OPHTHALMIC EPIDEMIOLOGY
2018, VOL. 25, NO. S1, 79–85
https://doi.org/10.1080/09286586.2018.1467466

Prevalence of Trachoma and Access to Water and Sanitation in Benue State, Nigeria: Results of 23 Population-Based Prevalence Surveys

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ABSTRACT

Purpose: We sought to determine the prevalence of trachoma in each local government area (LGA) of Benue State, Nigeria.

Methods: Two-stage cluster sampling was used to conduct a series of 23 population-based prevalence surveys. LGAs were the evaluation units surveyed. In each LGA, 25 households were selected in each of 25 clusters, and individuals aged 1 year and above resident in those households were invited to be examined for trachoma. Data on access to water and sanitation were also collected at household level.

Results: A total of 91,888 people were examined from among 93,636 registered residents across the 23 LGAs. The LGA-level prevalence of trachomatous inflammation—follicular (TF) in 1–9 year olds ranged from 0.3% to 5.3%. Two LGAs had TF prevalences of 5.0–9.9%. The LGA-level prevalence of trichiasis in ≥15-year-olds ranged from 0.0% to 0.35%. Access to improved drinking water sources ranged from 0% in Gwer West to 99% in Tarka, while access to improved sanitation ranged from 1% in Gwer West to 92% in Oturkpo.

Conclusion: There is a need for public health-level interventions against trachoma in three LGAs of Benue State.

ARTICLE HISTORY
Received 13 January 2018
Revised 17 March 2018
Accepted 13 April 2018

KEYWORDS
Benue State; epidemiology; Global Trachoma Mapping Project; Nigeria; trachoma; trichiasis

Introduction

Trachoma is the world's most common infectious cause of blindness.[1] The disease is caused by repeated bouts[2] of infection with the obligate intracellular bacterium *Chlamydia trachomatis*, which passes from person to person through contaminated hands, through clothes and bedding, and via the eye-seeking fly, *Musca sorbens*.[3] Trachoma disappeared from most developed countries decades ago, but it continues to be a public health problem in much of Africa,[4,5] including Nigeria.[6]

In 1996, the World Health Organization (WHO) established the WHO Alliance for the Global Elimination of Trachoma by 2020 (GET2020).[7] The comprehensive strategy to achieve elimination goes by the acronym "SAFE," which represents surgery, antibiotics, facial cleanliness, and environmental improvement.[8] The need for SAFE strategy implementation is determined on the basis of prevalence estimates of trichiasis in ≥15-year-olds and trachomatous inflammation—follicular (TF) in 1-9-year-olds.[9] WHO recommends use of the SAFE strategy until elimination threshold prevalences (trichiasis <0.2% in ≥15-year-olds and TF <5% in 1-9-year-olds) are reached in each formerly endemic district.[9,10]

From 2012 to 2016, members of the WHO Alliance for GET2020 made considerable progress in baseline mapping of suspected trachoma-endemic districts worldwide within the Global Trachoma Mapping

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Project (GTMP).[11] Its goal was to provide a complete picture of the global burden of trachoma, enabling all stakeholders to see where work was needed to achieve elimination as a public health problem.[12] Though many other states of Nigeria had previously been mapped for trachoma,[13–25] no population-based surveys had been undertaken in Benue State, despite the fact that SAFE interventions had been required in neighbouring Nasarawa State, including in a number of bordering local government areas (LGAs).[13]

The work described here was therefore conducted to (a) determine the LGA-level prevalence of TF and trichiasis in Benue, (b) determine LGA-level prevalence of access to improved water and sanitation, and (c) estimate the likely number of doses of antibiotics and the number of people to be managed for trichiasis that will be needed in Benue State in order to meet the targets of GET2020.

Methods

Study design and setting

Surveys were undertaken between April and September 2014, following standard GTMP procedures, as described previously.[26] Benue State, located in the north–central zone of Nigeria, has an ethnically diverse population, which was estimated to total 4.3 million people at the last (2006) census.[27] Benue contains 23 LGAs within a land area of 34,059 km.[2]

Field team preparation

Teams were trained using version 2 of the GTMP training system.[28] To be certified to participate in the surveys, graders were required to pass a 50-subject inter-grader agreement test in the field, with the assessments of a GTMP-certified grader trainer used as the reference. Data recorders were also required to pass a test before deployment.[26]

