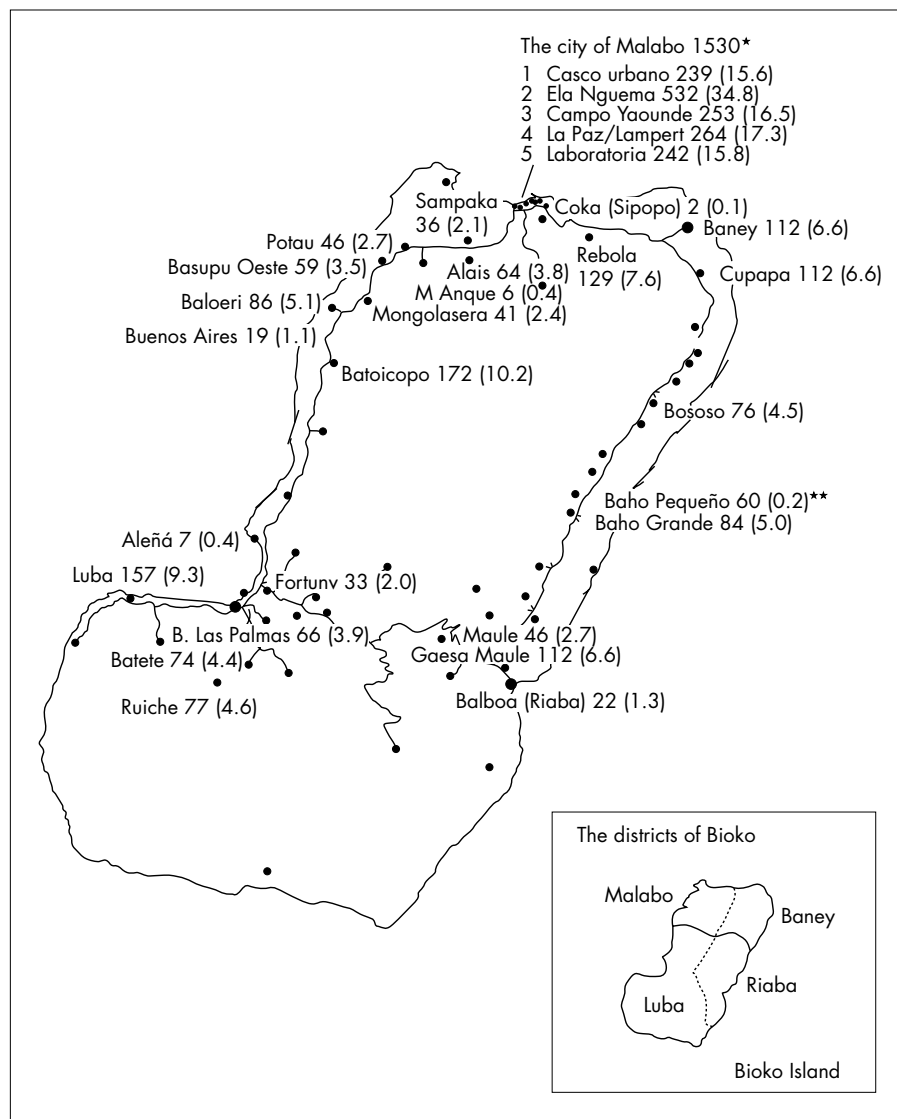


Figure 1 Geographical distribution of the subjects included in the study. Data are presented as number of studied subjects (percentage over the area—urban or rural). *The urban area is limited to the city of Malabo, from which 1530 subjects were selected by simple random sampling, proportionally to the population of the five quarters of the city, as shown in the figure. **A point in the map represents villages in the rural area. For those included in the study sample, the name of the village, the number of surveyed subjects, and the percentage over rural sample (in parentheses) are quoted.

indirect ophthalmoscopy, anterior segment examination with a slit lamp, and intraocular pressure recording with an appla-nation tonometer.

Definitions

The WHO criteria were applied to define blindness in subjects who were unable to count fingers at 3 metres (visual acuity (VA) inferior to 3/60 in the better eye). Unilateral blindness was defined as blindness (VA < 3/60) in one eye, the other eye being sighted (VA ≥ 0.3). Visual impairment was defined as a visual acuity of less than 0.1 (6/60) in the better eye. Visual field reduction criteria were not applied, as visual field determination was not performed because of practical limitations.

Glaucoma was defined as an intraocular pressure greater or equal to 21 mm Hg if glaucomatous excavation of the optic nerve was detected or an intraocular pressure greater or equal to 30 mm Hg in any case.

Statistical analysis

Statistical analysis was carried out with the SPSS statistical package. The prevalence of blindness and visual impairment

were estimated globally and in different subgroups, and they are presented with the corresponding 95% confidence intervals. Demographic characteristics were compared between blind subjects and the rest on the one hand, and between visually impaired subjects and subjects with no visual impairment on the other. The χ^2 test was applied to assess differences in categorical variables between groups. Quantitative variables were compared among groups using Student's *t* tests. Stratification was applied to adjust for the effect of age group on visual impairment or blindness prevalences when comparing sexes. All tests were done as two sided tests and *p* values less than 0.05 were considered significant.

