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Risk factors for trachomatous trichiasis in children: cross-sectional household surveys in Southern Sudan

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Summary We have previously documented blinding trachoma to be a serious public health problem in Southern Sudan, with an unusually high prevalence of trachomatous trichiasis (TT) among children. We aimed to investigate risk factors for TT in children in Southern Sudan. Cross-sectional surveys were undertaken in 11 districts between 2001 and 2006, and eligible participants were examined for trachoma signs. Risk factors were assessed through interviews and observations. Using logistic regression, associations between TT in children and potential risk factors were investigated. In total, 11 155 children aged 1—14 years from 3950 households were included in the analysis. Overall prevalence of TT was 1.5% (95% CI 1.1—2.1). Factors independently associated with increased odds of TT in children aged 1—14 years were: increasing age ($P_{trend} < 0.001$); female gender (odds ratio = 1.5; 95% CI 1.1—2.1); increasing proportion of children in the household with trachomatous inflammation-intense (TI) ($P_{trend} = 0.002$); and increasing number of adults in the household with TT ($P_{trend} < 0.001$). Our study revealed risk factors for TT in children consistent with those previously reported for TT in adults. While the associations of TT in children with TI in siblings and TT in adult relatives merit further investigation, there is an urgent need for trachoma prevention interventions and trichiasis surgery services that are tailored to cater for young children in Southern Sudan.

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1. Introduction

Trachoma is the leading infectious cause of blindness and is estimated by WHO to be responsible for 2.9% of blindness globally.[1] Recurrent infection with ocular *Chlamydia trachomatis* results in chronic conjunctival inflammation, conjunctival scarring, trichiasis and corneal opacification.[2–4] Development of increasingly severe cicatricial changes is thought to be dependent on the frequency, intensity and duration of infection, and induced inflammation.[5] It is generally accepted that trachomatous trichiasis (TT) usually starts in the second and third decades of life, with up to 10% of adults in endemic communities being affected.[6–8] However, in populations severely affected by blinding trachoma, early onset of trichiasis has been well documented in children. Population-based surveys conducted between 2001 and 2006 in 11 districts, across five states in Southern Sudan (Figure 1) reported TT prevalence in children aged 1–14 years ranging from 0.1% to 3.5%.[9–11]

Risk factor studies are important in identifying potential targets for interventions. Survey data have consistently shown prevalence of cicatricial signs of trachoma and trachoma-related blindness to be two- to four-fold in women compared with men.[12] A number of studies have specifically explored risk factors for trichiasis among adults.[13–17] Turner et al. studied risk factors for TT among women in Tanzania and found TT to be associated with a history of trichiasis in the woman's mother, sleeping in a room with cooking fire during childbearing years, illiteracy and five or more deaths among the woman's children.[13] A case–control study of environmental risk factors for TT among adults in Dalocha District of Central Ethiopia, found irregular face washing and illiteracy to be associated with increased odds of TT using a univariate regression analysis.[14] In a recent survey of trachoma in Amhara Region of Ethiopia, TT was found to be independently associated with increasing age, female gender, increasing prevalence of active trachoma in children and increasing altitude.[15] Results of a seven-year longitudinal follow-up of adult women showed higher incidence of TT in women with trachomatous scarring (TS) at baseline, ocular chlamydial infection and older age.[16] In a 12-year longitudinal follow-up of adults with TS in the Gambia, Bowman et al. found increasing age and Mandinka ethnicity to be associated with progression of TS to TT.[17] While risk factors for trichiasis among adults have been studied previously, there has been less focus on trichiasis in children. In this paper, we report on potential risk factors associated with TT in children aged 1–14 years in Southern Sudan.

2. Materials and methods

2.1. The study population and sampling

Population-based surveys of trachoma were conducted in 11 districts of Southern Sudan between 2001 and 2006 (Figure 1). The sample for this study included children aged 1–14 years who had participated in population-based surveys for trachoma in 11 districts. The sample size estimation and sampling methods of the surveys have been described previously.[9–11] In brief, the sample size was calculated to allow for estimation of at least 50% prevalence of active trachoma signs in children aged 1–9 years within a precision of 10% given a 95% confidence limit and a design effect of 5. We also aimed to estimate at least 2.5% prevalence of TT in people aged 15 years and above within a precision of 1.5% at 95% confidence limit and a design effect of 2. The districts were selected on the basis of pragmatic program implementation criteria of: (1) anecdotal reports of blinding trachoma; (2) security and accessibility; and (3) feasibility of initiating trachoma control interventions after the survey. In two of the districts (Paluer and Padak), trichiasis surgery services had been offered to the communities during eye-surgery camps, which had been conducted in the districts in July 2000, prior to the baseline surveys.

