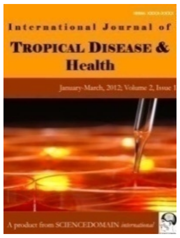

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The Epidemiology of Trachoma in the Lower Shire Valley of Southern Malawi and Implications for the "SAFE" Strategy

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Authors' contributions

This work was carried out in collaboration between all authors. Author KK conceived the study, designed the study, interpreted the data, drafted the manuscript and critically revised the manuscript for intellectual content. Author IS conceived the study, analyzed the data, interpreted the data and critically revised the manuscript for intellectual content. Author MM analyzed the data, interpreted the data, drafted the manuscript and critically revised the manuscript for intellectual content. Author LS interpreted the data, critically revised the manuscript for intellectual content. All authors read and approved the final manuscript.

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ABSTRACT

Aims: To determine the prevalence of trachoma and associated risk factors in the Lower Shire Valley of Southern Malawi.
Study Design: Population based cross sectional study.
Place and Duration of Study: Lower Shire Valley of southern Malawi between July and October 2012.
Methodology: Children aged 1-9 years (total 2957) were assessed for clinical signs of

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active trachoma follicular (TF) and adults aged 15 and above (total 2247) were assessed for signs of trachoma trichiasis (TT), which is potentially blinding trachoma. A questionnaire survey was conducted to explore the potential risk factors.

Results: A total of 2957 children aged 1-9 years who were assessed for clinical signs of TF and 2247 adults aged 15 and above were assessed for signs of TT.The prevalence of TF among children aged 1-9 years was found to be 18.5% (95% CI 16.4-20.8) in Nsanje and 7.8% (95% CI 6.6-9.2) in Mwanza districts respectively. The prevalence of TT in adults aged 15 and above was 0.5% (95% CI: 0.1-0.9) in Nsanje district and 0.2% (95% CI: 0.1-0.4) in Mwanza district, respectively. In regards to risk factors, only the presence of a dirty face was associated with trachoma follicular (TF) in Nsanje and Mwanza districts (P< 0.001).

Conclusion: In this study, prevalence of active trachoma infections was 18.5% in Nsanje and 7.8% in Mwanza district. Dirty face was associated with trachoma follicular in both districts. According to WHO, Nsanje therefore needs a SAFE (Surgery, Antibiotics, Face Washing and Environmental) control strategy.

Keywords: Trachoma; prevalence; risk factors; blindness; trichiasis; follicles; Malawi; Lower Shire; epidemiology; mapping.

1. INTRODUCTION

Trachoma is the oldest reported endemic infectious eye disease and is caused by serotypes A, B, Ba and C of the bacterium Chlamydia trachomatis [1,2]. Repeated infections can eventually lead to eyelids thickening and developing scars resulting in the eyelashes turning inwards and rubbing on the cornea [3,4], causing abrasions and ulceration, eventually leading to visual loss and blindness. According to the World Health Organization (WHO) using the WHO simplified grading system [5,6] there are five stages that categorize the clinical features of trachoma: trachomatous inflammation follicular (TF), trachomatous inflammation intense (TI), trachoma scarring (TS), trachomatous trichiasis (TT) and corneal opacity (CO).

Trachoma remains one of the leading causes of preventable blindness in Sub-Saharan Africa especially in countries that have poor environmental sanitation, inadequate water supply and poor socio-economic status [7,8]. Chlamydia Trachomatis usually spreads by direct contact with ocular and nasal discharges which are common in children, either through direct contact with these secretions or through flies (Musca sorbens) acting as a vector for transmitting infections from one person to the other [9-11]. Chronic recurrent infections lead to scaring of the conjunctiva and eventually in-turn of the eyelids (known as Entropion). Entropion causes trichiasis, an extremely painful rubbing of the lashes against the globe, and leads to corneal scarring, visual impairment and blindness. There is an increased burden for blinding trachoma in women than men, with the overall number of trichiasis cases almost twice in women than men [12]. In some highly trachoma endemic areas such as Ethiopia, it has been reported that women are six times more likely to have conjuctival bacterial infections than men [13] probably due to frequent contact with children.

