BMC Infectious Diseases

RESEARCH

Open Access

Impact of trachoma elimination efforts in afar regional state, Ethiopia: survey findings from 26 evaluation units

Getachew Gebreselassie[1*], Kasahun Negash[1], Dawit Woga[1], Misrak Makonnen[1], Baye Deneke[1], Muluken Desalegn[1], Seada Ali[2], Colin L. Beckwith[3], Fentahun Tadesse[3,5], Fikre Seife[4], Genet Kiflu[4] and Fikreab Kebede[4]

Abstract

Background Following interventions to eliminate trachoma in the Afar region of Ethiopia, our goal was to reassess the prevalence of trachomatous trichiasis (TT) and trachomatous inflammation—follicular (TF) at the woreda level, and to identify factors associated with the disease.

Methods Cross-sectional community-based surveys were conducted in 26 trachoma-endemic woredas, employing a standardized approach. Households were selected as the secondary sampling unit. Surveys involved interviews with household heads, direct assessment of water, sanitation, and hygiene (WASH) access, and clinical examination of eligible household members for trachomatous trichiasis (TT) and trachomatous inflammation—follicular (TF).

Result Overall, 18 out of the 26 woredas (69%) achieved the World Health Organization-recommended threshold for active trachoma elimination, with a prevalence of trachomatous inflammation—follicular (TF) below 5% in children aged 1–9 years. Additionally, 14 woredas (54%) met the threshold for trachomatous trichiasis (TT) elimination, with a prevalence of TT cases unknown to the health system below 0.2% in adults aged 15 years and older. However, access to improved drinking water sources within a 30-minute trip was limited to only 17% of households, and merely 9% had access to improved latrines. Addressing these WASH (Water, Sanitation, and Hygiene) challenges remains critical for sustaining progress in trachoma control and achieving long-term public health improvements in the Afar region.

Conclusion In seven woredas, further rounds of antibiotic mass drug administration are required, complemented by initiatives to promote facial cleanliness and improve environmental conditions. Additionally, surgical campaigns for trachomatous trichiasis (TT) are needed in 12 woredas. There is a critical need to enhance access to improved Water, Sanitation, and Hygiene (WASH) facilities across all surveyed woredas to consolidate gains in trachoma control and achieve sustained public health improvements.

Keywords Trachoma, Survey, Elimination, Afar region, Ethiopia

*Correspondence:
Getachew Gebreselassie
getgebr@yahoo.com
[1]Amref Health Africa, Addis Ababa, Ethiopia
[2]Afar Regional Health Bureau, Semera, Ethiopia
[3]Sightsavers, Georgia, USA
[4]Ethiopia Ministry of Health, Addis Ababa, Ethiopia
[5]Sightsavers, Addis Ababa, Ethiopia

Introduction

Trachoma, caused by specific strains of the bacterium *Chlamydia trachomatis*, leads to inflammation of the conjunctiva, primarily affecting children. Without treatment, it can result in corneal scarring, opacity, and eventual blindness in adulthood [1]. The disease is predominantly found in impoverished rural communities of low-income countries, where access to clean water, sanitation, and healthcare is inadequate [2].

World Health Organization (WHO), in collaboration with national health ministries and non-governmental organizations (NGOs), initiated a program aimed at eliminating trachoma as a public health issue by 2020 [3]. The strategy employed to achieve this goal is known as SAFE, which includes four key interventions: Surgery for trichiasis (to correct eyelash misalignment that can damage the cornea), Antibiotics to treat infection, and Facial cleanliness and Environmental improvements (such as fly control and better access to water) to reduce transmission of Chlamydia trachomatis [3, 4].

WHO recommends conducting prevalence surveys at the district level (termed evaluation units or EUs) to determine the need for public health interventions against trachoma [5]. As of June 2022, 1,649 EUs globally reported a prevalence of trachomatous trichiasis (TT) above the elimination threshold of 0.2% among individuals aged 15 years and older [2], indicating a total eligible population of 125 million for implementing the SAFE strategy components. The majority (84%) of these individuals are in the WHO African Region, with Ethiopia alone representing 52% of the global total.