A two-stage random cluster sampling with probability proportional to size was used to select the sample population in each site. A cluster was defined as the population within a single village. Using a line listing of all the villages in each study site, villages were grouped into sub-districts. Villages that were inaccessible and/or insecure were excluded from the sampling frame. In the first stage, villages were randomly selected with probability proportional to the estimated population of the sub-district. In the second stage, households were selected from the villages selected in the previous stage using the random-walk method,[18] except in Ayod District, where the compact segment method[19] was used for sampling households. All residents of selected households were enumerated and those present examined. It was not possible to return later to the households to pick up any absentees, and households where residents were not available were skipped. Only children aged 1–14 years were included in the sample for this risk factor analysis.

2.2. Trachoma examination

Trainee examiners comprising auxiliary nurses and community health workers were trained using the WHO simplified grading system[20] by a senior examiner experienced in trachoma grading (ophthalmologist or ophthalmic nurse). The simplified grading system comprises five signs: trachomatous inflammation-follicular (TF), trachomatous inflammation-intense (TI), TS, TT and corneal opacity (CO). The minimum accepted inter-observer agreement was set at 80% and reliability assessed in two stages. In the first stage, trainee examiners identified trachoma grades using the WHO sets of trachoma slides.[21,22] Those examiners who achieved at least 80% agreement then proceeded to the second stage of field evaluation. During field evaluation a reliability study comprising 50 people of varying age and sex were selected by the ophthalmic nurse to represent all trachoma grades. Each trainee examiner evaluated all 50 subjects independently and recorded their findings on a pre-printed form. Inter-observer agreement was then calculated for each trainee using the senior examiners' observation as the 'gold standard'. Only trainees achieving at least 80% inter-observer agreement after the field evaluation were included as graders.

All people living within each selected household who gave verbal consent were examined using a torch and a 2.5× magnifying binocular loupe. Each eye was examined first for in-turned lashes (TT), and the cornea was then inspected for corneal opacities (CO). The upper conjunctiva