According to the International Coalition for Trachoma Control (ICTC) (http://www.trachomacoalition.org/), a group comprised of many organizations committed to trachoma control, trachoma is believed to be endemic in 59 countries, most of them among the poorest countries in the world. The global trachoma atlas (http://www.trachomaatlas.org/), produced by the ICTC provides updated and publicly accessible country maps of the geographical distribution of trachoma, obtained through the Alliance for Global Elimination of Trachoma by the year 2020(GET2020), an international alliance led by the WHO. It is reported that nearly 100 million people live in areas where trachoma is confirmed endemic, while another 210 million live in areas where trachoma is suspected to be endemic. Whereas not long ago it was reported that there were still about 8.2 million people with trachoma trichiasis and an estimated 40 million who had active disease [7,14,15], data obtained from the 2011 country reports from the 53 countries that attended the GET2020 estimated that 7.2 million have trichiasis and that 21.4 million have active trachoma [16]. Endemic regions include poor developed countries in large areas of Africa, the Middle East, Southwestern Asia, regions of India, China and small regions in South and Central America. The biggest burden of trachoma is in Africa and it is reported that more than half of all the districts that are suspected to be trachoma endemic are in Ethiopia and Nigeria alone (http://www.trachomaatlas.org/). Recent mapping surveys done in Nigeria [17-20] and in Ethiopia [21,22] have shown high trachoma prevalence rates for trachoma follicular (TF) and trachoma trichiasis (TT).

1.1 Safe

The strategy recommended for control of trachoma was adopted in 1998 through the World Health Assembly resolution and is known as SAFE, “ S” stands for Surgery for trachoma trichiasis, “A” stands for Antibiotic for mass drug administration(MDA) for active trachoma, “F” stands for Facial cleanliness and “E” stand for Environmental improvement. The WHO aims to achieve GET2020 goal through implementation of the SAFE strategy [23].

1.2 Risk Factors

Several risk factors have been proposed for promoting severe trachoma transmission [24] and some of these include the family's socio-economic status, absence of readily available water and distance to water source, poor environmental hygiene practices (absence of toilet facilities, presence of animal waste) and gender(women more exposed than men). Facial cleanliness and environmental improvements have generally been promoted to reduce the risk of trachoma infection. There is currently a large volume of literature on facial cleanliness and environmental improvements in relation to trachoma; however the roles that these play in trachoma control are still not clearly understood, as different reviews have reported weak evidence or conflicting study findings. Rabiu et al. [25] in a systematic review of environmental sanitary interventions for preventing active trachoma concluded that there was little evidence and that more data was needed to determine the effectiveness of all aspects of environmental sanitation in the control of trachoma. Another trial on face washing concluded that there was some evidence that face washing with topical tetracycline was beneficial but the evidence generally did not support face washing alone. The presence of a dirty face as a risk factor has been supported in several recent studies [17,26-30]. Evidence in support of environmental improvements in trachoma control is inconsistent [31], though there is evidence that in the absence of a full SAFE strategy, environmental improvement alone is unlikely to contribute to the control of trachoma [31]. Lavett et al. [32] recently reviewed studies related to SAFE from 1998-2013 and concluded that in regard to risk factors, more research is needed in understanding the effect and impact of environmental improvements on prevention of trachoma.

