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Prevalence and risk factors for trachoma in Sarlahi district, Nepal

Joanne Katz, Keith P West, Jr, Subarna K Khatry, Steven C LeClerq, Elizabeth Kimbrough Pradhan, M D Thapa, Sharadar Ram Shrestha, Hugh R Taylor

Abstract

***Aims*—To estimate the prevalence of trachoma in preschool children in Sarlahi district, Nepal, and to identify risk factors for the disease.**

***Methods*—A stratified random sample of 40 wards was selected for participation in a trachoma survey. Within each ward, a systematic 20% sample of children 24-76 months of age was chosen to determine the presence and severity of trachoma using the World Health Organisation grading system.**

***Results*—A total of 891 children were selected and 836 (93.8%) were examined for trachoma from December 1990 to March 1991. The prevalence of active trachoma was 23.6% (21.9% follicular and 1.7% intense inflammatory). Cicatricial trachoma was not seen in this age group. The prevalence of trachoma ranged from 0 to 50% across wards with certain communities at much higher risk for trachoma than others. Three year old children had the highest prevalence of follicular (25.5%) and intense inflammatory trachoma (4.3%). Males and females had similar prevalence rates. Wards without any tube wells were at higher risk than those with one or more tube wells. Lower rates of trachoma were seen in families who lived in cement houses, had fewer people per room, more servants, more household goods, animals, and land. Hence, less access to water, crowding and lower socioeconomic status were risk factors for trachoma.**

***Conclusions*—Although follicular trachoma is prevalent, intense inflammatory trachoma is relatively rare and scarring was not observed in this preschool population. Hence, this population may not be at high risk for repeat infections leading to blindness in adulthood.**

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Department of International Health, The Johns Hopkins University, School of Hygiene and Public Health, and the Dana Center for Preventive Ophthalmology, Baltimore, Maryland, USA
J Katz
K P West, Jr
S C LeClerq
E K Pradhan

National Society for the Prevention of Blindness and the World Health Organisation Prevention of Blindness Programme, Kathmandu, Nepal
S K Khatry
M D Thapa
S Ram Shrestha

Department of Ophthalmology, University of Melbourne, Melbourne, Australia
H R Taylor

Correspondence to: Dr Joanne Katz, Johns Hopkins School of Hygiene and Public Health, Room 5515, 615 N Wolfe Street, Baltimore, MD 21205-2103, USA.

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Trachoma is the second leading cause of blindness worldwide.[1,2] It is estimated that 6 million people are currently blind from trachoma and that 500 million are infected. A national blindness survey conducted in Nepal in 1981 found that trachoma was the second most common ocular disorder in the country and the second leading cause of blindness in women.[3,4] Inflammatory trachoma was more prevalent among certain ethnic groups and in certain areas, particularly in the far west of the country. More recent information on the prevalence of trachoma is not available. Other than a few demographic characteristics described in the Nepal Blindness Survey, risk factors for trachoma in Nepal have not been studied. We conducted a prevalence survey of active trachoma from December 1990 to March 1991 in the east central terai district of Sarlahi in order to assess the magnitude of the current trachoma problem in this area, and to identify risk factors associated with this disease in preschool children.

Materials and methods

This trachoma survey was conducted within the framework of a larger study assessing the impact of vitamin A supplementation on mortality, morbidity, growth, and xerophthalmia.[5-7] The sampling plan has been described elsewhere.[5,8] Briefly, 29 village development areas were selected at random from a list of village development areas in Sarlahi that were included in the sampling frame on the basis of accessibility and distance from the Indian border. Each village development area is made up of nine administrative areas known as wards. Using a random start, a 15% systematic sample of 40 wards out of the possible 261 was selected to participate in an ocular survey. A house to house census of preschool children was conducted in September 1989 and updated at 4 monthly intervals. In December 1990, a systematic 20% subsample of children in the 40 ocular survey wards who were between 24 and 76 months of age was selected to be examined for signs of trachoma. The survey took 4 months to complete and took place in the season after monsoon (July to September) but before the driest time of year (April to June). The target sample size was calculated to allow for estimation of a 25% prevalence rate with a 95% confidence interval from 22% to 28%.

