PN-AAK-131

Reprinted from THE LANCET, *June 27, 1981 p. 1407–1408*

INCIDENCE, PREVALENCE, AND SCALE OF BLINDING MALNUTRITION

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Summary 4595 pre-school-age children in six villages of West Java were examined every 3 months. The incidence of active corneal xerophthalmia was 5 per 1000 per year (95% confidence limits, 2·6–7·5), and the average prevalence during each round of examinations was 12 per 10 000. In a randomised, multistage cluster survey of 27 084 rural children throughout Indonesia the population-weighted prevalence of active corneal disease among pre-school-age children was 6·4 per 10 000 (95% confidence limits 3·2–9·6), 53% of that in the longitudinal study areas. At an adjusted incidence rate of 2·7 per 1000 per year, over 60 000 Indonesian children become xerophthalmic every year. By extrapolation of these findings about 500 000 new cases of xerophthalmia, half of which lead to blindness, occur each year in India, Bangladesh, the Philippines, and Indonesia combined.

INTRODUCTION

THERE is little established information on the incidence and scale of major blinding diseases in either industrialised or developing societies.[1] Published estimates of the number of new cases of corneal xerophthalmia, one of four priority diseases in the World Health Organisation's Programme for Prevention of Blindness, range from 20 000[2] to 250 000[3] per year. We have combined the findings of a longitudinal and a cross-sectional study to obtain what we believe is a reasonably accurate estimate of the incidence of xerophthalmic corneal involvement for Indonesia. The findings have been extrapolated to give rates for much of Asia.

METHODS

The background and methodology of our studies have been described in detail.[4] A prospective longitudinal field study of about 4600 pre-school-age (0–6 years) children was done in a rural area in

West Java where xerophthalmia is endemic. After enumeration and mapping of the households in the six study villages, all families with pre-school-age children were enrolled in the study.

In February, 1977, a team composed of an ophthalmologist, paediatrician, nutritionist, two nurses, and eight field workers set up its headquarters in the area. For the next 2 years the field workers visited homes every 3 months to update socioeconomic and medical data, to enrol children who were born or who joined households since the previous visit, and to bring the children to a centre for their clinical examination. Cooperation was reasonably high, 4595 (82%) eligible children being examined on each round. Children with frank corneal involvement were immediately sent to the Cicendo Eye Hospital for assessment and therapy. Symptomatic treatment was given to all children with respiratory tract infections or diarrhoea. Children with severe malnutrition or systemic infections were encouraged to attend the local clinic or hospital. No child was given vitamin A until the last round, although those with mild xerophthalmia (Bitot's spots or night blindness) were carefully followed up.

The randomised multistage cluster probability survey (the cross-sectional study), done in 23 of the 27 provinces of Indonesia, covered 96% of the country's population. 36 060 pre-school-age children were examined in 254 sampling areas. Only the rural sample of 27 084 children was truly representative of the rural pre-school-age population and will be considered in this report. Examinations were carried out by three teams of similar composition and training to those of the team for the longitudinal study; periodic checks were made to see that observations made were standardised. All children with xerophthalmia received 200 000 IU vitamin A orally. The survey period, October, 1977, to May, 1978, was dictated by political considerations and a desire to avoid Ramadan, with its attendant effect on dietary patterns.

All data were entered on self-coding forms, checked twice (once in the field and once at study headquarters, Bandung), transferred to 80 column IBM cards, and analysed on an IBM 370 computer. Standard diagnostic criteria for xerophthalmia were employed,[5] and all corneal lesions were drawn and photographed.

RESULTS

Incidence

To minimise the influence of seasonal variations, calculation of annual incidence was based on data from the 12-month period covered by rounds 2 to 5 (July, 1977–June, 1978), inclusive, of the longitudinal study. 16 study children had active xerophthalmic corneal disease (X2/X3[5]) during this period (table I). Incidence was calculated in two ways. A higher incidence (6 per 1000) was obtained when the denominator consisted of the average number of children examined in each round who were also examined, and known

TABLE I—ANNUAL INCIDENCE OF ACTIVE CORNEAL XEROPHTHALMIA IN SIX VILLAGES

Village	No. of cases	Method I		Method II	
		Mean no. examined	Annual incidence per 1000	Mean no. eligible for exam.	Annual incidence per 1000
Citalang	2	900	2·2	1445	1·4
Cikao	1	202	5·0	283	3·5
Cilegong	1	239	4·2	357	2·8
Kembang	1	187	5·3	276	3·6
Gandasoli	8	793	10·1	1146	7·0
Citeko	3	453	6·6	1088	2·8
Total	16	2774	5·8*	4595	3·5*
95% C.L.	..	..	3·0–8·6	..	1·8–5·2

Method I: denominator is number of children examined over a year at each of four consecutive examinations who were also examined, and found to be free of corneal disease, at the preceding examination.
Method II: denominator is average number of children eligible for examination at each of the four consecutive examinations, irrespective of whether or not they were examined.
*Weighed average.

