The epidemiology of trachoma in Eastern Equatoria and Upper Nile States, southern Sudan

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Objective Limited surveys and anecdotal data indicate that trachoma is endemic in the states of Eastern Equatoria and Upper Nile in southern Sudan. However, its magnitude and geographical distribution are largely unknown. We conducted surveys to ascertain the prevalence and geographical distribution of trachoma, and to identify targets for control interventions.

Methods Population-based cross-sectional surveys were conducted in nine sites in southern Sudan between September 2001 and June 2004. Two-stage random cluster sampling with probability proportional to size was used to select the sample. Trachoma grading was done using the WHO simplified grading system.

Findings A total of 17 016 persons were examined, a response rate of 86.1% of the enumerated population. Prevalence of signs of active trachoma in children aged 1–9 years was: TF = 53.7% (95% confidence interval (CI) = 52.1–55.3); TI = 42.7% (95% CI = 41.2–44.2); TF and/or TI = 64.1% (95% CI = 62.5–65.5). Prevalence of trichiasis (TT) in children aged less than 15 years was 1.2% (95% CI = 0.9–1.4), while TT prevalence in persons aged 15 years and above was 9.2% (95% CI = 8.6–9.9). Women were more likely to have trichiasis compared to men (odds ratio (OR) = 1.57; 95% CI = 1.34–1.84). Tentative extrapolation to the states of Eastern Equatoria and Upper Nile estimates that there is a backlog of 178 250 (lower and upper bounds = 156 027–205 995) persons requiring surgery and the entire population, estimated to be over 3.9 million, is in need of the SAFE strategy to control blinding trachoma.

Conclusions Trachoma is a public health problem in all nine of the study sites surveyed. The unusually high prevalence of active trachoma and TT in children points to the severity of the problem. There is urgent need to implement trachoma control interventions in trachoma endemic regions of southern Sudan.

Keywords Trachoma/epidemiology; Eyelid diseases/epidemiology; Sudan (*source: MeSH, NLM*).

Mots clés Trachome/épidémiologie; Paupière, Maladies/épidémiologie; Soudan (*source: MeSH, INSERM*).

Palabras clave Tracoma/epidemiología; Enfermedades de los párpados/epidemiología; Sudán (*fuente: DeCS, BIREME*).

Arabic

Bulletin of the World Health Organization 2005;83:904-912.

Voir page 910 le résumé en français. En la página 911 figura un resumen en español.

Introduction

Trachoma, caused by ocular infection with *Chlamydia trachomatis*, is the most common infectious cause of blindness. It is a leading cause of preventable blindness, estimated to be responsible for at least 3.6% of all blindness worldwide (1). WHO estimates that active trachoma affects 84 million persons and 7.6 million have trichiasis, the potentially blinding state of the disease, in 55 countries (2). WHO defines trachoma to be a serious public health problem if the prevalence of TF among children aged 1–9 years exceeds 10% (trachomatous inflammation, follicular (TF) and trachomatous inflammation, intense (TI) are signs of "active" trachoma). Trachoma, though largely a forgotten disease of forgotten people, causes immense impact globally through visual disability, dependency and impediment of development (3, 4). In southern Sudan where a 21-year civil war has raged health infrastructure is poor or absent, there is widespread illiteracy, poor sanitation, lack of potable water and extreme poverty, and over 90% of the population earns less than 1 US dollar a day (5).

Trachoma has long been known to be prevalent in parts of Sudan (6); however, the magnitude and geographical distribution of trachoma in southern Sudan has not been well documented. Two studies, conducted in 1975 (7) and 1994 (8), have described the prevalence of trachoma in southern Sudan; however, these older studies are now of limited use for guiding current prevention of blindness programmes. A survey by Tizazu and colleagues highlights trachoma as a cause of vision loss in Eastern Equatoria; however, trachoma prevalence was not quantified in this study (9). More recent, unpublished surveys have shown that trachoma is a public health problem in Oriny and Lankien (both in Upper Nile State) with a 54.0% prevalence of active trachoma in children aged 1–10 years, and a trachoma trichiasis (TT) prevalence of 17.7% in women and 7.2% in

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Ref. No. **05-023309**
(*Submitted: 18 April 2005 – Final revised version received: 30 June 2005 – Accepted: 3 August 2005*)

men aged 15 years and above (10). Additionally, anecdotal data suggest that trachoma is more widespread in Eastern Equatoria and Upper Nile States, southern Sudan, and the actual extent of the problem is unknown. The WHO Alliance for the Global Elimination of Trachoma (GET 2020) has identified Sudan as one of the priority countries to be targeted for implementation of the SAFE strategy for trachoma control: Surgery, Antibiotics, Facial cleanliness and Environmental change (11–13).

The objectives of this study were: (a) to ascertain the prevalence, pattern and geographical distribution of trachoma in Eastern Equatoria and Upper Nile States, southern Sudan; (b) to identify targets for trachoma control interventions; and (c) to establish baselines for future monitoring and evaluation of those interventions.

Methods

This population-based cross-sectional study was conducted in nine sites in southern Sudan between September 2001 and June 2004. Southern Sudan is administratively divided into states, counties and payams. Payams are equivalent to a district. Five study sites were located in the Upper Nile State (Paluer, Padak, Kongor, Boma, Kiech Kuon) while the other four (Katigiri, Tali, Narus, Kimotong) were located in the Eastern Equatoria State (Fig. 1). These sites correspond to catchment areas covered by a single non-governmental organization (NGO) in the provision of primary health care. With the absence of a Ministry of Health infrastructure during the civil war, NGOs have been responsible for provision of health care and humanitarian services under the United Nations Operation Lifeline Sudan (UN-OLS) consortium.