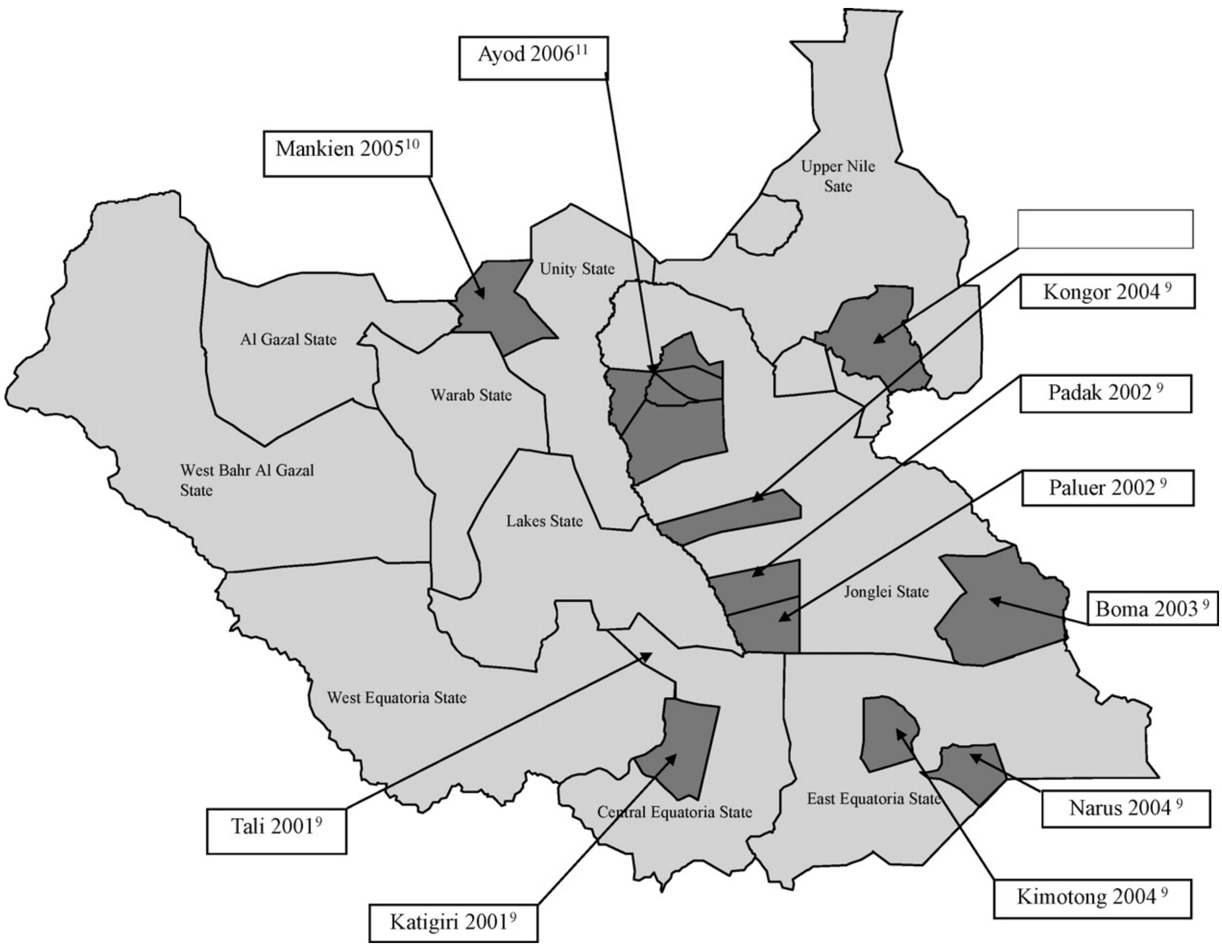

Figure 1 Map of Southern Sudan showing the survey districts and the year when the survey was conducted.

was subsequently examined for inflammation (TF and TI) and scarring (TS). Both eyes were examined. Signs had to be clearly visible in accordance with the simplified grading system in order to be considered present. Alcohol-soaked cotton swabs were used to clean the examiner's fingers between examinations. All examined participants were assigned a dichotomous outcome for each trachoma sign based on the worst affected eye.

2.3. Risk factor measurement

Structured interviews with mothers of children as principal household respondents and direct observations were used to measure personal and environmental (household) risk factors. Interviews were conducted by community health workers experienced in conducting household health interviews. Standard questionnaires were printed and pre-coded in English and interviews conducted in a variety of local languages. Before the survey, the questionnaire was translated and then back translated in the field by two interviewers, who were familiar with both English and the local language (in each district) to ensure accuracy.[23]

During household interviews, respondents were asked about: their main source of drinking water; time to collect water; toilet facilities; and cattle ownership. We defined the source of drinking water as being 'improved' if it was a protected hand-dug well, tube well, borehole or piped water. Other water sources were described as 'unsafe' and were unprotected springs, unprotected hand-dug wells and surface water. Direct observation was used to verify the presence of reported pit latrines and the location in the households where cattle were reported to be kept.

2.4. Statistical analysis

Statistical analysis was conducted using Stata 8.2 (Stata Corp., College Station, TX, USA). Distribution of trachoma prevalence and risk factors were assessed using contingency tables and χ^2 tests. Association between district prevalence of TT in children was compared with district prevalence of TF, district prevalence of TI in children and district prevalence of TT in adults using Spearman's rank correlation. To investigate the association between TT in children and risk factors, hierarchical regression models were developed using generalized linear models (GLM).[24] The multilevel structure of GLM allowed for non-independence of the household variables, enabled clustering of individual observations within households and clusters, and allowed for variability at individual, household, cluster and district levels. Risk factors for TT in children were explored using conventional logistic regression for dichotomous outcomes. Univariate analysis was