Afar region is one of the twelve regional states that make up the Federal Democratic Republic of Ethiopia. The region is divided into 6 zones, 42 woredas and 8 city administrations. In 2007, Afar region was estimated to have a total population of 2.1 Million of which 92% are pastoralists or Agro-pastoralists living in rural areas, in addition, it has International boundaries with Eritrea in the northeast and Djibouti in the east.

Between 2013 and 2017, standardized baseline trachoma prevalence surveys were conducted in the Afar region with support from the Global Trachoma Mapping Project (GTMP) and Tropical Data, aimed at identifying districts requiring interventions [6–8]. During this period, the prevalence of trachomatous inflammation—follicular (TF) ranged from 2.90 to 16.30%. Subsequently, 19 woredas with TF prevalence between 5.0% and 9.9% received one round of antibiotic mass drug administration (MDA) between December 2019 and January 2020, while 3 woredas with TF prevalence between 10% and 29.9% underwent three rounds of MDA from December 2018 to December 2020.

Additionally, Amref Health Africa, in partnership with the Ministry of Health (MoH) and Regional Health Bureau (RHB), implemented a project from 2020 to 2023 targeting all trachoma-endemic woredas in the Afar region to address the Facial cleanliness (F) and Environmental improvements (E) components of the SAFE strategy.

The current study aims to re-estimate trachoma prevalence in the 25 woredas of the Afar region that received the recommended number of MDA rounds according to WHO guidelines. The objective is to assess whether interventions should be sustained or discontinued. Specific goals include evaluating TF prevalence among children aged 1–9 years and TT among individuals aged 15 years and older at the woreda level, and gathering population-based data on access to water, sanitation, and hygiene (WASH).

Materials and methods

Surveys were conducted with support from Tropical Data, adhering to WHO-recommended methodologies and leveraging advancements developed under the Global Trachoma Mapping Project (GTMP) [9].

Training of graders and recorders

Tropical Data conducted standardized five-day basic and refresher training sessions immediately before each series of surveys [10]. Grader training focused on eye examinations for signs of trachoma using WHO's simplified trachoma grading system [11]. Grader trainees who achieved a kappa score of ≥0.7 in a slide-based inter-grader agreement (IGA) test proceeded to a field-based IGA test. During this test, they graded 50 children's eyes and needed to achieve a kappa of ≥0.7 for TF grading compared to a Tropical Data-certified grader trainer.

Graders were also trained to identify trichiasis, trachomatous scarring (TS), and trachomatous inflammation—intense (TI), although they were not formally tested on the diagnostic accuracy of these signs. Recorder trainees underwent thorough training on survey procedures, recognizing WASH infrastructure, and using the Tropical Data Android phone app for data recording (Tropical Data). Trainees were deployed for surveys if they achieved ≥90% in the recorder reliability test.

Eighteen (18) new trainees underwent the basic training program before commencing survey work. Additionally, 15 graders and 21 recorders, who had previously been trained but had not attended basic or refresher training in the past 12 months, participated in refresher training before beginning fieldwork. Each team was supervised by field supervisors, with one supervisor overseeing 6–7 teams.

Survey design

The surveys utilized a community-based cross-sectional design, incorporating interviews with heads of

households to assess access to water, sanitation, and hygiene (WASH). The methodology included direct inspection of WASH facilities and clinical examinations of eligible household members. Specifically, these examinations focused on trichiasis (upper and lower eyelids separately), trachomatous scarring (TS) for individuals with trichiasis on either eyelid, and assessments for trachomatous inflammation—follicular (TF) and trachomatous inflammation—intense (TI). Each woreda underwent a separate survey.