Table 1 Prevalence of trachoma by age in Sarlahi, Nepal

		Follicular		*Inflammatory*		*All active trachoma*	
Age (years)	*No*	*n*	*%*	*n*	*%*	*n*	*%*
2	187	46	24.6	1	0.5	47	25.1
3	141	36	25.5	6	4.3	42	29.8
4	192	45	23.4	2	1.0	47	24.5
5	231	38	16.5	5	2.2	43	18.6
6	85	18	21.2	0	0.0	18	21.2
Total	836	183	21.9	14	1.7	197	23.6

Trachoma was graded according to the current simplified World Health Organisation grading scheme.[9,10] An ophthalmologist and a senior ophthalmic assistant with more than 10 years experience examined the children at one or more central sites in each ward. Both had undergone extensive training in the World Health Organisation grading scheme by an expert against whom they were found to have acceptable agreement before the start of the survey. The examination was done with 2.5 × loupes. The upper lid was everted and the tarsal conjunctiva was examined for signs of trachoma. Active inflammatory disease was classified into follicular trachoma (TF) if five or more follicles were observed on the tarsal plate. Intense inflammatory trachoma (TI) was defined as hypertrophy that obscured more than half of the normal deep tarsal vessels. Cicatricial trachoma was graded as the presence of conjunctival scarring (TS) or trichiasis due to scarring (TT), and corneal opacities due to trachoma (CO). Active trachoma was defined as the presence of TF or TI in either eye. If both eyes had trachoma, the classification was based on the eye with the more severe disease.

Risk factors for trachoma were collected at the ward, household, maternal, and individual child levels. Types of water sources available in the ward and the access to water at the household level were ascertained. Markers of crowding included number of houses per ward, number of household members, and number of people per room. Because of the systematic sampling within selected wards, children participating in the survey came from different households. Hence, we were unable to look at presence of trachoma in other siblings as a risk factor for household transmission. Markers of socioeconomic status included literacy and occupation of the head of the household, number of servants, house construction, presence and type of latrine, and ownership of household goods, animals, and land. Maternal characteristics included age, literacy, and number of children who had died. Morbidity of children in the past week was also known based on a history obtained from the mother.

Pairwise odds ratios were used to estimate the clustering of trachoma within wards and to estimate the design effect generated by cluster sampling.[11,12] Confidence intervals for the prevalence of trachoma were adjusted to account for the clustering of disease within wards. The association between trachoma and each risk factor was examined separately. Factors that were associated with p values of 0.1 or less were included in a logistic regression model to assess the strength of the association between trachoma and multiple risk factors.

Table 2 Distribution of number of children sampled and active trachoma prevalence by wards

	n	*%*
No of children sampled per ward:		
<10	6	15.0
10–19	18	45.0
20–29	6	15.0
30–39	6	15.0
40–49	2	5.0
50–59	2	5.0
Total	40	100.0
Ward prevalence (%)		
0–9	8	20.0
10–19	11	27.5
20–29	5	12.5
30–39	10	25.0
40–49	4	10.0
50–59	2	5.0
Total	40	100.0

Ethical approval for this study was obtained from the Joint Committee on Clinical Investigations of the Johns Hopkins University, and by the Nepal Health Research Council. Verbal informed consent was obtained from parents of children selected to participate. Children found to have trachoma were treated with tetracycline ointment in both eyes twice daily for 5 consecutive days.

Results

A total of 891 children between the ages of 24 and 76 months from 890 households were systematically selected for the survey from the census lists of the 40 ocular survey wards. Of these, 836 (93.7%) were examined for signs of trachoma. The lowest response rate was among 2 year old girls at 86.5%. There were six children where only one eye was examined. The fellow eyes of each of these children were normal and the child was classified as normal for purposes of estimating prevalence. The prevalence of all active disease was 23.6% (95% confidence interval (CI): 19.0, 28.2). The prevalence of follicular trachoma and intense inflammatory trachoma was 21.9% and 1.7%, respectively. No cases of cicatricial trachoma were seen in this population. The highest prevalence of both follicular and intense inflammatory trachoma was found in 3 year old children (Table 1). The overall prevalence was 23.0% for males and 24.2% for females. All cases of intense inflammatory disease were bilateral, whereas 16% of those with follicular disease were observed in one eye only.

