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Prevalence of Trachoma in Bauchi State, Nigeria: Results of 20 Local Government Area-Level Surveys

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ABSTRACT

Purpose: To determine the prevalence of trachomatous inflammation – follicular (TF) and trichiasis in each of the 20 local government areas (LGAs) of Bauchi State, Nigeria.

Methods: We undertook a population-based prevalence survey in each LGA in Bauchi State, employing the Global Trachoma Mapping Project methodology. We used a 2-stage, systematic and quasi-random sampling strategy. Using probability proportional to size, we selected 25 clusters, in each of which 25 households were selected by random walk. All residents of selected households 1 year and older were examined for TF, trachomatous inflammation – intense, and trichiasis, using the World Health Organization simplified grading scheme.

Results: Only two LGAs in Bauchi State had TF prevalences in 1–9-year-olds over 5%, with none having TF prevalences of 10% or greater. Only one LGA had a trichiasis prevalence in adults below the elimination threshold; all the others had trichiasis at levels suggestive of public health significance. In all 20 LGAs, more than 60% of households were within 1 km of an improved source of water for hygiene.

Conclusion: Efforts need to be made in Bauchi State to provide trichiasis surgery in order to avert trachomatous blindness. Water supplies needs to be sustained and good personal hygiene practices assured so that elimination of trachoma as a public health problem will be achieved and sustained.

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Introduction

In Nigeria, 84% of cases of blindness are avoidable, with trachoma responsible for 4% of blindness overall.¹ Trachoma is the leading infectious cause of blindness worldwide.² It can be prevented by implementing the SAFE strategy (surgery for trichiasis, antibiotics to clear infection, and promotion of facial cleanliness and environmental improvement to reduce transmission), as recommended by the World Health Organization (WHO).³ A prerequisite for launching SAFE interventions is an understanding of the local prevalence of disease; specifically the district-level prevalences of trachomatous inflammation – follicular (TF) in children aged 1–9 years, and trachomatous trichiasis in adults aged 15 years and older. This helps to determine which

aspects of the SAFE strategy need to be undertaken in each district.⁴

Bauchi State is located in north-eastern Nigeria; the region with the highest burden of blindness in the country.⁵ There has been no established trachoma control program and no comprehensive blindness prevention program in the State, in part due to lack of data. Surveys in neighboring Jigawa and Yobe States have indicated that trachoma is a public health problem in contiguous populations.^{6,7}

Since Bauchi State is adjacent to known trachoma endemic areas, we sought to determine the district-level (local government area, LGA) prevalence of trachoma throughout Bauchi, in order to provide government and partners the necessary data required for the establishment of a trachoma control program, if required.

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*See Appendix

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This study was conducted as part of the Global Trachoma Mapping Project (GTMP).

Materials and methods

Sample size calculations, field team training and certification protocols, data collection procedures, data processing and analysis techniques all followed GTMP standards, which have been previously published.⁸ Version 2 of the GTMP training system was used. As described elsewhere (in a companion paper on GTMP outputs for Kano State⁹), in Bauchi, for each LGA, we selected 25 households in each of 25 villages, chosen using a 2-stage, systematic and quasi-random sampling strategy. In each selected household, all residents aged 1 year and older were invited to be examined by GTMP-certified¹⁰ graders for signs of TF, trichomatous inflammation – intense and trichiasis.¹¹ We also collected data on household-level access to water and sanitation, using a combination of questioning adult residents and direct observation.⁸

Ethics

Following local-language explanation of survey goals and procedures, we obtained verbal consent for examination from this mostly illiterate population, and recorded it electronically in a smartphone application (LINKS system).^{8,12} Individuals aged over 15 years gave consent for their own participation, and for the participation of children in their care. We offered participants who had clinical evidence of active trachoma two tubes of 1% tetracycline ophthalmic ointment, and told them or a carer how to apply it. Participants with trichiasis were referred to the nearest trained trichiasis surgeon for free lid surgery. Protocols were approved by the Ethics Committee of the London School of Hygiene & Tropical Medicine (reference 6319), the National Health Research Ethics Committee of Nigeria (NHREC/01/01/2007), and the Bauchi State Health Research Ethics Committee (NREC/12/05/2013/4). Bauchi State Ministry of Health also gave administrative permission for the work to proceed.