RESULTS

Demographic data

Between January and September 1999, 3218 subjects were screened. Almost half of them (47.5%; 1530 subjects) lived in the capital, Malabo, and the rest in the villages previously selected at random, as shown in Figure 1. In the rural area, 53.4% of the visits (902 subjects) were done in villages with less than 400 inhabitants according to the 1998 census.

Table 1 Examination of visual acuity in the better eye

VA in the better eye	Category of visual impairment*	No	%
≥0.3		2644	89.9
<0.3		296	10.1
	1	147	
	2	52	
	3	35	
	4	43	
	5 (no light perception)	15	
	Not explored‡	4	
		2940†	100.0

*WHO/ICD 10 definition; †VA in the better eye could not be determined in 278 cases; ‡in four subjects with better eye acuity less than 0.3, capability for counting fingers was not explored.

There were 1542 men (47.9%) and 1676 women. Mean age was 34.1 (SD 21.6) years, ranging from 1 month to 102 years (median 34 years); 100 cases (3.1%) were not older than 2 years.

Exploration of visual acuity

The visual acuity in the better eye could not be determined in 278 subjects (8.6%). Most of those cases were children younger than 10 years, and the majority of them were able to fix centrally on a moving focal light. For the remaining 2940 subjects examined, visual acuity was less than 0.3 in both eyes in 10.1% (CI 95%: 9.0% to 11.2%) (Table 1). Globally, 4.9% of the subjects were not able to count fingers at 6 metres.

Visual acuity was less than or equal to 0.7 in 940 right eyes and 970 left eyes; 85.2% and 83.1% of them, respectively, were further checked by means of a pinhole, an improvement in visual acuity being registered in 22.2% and 21.3%, respectively.

Prevalence of blindness

The overall prevalence of blindness was 3.2% (93 patients, 95% CI: 2.6% to 3.9%). Fifty eight subjects (2.0%) were not able to count fingers at 1 metre with either eye. Unilateral blindness was present in 4.2%.

Blindness was significantly more frequent in men than in women (3.9% v 2.5%, $p=0.03$). Blind people were older than the rest (57.2 (20.4) years v 36.2 (20.1) years, $p<0.00005$). The frequency of blindness according to age group is shown in Table 2. The prevalence of blindness was higher in the rural area than in the capital (4.0% v 2.3%, $p=0.009$). Such a difference was mainly because the bigger villages (more than 400 inhabitants) had 5.1% subjects bilaterally blind.

The ophthalmological conditions more probably related to blindness were registered in 75 patients (80.6%). Globally, 46 blind subjects (61.3%) had cataracts in both eyes; 25.3% (19 patients) had a bilateral macula affection, 16% (12 patients)

Table 2 Age specific prevalence of blindness

Age group (years)	No of subjects explored	No of blind subjects	Blindness	
			%	95% CI
0–9	246	2	0.8	0.1 to 2.9
10–19	566	3	0.5	0.1 to 1.5
20–29	356	5	1.4	0.4 to 3.2
30–39	380	7	1.8	0.7 to 3.8
40–49	506	10	2.0	0.9 to 3.6
50–59	400	17	4.3	2.5 to 6.7
≥60	481	49	10.2	7.5 to 12.9
Total	2935*	93	3.2	2.6 to 3.9

*In 278 subjects, better eye acuity could not be determined; in four subjects with better eye acuity less than 0.3, capability for counting fingers was not explored; in another subject, age was not registered.

presented with a bilateral optic atrophy, 10 had bilateral glaucoma, and two patients had bilateral corneal opacities. Phthisis bulbi was detected in eight blind patients, five in the right eye, four in the left eye, one being bilateral.

Prevalence of visual impairment

Visual impairment was diagnosed in 200 patients (6.8%). Those people were significantly older than subjects with higher visual acuity (61.2 (15.4) years v 34.3 (19.1) years, $p<0.0005$). Visual impairment was more frequently detected in women than in men (8.0% v 5.9%, $p=0.03$). Although globally such difference lost statistical significance when adjusting for age, the proportion with visual impairment remained statistically different between sexes in the age group 50–59 years (12.2% in women v 5.4% in men, $p=0.02$). The frequency of visual impairment was higher in individuals visited in the rural area in comparison with the capital (10.1% v 3.9%, $p<0.00001$).

In 157 subjects (78.5%) the aetiology or aetiologies of visual impairment were registered. There were bilateral cataracts in 136 patients (86.6%), bilateral macular affection in 46 (29.3%), bilateral glaucoma in seven patients (4.5%), bilateral optical atrophy in five patients (3.2%), and corneal scars in four (2.5%).

Onchocerciasis and coverage with ivermectin

Ocular onchocerciasis was detected in 12 cases, 0.4% of the study subjects. Their median age was 61.5 years (range 35–78 years), nine were women. The majority of these cases ($n=9$) were from the islands of Equatorial Guinea; four had been visited in Malabo, and the rest in the rural area of Bioko.