Sample size determination and sampling

The sample size for each survey was calculated using the single population proportion for precision formula. A design effect of 2.63 was applied [11], and an inflation factor of 1.2 was used to adjust for non-response. To achieve a precision of ±2% at the 95% confidence level for measuring a prevalence of trachomatous inflammation—follicular (TF) of 4%, a total of 1,164 children aged 1–9 years were required [9]. For woredas with a population size less than 100,000, the sample size was adjusted to account for a small, finite population.

The number of clusters required from each evaluation unit (EU) was calculated by dividing the total targeted number of children aged 1–9 years by the product of the average number of households a team could feasibly visit per day (30 households) and the estimated mean number of 1–9-year-olds per household (1.5 [12].

A two-stage cluster sampling method was employed for the surveys. In the first stage, 4 (or fewer for smaller woredas) were selected using a probability proportional to population size approach. However, for the 21 evaluation units (EUs) surveyed between 2021 and 2023, 30 clusters were chosen based on statistical modeling, which demonstrated that surveying 30 clusters provides sufficient precision around the prevalence estimate of trachomatous trichiasis (TT) [13, 14].

In the second stage, compact segment sampling was used to select 30 households from each selected kebele. After the villages were selected, the next step was involved dividing each village into smaller segments, followed by selecting 30 households (HHs) from those segments.

All individuals aged one year and above residing in the sampled households were invited to participate in the survey.

Data collection

Data were collected using an Android app, starting with informed consent from household heads and standard WHO recommended tropical data tools/questionnaires were used [15]. The team recorded GPS coordinates and asked WASH-related questions. Certified graders examined individuals for eye conditions using magnifying loupes and sunlight. Data collection proceeded until 30 selected households were visited, with efforts to revisit households missing children aged 1–9 years by day's end. Those identified with active trachoma received 1% tetracycline eye ointment. The survey team collaborated with local eye centers for treating individuals with trachomatous trichiasis (TT) and other eye conditions through suitable referrals.

Those with trichiasis or conjunctivitis were treated onsite with tetracycline ointment. Data were stored on the smartphone until transmitted to a secure Cloud database.

Data analysis

The prevalence of trachomatous inflammation—follicular (TF) was adjusted for age in one-year age bands, while the prevalence of trachomatous trichiasis (TT) was adjusted for age and gender in five-year age bands. These adjustments utilized data from the most recent census [7, 13]. To investigate associations between TF and factors at both the individual and household levels, data on TF prevalence at the individual level were analysed using mixed effects models. Various models were evaluated to determine the most suitable random effects for analysing the presence of TF. This involved comparing models with random effects at the household, cluster, and woreda levels, both individually and in combination. The analysis included WASH variables as fixed effects, alongside the number of children in the household, age, and gender. The responses for latrine type and drinking water source from the WASH questionnaire were categorized into groups: improved, unimproved, and open. Washing water was excluded from the analysis because it showed a strong correlation with drinking water. First, univariable models were tested for each WASH variable individually. Subsequently, a multivariable model was constructed that included all significant variables identified in the univariable analysis. Each level of every variable was compared against a chosen reference level within its respective group. Odds ratios for all variables were computed relative to this reference level. All statistical analyses were performed using the R statistical software [16].

Results

Fieldwork was conducted between December 2020 and September 2023, covering a total of 26 surveys. During this period, 74,525 individuals were enumerated across 23,091 households within 772 clusters.