1.3 Need for Mapping in Malawi

District level mapping of trachoma is required to generate prevalence and risk factors for trachoma before the SAFE strategy is implemented at a district level. Currently, a lack of district level prevalence data exists in many other countries suspected of having endemic trachoma [33] and this leads to incorrect country information displayed on the global trachoma atlas which needs updating [34]. Malawi is no such exception, with the Lower Shire Valley (comprising of Nsanje, Chikwawa and Mwanza districts), in Southern Malawi, commonly known as the “trachoma endemic belt of Malawi” not completely mapped. Information regarding the endemicity of this valley was initially obtained from a population based survey of ocular diseases in one district (Chikwawa) in 1988 ,where the prevalence of TF was found to be 48.7% in children aged 1-2 years [35]. In this study, risk factors for inflammatory disease in young children included low socioeconomic status of the family, long walking distance to the household's primary source of water, absence of a latrine in the family compound and presence of trachoma among siblings. Two follow up blindness studies conducted a decade later [36,37] in the same district suggested that trachoma was on the decline due to some components of the SAFE strategy (mainly F& E) having been implemented and that there was need to determine the actual prevalence. Following this, a study using the WHO recommended trachoma mapping methodology [38] was conducted in the same district and found that trachoma was still a disease of public health importance (TF prevalence 13.6%, TT prevalence 0.6%) [26] and recommended a full SAFE strategy. The situation of trachoma in the other two districts (Nsanje and Mwanza) remained unknown, as none had been surveyed before.

In consideration to the issues discussed above, we sought to determine the prevalence and risk factors of trachoma in Nsanje and Mwanza districts which were suspected of having trachoma but with no previous prevalence data.

2. MATERIALS AND METHODS

The study was a cross-sectional population based household survey designed to obtain district level prevalence estimates for trachoma follicular (TF) in children aged 1-9 years and trachoma trichiasis (TT) in adult men and women aged 15 years and above and to assess the predisposing risk factors for trachoma infection. The study was conducted between July and October 2012.

2.1 Ethical Approval

Ethical approval was obtained from the National Health Sciences Research Committee (NHSRC) and separate approval was obtained from each of the district health administrative offices (DHO) for Nsanje and Mwanza districts, in Malawi. Upon explanation of the purpose of the study, written informed consent was obtained from all subjects who participated in the study. Where the participant was a minor, written informed consent was obtained from the guardian.

2.2 Study Sites

The study districts in the Lower Shire were Nsanje (population 238, 041) and Mwanza districts (Population 86, 314), which according to routine ministry of health (MOH) hospital records were reporting trachoma cases but had not been surveyed before. Fig. 1 shows map of Malawi and the districts in the Lower Shire Valley where the study was done.

Fig. 1. Map of Malawi showing survey sites Mwanza, Chikwawa and Nsanje districts comprising Lower Shire Valley, Southern Malawi.

2.3 Sample Size

The sample size was calculated using the formula provided by the WHO guide manual for trachoma program managers [38].

The formula allows determination of the prevalence of TF/TI in children aged 1–9 years old with a 95% degree of certainty to achieve narrow confidence intervals (CI). This age group was chosen because the prevalence of TF is highest in the 1-9 years group. To determine the required sample size for each district we used the following parameters:

a) Size of the population in each of the districts (i.e. the number of 1–9 years old children in the district).
b) Expected prevalence of 20% of TF in 1–9-year-old children:(estimates based on prevalence rates of 13.6% for TF/TI as determined from the previous survey in Chikwawa district [26].
c) Desired precision of the estimate of 0.04 (taken as 20% of the expected prevalence).

d) Required alpha risk (risk of the true prevalence being outside the confidence interval; usually 5%), expressed as the Z score for the alpha risk: for an alpha risk of 5%, the Z score is 1.96.
e) Expected design effect (usually 4 for the clustering effect).

Using these parameters the sample size required as given in the WHO guide manual for trachoma program managers [38] is

$= e \times d^2 \times b \times (1–b)/C^2 = 4 \times (1.96)^2 \times 0.20 \times 0.80/ (0.04)^2$
= 1537children aged 1-9 years

For trichiasis a similar calculation was done assuming an expected prevalence of 2% with a desired precision of 1% and the required sample size was1152 adults aged 15 years and above. The same households where the 1537 children were sampled also provided an adequate sample size to estimate the prevalence of trichiasis.

2.4 Selection of Clusters and Households for Survey

With an average of 1.4 children aged 1-9 years per household in Malawi this translates to 1080 households needed. Hence a total of 24 clusters with 45 households (HH) per cluster for Nsanje and 20 clusters with 54 HH per cluster for Mwanza were selected with using probability proportional to size sampling (PPS),as described in the Trachoma control guide for programme managers [38]. In each cluster eligible households were listed and the required number was selected from the list at random. Members of the selected households within the required age-range were examined.