Data analyses

As described previously,⁸ data were checked and cleaned by the GTMP Data Manager (RW). To derive LGA-level prevalence estimates, we adjusted TF data for age of participants (in 1-year age bands), and number of participants per cluster, and trichiasis data for age of participants (in 5-year age bands), sex of participants, and number of participants per cluster. The trichiasis backlog in each LGA was calculated by multiplying the prevalence estimate in persons

aged 15 years and older by 56% of the total population in the LGA (as determined in the most recent census), because 56% of the Nigerian population is 15 years and older.¹³

Results

Fieldwork was undertaken from December 2013 to February 2014. In Bauchi State as a whole, a total of 75,843 residents were enumerated in selected households; 71,599 (94%) people were examined, 2841 (4%) were absent on the day that field teams visited, 1348 (2%) refused examination, and 55 (0.1%) could not be examined for various other reasons. The age range of persons enumerated ranged from 1 year to over 100 years. More females (38,888, 54.3%) were examined than males (32,711, 45.7%; [Table 1](#)).

We examined a total of 23,626 children aged 1–9 years. Of these, 12,065 (51.1%) were male. The state-wide crude prevalence of TF in 1–9-year-old males was 1.5% (95% confidence interval, CI, 1.3–1.7%), which was also the prevalence in 1–9-year-old females (odds ratio 1.0, 95% CI 0.8–1.2; $p = 1.0$). The age-adjusted LGA-level prevalences of TF are shown in [Table 2](#) and [Figure 1](#).

A total of 31,444 persons aged 15 years and older were examined. Of these, 12,835 (40.8%) were male. The state-wide crude prevalence of trichiasis was 1.9% (95% CI 1.8–2.1%). In males aged ≥ 15 years crude trichiasis prevalence was 1.4% (95% CI 1.2–1.6%), in females in the same age range it was 2.2% (95% CI 2.0–2.5%). This difference in trichiasis prevalence between adult females and adult males was statistically significant (odds ratio 1.6, 95% CI 1.3–1.9; $p < 0.001$). [Table 1](#) and [Figure 2](#) show the LGA-level age- and sex-adjusted prevalences of trichiasis.

Two LGAs (Shira and Tafawa Balewa) had TF prevalences between 5% and 9.9%. No LGAs had TF prevalences $\geq 10\%$. Trichiasis prevalences ranged between 0.1% (Das) and 3.3% (Zaki).

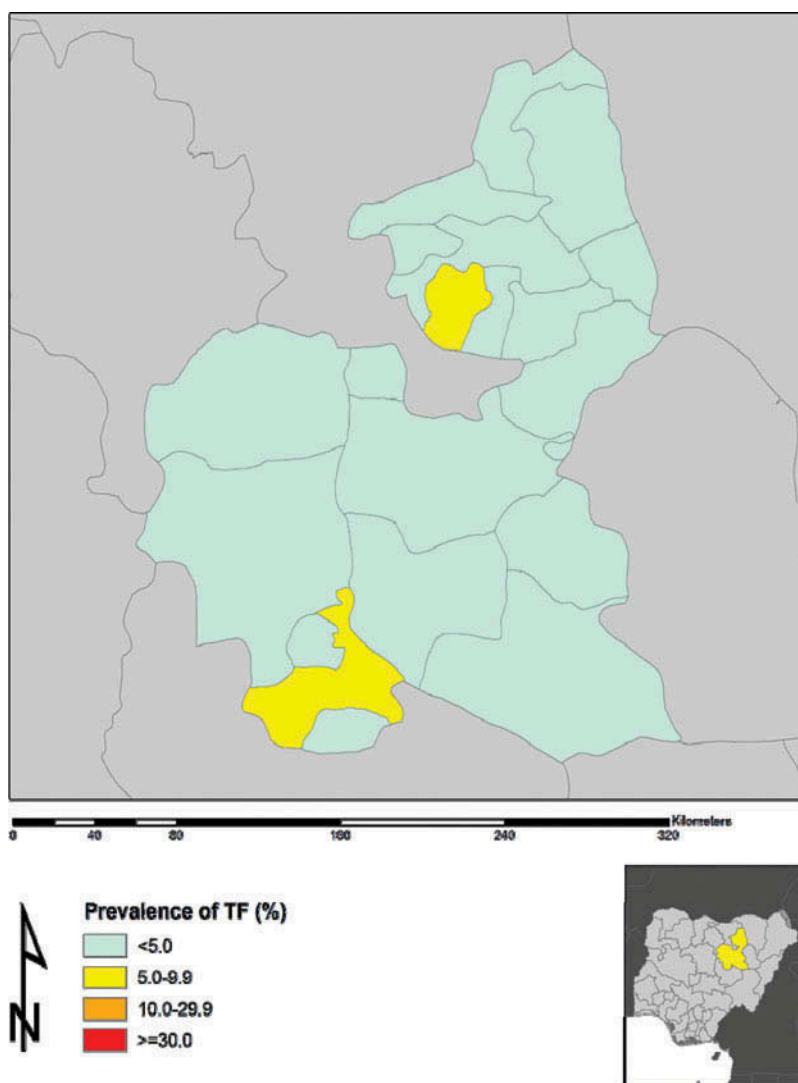
With a population (according to the most recent census¹⁴) of over 4 million people, there is an estimated trichiasis surgery backlog of 28,559 people in Bauchi