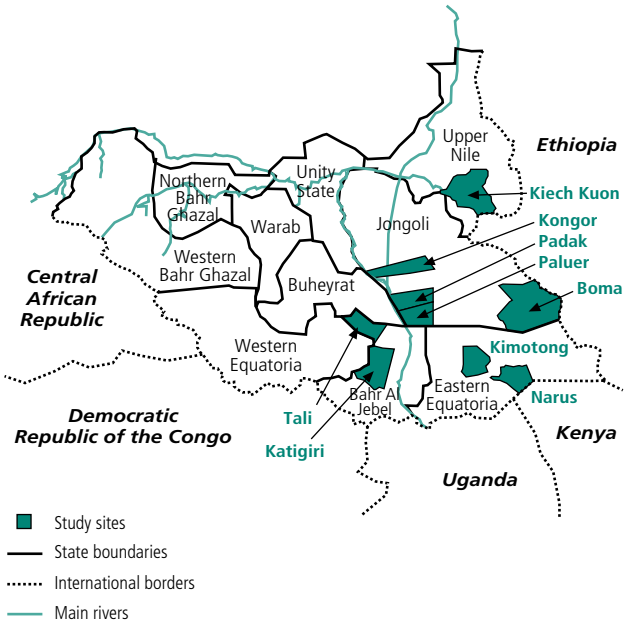
The sample size was calculated to allow for estimation of at least 50% prevalence of active trachoma (grades TF and/or TI) in children aged 1–9 years and at least 2.5% prevalence of TT in persons aged 15 years and above; within a precision of 10% at 95% confidence limit given a design effect of 5 (14, 15). It was estimated that at least 480 children aged 1–9 years were to be examined in each site. Children aged 1–9 years were assumed to comprise approximately 25% of the population; therefore at least 1920 persons of all ages and sexes were needed to allow for the required precision of the point prevalence estimates in each site.

Study sites were selected on the basis of pragmatic programme implementation criteria of: (a) anecdotal reports of blinding trachoma; (b) security and accessibility; and (c) feasibility of initiating trachoma control interventions after the survey. 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 subdistricts. 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 subdistrict. In the second stage, households were selected from the villages selected in the previous stage. The first household was selected by going to the middle of the village and spinning a pen after which the household nearest to the ball-tip of the pen was selected. Subsequent households were selected by a random walk around the village (16). 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.

Trainee examiners comprising nurses and community health workers were trained by an experienced ophthalmologist using the WHO simplified grading system (17). Minimum accepted interobserver agreement was set at 80% and reliability assessed in two stages. In the first stage, trainee examiners identified trachoma grades using the WHO set of trachoma slides (14). Those examiners who achieved at least 80% agreement proceeded to the second stage — field evaluation. During field evaluation a reliability study was conducted using 50 volunteers of various ages and sexes, selected by the ophthalmologist to display all the signs of trachoma, and others with no clinical signs of trachoma. All trachoma signs (TF, TI, TT, trachomatous scarring (TS), and corneal opacity (CO)) were represented in this set of persons. Each trainee examiner evaluated each subject and recorded his/her findings. Agreement was against the 'gold standard' provided by the ophthalmologists, and those achieving at least 80% agreement were included as graders. All persons living within each selected household who gave verbal consent were examined using a torch and a x2.5 magnifying binocular loupe. Alcohol-soaked cotton swabs were used to clean the examiner's fingers between examinations. Individuals with signs of active trachoma (TF and/or TI) were offered treatment with 1% tetracycline eye ointment. TT patients were referred to health centres where free surgery was available.

Data were double entered and validated using EPI Info version 6.04. Descriptive statistics were generated using Stata™ 8.0. Confidence intervals for the point prevalence estimates were generated using the Huber/White sandwich estimator of variance to adjust for the clustering effects of trachoma at the household level (18). To estimate the trachoma burden at the state level, data were extrapolated assuming a homogenous distribution of the household and environmental risk factors that favour trachoma transmission, and sociocultural similarities of the resident ethnic groups. The population structure was also

Fig. 1. **Map of southern Sudan showing the study sites**



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

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assumed to be uniform across the regions. Age- and sex-adjusted prevalence was generated and applied to the population estimates for 2003 to estimate the burden of TT and number of persons with active trachoma (19). The 95% confidence intervals of the adjusted prevalence estimates were multiplied by the population estimates to derive the lower and upper bounds.

The Institutional Review Board of Emory University approved the protocol (IRB ID 327-2001) and clearance to conduct the surveys was obtained from the local authorities. Verbal consent to participate was sought from the head of the household and from each individual and the parents of small children in accordance with the declaration of Helsinki. Personal identifiers were removed from the data set for analyses.

Results

A total of 17 016 persons was examined out of the 19 773 enumerated, a response rate of 86.1%. Five individuals were excluded from analysis due to unspecified age or sex. Most of the 2757 persons not examined were men aged 15–50 years, who were absent during the household visit. Of the 17 011 subjects included in the analysis, 7141 (42.0%) were males and 9870 (58.0%) females. The age range was 1 week to 86 years, with a mean age of 19.2 years (standard deviation (SD) = 16.6) and median age of 13 years (interquartile range = 5–30). The mean household size was 5.6 (SD = 2.5) persons with a range from 4.2 in Narus to 7.2 in Paluer (Table 1).