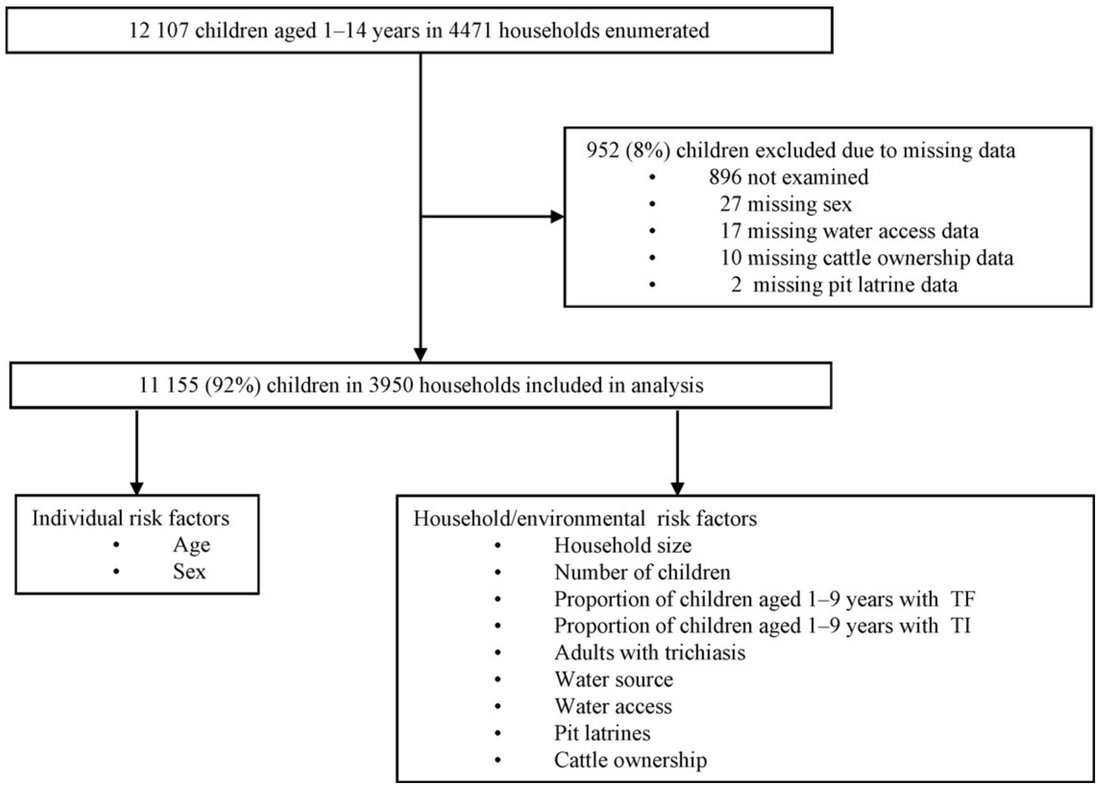

Figure 2 The sample population. TF: trachomatous inflammation-follicular; TI: trachomatous inflammation-intense.

conducted for each potentially explanatory risk factor. Multivariate models were then developed by stepwise regression analysis for model selection. This involved starting with a null model then proceeding in a sequential fashion of adding/deleting explanatory variables if they satisfied the entry/removal criterion, which was set at 5% significance level using a log-likelihood ratio test. For all statistical tests, a *P*-value of <0.05 was considered to be statistically significant.

2.5. Ethical considerations

Informed consent was sought from each individual and parents of children aged 10 years and younger in accordance with the tenets of the declaration of Helsinki. Individuals with signs of active trachoma (TF and/or TI) were offered treatment with 1% tetracycline eye ointment. TT patients were referred to the health centre where free surgery was available or to attend a trichiasis surgery-camp conducted after the survey in each district. Personal identifiers were removed from the dataset before analyses were undertaken.

3. Results

3.1. Characteristics of study participants and prevalence of trichiasis

Figure 2 summarizes the sample population. A total of 11 238 children aged 1—14 years were surveyed of whom 11 155 (99%) in 3950 households were included in the analysis. The mean age was 6.2 years (SD 3.6), and there was no difference in the proportion of boys compared to girls across all the age strata (Table 1).

3.2. Prevalence of trachoma signs

The prevalence of TT increased with age, and girls were more affected by trichiasis than boys for all age strata (Table 2). Table 3 summarizes the district prevalence of TF and TI in children aged 1—9 years, prevalence of TT in children aged 1—14 years and prevalence of TT in adults aged 15 years and above. Figure 3A shows the age-specific

Table 1 Demographic characteristics of study participants

Age group (years)	Males *n* (%)	Females *n* (%)	Total *n* (%)
1—4	2216 (19.9)	2087 (18.7)	4303 (38.6)
5—9	2187 (19.6)	2303 (20.7)	4490 (40.2)
10—14	1182 (10.6)	1180 (10.6)	2362 (21.2)
Total	5585 (50.1)	5570 (49.9)	11 155 (100.0)

Table 2 Age-specific prevalence of trichiasis in 11 155 children aged 1–14 years by gender

Age group (years)	Prevalence			
	Males *n* (%)	Females *n* (%)	Total *n* (%)	95% CI
1–4	2 (0.1)	7 (0.3)	9 (0.2)	0.1–0.4
5–9	34 (1.6)	44 (1.9)	78 (1.7)	1.2–2.3
10–14	32 (2.7)	47 (4.0)	79 (3.3)	2.3–4.9
Total	68 (1.2)	98 (1.8)	166 (1.5)	1.1–2.1

prevalence of TF and TI, whereas Figure 3B shows the age-specific prevalence of TS and TT from our sample (n = 11 155). The overall prevalence of TT in children was 1.5% (95% CI 1.1–2.1). TT in children ranged from 0.1% (95% CI 0.01–0.7) in Padak and Kongor districts to 3.5% (95% CI 2.0–5.0) in Kimotong District (Table 2). Excluding Paluer and Padak districts, where trichiasis surgery interventions had taken place before the surveys, TT in children was markedly correlated with TI in children aged 1–9 (Spearman's $\rho = 0.67$; $P = 0.04$) and TT in adults (Spearman's $\rho = 0.75$; $P = 0.02$); however, correlation of TT in children and TF in children in children aged 1–9 was low (Spearman's $\rho = 0.28$; $P = 0.48$).