Ocular onchocerciasis was present in four subjects out of the 200 patients with visual impairment (2.0%), and in four of the 93 blind people (4.3%).

A total number of 3059 subjects (95.1%) were able to answer a question about previous treatment with ivermectin; 71.1% (2176 cases) had taken the drug once or more than once, while 883 patients (28.9%) had never taken ivermectin.

DISCUSSION

Although the prevalence of blindness and visual impairment reported in this survey was high, it is worth noting that several methodological aspects may have affected the estimation of the actual burden of the problem in Bioko. In fact, since no visual field testing was performed, visual loss due to visual field constriction, which had to be expected in an onchocerciasis endemic area, might have been underdiagnosed. Another unresolved issue is whether blind subjects had a higher probability of being present at the moment of the survey, compared to sighted subjects, especially in rural areas. It is generally accepted that blind people are overrepresented in such studies because of their reduced mobility, but some authors report contradictory results on this matter.³ Finally, other practical limitations encountered during the ophthalmological visit, especially those related to funduscopy, may have slightly biased the distribution of the different aetiologies of blindness and visual impairment,⁴ but are not likely to affect the estimation of blindness itself.

The study design features also deserve some attention. For operative reasons, although proportionality to the population distribution was always required, the sampling method differed between Malabo and rural Bioko. Cluster random sampling was applied to select small villages from the rural area. In this stratum, involving 30% of the study population, the computation of statistics assuming simple random sampling, with no consideration of the design effect, is an oversimplified option.

The blindness prevalence (3.2%; % CI 95: 2.6% to 3.9%) found in Bioko is rather higher than the values reported in other developing countries.^{5,6} Comparisons among studies are

to be treated with caution as surveys on blindness are very sensitive to the definitions used and the population studied. These results point to a very poor availability of eye care resources in this area, and may be worsened by a trend towards population ageing.

Cataract was the most prevalent aetiology of blindness (61.3%) and visual loss (86.6%). In this sense, our data reproduce the majority of the population based studies in developing countries.^{3 7-10} In most countries of Africa and Asia, cataract accounts for approximately half of all blindness.¹¹ As expected, since cataract is an age related condition, our results show an increase in the proportion of blindness in the older groups, similar to what has been reported in previous studies worldwide. Other causes of preventable blindness, such as xerophthalmia or trachoma, specifically addressed by the WHO programme for the prevention of blindness,¹² and quite common in underserved rural areas in some developing countries, do not represent a problem in Bioko. This explains the very low contribution of corneal scars to the aetiology of blindness or visual impairment in our study, in comparison with other developing areas where up to 25% of all blinding conditions are caused by corneal opacification.^{10 13} Macular degeneration, which is becoming a common disabling condition in many countries due to population ageing, was also detected as a frequent cause of visual impairment in this survey. On the contrary, the prevalence of glaucoma was rather low, and probably underestimated in our study because of the limited methods of assessment, as previously mentioned.

According to this study, ocular onchocerciasis was present only in 0.4% of the subjects, in a region where the prevalence of onchocerciasis, defined as skin snips positive for *Onchocerca volvulus*, has been estimated to reach hyperendemic levels.¹ What is more, blindness from ocular onchocerciasis was very uncommon (4.3% of blind people) in comparison with data from surveys in other endemic African regions, where onchocerciasis was identified as the main cause of blindness.^{2 14} The prevalence of onchocerciasis has probably decreased in Bioko since the 1987-9 survey. But this reduction hardly explains the low proportion of ocular onchocerciasis found in the island, as corneal and retinal scars would still be found in previously infected subjects. In fact, even in endemic areas, the contribution of onchocerciasis to blindness varies widely. Schwartz *et al* found onchocerciasis to be the single most important cause of blindness (73.1%) in the district of Bossangoa, Central African Republic.³ Abiose *et al*¹⁴ reported 43% of blindness due to onchocerciasis in Nigeria. Both areas corresponded to onchocerciasis endemic savanna zones. Very different results were reported from other surveys conducted in forest zones, such as Ghana¹⁵ and Sierra Leone,¹⁶ where onchocerciasis accounted for 12.5% and up to 6%, respectively, of global blindness. Ocular involvement is known to be far more frequent in savanna than in forest areas with the same levels of onchocerciasis endemicity.¹⁷ Several factors have been considered to explain such different features,¹⁸⁻²⁰ such as the existence of different strains of *Onchocerca volvulus*²¹ or different species of its vector, the *Simulium* fly.²²

In conclusion, the prevalence of blindness in Bioko, estimated in 3.2% (2.6% to 3.9%), is high, cataracts being by far the major cause of blindness and visual impairment. More than 20% of the acuities inferior to 0.7 improved when explored with a pinhole. These results highlight the lack of basic ophthalmologist eye care and optician resources in the island. Ocular onchocerciasis was very uncommon in an area of high endemicity and its role in the aetiology of blindness and visual impairment was limited.

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