The prevalence of active trachoma and TT found in the study sites is shown in Table 2 while Figs 2 and 3 show the age-sex specific prevalence of trachoma signs. The overall prevalence of TF in children aged 1–9 years was 53.7% (95% CI = 52.1–55.3), ranging from 33.2% in Kongor to 77.2% in Paluer. Prevalence of TI in the same age group was 42.7% (95% CI = 41.2–44.2), ranging from 23.8% in Narus to 63.6% in Paluer and Padak. Active trachoma (TF and/or TI) prevalence in children aged 1–9 years was 64.1% (95% CI = 62.5–65.5). There was no difference in prevalence of active trachoma between boys and girls aged less than 10 years (OR = 0.98; 95% CI = 0.88–1.09). A high prevalence of active trachoma (40.1%; 95% CI = 38.8–41.4) was also observed in the population aged 10 years and above. For those persons aged 10 years and above, female sex was associated with a greater prevalence of active trachoma than male (OR =1.25; 95% CI = 1.15–1.36).

TS was found in 10.0% (95% CI = 9.1–10.9) of persons aged 1–9 years, 23.0% (95% CI = 20.8–25.3) of the 10–14 age group, and 43.0% (95% CI = 41.6–44.4) of persons aged 15 years and above. TS prevalence increased gradually with age (Fig. 3). Females had greater odds of TS compared to males across all the age groups (OR =1.42; 95% CI = 1.32–1.55). The overall prevalence of TT was 5.0% (95% CI = 4.7–5.4). Females were more likely to have TT compared to males (OR =1.57;

Table 1. **Characteristics of the sample population**

Study sites	Upper Nile State					Eastern Equatoria State				Overall
	Paluer[a]	Padak[b]	Kongor	Boma	Kiech Kuon[c]	Katigiri	Tali	Narus	Kimotong	
Villages (clusters)	14	10	11	12	8	10	10	11	7	93
Households surveyed	510	348	424	389	312	350	344	486	391	3554
Mean household size	7.2	6.5	5.8	6.6	5.6	5.0	4.4	4.2	4.4	5.6
Population enumerated	3650	2277	2475	2576	1738	1743	1530	2049	1735	19 773
Population examined	3000	1822	1927	2391	1530	1645	1434	1681	1586	17 016
Response rates (%)	82.2	80.0	77.9	92.8	88.0	94.4	93.7	82.0	91.4	86.1
Age structure										
Mean	20.8	18.4	20.3	17.9	19.4	18.1	20.5	17.1	19.2	19.2
Median	16	12	13	12	13	13	16	9	14	13
Less than 1 year, *n* (%)	112 (3.7)	49 (2.7)	55 (2.9)	91 (3.8)	50 (3.3)	63 (3.8)	56 (3.9)	69 (4.1)	37 (2.3)	582 (3.4)
1–9 years, *n* (%)	1022 (34.1)	739 (40.6)	789 (40.9)	905 (37.9)	592 (38.7)	552 (33.6)	482 (33.6)	772 (45.9)	580 (36.6)	6433 (37.8)
10–14 years, *n* (%)	309 (10.3)	186 (10.2)	154 (8.0)	276 (11.5)	148 (9.7)	250 (15.2)	156 (10.9)	104 (6.2)	191 (12.0)	1774 (10.4)
15 years and above	1556 (51.9)	848 (46.5)	929 (48.2)	1119 (46.8)	740 (48.4)	777 (47.3)	739 (51.6)	736 (43.8)	778 (49.1)	8222 (48.3)
Sex										
Females: *n* (%)	1802 (60.1)	970 (53.2)	1055 (54.7)	1303 (54.5)	950 (62.1)	927 (56.5)	822 (57.4)	1091 (64.9)	950 (59.9)	9870 (58.0)
Males: *n* (%)	1197 (39.9)	852 (46.8)	872 (45.3)	1088 (45.5)	580 (37.9)	715 (43.5)	611 (42.6)	590 (35.1)	636 (40.1)	7141 (42.0)
Main ethnic group	Dinka	Dinka	Dinka	Murle	Nuer	Pojulu and Nyangware	Modari	Toposa	Boya	

[a] Paluer comprises of three payams: Anyidi, Kolnyang and Makuac.
[b] Padak comprises of two payams: Baidit and Jalle.
[c] Kiech Kuon comprises of two payams: Luakpiny and Ulang.