2.5 Training

A total of 12 ophthalmic clinical officers (6 paired teams) from the Ministry of Health were selected as trachoma graders for training and underwent a 3 day refresher training course in grading trachoma in Nsanje District. All of these were already trained trachoma graders and were attending to trachoma cases on a regular basis and among these some were trachoma trichiasis (TT) surgeons. The trainings had theoretically classroom lessons, followed by several classroom practice and then field practice. Graders were trained and certified using eyelid photographs derived from the Partnership for Rapid Elimination of Trachoma (PRET) study [39,40]. An initial slide test was administered on day one after the first revision exercise and only trainees who demonstrated proficiency on this continued with the training for the entire 3 days. The graders were taught in class on how to safely examine children and adults for evidence of TF, TI, TT or corneal opacity (CO) and recognize and refer other priority diseases and then went to a village where they were shown the techniques. During the second day, an inter-observer agreement practice exercise was undertaken in classroom using 50 children slides and a kappa score was calculated for certification, with the minimum required being 0.70. The highest and lowest kappa scores were 0.85 and 0.72 respectively. After certification, the graders were paired and the third day was entirely spent in the field, where the teams practiced examining of children and adults and filling in the questionnaire under observation. Training and fieldwork were externally observed by a Sightsavers epidemiologist from the United Kingdom (UK).

2.6 Field Methods

Three generic questionnaires were used in this survey:

a) Village headman questionnaire: collected village level information in terms of availability of health services and barriers to their uptake, water sources and sources of health education.
b) Household questionnaire: collected data on household member characteristics and household level risk factors, such as water sources, water availability and sanitation services.
c) Ocular examination questionnaire: collected data on demographics of survey subjects, individual risk factors for trachoma, signs and symptoms and history of previous trachoma treatment.

All the information was recorded using paper questionnaire forms. The selected clusters were visited a few days in advance by community health workers from ministry of health also known as Health Surveillance Assistants (HSAs) who are responsible for disease surveillance and implementing health promotion. They briefed the village chiefs and the community members and organized the selected cluster (village) household (HH) list that was used for random household (HH) selection by the survey team. During the actual survey days the ophthalmic team assigned to the cluster obtained the list and only chose the random numbers of HHs that had been preselected using a computer. All 6 teams were supervised by a team leader and the 3 supervisors who checked forms at the end of each day.

2.7 Clinical Examination and Determination of Risk Factors

Each eye of the participants was everted separately and examined for presence of trachoma using a 2.5 x magnifying loupe (Binomag plastic, Zabby's, India) and graded according to the WHO simplified system [41] and any incidental ocular conditions noted. Subjects complaining of visual difficulty had their visual acuity tested using Snellen E charts and were referred or advised as appropriate.

Risks factors for clinical trachoma and ocular chlamydia infection were enumerated from the household and village questionnaire and the ocular examination questionnaire and these included gender, distance to primary water source, presence of household latrine, presence of solid waste or animal pens, and determination of children's facial cleanliness using a definition of a clean face as absence of ocular discharge and dry nasal discharge [42].

2.8 Quality Control of Trachoma Observations

At the end of each day, debriefing was held, where the investigators, observers, supervisors and enumerators discussed challenges faced and suggested solutions for improvement. Recommendations were implemented in the following days.

2.9 Data Management, Analysis and Reporting

Survey questionnaires were collected from the field and sent to a central location (at BICO Lions Sight First Eye Hospital) for double data entry. The data entry programs were developed in Epidata version 3.1. The data entry programs have in-built range checks, consistency checks and controls for skip patterns to minimize data entry errors. However, this was also complemented with data validation techniques in Epidata and detailed data range and consistency checks programs written in STATA version 11, which also facilitated in listing all the outstanding errors for cleaning. Data was analyzed in STATA version 11 by a Biostastician from the Malawi Liverpool Welcome Trust. Univariate analysis using frequencies and other descriptive statistics and bivariate analysis were done to examine relationships using the Yates' corrected Chi-squared test for 2 by 2 tables.