The distribution of the number of children sampled in each ward is given in Table 2. The numbers ranged from 3 to 53 since those sampled were a 20% systematic sample of children from each ward who were in the eligible age range. Because of the systematic sampling of every fifth child from the census lists, all children except one were from different households. The prevalence of trachoma in the different wards ranged from zero to 50%, with 20% of the wards having prevalence rates below 10% and 15% of the wards having prevalence rates of 40% and higher (Table 2). There was a large variation in prevalence rates

Table 3 Risk factors for active trachoma in Sarlahi district, Nepal

Risk factors	*No*	*Prevalence (%)*	*Odds ratios*		*95% CI*
			Crude	*Adjusted**	
Servants:					
None	747	24.9			
Any	83	13.3	0.46	0.69	0.33,1.44
People/room:					
<5	478	20.5			
≥5	352	28.1	1.52	1.46	1.03,1.75
Irrigated land (biggars†):					
<20	510	26.3			
20–99	266	22.6	0.84	1.01	0.68,1.50
≥100	54	5.6	0.21	0.39	0.11,1.40
Bicycles owned:					
None	685	25.1			
Any	145	17.2	0.62	0.85	0.51,1.42
Type of house:					
Thatch only	273	25.3			
Bamboo/thatch/tile	372	20.2	0.75	0.90	0.59,1.35
Wood/thatch/tile	148	34.5	1.55	1.54	0.92,2.56
Cement/tile	37	5.4	0.17	0.27	0.06,1.17
Primary household water source:					
Tube well	412	21.6			
Ring well	350	26.9	1.33	0.87	0.56,1.34
Unprotected	68	20.6	0.94	0.52	0.23,1.17
Houses/water source in ward:					
<10	389	20.8			
10–29	253	25.3	1.29	1.07	0.68,1.67
≥30	194	27.8	1.47	0.90	0.46,1.78
Tube wells in ward:					
None	191	34.0			
Any	645	20.5	0.50	0.53	0.30,0.93
Pharmacies in ward:					
None	710	24.6			
Any	126	17.5	0.65	0.86	0.49,1.51

Six households could not be interviewed and are missing household specific data.
*Adjusted for age of the child in years (separate odds ratios for each year) and all other factors listed in this table.
†1 biggar = 1.67 acres.

by ward. The pairwise odds ratio for trachoma within wards was 1.33 (95% CI: 1.12, 1.59). This means that a child from one ward will be 1.33 times more likely to have trachoma if another randomly chosen child from that ward was found to have trachoma. The design effect was 2.62 (95% CI: 1.55, 3.95). This means that the variance of the prevalence estimate was 2.62 times larger because wards, rather than individuals were randomly sampled.

There was only one ward with a health post. The prevalence of trachoma in this ward was 5.9%. Only five wards had any pharmacies. The prevalence of trachoma in these wards was 17.5%, compared with 24.6% in those without pharmacies (Table 3). There was substantial variation in type and number of water sources within wards. Ninety per cent of wards had between one and 11 ring wells, and 78% had between one and 59 tube wells. Ten wards had one or more borings (used as a water source for irrigation only) and nine wards had one or more ponds. The number of houses per ward ranged from 32 to 312 and the number of houses per domestic water source (total number ring wells and tube wells) ranged from 2.6 to 71.0 across wards. The prevalence of trachoma was 20.8% in wards with less than 10 houses per water source and 27.8% among those where one water source served 30 or more houses. The prevalence of trachoma among children in wards without tube wells was 34.0% versus 20.5% among those in wards with at least one tube well.

Tube wells were the main water source for 49.6% of all households since these were more numerous within the wards that did have tube wells (Table 3). Ring wells were the primary water source for 42.2% of households. Unprotected water sources such as ponds, streams, and rivers were the primary source for only 8.2% of households. Eighty nine per cent of households were within 30 minutes' walk of their primary water source, and 33% were within 5 minutes' walk. There was no association between the distance to the primary water source and the risk of trachoma to children in that household.