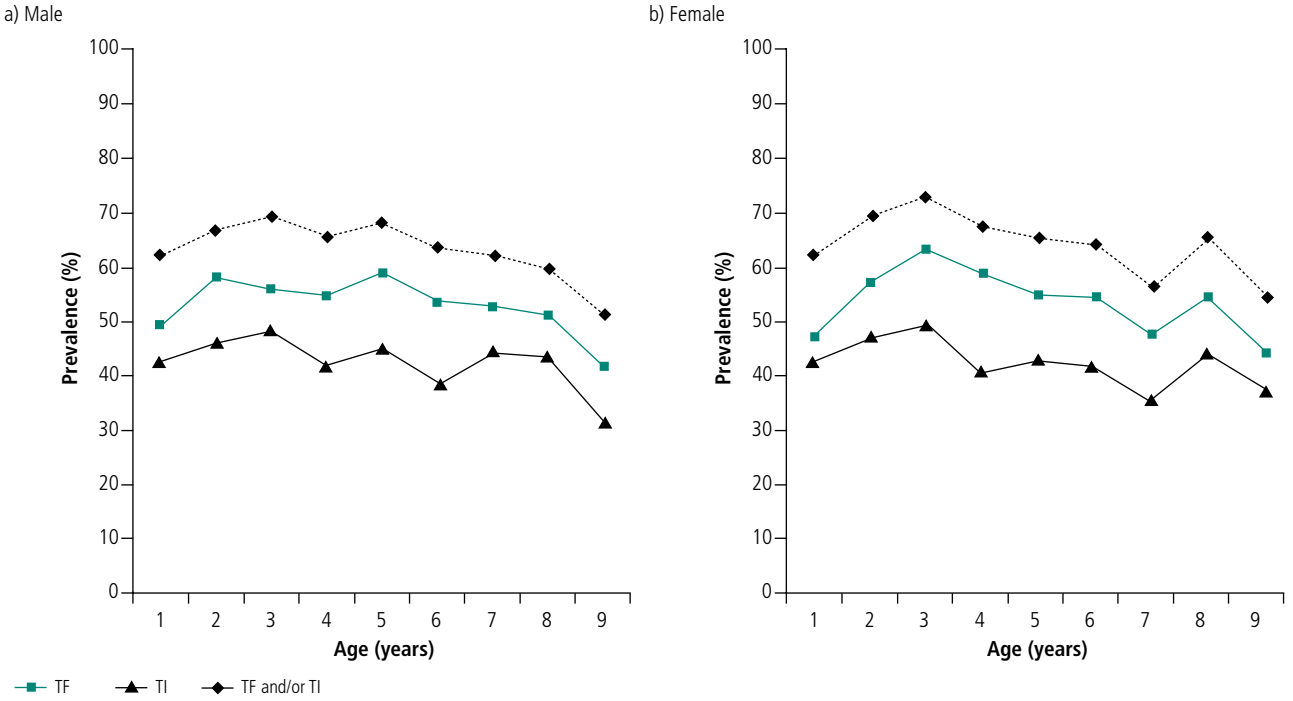
Table 2. **Key trachoma prevalence indicators by study site**

Prevalence indicators			Upper Nile State					Eastern Equatoria State				Overall
			Paluer	Padak	Kongor	Boma	Kiech Kuon	Katigiri	Tali	Narus	Kimotong	
Trachomatous inflammation – follicular (TF) in children aged 1–9 years	Female	*n* (%)	393 (78.4)	252 (66.0)	127 (33.9)	238 (55.5)	191 (62.4)	133 (47.3)	145 (61.2)	158 (35.3)	117 (39.4)	1754 (53.9)
	Male	*n* (%)	396 (76.0)	230 (64.4)	135 (32.6)	243 (51.1)	182 (63.6)	118 (43.5)	167 (68.2)	115 (35.4)	115 (40.6)	1701 (53.5)
	Overall	*n* (%)	789 (77.2)	482 (65.2)	262 (33.2)	481 (53.1)	373 (63.0)	251 (45.5)	312 (64.7)	273 (35.4)	232 (40.0)	3455 (53.7)
		95%CI (%)	(74.0–80.1)	(61.1–69.1)	(29.3–37.4)	(48.9–57.4)	(58.3–67.5)	(40.0–51.1)	(59.9–69.3)	(31.6–39.3)	(34.6–45.7)	(52.1–55.3)
Trachomatous inflammation – intense (TI) in children aged 1–9 years	Female	*n* (%)	316 (63.1)	233 (61.0)	110 (29.3)	187 (43.6)	145 (47.4)	65 (23.1)	85 (35.9)	116 (26.0)	126 (42.4)	1383 (42.5)
	Male	*n* (%)	334 (64.1)	237 (66.4)	120 (29.0)	170 (35.7)	162 (56.6)	70 (25.8)	85 (34.7)	68 (20.9)	117 (41.3)	1363 (42.9)
	Overall	*n* (%)	650 (63.6)	470 (63.6)	230 (29.2)	357 (39.4)	307 (51.9)	135 (24.5)	170 (35.3)	184 (23.8)	243 (41.9)	2746 (42.7)
		95%CI (%)	(59.9–67.2)	(59.8–67.2)	(25.5–33.1)	(35.4–43.6)	(47.3–56.4)	(19.8–29.7)	(30.1–40.8)	(20.6–27.5)	(37.0–46.9)	(41.2–44.2)
Active trachoma (TF and/or TI) in children aged 1–9 years	Female	*n* (%)	442 (88.2)	290 (75.9)	164 (43.7)	277 (64.6)	241 (78.8)	143 (50.9)	166 (70.0)	185 (41.4)	184 (62.0)	2092 (64.3)
	Male	*n* (%)	455 (87.3)	275 (77.0)	178 (43.0)	269 (56.5)	234 (81.8)	133 (49.1)	184 (75.1)	135 (41.5)	166 (58.7)	2029 (63.8)
	Overall	*n* (%)	897 (87.8)	565 (76.5)	342 (43.3)	546 (60.3)	475 (80.2)	276 (50.0)	350 (72.6)	320 (41.5)	350 (60.3)	4121 (64.1)
		95%CI (%)	(85.4–89.8)	(72.8–79.7)	(39.2–47.6)	(56.0–64.6)	(76.2–83.7)	(44.5–55.5)	(67.9–76.9)	(37.3–45.7)	(55.2–65.3)	(62.5–65.5)
Trachomatous trichiasis (TT) in children aged less than 15 years	Female	*n* (%)	2 (0.3)	1 (0.2)	0 (0.0)	23 (4.1)	9 (2.3)	1 (0.2)	1 (0.3)	4 (0.8)	19 (4.8)	60 (1.4)
	Male	*n* (%)	5 (0.8)	0 (0.0)	1 (0.2)	13 (2.1)	7 (2.0)	1 (0.3)	1 (0.3)	1 (0.3)	8 (2.1)	37 (0.9)
	Overall	*n* (%)	7 (0.5)	1 (0.1)	1 (0.1)	36 (3.0)	16 (2.2)	2 (0.2)	2 (0.3)	5 (0.6)	27 (3.5)	97 (1.2)
		95%CI (%)	(0.2–1.1)	(0.01–0.7)	(0.01–0.7)	(2.0–4.3)	(1.3–3.5)	(0.06–1.0)	0.08–1.2)	(0.2–1.3)	(2.0–5.0)	(0.9–1.4)
Trachomatous trichiasis (TT) in persons aged 15 years and above	Female	*n* (%)	121 (11.2)	49 (10.2)	33 (5.7)	93 (13.4)	94 (17.7)	8 (1.7)	20 (4.2)	29 (5.3)	90 (16.8)	537 (9.9)
	Male	*n* (%)	34 (7.1)	37 (10.1)	18 (5.2)	45 (10.5)	15 (7.2)	2 (0.7)	10 (3.7)	17 (9.1)	42 (17.4)	220 (7.8)
	Overall	*n* (%)	155 (10.0)	86 (10.1)	51 (5.5)	138 (12.3)	109 (14.7)	10 (1.3)	30 (4.1)	46 (6.3)	132 (17.0)	757 (9.2)
		95%CI (%)	(8.5–11.7)	(8.3–12.3)	(4.2–7.2)	(10.1–15.0)	(12.2–17.6)	(0.7–2.4)	(2.9–5.7)	(4.7–8.2)	(14.6–19.6)	(8.6–9.9)