3.3. Association between trichiasis in children and risk factors

Tables 4 and 5 summarize associations between TT in children and potential risk factors derived from univariate and multivariate multilevel logistic regression. Univariate analysis showed that increasing age ($P_{trend} < 0.001$), female gender [odds ratio (OR) = 1.5; 95% CI 1.1–2.2], increasing proportion of children in the household with TI ($P_{trend} = 0.03$) and increasing number of adults in the household with trichiasis ($P_{trend} < 0.001$) were associated with increased odds of trichiasis (Table 4). Although cattle ownership was correlated with increased prevalence of TT in kids in the contingency table analysis ($\chi^2 = 13.2$; $P < 0.001$), this association was not statistically significant in our univariate multilevel logistic regression model (OR = 1.6; 95% CI 0.8–3.0). In the multivariate analysis, increasing age, female gender, increasing proportion of children siblings with TI and increasing number of adult relatives with TT were independent predictors of increased odds of trichiasis in children (Table 5).

4. Discussion

Despite the secular decline in global burden of trachoma,[25] blinding trachoma remains a serious public health problem in Southern Sudan. The high prevalence of TT in children underscores the severity of blinding trachoma in this setting and calls for urgent measures to implement the Surgery, Antibiotics, Facial cleanliness and Environmental (SAFE) strategy for trachoma control. Our study found TT in children to be independently associated with increasing age, female gender, TI among children siblings and TT among adult relatives.

This study estimated an overall prevalence of TT in children of 1.5%, which far exceeds that documented in recent surveys of trachoma in children aged under 15 years in Tanzania (0.1%)[8] and Ethiopia (0.3%),[26] both of which

Table 3 Prevalence of trachoma signs by survey districts

District	Prevalence			
	TF in children aged 1–9 years[a] (%)	TI in children aged 1–9 years[a] (%)	TT in children aged 1–14 years (%)	TT in people aged 15 years and above[a] (%)
Paluer[b]	77.2	63.6	0.5	10.0
Padak[b]	65.2	63.6	0.1	10.1
Kongor	33.2	29.2	0.1	5.5
Boma	53.1	39.4	3.0	12.3
Kiechkuon	63.0	51.9	2.2	14.7
Mankien	57.5	39.8	2.3	19.2
Katigiri	45.5	24.5	0.2	1.3
Tali	64.7	35.3	0.3	4.1
Narus	35.4	23.8	0.6	6.3
Kimotong	40.0	41.9	3.5	17.0
Ayod	80.9	60.7	2.4	14.6

TF: trachomatous inflammation-follicular; TI: trachomatous inflammation-intense; TT: trachomatous trichiasis. Note: Excluding Paluer and Padak, TT in children was highly correlated with TI (Spearman's $\rho = 0.67$; $P = 0.04$) and TT in adults (Spearman's $\rho = 0.75$; $P = 0.02$) but not correlated with TF in children (Spearman's $\rho = 0.28$; $P = 0.48$).

[a] Derived from references 9, 10 and 11.

[b] Paluer and Padak had received trichiasis surgery interventions prior to baseline survey.

Table 4 Univariate multilevel logistic regression analysis of association of trichiasis and potential risk factors in 11 155 children[a]