Table 1. Age and sex distribution of participants, Global Trachoma Mapping Project, Bauchi State, Nigeria, 2013–2014.

Age group (years)	Female, <i>n</i> (%)	Male, <i>n</i> (%)	Total, <i>n</i> (%)
1–10	14,544 (48.9)	15,211 (51.1)	29,755 (41.6)
11–20	7583 (58.9)	5289 (41.1)	12,872 (18.0)
21–30	7397 (71.8)	2904 (28.2)	10,301 (14.3)
31–40	4177 (58.2)	2998 (41.8)	7175 (10.0)
41–50	2492 (50.5)	2444 (49.5)	4936 (6.9)
51–60	1380 (41.9)	1912 (58.1)	3292 (4.6)
61–70	885 (41.8)	1232 (58.2)	2117 (3.0)
71–80	345 (37.8)	568 (62.2)	913 (1.3)
80+	85 (35.7)	153 (64.3)	238 (0.3)
Total	38,888 (54.3)	32,711 (45.7)	71,599 (100)

Table 2. Local government area-level prevalences of trichomatous inflammation – follicular (TF) and trichiasis, Global Trachoma Mapping Project, Bauchi State, Nigeria, 2013–2014.

Local government area	Age-adjusted TF prevalence in 1–9-year-olds, % (95% confidence interval)	Age- and sex-adjusted trichiasis prevalence in those ≤ 15 years, % (95% confidence interval)
Alkaleri	0.7 (0.3–1.1)	0.7 (0.2–1.4)
Bauchi	0.5 (0.1–0.9)	0.4 (0.2–0.6)
Bogoro	2.5 (1.4–3.4)	0.7 (0.3–1.5)
Damban	0.0 (0.0–0.0)	0.7 (0.3–1.2)
Darazo	2.3 (1.2–3.2)	1.2 (0.8–1.7)
Dass	0.1 (0.0–0.2)	0.1 (0.1–0.2)
Gamawa	1.4 (0.7–2.4)	1.9 (1.3–2.7)
Ganjuwa	1.2 (0.5–1.8)	0.9 (0.6–1.2)
Giade	0.1 (0.0–0.1)	0.9 (0.5–1.3)
Itas/Gadau	4.5 (3.0–6.5)	1.6 (1.0–2.2)
Jamaare	2.3 (1.2–3.6)	2.1 (1.4–3.0)
Katagum	0.9 (0.5–1.6)	2.0 (1.6–2.6)
Kirfi	1.3 (0.6–2.1)	2.3 (1.6–2.9)
Misau	0.0 (0.0–0.0)	0.5 (0.2–0.8)
Ningi	0.0 (0.0–0.0)	1.4 (0.7–2.4)
Shira	7.5 (5.4–9.9)	0.5 (0.2–0.8)
Tafawa Balewa	7.3 (5.3–9.2)	0.2 (0.1–0.4)
Toro	0.1 (0.0–0.2)	0.2 (0.1–0.5)
Warji	2.5 (1.1–4.2)	1.6 (1.0–2.4)
Zaki	3.1 (1.6–4.8)	3.3 (1.9–5.3)

**Figure 1.** Prevalence of trichomatous inflammation – follicular (TF) in 1–9-year-old children, by local government area, Global Trachoma Mapping Project, Bauchi State, Nigeria, 2013–2014.