In a bivariate analysis, household characteristics that were significantly associated with trachoma risk were the presence of servants, number of household members per room, ownership of irrigated land, bicycle ownership, and type of housing (Table 3). Several differences that were not statistically significant were observed between households with and without trachoma. Trachoma was less prevalent among households where the head of household's occupation was a private business or service (19.1%) compared with farmers or labourers (28.5%). Trachoma prevalence was lower in households with a pit or water sealed latrine (19.6%) compared with households without any latrine (24.0%). Brahmins and non-Hindus had lower rates of trachoma than other castes (19.8% and 14.0%, respectively). Households with trachoma owned fewer carts, radios, watches, and animals. Literacy of the head of the household was not associated with trachoma (24.1% among those not literate versus 23.3% among those who were). This was the case in spite of the fact that head of household literacy was associated with ownership of household goods, employment of servants, and caste.

Maternal literacy was associated with a lower risk of trachoma (17.6% versus 23.7%) but this difference was not statistically significant because of the low rates of literacy in this population (8.2%). Maternal age and whether the mother had previous children who had died was not associated with trachoma risk. The prevalence of trachoma was higher among children who had been sick in the past week (26.9% versus 22.6%), but this difference was not statistically significant.

Risk factors that were significantly associated with trachoma risk in bivariate analyses were entered into a multivariate logistic regression model (Table 3). Factors that remained significant at the 0.05 level in this model were number of people per room and the presence of one or more tube well in the ward. The odds of trachoma were 1.46 (95% CI: 1.03, 1.75) times greater for children from households with five or more people per room than households with fewer people per room. The odds of trachoma were 0.53 (95% CI: 0.30, 0.93) for children living in wards with at least one tube well compared with those in wards without any tube wells. The presence of a tube well in the ward was more important as a protection against trachoma than the use of the tube well as the primary water source for individual households.

An analysis was also done separately for the 19 low prevalence wards (< 20% of children with trachoma) and the 16 high prevalence wards (> 30% of children with trachoma). Among low prevalence wards, the only significant risk factor was the number of people per room (odds ratio: 1.85 for five or more people per room, 95% CI: 0.95, 3.58). Among high prevalence wards, the employment of one or more servants was the only factors significantly associated with a lower risk of trachoma (odds ratio: 0.39, 95% confidence interval: 0.14, 0.96). The presence of tube wells in the ward was not associated with trachoma in the high or low prevalence wards because this was a characteristic of the ward. The presence of tube wells explained some of the variation between high and low prevalence wards, but not the variation within low prevalence or high prevalence strata.

Discussion

Follicular trachoma is prevalent in this population although very few children had intense active inflammatory disease. Cicatricial trachoma was not seen in this population but this is probably due to the young age of the population examined. The prevalence of intense inflammatory trachoma has been found to be much higher in Africa,[13-18] South Asia,[19-21] and among Australian aboriginal populations.[22 23] Our rates of intense inflammation were comparable with those found in Sao Paulo, Brazil, although their rates of follicular disease were lower.[24] Because of the low rates of intense inflammatory trachoma, the Sarlahi population is at low risk for scarring and corneal opacification in adulthood. Adults were not examined so we are unable to say anything about the prevalence of trichiasis/entropion or the need for surgery in the adult population since this would represent the sequelae of childhood exposures 40–60 years ago.