95% CI = 1.34–1.84). A high prevalence of TT of 1.2% (95% CI = 0.9–1.4) was found in children aged less than 15 years, with TT being recorded in children as young as 4 years. As age increased, the prevalence of TT was found to increase (Fig. 2). Overall TT prevalence in persons aged 15 years and above was 9.2% (95% CI = 8.6–9.9). The highest TT prevalence (17.0%; 95% CI = 14.6–19.6) was found in Kimotong, and the lowest (1.3%; 95% CI = 0.7–2.4) in Katigiri. Trachoma-related CO was found in 2.2% (95% CI = 1.9–2.4) of the sample population. Prevalence of trachoma-related bilateral CO was 1.4% (95% CI = 1.2–1.6). Consistent with findings for TT, CO prevalence increased with age. Females had higher odds of CO compared to males (OR =1.77; 95% CI = 1.39–2.26).

Estimates of trachoma burden and projected targets for trachoma control interventions are summarized in Table 3. The number of persons with TT in the study population is estimated

Fig. 2. **Age-sex specific prevalence of active trachoma signs in children aged 1–9 years, by gender**[a]



[a]TF, trachomatous inflammation – follicular; TI, trachomatous inflammation – intense.

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at 23 507 (lower and upper bound = 18 808–29 969), while the number of persons with signs of active trachoma is estimated at 239 168 (lower and upper bounds = 221 324–257 075). Extrapolation of the burden estimates to the state level suggests that 178 250 (lower and upper bounds = 156 027–205 995) have TT. It is further estimated that 1 950 887 (lower and upper bounds = 1 876 197–2 025 801) persons have active trachoma in East Equatoria and Upper Nile States. For planning purposes, the number of persons requiring corrective TT surgery is estimated at 30 000 in the population sampled, with a regional estimate of 206 000: these correspond to the upper bound estimates of TT burden. The high prevalence of active trachoma suggests that the entire population of over 3.9 million persons in East Equatoria and Upper Nile States qualify for mass Antibiotic treatment, and Facial hygiene and Environmental sanitation promotion, according to WHO standards.

Discussion

This is the first large-scale population-based trachoma prevalence survey done in areas of Sudan not under government control. With the advent of peace, access to these populations and resources for south Sudan will increase and these data will be important in establishing health priorities. This study found trachoma to be a serious public health problem in all the areas surveyed. The overall prevalence of TF in children aged 1–9 years was 53.7% (95% CI = 52.1–55.3) while TI prevalence was 42.7% (95% CI = 41.2–44.2). TT prevalence in persons aged 15 years and above was 9.2% (95% CI = 8.6–9.9). An exceptionally high prevalence of TT (1.2%; 95% CI = 0.9–1.4) was found in children aged less than 15 years. The overall prevalence of trachoma-related bilateral CO was alarming at 1.4% (95% CI = 1.2–1.6), which represents the proportion of sample population who were visually impaired due to trachoma. It is estimated that TT surgery is indicated for 30 000 persons in the study areas while the entire study population of 480 636 is in need of mass treatment with antibiotics. Regional extrapolation of the survey data further estimates that surgery is indicated for up to 206 000 persons, while 3.9 million persons qualify for the SAFE strategy in Eastern Equatoria and Upper Nile States.