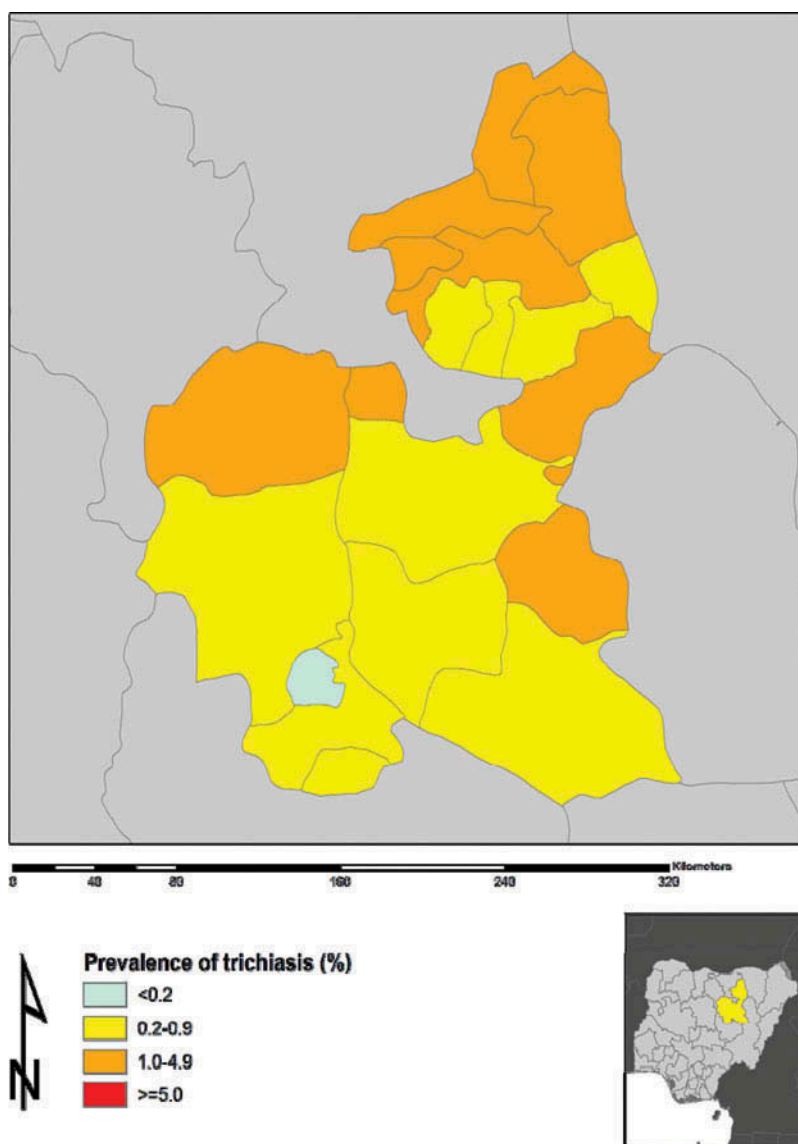


Figure 2. Prevalence of trichiasis in adults ≥ 15 years, by local government area, Global Trachoma Mapping Project, Bauchi State, Nigeria, 2013–2014.

State, with at least 23,377 surgeries needing to be performed to reach the WHO target for the trichiasis component of “elimination of trachoma as a public health problem”¹⁴ in each LGA of Bauchi State. Zaki has the greatest need for provision of trichiasis surgery amongst all Bauchi LGAs (Table 3).

Access to an improved source of water for hygiene purposes (defined as one which by nature of its construction and proper use adequately protects its contained water from outside contamination) is generally good in Bauchi State. In all 20 LGAs, $>60\%$ of households had access to an improved water source within 1 km, and in 15 LGAs (all except Bogoro, Gamawa, Itas-Gadai, Missau and Tafawa Balewa) this was true for $>80\%$ of households. Access to improved latrines defined

as any latrine facility that hygienically separates human excreta from human contact ranged from approximately 3% in Bogoro to 99% in Missau LGA (Table 4).

Discussion

In Bauchi State, there is a high prevalence of trichiasis, the potentially blinding stage of trachoma. State-wide, we estimate there are more than 28,000 people with trichiasis; if left untreated, this could progress in each person to cause corneal damage and irreversible visual impairment or blindness. To prevent this number of people from potentially losing vision due to trachoma, urgent scale-up of the surgery component of the SAFE strategy is required. Particular attention should be

Table 3. Local government area-level estimates of trichiasis surgery backlog, Global Trachoma Mapping Project, Bauchi State, Nigeria, 2013–2014.