TF prevalence

In the study, a total of 33, 773 children aged 1–9 years were examined (Table 1). The age-adjusted prevalence of trachomatous inflammation—follicular (TF) among 1–9-year-olds at the woreda level varied from 1% (95% CI: 0.00-0.02) in Megalle woreda to 12% (95% CI:

Table 1 Age distribution of survey participants, trachoma surveys, Afar region, Ethiopia, 2020–2023

Zone	Evaluation unit	Age, years	Examined, *n*	Absent, *n*	Refused, *n*	Other, *n*	Total, *n*
Kilbat	Megalle, Yalo, Telalak, Teru, Samorobigelalu	1–9 years	6,706	23	2	0	6,731
		15+	7,436	449	109	0	7,994
Awsa	Argoba, Awash Fentale, Chifra, Abala, Afambo, Amibara, Awra, Asyaeta, Dubti, Elidari, Kori	1–9 years	13,858	12	0	0	13,870
		15+	17,881	584	121	0	18,586
Fanti	Berhale and Buremodaytu	1–9 years	2,712	0	0	0	2,712
		15+	3,111	64	28	0	3,203
Gabi	Dalifage, Dalul, Dewe, Dulech	1–9 years	5,288	18	3	0	5,309
		15+	6,454	142	66	0	6,662
Harri	Hadaleelila, Koneba, Gulina and Gewane	1–9 years	4,064	8	0	0	4,072
		15+	5,870	228	52	2	6,152

0.08–0.17) in Argoba woreda. Among the 26 surveys conducted, TF prevalence was below 5% in 18 woredas (69%) and exceeded 10% in one woreda (4%). Additionally, six woredas had TF prevalence rates ranging from 5 to 9.9%. Detailed findings are presented in Table 2.

TT prevalence

In the study, a total of 40,752 adults aged 15 years and older were examined (Table 1). Among them, 554 cases of trachomatous trichiasis (TT) were identified, with 453 cases previously unknown to the health system. The age- and gender-adjusted prevalence of TT unknown to the health system in individuals aged 15 years and older ranged from 0 to 0.54% (95% CI: 0.00-0.01). Specifically, this prevalence was below 0.2% in 14 out of the 26 surveyed woredas (Table 2).

WASH access

A total of 23,091 households were visited; 17% (n=3,888) had access to improved drinking water within a 30-minute journey. Only 4% (n=971) of households had an improved latrine, and 9% (n=2,049) of households had a latrine with a handwashing station (Table 2).

Associated factors

Firstly, the study found that age is a significant factor influencing TF prevalence. Children aged 1–3 years old had notably lower odds of TF prevalence compared to older age groups. This finding aligns with existing knowledge that TF tends to peak in prevalence among children aged 4–6 years old and gradually decreases with age. The exceptionally high odds ratios observed in the younger age group underscore the vulnerability of preschool-aged children to TF and highlight the importance of early intervention and preventive measures.

Contrary to some expectations, the analysis did not reveal a significant association between sex and TF prevalence. This suggests that TF affects both males and females equally in the studied population, emphasizing the need for gender-neutral approaches in trachoma control programs.

Unimproved water sources and unimproved latrines are associated with lower odds of the outcome, suggesting that improving water and sanitation access could have a beneficial impact on the outcome being studied. This might be because of other factors may influence the relationship between water, sanitation, and TF prevalence. People with unimproved sources might adopt better hygiene or live in areas with lower TF rates due to other environmental factors. In some cases, unimproved water sources or latrines might be less contaminated or better maintained than improved ones, leading to unexpected results. Additionally, unimproved sources in certain settings may still offer better health or hygiene conditions than in others.

Interestingly, household size showed a trend towards higher odds of TF prevalence, particularly in larger households. While this association was not statistically significant in the multivariable analysis, it raises important questions about the potential role of household dynamics and overcrowding in facilitating the transmission of trachoma within households (Table 3).

Surprisingly, the presence of handwashing stations did not show a significant association with TF prevalence. This unexpected finding suggests that simply having access to handwashing facilities may not be sufficient to reduce TF prevalence and underscores the importance of behavior change interventions to promote proper hand hygiene practices among community members.

Overall, the findings from this analysis provide valuable insights into the determinants of TF prevalence in the Afar region of Ethiopia and underscore the importance of multifaceted approaches that address social, environmental, and behavioral factors in trachoma control efforts.