We report the districts level prevalence of the WHO indicators (TF in 1-9 year olds and TT in those aged 15 and over). Individual and household risk factors associated with TF and TT and the strength of their association and joint effects have also been reported.

3. RESULTS

A total of 2,286 persons from 911 households in Nsanje and 2,933 persons from 985 households in Mwanza were examined respectively. In total there were 2957 children aged 1-9 years who were assessed for clinical signs of active trachoma follicular (TF) and 2247 adults aged 15 and above were assessed for signs of trachoma trichiasis (TT).

Table 1 shows the baseline characteristics (age-grouping separated by sex) of study participants from Nsanje and Mwanza districts respectively. There was an almost equal distribution according to gender in the children aged 1-9 years but in the adults aged 15 and above, more females than males were represented. The mean age for children aged 1-9 was 5 years while the median was 2 years. For adults aged 15 and above the mean age was 36 years while the median was 28 years.

Table 1. Base line characteristics of the study participants

Age Group (years)	Nsanje				Mwanza			
	Males	**Females**	**Total**	**% Females**	**Males**	**Females**	**Total**	**% Females**
1-9	627	653	1280	51	800	877	1677	52
10-14	4	7	11	64	1	3	4	75
15+	305	690	995	69	307	945	1252	75
ALL	936	1350	2286	59	1108	1825	2933	62

Table 2 shows availability of household characteristics and trachoma risk factors that were studied in the two districts.

In-terms of latrine availability and usage, 39.1% and 24.3% had no toilet facilities in Nsanje and Mwanza districts respectively. Loose garbage was present in 22.2% and 15.9% of Nsanje and Mwanza districts respectively. The common source of water was borehole in both districts, with water being around all the year in approximately 80% of all times and 80% of residents having access to water within a distance of 30 minutes. Dirty faces were present in 29.1% of children from Nsanje and 36.4% of children from Mwanza districts respectively.

Table 2. Availability of household characteristics in Nsanje and Mwanza districts

	Nsanje		Mwanza	
	No.	**%**	**No.**	**%**
Type of Toilet				
Traditional pit-latrine	416	45.7	584	60.5
Improved pit-latrine	37	4.1	23	2.4
Shared pit-latrine	100	11.0	123	12.7
Flushed toilet at the residence	1	0.11	1	0.1
None	356	39.1	235	24.3
Feces around 15 m of the house				
Yes	13	1.4	15	1.5
No	894	98.6	958	98.5
Loose garbage around the house				
Yes	201	22.2	155	15.9
No	706	77.8	818	84.1
Water source				
Tap water	19	2.1	25	2.6
Rain Water Harvest	3	0.3	7	0.7
Protected Well	4	0.4	2	0.2
Unprotected Well	9	1.0	41	4.2
Borehole	753	82.7	767	78.4
Dam	1	0.1	1	0.1
River/Stream	122	13.4	134	13.7
Water all year round				
Yes	749	82.3	778	79.8
No	161	17.1	197	20.2
Distance to main water source				
<15 minutes	578	63.5	584	59.7
16-30 minutes	210	23.1	294	30.0
31-60 minutes	106	11.6	76	7.8
>60 minutes	17	1.9	25	2.6
Clean face (1-9years)				
Yes	930	70.1	1143	63.6
No	413	29.1	649	36.4

The prevalence rates of trachoma follicular (TF) and trachoma intense (TI) in children aged 1-9 years and trachoma trichiasis (TT) in adults aged 15 years and above in Nsanje and Mwanza districts are shown in Table 3.