The response rate of 86.1% achieved was adequate to meet the study objectives, and satisfactory given the logistical and practical constraints of conducting a survey in a conflict environment. Despite adequate overall sample coverage, Kiech Kuon, Katigiri, Tali, Narus and Kimotong had lower numbers sampled than was desired due to poor access on account of the security situation. Most of the persons not examined were men aged 15–50 years, who were absent from the households either looking after cattle or in the military. This is a potential source of bias since this subgroup is less likely to have TT thus causing overestimation of TT prevalence in persons aged 15 years and above. Several villages were excluded from the sampling frame due to insecurity and inaccessibility; however, we do not expect this to introduce bias given the homogenous nature of the study areas and the fluid nature of insecurity that affects all villages from time to time. The prevalence of trachoma in the remaining states of Western Equatoria and Bahr al Jebel would need to be measured to obtain comprehensive and unbiased estimation of overall trachoma prevalence in southern Sudan. Nonetheless, the populations surveyed so far provide useful data on the epidemiology of trachoma in much of southern Sudan. Given the similarities of the environment and the sociocultural aspects, it is reasonable to assume that there is a serious trachoma problem in southern Sudan.

Two key prevalence indicators have been suggested by the WHO for determining the public health importance of blinding trachoma: TF prevalence of 10% or more in children aged 1–9 years, and TT prevalence of 1% or more in persons

Table 3. **Estimated burden of trachoma by study site and State**

Geographical location	Estimated population[a]	Estimated trachoma burden: Persons with trichiasis: Point estimate	Lower bound	Upper bound	Persons with active trachoma: Point estimate	Lower bound	Upper bound	Trachoma control programme targets: Trichiasis surgery[b]	A, F and E components of SAFE strategy[c]
Study population estimates									
Paluer	74 850	3870	3244	4673	49 592	47 545	51 553	4673	74 850
Padak	48 500	2507	2049	3112	26 865	25 053	28 652	3112	48 500
Kongor	36 600	1027	778	1392	8906	7893	10 015	1392	36 600
Boma	50 000	3488	2770	4425	26 314	24 374	28 235	4425	50 000
Kiech Kuon	63 028	5002	4060	6221	36 146	33 847	38 369	6221	63 028
Katigiri	60 000	428	221	872	21 578	18 994	24 302	872	60 000
Tali	55 000	1169	804	1763	28 681	26 383	30 965	1763	55 000
Narus	45 553	1496	1110	2045	16 316	14 667	18 040	2045	45 553
Kimotong	47 105	4521	3772	5466	24 770	22 567	26 944	5466	47 105
Total	480 636	23 507	18 808	29 969	239 168	221 324	257 075	29 969	480 636
State extrapolations									
Eastern Equatoria	1 385 479	39 226	31 363	49 525	602 250	571 687	633 146	49 525	1 385 479
Upper Nile	2 607 471	139 024	124 664	156 471	1 348 637	1 304 510	1 392 655	156 471	2 607 471
Total	3 992 950	178 250	156 027	205 995	1 950 887	1 876 197	2 025 801	205 995	3 992 950

[a] Estimated population for 2003 derived from (19).
[b] Upper bound estimate for trichiasis burden.
[c] Mass treatment with Antibiotics, promotion of Facial cleanliness and Environmental sanitation. These interventions target the entire population at risk for trachoma where the threshold of 10% active trachoma in children aged 1–9 years is exceeded.

aged 15 years and above (20). Prevalence of active trachoma and TT revealed in this study exceed the WHO prevalence indictors with TF prevalence ranging from over threefold (in Kongor) to eightfold (in Paluer). The overall TT prevalence was an order of magnitude greater than the WHO indicator, ranging from 1.3% in Katigiri to 17.0% in Kimotong. The sustained high prevalence of active trachoma in the population aged 10 years and above is indicative of an area hyperendemic for trachoma. The pattern of signs of trachoma has similarities with that in Ethiopia (21, 22), and is more severe than that of the central United Republic of Tanzania where the prevalence of active trachoma has been observed to decline drastically after the age of 10 years (23).