Risk factor		Total children ($n = 11\,155$)	Children with TT ($n = 166$)	Prevalence (%)	Odds ratio	95% CI	*P*-value
Age (years)	1–4	4303	9	0.2	1.0		$P_{trend} < 0.001$
	5–9	4490	78	1.7	8.5	4.1–17.4	
	9–14	2362	79	3.3	17.5	8.4–36.4	
Gender	Male	5585	68	1.2	1.0		
	Female	5570	98	1.8	1.5	1.1–2.2	0.01
Household size	1–5	3517	46	1.3	1.0		$P_{trend} = 0.63$
	6–10	6130	93	1.5	1.0	0.7–1.6	
	>10	1508	27	1.8	1.3	0.7–2.6	
Number of children aged 1–14 years	1–5	9232	132	1.4	1.0		$P_{trend} = 0.69$
	6–10	1854	29	1.6	0.8	0.4–1.3	
	>10	69	5	7.2	2.6	0.5–13.0	
Proportion of children 1–9 years with TF in HH (%)	0 to <10	2703	39	1.4	1.0		$P_{trend} = 0.79$
	≥10 to <50	1472	32	2.2	1.5	0.8–2.7	
	≥50	6980	95	1.4	1.0	0.7–1.7	
Proportion of children 1–9 years with TI in HH (%)	0 to <10	4031	41	1.0	1.0		$P_{trend} = 0.03$
	≥10 to <50	1701	28	1.6	1.2	0.6–2.2	
	≥50	5423	97	1.8	1.6	1.0–2.6	
Adults ≥15 years with TT in HH	0	8558	70	0.8	1.0		$P_{trend} < 0.001$
	1	2102	64	3.0	2.5	1.6–3.9	
	2	383	20	5.2	3.6	1.8–7.2	
	≥3	112	12	10.7	6.7	2.5–17.9	
Type of water source	Improved	6747	97	1.4	1.0		
	Unsafe	4408	69	1.6	1.0	0.6–1.6	0.937
Time to water source (min)	≤30	7114	102	1.4	1.0		
	>30	4041	64	1.6	1.2	0.8–1.9	0.350
Pit latrine	Yes	521	6	1.2	1.0		
	No	10 634	160	1.5	0.7	0.2–2.1	0.535
Cattle ownership	No	3073	25	0.8	1.0		
	Yes	8082	141	1.7	1.3	0.7–2.3	0.440
District	Paluer	1331	7	0.5	1.0		
	Padak	925	1	0.1	0.2	0.01–1.9	0.153
	Kongor	943	1	0.1	0.2	0.02–1.9	0.153
	Boma	1181	36	3.0	2.8	0.8–9.3	0.092
	Kiechkuon	740	16	2.2	5.5	1.4–21.0	0.013
	Mankien	1886	43	2.3	4.2	1.3–13.4	0.015
	Katigiri	800	2	0.3	0.4	0.1–3.0	0.623
	Tali	638	2	0.3	0.5	0.1–3.7	0.515
	Narus	876	5	0.6	0.9	0.2–4.5	0.936
	Kimotong	771	27	3.5	10.2	3.2–32.2	<0.001
	Ayod	1064	26	2.4	4.7	1.4–15.5	0.012

HH: household; TF: trachomatous inflammation-follicular; TI: trachomatous inflammation-intense.
[a] Adjusted for variability at the household, cluster and district levels.