Table 3. Prevalence rates for Trachoma TF and TT in Nsanje and Mwanza districts

District	TF prevalence (Children aged 1-9 years)		TT prevalence All adults aged >=15		TT prevalence Adults aged >=15 (by sex)	
	%	**95% CI**	**%**	**95% CI**	**% in males**	**% in females**
Nsanje	18.5	16.4-20.8	0.5	0.1-0.9	0.3	0.7
Mwanza	7.8	6.6-9.2	0.2	0.1-0.4	0	0.2

The prevalence of TF among children aged 1-9 years was found to be 18.5% (95% CI 16.4-20.8) in Nsanje and 7.8 %(95% CI 6.6-9.2) in Mwanza districts respectively. The prevalence of TT in adults aged 15 and above was 0.5% (95% CI: 0.1-0.9) in Nsanje district and 0.2% (95% CI: 0.1-0.4) in Mwanza district, respectively. The prevalence of trichiasis (TT) observed in adults aged 15 years and above in Nsanje is twice as much as in Mwanza. Trachomatous trichiasis was observed to be more common in women than men in Nsanje (prevalence 0.7% in women and 0.3% in men) and exclusively present only in women in Mwanza districts (prevalence 0.2%).

Table 4 shows the correlation between TF and hygiene and environmental risk factors.

Table 4. Correlation between TF and environmental risk factors

Risk factor	Nsanje District		P-value	Mwanza District		P-value
	TF N (%)	No TF N (%)		TF N (%)	No TF N (%)	
Presence of Solid Waste						
Yes	18(29.9)	146(70.1)	0.8	8(3.0)	261(97.0)	0.4
No	127(11.0)	1026(89.0)		79(4.8)	1555(95.2)	
Presence of Animal Pens						
Yes	72 (10.1)	643(89.9)	0.2	61 (5.6)	1021 (94.4)	0.05
No	177(10.7)	1478(89.3)		56 (3.9)	1360 (96.1)	
Water source >30 min						
Yes	215(11.3)	1680(88.7)	1.0	106(4.7)	2131(95.3)	0.7
No	34(11.3)	266(88.7)		11(4.2)	253 (95.8)	
Clean Face						
Yes	93(9.6)	877(90.4)	<0.001	34(3.0)	1099(97.0)	<0.001
No	138(33.0)	275(66.6)		93(14.3)	556(85.7)	
Toilet availability						
Yes	99(12.0)	725(88.0)	0.4	27(4.9)	522(95.1)	0.8
No	148(10.8)	1218(89.2)		89 (4.6)	1840(95.4)	

The main positive significant risk factor for trachoma follicular (TF) obtained through logistical regression after accounting for clustering in households in both districts was the presence of a dirty face in both Nsanje and Mwanza districts($P<0.001$). Other hygiene and environmental factors were not significant.

4. DISCUSSION

This study was conducted to determine the prevalence of trachoma and associated risk factors in Nsanje and Mwanza districts, two of three districts comprising the Lower Shire Valley of Southern Malawi. This information was needed to guide in deciding if any of the districts were endemic and needed a full "SAFE" control strategy. According to the WHO guidelines that states that for a district to be categorized as a public health problem, either TF prevalence in children aged 1-9 years has to be 10% or TT prevalence in adults aged 15 and above has to be more than 1% [38], trachoma is a disease of public health importance in Nsanje but not in Mwanza district (Table 3). Nsanje is therefore eligible for a full "SAFE strategy and should be prepared to implement" sooner than later. Since the prevalence rate is less than 30%, the implementation would have to be conducted for a period of 3 years, followed by impact surveys to warrant stopping the interventions [38].

For Mwanza district, the WHO Trachoma control guidelines [38] recommendation is to conduct further sub-district (community) surveys, to determine which communities are above 10% (implement SAFE) or below 5% (no intervention). In sub-districts (communities) where baseline prevalence is between 5% and 10%, only F and E interventions should be implemented for 3 years and then a further assessment should be done, to decide if the control interventions can be discontinued [38]. It should be noted that resurveying can be expensive and this can lead to districts with prevalence between 5 and 10% been left unattended.