The Nepal Blindness Survey found that the prevalence of trachoma was highest in the far west (28.5% for males and 31.9% for females).[2] The prevalence of active trachoma among preschool children in our study area (east central terai) was comparable with that for all age groups in Bheri and Seti zones (far west) in 1981, and much higher than that reported from the eastern terai in 1981. The Nepal Blindness Survey did not report trachoma prevalence by age and geographical zone. Hence, an age specific comparison is not possible. Gilbert and Marx studied sociomedical factors associated with trachoma risk within the Nepal Blindness Survey.[25 26] Our study found a similar pattern of trachoma risk in different castes to that observed in the Nepal Blindness Survey. The prevalence of trachoma was slightly lower among Brahmins and non-Hindus (mostly Muslims and a few Buddhists), and highest among the Chhetris. In the blindness survey, watch ownership, as a reflection of family wealth, was associated with lower rates of trachoma. We found households that owned bicycles, watches, and carts had lower rates of trachoma, although these were strongly associated with other more closely associated factors such as type of housing, crowding, and type of water source. Studies in other parts of South Asia found associations between caste and trachoma risk,[19] personal hygiene and education level of parents,[20] and general socioeconomic status.[21]

Lower socioeconomic status has been associated with higher risk of trachoma in many different environments.[13 16 17 19-21 24-30] In our study, better housing, non-agricultural cash employment, presence of a latrine, and ownership of land, animals, and household goods were each associated with slightly lower rates of trachoma. The type of water source was more important as a risk factor for trachoma than access to water as measured by time taken to walk to the water source. The presence of one or more tube wells in a ward and the household use of tube wells were both associated with lower rates of trachoma than the presence and use of ring wells. Seven of the nine wards without tube wells did have access to ring wells but still had higher rates of trachoma than those wards with tube wells. This may reflect poorer access to water from ring wells compared with tube wells. More effort is required to pull water from a ring well than to access a tube well, and this might reduce the volume used by the household. Alternately, the absence of tube wells in the ward or their use by families might be a marker for other socioeconomic or hygiene factors associated with trachoma risk. Since the presence of tube wells in the ward was more strongly associated with lower trachoma risk than the use of tube wells as the primary water source for a household, the latter is the more likely explanation.

Water access and consequent quantity of water used is important because it is associated with facial cleanliness which has been shown to be associated with trachoma in observational studies.[13 29 31-33] A community intervention to increase face washing was able to demonstrate a reduction in trachoma prevalence.[34] A study in the Gambia found an association between the amount of water used to wash children and trachoma risk.[35] In Brazil, almost all households had access to piped water, but water piped into the house, rather than accessible nearby, was protective against trachoma.[24] The type of water source was also found to be important in Taiwan where lower rates of trachoma were found in households with internal piped water compared with hand pumps and draw wells.[27] In general, access was quite good in this population compared with many parts of Africa. Only 11% of households had to walk more than 30 minutes to their primary water source, compared with 80% of households in Kongwa, Tanzania.[31 36] However, a strong association was seen between distance to water and trachoma prevalence in Malawi, where only 13% of children came from households where the primary water source was more than 30 minutes' walk from the house.[13] Distance to a water source has generally been found to be more strongly associated with trachoma risk than quantity or quality of water.[37] In Nepal, access, as measured by the number of houses per water source within a ward, was marginally associated with higher rates of trachoma but only for wards with more than 30 houses per water source.

Extensive crowding and poor hygiene result in repeated infections within households and within neighbourhoods. Repeat infections lead to scarring of the conjunctiva among school age children and young adults that results in trichiasis/entropion and blindness among older adults. Crowding, as measured by the number of household members per room, was found to be a risk factor for trachoma in our study in Nepal. Others have also shown this association.[15 24] The presence of siblings with trachoma was not examined in this study because of the way children were sampled, but this has been shown to be strongly associated with trachoma risk in several studies.[13 17 28 38] Our measure of crowding was probably a surrogate for the number of preschool age children who act as the main reservoir of active trachoma.

Follicular but not intense inflammatory trachoma was common among preschool children in this area of Nepal. Given the prevalence and severity seen in this population, the risk of blindness from trachoma should be relatively low if environmental conditions remain the same over time. Nevertheless, it is important to note that trichiasis/entropion is still seen in clinic settings among older patients in this area. Hence, modest rates of active disease among children does not necessarily translate into reduced need for trichiasis/entropion surgery in the adult population. Although active trachoma is not endemic in this area, it is important not to ignore the problem of active trachoma because a pool of infection clearly exists that can increase the severity and intensity of the disease if the environmental conditions change for the worse, particularly if crowding increases or if access to water is reduced from current levels.

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