The true incidence probably lies somewhere between these two estimates, and closer to the higher than the lower. Subtracting one-third of the difference between them from the higher rate yields an overall estimate of 5 per 1000 per year (95% confidence limit 2·6–7·5 per 1000).

Prevalence

Calculation of prevalence rates was based on the number of children actually examined. The average prevalence of active corneal disease during round 2–5 of the longitudinal study was 12 per 10 000 (table II). The average weighted prevalence to be free of corneal disease, in the immediately preceding round. This estimate assumes that children not examined on consecutive rounds had the same rate of disease as those who were. All the abnormals, but not all the normals, were examined in the preceding round, so this rate is probably a mild overestimate.

A lower estimate (3·5 per 1000) was obtained when the denominator consisted of the average number of children eligible for examination in each round, whether or not they were examined. It assumes that all children not examined were free of disease, and is certainly an underestimate.

of active corneal disease for rural Indonesia as a whole was 6·4 per 10 000 (table III), 53% of that of the longitudinal study area.

TABLE II—PREVALENCE* OF ACTIVE CORNEAL XEROPHTHALMIA IN SIX VILLAGES

Village	No. of children examined	No. of cases	Prevalence (per 10 000)
Citalang	4260	2	4·7
Cikao	929	1	10·8
Cilegong	1124	1	8·9
Kembang	883	1	11·3
Gandasoli	3701	8	21·6
Citeko	2438	3	12·3
Total	13 335	16	12·0†

*Averaged over the same four examinations as in table 1.
†Weighted average.

Magnitude of the Problem

Since the active stage of xerophthalmic corneal disease is a transient condition not expected to accumulate to any significant degree, and prevalence rates in the special study area and the country at large were not too dissimilar, it is reasonable to assume that spontaneous cure rates and differential mortality (between children with and without corneal xerophthalmia) in the two study populations were also similar. The incidence rates in the two populations should therefore be proportional to their respective prevalence rates. Thus, at 53% of the rate for the longitudinal study, the annual incidence of active corneal xerophthalmia

TABLE III—PREVALENCE OF ACTIVE CORNEAL XEROPHTHALMIA IN RURAL INDONESIA

Zone	No. of children examined	No. of cases	Rate (per 10 000)	95% confidence limits (per 10 000)
W. Java	4147	4	10	0–21
C. Java	4577	2	4	0–10
E. Java	3949	0	0	..
Bali	1326	1	8	0–23
Lombok	2353	5	21	3–39
Sumatra	4267	6	14	4–24
Sulawesi	3378	1	3	0–9
Kalimantan	2056	1	5	0–15
Ambon	1031	0	0	..
Indonesia (weighted)*			6·4	3·2–9·6

*Weighting proportional to size of the population of each zone.

in rural Indonesia is 2·7 per 1000. With a rural pre-school-age population of 23·5 million, at least 63 000 new cases of corneal xerophthalmia occur in Indonesia every year.

DISCUSSION

Although xerophthalmia is a major public health problem in many developing countries, its magnitude has been difficult to assess. By themselves, cross-sectional prevalence surveys yield little information: active corneal disease is a transient condition and under ordinary circumstances—i.e., when children do not receive treatment[1] mortality is extremely high, probably approaching 85%.[4] Accurate estimates require correlation of cross-sectional data with those of longitudinal surveys.

Our results suggest that at least 63 000 Indonesian children aged 0–6 get corneal xerophthalmia every year. This is probably an underestimate of incidence in the general population because both studies were restricted to pre-school-age rural children, whereas a considerable number of cases occur in older individuals and inhabitants of urban slums;[3,4] incidence rates were based on cases observed during periodic examinations, missing those who became xerophthalmic and died or underwent spontaneous cure between rounds; the presence of the survey team, treatment of mild infections, and referral of severely ill and malnourished children to local hospitals and clinics must have reduced the incidence; and the countrywide cross-sectional survey missed the period of peak prevalence.[4,8–9]

Existing prevalence data suggest corneal xerophthalmia is at least as common in areas of India,[6,10–12] Bangladesh,[13] and the Philippines,[14,15] as it is in Indonesia. If the annual incidence is 2·7 per 1000, roughly 500 000 pre-school-age children in these four countries will become xerophthalmic every year. One-third to one-half the cases probably result in bilateral blindness, while the number of children with milder manifestations (night blindness and Bitot's spots) is probably ten times that of active corneal disease.[4] These estimates do not include other countries in Asia where the disease is known to occur, nor countries in Africa, Middle and South America, the Caribbean, or Middle East.

This report was prepared under Cooperative Agreement AID/DSAN-CA-0267-931-0046 between the Office of Nutrition, United States Agency for International Development, and International Center for Epidemiologic and Preventive Ophthalmology.

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