Values of TT from both districts are higher than WHO cut off point of threshold for elimination of trichiasis (TT) as a public health problem (<0.1 %) and indicate that surgical intervention for trichiasis should be implemented in the two districts. However the observed TT prevalence only translates to a few cases (78) needing surgery in Mwanza as the population is small. For Nsanje there are more but manageable cases of TT (536 in total) so within the SAFE strategy it should be possible to address these cases. The observation that TT was more prevalent in women than men is a finding that is well accepted, possibly this is due to the number of increased recurrent trachoma infections in women resulting from frequent contacts with children [31]. It is important to note that not all cases of trachomatous trichiasis lead to cornea opacities and impaired visual acuity [43] and that some of the cornea opacities seen in the community are not caused by trachoma but may be caused by other cornea infections and concurrent use of traditional herbal medicines for treatment. Moreover the observed cases may be old prevalent cases and may need to be verified. Even though the advice would be to organize TT surgery for all the cases in Mwanza, it is likely that only a few cases in Mwanza among these TT cases will progress to cornea opacity.

In regards to risk factors, only the presence of a dirty face was associated with trachoma follicular (TF) in Nsanje and Mwanza districts (P<0.001). There is however a challenge in correctly determining absence or presence of a clean face in children. King et al. [42] in a randomized trial of face-washing to develop a standard definition of a clean face for monitoring trachoma control programmes concluded that though the absence of ocular and dry nasal discharge can be used as an indicator of 'clean face', it is not a good predictor of whether a face has been washed. Ejere et al. [44] in a systematic review found that there was no evidence to support that face washing alone was beneficial in trachoma control. A recent review on the effectiveness of SAFE in trachoma control concluded that although several risk factors are independently identified in different settings, there is little evidence available of the effectiveness of sanitation and hygiene improvements in trachoma control [31]. A long distance to a water source was not a major factor in the transmission of trachoma in both districts. This is not surprising considering that approximately 80% of the population in both districts reported having access to a water source of a distance of less than 30 minutes of walking distance. Hoechsmann et al. [14] found that trachoma follicular was associated with a longer distance to the primary water source in Chikwawa district, which shares boundaries between both Nsanje and Mwanza. It should be noted that since the Hoechsmann study [14], many boreholes were drilled in the Lower Shire Valley by Non-Governmental Organizations (NGOs) in the “WASH” sector such as World Vision, Goal Malawi, and Water Aid resulting in most residents accessing water within a walking distance of 30 minutes. These NGOs are not addressing trachoma per se but rather reacting to addressing the United Nations Millennium Developmental Goals(MDGs) [45] which have to be achieved by 2015. Among these goals is the need to halve the proportion of the population without sustainable access to safe drinking water and basic sanitation by 2015 (MDG 7). The hypothesis that reduction in trachoma follicular (TF) can be related to environmental improvement in absence of antibiotic treatment [14] is indeed supported by the readily availability of water in these districts and not the antibiotic. Currently both districts have access to only limited amounts of tetracycline eye ointment as an available drug and only use it for treating severe eye infections. Nsanje district will need the full SAFE strategy, while Mwanza district will need sub-district level mapping, implement SAFE in sub-districts with TF prevalence of >10% and implement F and E in communities having a TF prevalence of between 5 and 10%. With this approach, it will be possible to eliminate blinding trachoma in both districts.

The Lower Shire Valley share boundaries with Mozambique but the situation of trachoma on the Mozambican side is unknown. The Lower Shire Valley is known to be co-endemic for at least 5 neglected tropical diseases (lymphatic filariasis, schistosomiasis, onchocerciasis, and soil transmitted helminthes and trachoma). It is therefore important to explore issues of cross-border infections with Mozambique and how trachoma control strategies can be integrated with other neglected tropical diseases (NTD's) as this has been suggested to be beneficial in sub-Saharan Africa [46,47].

5. CONCLUSION

The prevalence rates of active trachoma infections is not uniform among districts in the Lower Shire Valley, with rates higher than the WHO cutoff point (TF >10%) in Nsanje district, suggesting that trachoma is a disease of public health importance and that the full SAFE (Surgery, Antibiotics, Face Washing and Environmental) control strategy should be undertaken. For Mwanza district, it is recommended that sub-district/community level surveys be conducted, to identify and treat focal areas with high TF prevalence. The study only found one risk factor for trachoma (dirty face), possibly due to environmental improvements over the recent years, however there is a need for further local operational research on risk factors before making generalization.

CONSENT

All authors declare that 'written informed consent was obtained from the patient (or other approved parties) for publication of this report and accompanying images.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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