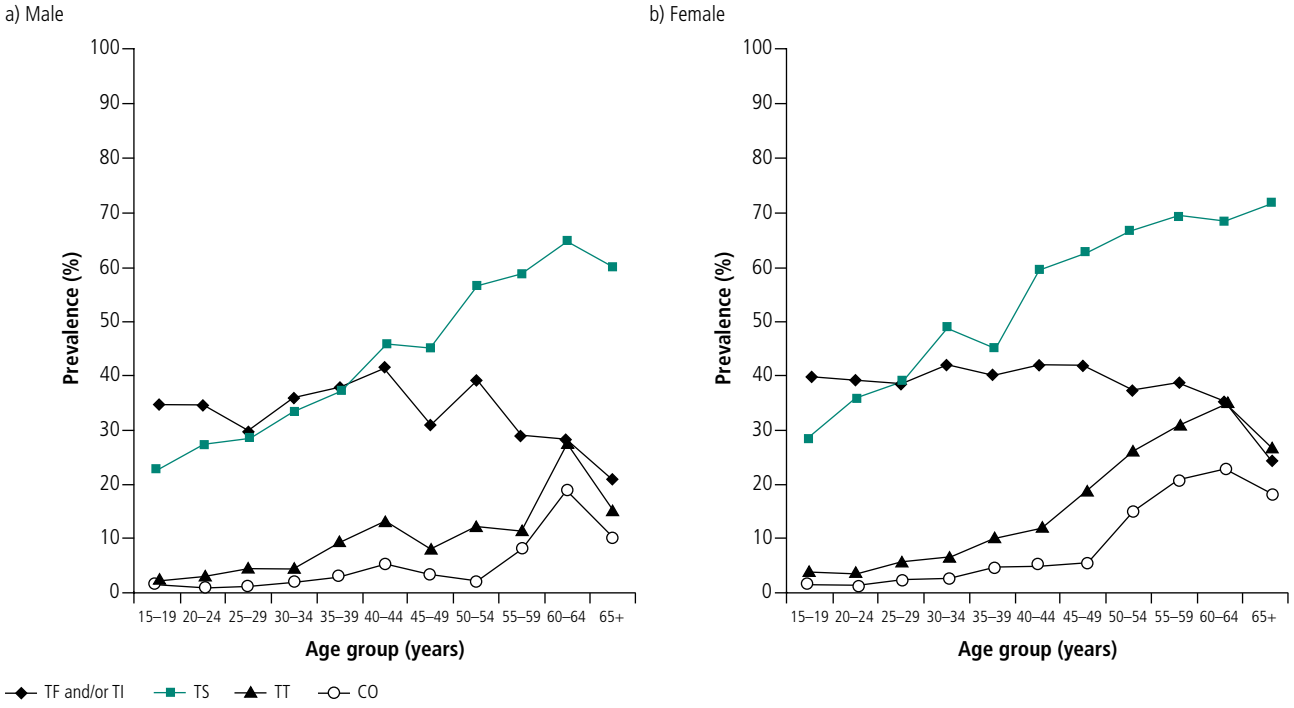
Trachoma starts in early life in this population; among 582 infants examined, 46.2% had signs of active trachoma. This early onset, coupled with high prevalence of active trachoma in children, is consistent with the observed early onset of scarring which was seen in 10.0% of children aged 1–9 years and 23.0% of children aged 10–14 years. After the age of 15 years almost half of the persons examined (43.0%) had evidence of TS. The high prevalence of TS in younger age groups implies that there is very intense transmission and reinfection, and predicts a high prevalence of TT among children and young adults with the risk of blindness early in life. This concern is supported by the observed prevalence of TT of 1.2% in children aged less than 15 years. The prevalence of trachoma-related bilateral CO of 1.4% represents the proportion of the study population that is visually impaired due to trachoma. Trachomatous blindness was found to occur early in life with 5% of women aged 30 years and above experiencing bilateral CO. This implies that one out of every 20 women is visually impaired by trachoma by the age of 30 years.

During the study we observed poor facial hygiene in children, lack of latrines, flies on faces of children, and cohabitation with cattle — all of which have been suggested to be risk factors for trachoma transmission. Similar observations have been documented in Oriny and Lankien (Upper Nile State) where 69.4% of children aged 1–10 years were found to have dirty faces, 43.0% of households cohabited with cattle and there were no latrines in all 193 households sampled (10). The nomadic nature of these communities has been suggested to be associated with flies, poor hygiene and poor sanitation (9). It is further estimated that 27% of the population in southern Sudan has got access to improved water sources and 16% of the population has got access to sanitation facilities (5). These observations indicate the need for Facial cleanliness and Environmental change interventions in these communities. Sustainable interventions based on the "F" and "E" components of the SAFE strategy will be the back-bone of long-term trachoma control efforts. Further research is suggested to explore the risk factors that predispose these communities to such overwhelming levels of trachoma.

Conclusion

The study areas have trachoma of severe public health magnitude with fivefold and ninefold prevalence of active trachoma and TT respectively, compared to WHO parameters. An unusually high prevalence of active trachoma was seen in adults and a high prevalence of TT (1.2%) observed in children aged less than 15 years. Data extrapolation estimates that up to 206 000 persons are in immediate need of TT surgery and 3.9 million persons require mass treatment with antibiotics and hygiene

Fig. 3. **Age-sex specific prevalence of trachoma signs in persons aged 15 years and above, by gender**[a]



[a]TF, trachomatous inflammation – follicular; TI, trachomatous inflammation – intense.

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and environmental interventions in the Eastern Equatoria and Upper Nile States alone. There is an urgent need to target the SAFE strategy for trachoma control in all trachoma endemic areas of southern Sudan. The recently concluded peace process provides an additional opportunity for implementing regional-wide trachoma-control activities in southern Sudan. ■

Acknowledgements

We thank the following collaborating NGOs who were instrumental in facilitating the surveys: Sudan Relief and Rehabilitation Commission (SRRC) in all study sites; Adventist Development and Relief Association (ADRA) in Kiech Kuon and Kimotong; Association of Christian Relief Organizations Serving Sudan (ACROSS) in Paluer, MEDAIR in Padak; Sudan Medical Care (SMC) in Paluer, Kongor, Boma and Narus; and ZOA Refugee Care in Katigiri and Tali. We are also grateful to Carol Brayne and Stephen Kaptoge (Department of Public Health and Primary Care, University of Cambridge, England), and Anthony Solomon (London School of Hygiene and Tropical Medicine, London) for their invaluable assistance with editing the manuscript.