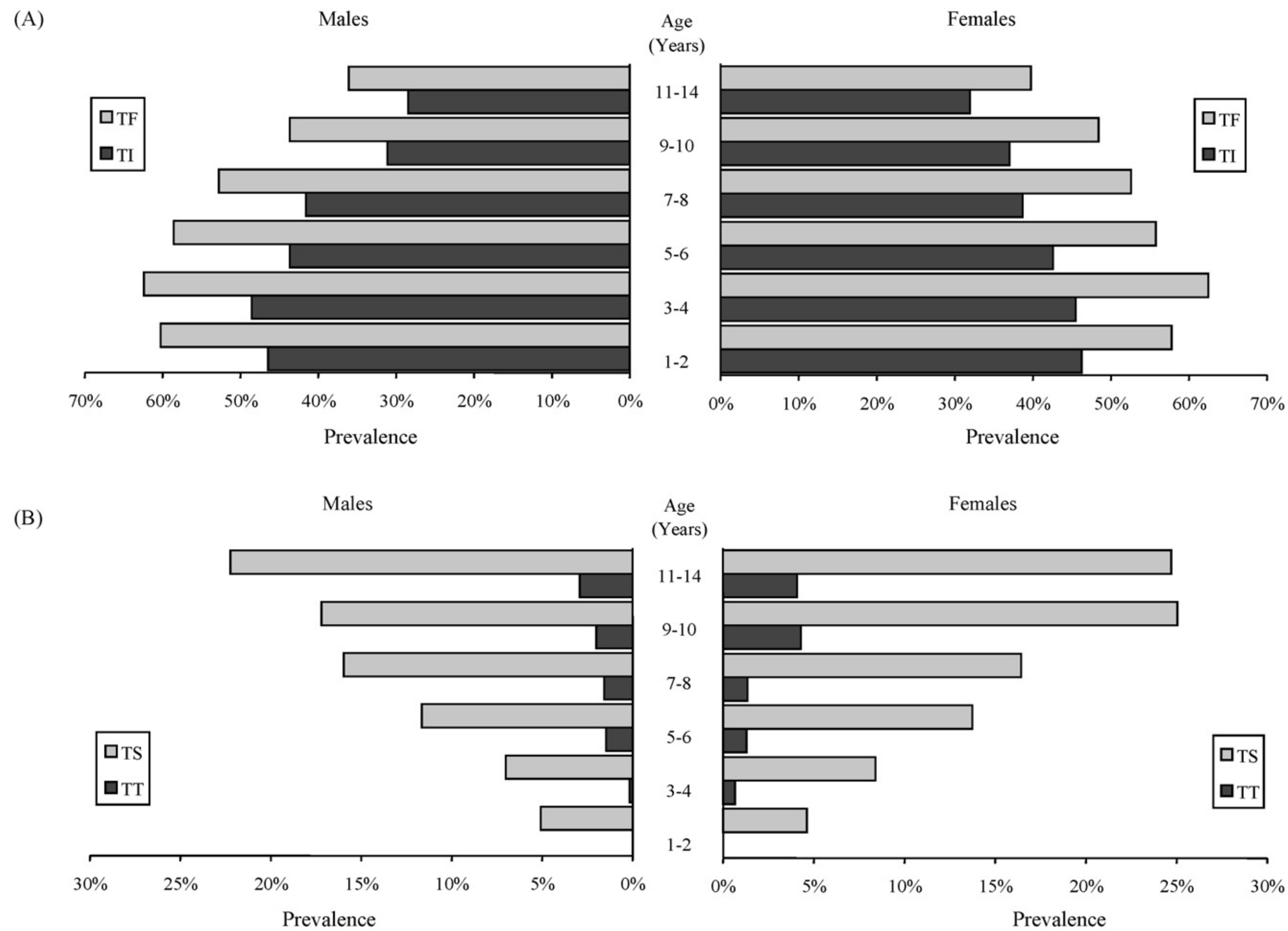

Figure 3 Age-specific prevalence of (A) active trachoma signs (TF and TI) and (B) cicatricial trachoma signs (TS and TT) in 11 155 children aged 1—14 years by gender. TF: trachomatous inflammation-follicular; TI: trachomatous inflammation-intense; TS: trachomatous scarring; TT: trachomatous trichiasis.

are considered trachoma hyperendemic countries. The TT prevalence in Southern Sudanese children is alarming, as it also exceeds the WHO indicator of determining public health importance of TT of at least 1% prevalence of TT in adults aged 15 years and above.[22] The epidemiologic picture of severe blinding trachoma in Southern Sudan is analogous to that reported in southern Morocco in 1954 and in Tunisia in 1969 by Reinhards et al. and Dawson et al., respectively.[27,28] Surprisingly, a survey conducted in Northern Sudan in 1963 and 1964 did not reveal any TT in children aged less than 15 years, although TT was reported in people aged 15 years and above.[29]

At present, there is no historical evidence whether blinding trachoma has always been severe in Southern Sudan or if the current trachoma picture is an emerging problem. In the modern world, Southern Sudan is unique, in that it has been

Table 5 Multivariate multilevel logistic regression analysis of risk factors for trichiasis in 11 155 children[a]

Risk factor		Odds ratio	95% CI	*P*-value
Age (years)	5—9	8.6	4.2—17.8	$P_{trend} < 0.001$
	9—14	18.2	8.7—38.1	
Female gender		1.5	1.1—2.1	0.03
Proportion of children 1—9 years with TI in HH	≥10 to <50%	1.5	0.8—2.9	$P_{trend} = 0.002$
	≥50%	2.0	1.2—3.2	
Adults ≥15 years with TT in HH	1	2.6	1.7—4.2	$P_{trend} < 0.001$
	2	3.7	1.7—7.7	
	≥3	7.6	2.7—21.8	

HH: household; TF: trachomatous inflammation-follicular; TI: trachomatous inflammation-intense.
[a] Adjusted for variability at the household, cluster and district levels.

plagued by nearly five decades of conflict, resulting in rudimentary health, education and physical infrastructure, and deplorable socio-economic status, with over 90% of the population living on less than a dollar per day.[30] These factors probably have to a large extent contributed to a worsening epidemic of blinding trachoma in this setting.

Our risk factor study revealed that household water source, water access, pit latrine use and cattle ownership were not associated with TT in children. However, Tizazu and Mburu suggest that the nomadic nature of communities in Southern Sudan is associated with flies, poor hygiene and poor sanitation, which possibly contribute to trachoma hyperendemicity.[31] Our study revealed risk factors for TT in children similar to those reported for TT in adults in a recent survey in Amhara Region of Ethiopia (increasing age, female gender, increasing proportion of active trachoma in children and TT in children aged <15 years in the household).[15] Consistent with our findings of increased odds of TT in children with adult relatives who had TT, Turner et al. found a 3.6-fold increase in odds of having TT in women who reported a history of TT among their mothers.[13] The association of TT in children with TT in adult relatives and TI in children siblings suggests a genetic component in the risk of TT. However, it is not possible to assert with confidence whether genetic susceptibility or living environment is the most important explanatory system, as related housemates with whom children were affected by TT shared genes, also shared the same living environment. Excess risk of TT in women is usually ascribed to gender roles: in particular caring for, and close proximity to, children, who are considered the reservoir of ocular chlamydial infection.[12] Our data show excess TT among girls for each five-year age group, not just the older girls who would be looking after younger siblings. This is suggestive of a separate biological link to excess TT risk in the female gender, although this cannot be concluded from the data.