Local government area	Estimated total population, <i>n</i>	Trichiasis prevalence in those ≥15 years, %	Estimated trichiasis surgery backlog, <i>n</i>	People to be offered trichiasis surgery to achieve the trichiasis component of WHO “elimination of trachoma as a public health problem”, <i>n</i>
Bauchi	493,730	0.4	1125	572
Bogoro	83,809	0.7	347	253
Damban	150,212	0.7	599	431
Darazo	249,946	1.2	1728	1448
Dass	90,114	0.1	71	0
Gamawa	284,411	1.9	3039	2721
Ganjuwa	278,471	0.9	1347	1035
Giade	156,022	0.9	804	630
Itas/Gadau	228,527	1.6	1997	1741
Jama'are	117,482	2.1	1367	1235
Katagum	293,020	2.0	3339	3011
Kirfi	145,636	2.3	1849	1686
Misau	261,410	0.5	662	370
Ningi	385,997	1.4	3101	2668
Shira	233,999	0.5	627	365
Tafawa	221,310	0.2	279	31
Balewa				
Toro	346,000	0.2	474	86
Warji	114,983	1.6	1006	877
Zaki	189,703	3.3	3489	3277
Total	4,653,066		28,559	23,377

WHO, World Health Organization.

Table 4. Household access to washing water and improved latrines, by local government area, Global Trachoma Mapping Project, Bauchi State, Nigeria, 2013–2014.

Local government area	Improved wash water access <1 km, %	Improved wash water use, %	Improved latrine access, %
Alkaleri	81.4	54.2	15.7
Bauchi	93.5	93.1	66.9
Bogoro	74.7	74.8	5.9
Darazo	89.9	89.7	49.2
Dass	95.9	96.1	68.4
Damban	93.7	93.4	21.7
Gamawa	62.6	62.6	20.9
Ganjuwa	99.8	99.8	10.6
Giade	98.9	98.7	87.0
Itas-Gadau	78.8	78.8	41.4
Jamaare	87.4	87.7	25.7
Katagum	95.8	95.8	64.3
Kirfi	100.0	63.8	2.7
Misau	69.0	68.8	99.0
Ningi	97.4	97.2	10.9
Shira	100.0	100.0	20.2
Tafawa Balewa	68.4	68.2	39.8
Toro	93.1	92.8	15.2
Warji	85.6	85.4	57.1
Zaki	83.3	83.3	7.0

directed to LGAs (such as Zaki, Katagum, Ningi, and Gamawa) where there are particularly large numbers of persons needing surgery. The trachoma program should train¹⁵ and deploy more trichiasis surgeons to these areas, while not neglecting the other LGAs, because the current contingent of 10 active trichiasis surgeons in Bauchi is inadequate for the size of the task at hand. Deliberate efforts to provide trichiasis surgery close to where people live,¹⁶ and to encourage female trichiasis patients to present, are required. Women usually have worse access to trichiasis surgery services, are more afraid of surgery, and are less likely to have been offered surgery in the past.¹⁷

Active trachoma is currently not at levels indicative of a public health problem in Bauchi State, with only two LGAs (Shira and Tafawa Balewa) having TF prevalences in 1–9-year-olds of 5% or higher; these two LGAs may benefit from a single round of azithromycin mass drug administration.¹⁸ Given that access to improved water for hygiene purposes is high in this state, emphasis on the “E” component of the SAFE strategy here should include maintenance of existing water sources, while continuing to aim for 100% of households having proximate access to water in all communities. Given the low prevalence of TF, relatively high prevalence of TT, and absence of previous specific trachoma control interventions, it is possible that

trachoma is already undergoing a secular trend towards elimination in Bauchi.

There is also a need to increase access to improved latrine facilities, with Kirfi, Bogoro and Zaki LGAs being high on the priority list in this regard. There were only two of 20 LGAs in which >80% of households had improved latrine access. These data call for collaboration with water and sanitation agencies to prioritize provision of latrines (or other means of safe disposal of human feces), as part of efforts to achieve United Nations sustainable development goals.¹⁹ Latrine provision, in tandem with maintaining good access to water, should greatly assist in eliminating trachoma and other neglected tropical diseases in Bauchi.

Trachoma may be disappearing from Bauchi State, but there is an urgent need for provision of high volume, high quality, community-based trichiasis surgery, and maintenance or further suppression of the (presumed) current low transmission rate of ocular *Chlamydia trachomatis* infection. Elimination of trachoma as a public health problem here could provide a template for action in similar areas of Nigeria and beyond.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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Appendix

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