Funding: Funding for this study was provided by The Carter Center.

Competing interests: none declared.

Résumé

Epidémiologie du trachome dans les États de l'Equatoria oriental et du Nil supérieur au Soudan méridional

Objectif Des enquêtes limitées et des données anecdotiques indiquent que le trachome est endémique dans les États de l'Equatoria oriental et du Nil supérieur au Soudan méridional. Toutefois, l'ampleur du phénomène et sa distribution géographique sont largement méconnues. Des enquêtes ont été menées pour déterminer la prévalence et la distribution géographique du trachome et identifier les cibles des interventions à mettre en œuvre contre cette maladie.

Méthodes Des enquêtes transversales en population ont été réalisées en neuf sites du Soudan méridional, entre septembre 2001 et juin 2004. La sélection des échantillons s'est effectuée par sondage en grappes à deux degrés, avec une probabilité proportionnelle à la taille de la population. Le codage de la maladie a été réalisé selon le système OMS simplifié de codage du trachome.

Résultats Au total 17 016 personnes ont été examinées, ce qui correspondait à un taux de réponses de 86,1 % pour l'ensemble de la population recensée. La prévalence des signes du trachome évolutif chez les enfants de 1 à 9 ans s'établissait de la manière suivante : trachome inflammatoire folliculaire (TF) = 53,7 % (intervalle de confiance à 95 % (IC) = 52,1-55,3) ; trachome inflammatoire intense (TI) = 42,7 % (IC à 95 % = 41,2-44,2) ; TF et/ou TI = 64,1 % (IC à 95 % = 62,5-65,5). Chez l'enfant de moins de 15 ans, la prévalence du trichiasis (TT) était de 1,2 % (IC à 95 % = 0,9-1,4), alors que chez les personnes de 15 ans et plus, elle atteignait 9,2 % (IC à 95 % = 8,6-9,9). Les femmes étaient plus sujettes au trichiasis que les hommes [odds ratio (OR) = 1,57 ; IC à 95 % = 1,34-1,84]. Les tentatives pour extrapoler ces chiffres aux États de l'Equatoria oriental et du Nil supérieur

conduisent à une estimation de 178 250 (limites inférieure et supérieure = 156 027 et 205 995) pour le nombre de personnes en attente de soins chirurgicaux. D'autre part, l'ensemble de la population, évaluée à plus de 3,9 millions d'habitants, a besoin de la stratégie CHANCE, destinée à indiquer le trachome cécitant.
Conclusion Le trachome pose un problème de santé publique pour l'ensemble des neuf sites ayant servi de cadre à l'enquête. La prévalence inhabituellement élevée du trachome évolutif et du TT chez l'enfant dénote bien la gravité du problème. Il est urgent de metre en œuvre des interventions de lutte contre le trachome dans les régions du Soudan méridional où cette maladie est endémique.

Resumen

Epidemiología del tracoma en las regiones de Equatoria oriental y Alto Nilo del sur del Sudán

Objetivo Según algunos estudios limitados y diversos datos no comprobados, el tracoma es endémico en las regiones de Equatoria oriental y Alto Nilo del sur del Sudán. Sin embargo, se desconocen en gran medida la magnitud del problema y la distribución geográfica de la enfermedad. Realizamos estudios para determinar la prevalencia y la distribución geográfica del tracoma, así como para identificar objetivos para las intervenciones de control.
Métodos Entre septiembre de 2001 y junio de 2004 se llevaron a cabo estudios transversales basados en la población en nueve sitios del sur del Sudán. Se utilizó un método de muestreo aleatorio por conglomerados en dos etapas con probabilidad proporcional al tamaño. La tipificación del tracoma se realizó conforme al sistema de clasificación simplificado de la OMS.
Resultados Se exploró a un total de 17 016 personas, con una tasa de respuesta del 86,1% de la población considerada. La prevalencia de signos de tracoma activo en los niños de 1 a 9 años era la siguiente: TF (inflamación folicular) = 53,7% (intervalo de confianza (IC) del 95% = 52,1 - 55,3); TI (inflamación intensa) = 42,7% (IC95% = 41,2 - 44,2); TF y/o TI = 64,1% (IC95% = 62,5 - 65,5). La prevalencia de triquiasis (TT) entre los niños de menos de 15 años era del 1,2% (IC95% = 0,9 - 1,4), mientras que la prevalencia de TT en las personas de 15 años y más era del 9,2% (IC95% = 8,6 - 9,9). Las mujeres tenían más probabilidades que los hombres de sufrir triquiasis (razón de posibilidades (OR) = 1,57; IC95% = 1,34 - 1,84). La extrapolación provisional a las regiones de Equatoria oriental y Alto Nilo arroja un cúmulo estimado de 178 250 personas (límites inferior y superior = 156 027 - 205 995) necesitadas de intervención quirúrgica; si se desea controlar el tracoma causante de ceguera, la estrategia SAFE debería abarcar a toda la población, estimada en más de 3,9 millones de personas.
Conclusión El tracoma constituye un problema de salud pública en los nueve sitios estudiados. La prevalencia excepcionalmente alta de tracoma activo y TT en la población infantil demuestra la gravedad del problema. Hay que aplicar urgentemente intervenciones de control del tracoma en las regiones del sur del Sudán donde la enfermedad es endémica.

Arabic

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