Sampling and field procedures

LGAs were the units of evaluation. Two-stage cluster sampling was undertaken. We used villages as first-stage clusters, choosing 25 of them from each of the 23 LGAs, with probability of selection proportional to village size.[9] From each village, 25 households were selected using the random walk technique, though we are aware of its limitations, detailed elsewhere.[18,29–31] With a resident's help, the centre of the village was located and from that starting position a direction for household sampling was selected by spinning a pen and letting it fall to the ground. All residents aged ≥1 year living in the 25 households found on the heading indicated by the pen's tip were invited to participate. This sampling strategy was designed to promote recruitment of a sample of at least 1019 children aged 1–9 years, as outlined previously.[26]

At each household, we collected GPS data on household location, the type of and distance to sources of drinking and washing water in the dry season, the setting (e.g., type of shared or private latrine, outside near the home, in the bush or field) in which household adults usually defecated, the presence or absence of a handwashing facility within 15 m of the latrine (if a latrine was used), and the presence or absence of water and soap at the handwashing facility (if a handwashing facility was present). This information was obtained through questions asked of a household key informant and by direct inspection.[28] Questions conformed closely to those used up to the year 2015 by the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation.[32,33] From each participant, we collected data on age, gender, and presence or absence of trichiasis, TF, and trachomatous inflammation—intense (TI).[34]

Operational definitions

Graders adhered to the definitions of signs in the WHO simplified trachoma grading system.[34] An "improved" water source was defined as one that, by nature of its construction, adequately protects the water from outside contamination, in particular from faecal matter. An improved sanitation facility was defined as one that hygienically separates human excreta from human contact.[32]

Data management

Data were cleaned by an independent data manager (RW), approved by the health ministry, then analysed; outputs were again approved by health ministry.[26] Cluster-level proportions of children with TF were adjusted for age in 1-year bands, and proportions of adults with trichiasis were adjusted for gender and age in 5-year bands; local 2006 census data[27] were used for this adjustment process. LGA-level prevalences were calculated as the means of adjusted cluster-level proportions. Confidence intervals (CIs) were determined by bootstrapping: sets of 25 adjusted cluster-level proportions were selected, with replacement, over 10,000 replications, then the 2.5th and 97.5th percentiles of the ordered means of those sets formed the lower and upper bounds of the CI.

Ethical considerations

Surveys were approved by the Ethics Committee of the London School of Hygiene & Tropical Medicine (6319) and the National Health Research Ethics Committee of Nigeria (NHREC/01/01/2007). The Benue State Ministry of Health gave permission for work to proceed and oversaw its implementation. Informed verbal consent was obtained from each participant or their parent or guardian. We adhered to the principles of the Declaration of Helsinki.[35] All data were collected into the Open Data Kit Android smartphone application, LINKS-GTMP, encrypted during transport, and stored in a password-protected database in the cloud to ensure confidentiality, fidelity, and accessibility.[26,36] Subjects with active trachoma were given antibiotics[37]; those who needed trichiasis surgery[38] were referred to the nearest provider.

Results

A total of 93,636 participants were enumerated across the 23 LGAs; 91,888 (98%) consented to participate and were examined, 602 refused participation, and 1146 were absent. The age of participants ranged from 1 year to 100 years (mean 18.3 years).

Prevalence of trachoma

Some 43,640 1-9-year-olds were examined. The LGA-level prevalence of TF among 1-9-year-olds ranged from 0.3% to 5.3% (Table 1). Two LGAs had TF prevalences of 5.0–9.9% among 1-9-year-olds. The remaining LGAs had TF prevalences of <5% (Table 1).

A total of 36,802 persons aged ≥15 years were examined. There were 42 adults with trichiasis, giving an overall (unadjusted) prevalence of trichiasis of 0.11% in examined ≥15-year-olds. The LGA-level trichiasis prevalence ranged between 0% (15 LGAs) and 0.35% (95% CI 0.12–0.50) in Okpokwu (Table 1). Twenty-one (91% of) LGAs had trichiasis prevalence estimates of <0.2% in adults. In the two LGAs with prevalence estimates of ≥0.2%, the estimated number of individuals needed to be managed to reduce the prevalence to less than the elimination threshold, ignoring incident disease and mortality in those with trichiasis, is 869.