We found TI in siblings to be associated with increased odds of TT in children; however, there was no association between TF in children and TT in children. This association of TI in siblings and TT is consistent with the findings of a seven-year longitudinal study of children in Tanzania, where constant TI was observed to be associated with higher incidence of TS, compared with TF. In addition, compared with TF, TI is associated with higher infection rates of ocular *Chlamydia*[32] and more copies of chlamydial DNA,[33,34] and is more sensitive to trachoma control interventions.[35,36] Despite TI being an important trachoma sign, it has been excluded from the current WHO guidelines for determining public health importance of trachoma at baseline and evaluation surveys.[22]

Our study has a number of limitations. Firstly, diagnosis of trichiasis posed a potential weakness in our study design. The integrated eye care workers were competent in using the WHO simplified grading system for trachoma; however, they were not trained to discriminate TT and trichiasis due to other causes. Distichiasis (abnormal growth of an eyelash or several extra eyelashes) and dysplastic eyelashes have been reported in a case series in Oman; however, all the 80 trichiasis cases described were aged 25 years and above.[37] Epiblepharon (a congenital horizontal skin fold near the margin of the eyelid, caused by abnormal insertion of muscle fibres) is a common cause of trichiasis, especially in children of Asian ancestry.[38] Although other causes of trichiasis in children cannot be excluded, our surveys revealed a high prevalence of inflammatory trachoma, with a concomitant high prevalence of conjunctival scarring and trichiasis in children. The pattern of conjunctival inflammation, conjunctival scarring and trichiasis observed in our survey strongly suggests that trachoma is the most probable cause of trichiasis in the children studied. In addition, our risk factor analysis revealed factors for TT in children consistent with those of TT in adults, including increasing prevalence with age, female gender and associations with prevalence of TI in children siblings and TT in adult relatives.

Secondly, the cross-sectional nature of our study has limitations in assessing temporality, as the outcome and exposures were assessed at the same time. Therefore the associations of TT in children with TI in siblings, TT in adult relatives and the excess risk associated with female gender all merit further investigation using longitudinal observations. Finally, trichiasis surgery services had already started in two districts (Paluer and Padak), where during eye-surgery camps children with TT would receive priority for trichiasis surgery conducted by an ophthalmologist. While this was a potential source of bias, the effect of having a smaller than expected number of children with TT in these two districts is likely to have biased the strengths of our associations towards the null.

This study has a number of programmatic implications. The hyperendemic pattern of blinding trachoma in Southern Sudan calls for urgent measures for implementing the full SAFE improvement strategy for trachoma control. Eyelid surgery for adults and children with TT should be a priority: it is crucial to identify and recruit children with trichiasis for surgery and to tailor trichiasis surgery services to cater for the young, who may require general anaesthesia. The A,F,E components of SAFE were designed to reduce the risk of trachomatous inflammation in individuals and communities. Community intervention with A,F,E will probably result in reducing the lifetime risk of conjunctival scarring and blinding complications of trachoma among Southern Sudanese children. Further research is needed to evaluate effectiveness of the existing eyelid surgical techniques and instruments among children with TT, in comparison to adults. In addition, systematic evaluation of the SAFE strategy in averting blinding trachoma in future generations of Southern Sudanese children is suggested.

In conclusion, the pattern of TT in Southern Sudanese children is alarming and is predictive of a massive future burden of blindness due to trachoma, especially in the absence of trachoma control interventions. Although prevalence of TT in children is not a prevalence indicator within the existing WHO guidelines, age-specific prevalence of TT in children may be a valuable extension of the WHO prevalence indicators in prioritizing urgent implementation of the SAFE strategy for trachoma control. The prevalence of TI in children is a valuable indicator for planning and evaluating trachoma control programmes, and therefore its reinstatement in the current WHO set of trachoma indicators is recommended. While the associations of TT in children with TI in siblings and TT in adult relatives merit further investigation, there is urgent need for trachoma prevention interventions and trichiasis surgery services that are tailored to cater for young children in Southern Sudan.

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