Access to water and sanitation

More than half of all participants (57%) lived in households without a latrine facility, in which adult residents defecated either in the bush or in the open near the household. At LGA level, the proportion of households with access to improved sanitation ranged from 1% in Gwer West to 92% in Oturkpo. In only two of 23 LGAs

Table 1. Local Government Area-level prevalence of trichiasis in ≥15-year-olds and prevalence of trachomatous inflammation—follicular (TF) in 1-9-year-olds, Global Trachoma Mapping Project, Benue State, Nigeria, April–September 2014.

Local Government Area	Number of ≥15-year-olds examined	Number of ≥15-year-olds with trichiasis	Prevalence of trichiasis in ≥15-year-olds, % (95% CI)[a]	Estimated total population aged ≥15 years	Estimated trichiasis backlog	Number of persons that need trichiasis management to achieve elimination threshold	Number of 1-9-year-olds examined	Number of 1-9-year-olds with TF	Prevalence of TF in 1-9-year-olds, % (95% CI)[b]
Ado	2087	11	0.19 (0.07–0.34)	97,142	187	0	3449	120	3.0 (2.1–4.2)
Agatu	1572	0	0	60,493	0	0	4053	23	0.5 (0.3–0.7)
Apa	1426	0	0	51,001	0	0	2109	8	0.3 (0.1–0.5)
Buruku	1364	0	0	108,425	0	0	1309	17	1.8 (0.7–3.4)
Gboko	1750	0	0	202,010	0	0	1235	5	0.3 (0.1–0.7)
Guma	997	1	0.01 (0.00–0.02)	101,355	6	0	1708	80	4.2 (3.2–5.4)
Gwer East	1709	5	0.23 (0.00–0.52)	90,299	210	29	1433	91	5.3 (3.3–7.7)
Gwer West	1175	0	0	63,901	0	0	1373	62	4.6 (2.9–6.6)
Katsina-Ala	1600	10	0.19 (0.03–0.43)	120,884	228	0	1172	28	1.9 (1.0–2.7)
Konshisha	1302	0	0	120,147	0	0	1972	17	0.8 (0.4–1.4)
Kwande	1265	0	0	133,246	0	0	1442	11	0.6 (0.3–0.9)
Logo	2938	0	0	89,816	0	0	2059	17	0.7 (0.3–0.9)
Makurdi	1879	0	0	176,405	0	0	1378	27	1.8 (0.7–2.8)
Obi	1883	0	0	52,081	0	0	3821	95	2.3 (1.5–3.2)
Ogbadibo	1657	1	0.01 (0.00–0.02)	70,791	5	0	1042	41	3.5 (1.8–5.1)
Ohimini	2644	1	0.03 (0.00–0.09)	37,847	11	0	3072	23	0.8 (0.5–1.2)
Oju	1481	0	0	92,435	0	0	1189	21	1.5 (0.8–2.3)
Okpokwu	1152	12	0.35 (0.12–0.50)	94,565	333	144	1012	8	0.5 (0.1–0.8)
Oturkpo	1322	0	0	148,700	0	0	1462	9	0.7 (0.2–1.5)
Tarka	771	0	0	41,295	0	0	3145	34	1.6 (0.8–2.7)
Ukum	1341	0	0	115,173	0	0	1111	66	5.2 (3.6–7.0)
Ushongo	1545	1	0.08 (0.00–0.25)	101,497	84	0	1701	24	1.1 (0.4–2.3)
Vandeikya	1942	0	0	125,214	0	0	1393	48	2.8 (1.5–4.7)
Total	36,802	42		2,294,722	1,064	173	43,640	875	

[a]Adjusted for gender and age, in 5-year bands.
[b]Adjusted for age, in 1-year bands.
CI, confidence interval.

Table 2. Household-level access to improved water and sanitation facilities by Local Government Area, Global Trachoma Mapping Project, Benue State, Nigeria, April–September 2014.

Local Government Area	Access to an improved drinking water source, %	Washing water source (improved or unimproved) <1 km from household (%)	Access to improved sanitation, %
Ado	21	48	29
Agatu	7	36	12
Apa	1	100	19
Buruku	69	82	17
Gboko	36	54	35
Guma	24	43	16
Gwer East	67	50	11
Gwer West	0	9	1
Katsina-Ala	63	75	53
Konshisha	56	68	5
Kwande	73	88	26
Logo	33	31	49
Makurdi	66	41	53
Obi	27	14	3
Ogbadibo	44	99	34
Ohimini	13	61	25
Oju	61	13	2
Okpokwu	3	58	80
Oturkpo	49	99	93
Tarka	99	74	43
Ukum	45	68	12
Ushongo	68	7	17
Vandeikya	57	100	16

did ≥80% of households have access to improved sanitation facilities, while only one (Tarka) of 23 LGAs had ≥80% of households with access to an improved water source (Table 2).

Discussion

Trachoma remains endemic in many parts of Nigeria. Many LGAs in states other than Benue need to implement the "SAFE" strategy to eliminate the condition as a public health problem. We have surveyed each of Benue State's 23 LGAs, and found prevalence estimates of TF and trichiasis that are very modest in comparison to more northern states of Nigeria,[13,14,17,22–25,39,40] or other settings in sub-Saharan Africa.[41–45] Only two LGAs (Gwer East and Okpokwu) require public health-level implementation of the S component of the SAFE strategy. Only two LGAs (Gwer East and Ukum) had TF prevalences suggesting a need for the A, F, and E components of SAFE. Both of the latter LGAs had TF prevalence estimates just above the 5% elimination threshold, with 95%CI lower bounds from 3.0% to 4.0%, and it is eminently possible that these estimates are simply statistical outliers, rather than representations of ongoing *C. trachomatis* transmission that should trigger public health concern. However, hard thresholds for elimination must be (and have been) defined, and implementation of interventions for neglected tropical disease elimination is justifiable in such cases on the basis of apparent very low risk, high community acceptability, and a range of benefits to communities beyond simply bringing about the end of the diseases in question.[46–52]

Trachoma prevalence was low in Benue State despite inadequate access to water and sanitation (Table 2). Though recent work[53,54] has begun to explore levels of community WASH coverage that might associate with lower risk of active trachoma, it does not necessarily follow that particular coverage levels are necessary or sufficient for active trachoma to be eliminated. Regardless, water and sanitation are human rights, and extension of these services to all residents of Benue should be vigorously pursued.

Our surveys had some limitations, including the relatively low numbers of adults examined in several LGAs (771 in Tarka, 997 in Guma; in both of these LGAs no examined adults had trichiasis) and the lack of data on the presence or absence of trachomatous conjunctival scar in eyes diagnosed as having trichiasis. However, the very low prevalences of trichiasis observed almost uniformly across the state would support an assertion that trachoma is close to being eliminated in this setting.

Implementation of community-based trichiasis surgery in the two LGAs observed to have above-elimination-threshold prevalences will help to both maximize the chance that impact surveys will return prevalence estimates below the threshold, and prepare the health system for routine delivery of such services, as and when needed, in the post-validation phase. Human resources, training, equipment, consumables, and funding for trichiasis case finding will be required. Although we estimated the number of cases of trichiasis that would need to be appropriately managed in order to achieve sub-threshold trichiasis prevalences (Table 1), we caution that such calculations ignore incident cases and are therefore only valid if interventions are conducted immediately after the prevalence survey underlying the calculations.

Trachoma is a public health problem in some LGAs of Benue State, and relevant stakeholders are urged to support the Ministry of Health to tackle the problem in order to achieve trachoma's elimination as a public health problem.

Declaration of interest

None of the authors have any proprietary or conflict of interest with this submission. The authors alone are responsible for the writing and content of this article.

Funding

This study was principally funded by the GTMP grant from the United Kingdom's Department for International Development (DFID; ARIES: 203145) to Sightsavers, which led a consortium of non-governmental organizations and academic institutions to support health ministries to complete baseline trachoma mapping worldwide. The GTMP was also funded by the United States Agency for International Development (USAID), through the ENVISION project implemented by RTI International under cooperative agreement number AID-OAA-A-11-00048, and the END in Asia project implemented by FHI360 under cooperative agreement number OAA-A-10-00051. A committee established in March 2012 to examine issues surrounding completion of global trachoma mapping was initially funded by a grant from Pfizer to the International Trachoma Initiative. AWS was a Wellcome Trust Intermediate Clinical Fellow (098521) at the London School of Hygiene & Tropical Medicine and is now, like SB, a staff member of WHO. The authors alone are responsible for the views expressed in this article and they do not necessarily represent the views, decisions, or policies of the institutions with which they are affiliated. None of the funders had any role in project design, in project implementation or analysis or interpretation of data, in the decisions on where, how, or when to publish in the peer-reviewed press, or in the preparation of the manuscript.

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