Table 2 Prevalence of trachomatous inflammation—follicular (TF) in children aged 1–9 years and trachomatous trichiasis (TT) in those aged ≥ 15 years in trachoma impact surveys, Afar region, Ethiopia, 2020–2023

Districts Name (Evaluation Unit	Number of 1–9-y-olds examined	Adjusted TF prevalence in 1–9-y-olds (95% CI	Number of ≥ 15-y-olds examined	Adjusted prevalence of TT unknown to the health system in people aged ≥ 15-y-olds (95% CI)**	Proportion of households with an improved drinking water source	Proportion of households with an improved drinking water source within a 30-min return journey of the household	Proportion of households with an improved latrine
Chifra	1152	0.02(0.01–0.03)	1452	0.33(0.00–0.00)	50%	26%	6%
Gulina	1314	0.04(0.02–0.07)	1451	0.55(0.00-0.01)	34%	21%	3%
Megalle	1410	0.01(0.00-0.02)	1463	0.18(0.00–0.00)	21%	20%	1%
Yalo	1435	0.02(0.01–0.03)	1506	0.19(0.00–0.00)	69%	30%	5%
Abala	1535	0.02(0.01–0.04)	1616	0.35(0.00-0.01)	45%	29%	9%
Afambo	1405	0.05(0.03–0.08)	1648	0.19(-)	26%	34%	9%
Amibara	1249	0.04(0.02–0.06)	1675	0.18(-)	76%	53%	8%
Awra	1380	0.01(0.01–0.02)	1652	0.07(0.00–0.00)	17%	5%	2%
Aysaeta	1281	0.03(0.02–0.04)	1669	0.28(0.00-0.01)	20%	38%	4%
Dubti	1219	0.04(0.02–0.07)	1679	0.18(0.00–0.00)	43%	37%	12%
Elidar	1268	0.04(0.02–0.06)	1656	0.03(-)	58%	17%	6%
Kori	1470	0.06(0.04–0.09)	1605	0.00(-)	41%	7%	0%
Berahle	1454	0.01(0.01–0.02)	1575	0.20(0.00–0.00)	27%	5%	5%
Buremodaytu	1258	0.04(0.02–0.06)	1536	0.11(0.00–0.00)	43%	49%	6%
Dalifage	1406	0.04(0.03–0.07)	1585	0.57(0.00-0.01)	25%	17%	0%
Dalul	1281	0.02(0.01–0.03)	1628	0.08(0.00–0.00)	37%	6%	2%
Dewe	1366	0.03(0.02–0.05)	1643	0.30(0.00–0.00)	24%	5%	1%
Dulech	1235	0.06(0.04–0.09)	1598	0.66(0.00-0.01)	31%	30%	2%
Hadaleelila	1190	0.04(0.02–0.07)	1436	0.13(0.00–0.00)	36%	30%	5%
Koneba	1560	0.03(0.01–0.04)	1611	0.57(0.00-0.01)	46%	9%	1%
Telalak	1306	0.06(0.04–0.08)	1512	0.21(0.00–0.00)	10%	3%	1%
Teru	1449	0.06(0.03–0.08)	1569	0.07(-)	43%	18%	2%
Aregoba	711	0.12(0.08–0.17)	1615	1.19(0.00-0.01)	38%	27%	6%
Gewane	1145	0.03(0.01–0.05)	1372	0.53(0.00–01)	48%	59%	7%
Samorobigelalu	1106	0.03(0.02–0.04)	1386	0.51(0.00-0.01	26%	17%	0%
Awash Fentale	1188	0.07(0.04–0.08)	1614	0.26(0.00-0.01)	52%	59%	5%

Table 3 Association between trachomatous inflammation—follicular (TF) prevalence in 1–9-year-olds and individual- and household-level variables in trachoma impact surveys, Afar region, Ethiopia, 2020–2023

Variable		Univariable OR (95% CI)	*p*-value	Multivariable OR (95% CI)	*p*-value
Age (Years)	1–3 years old	0.85 (0.73–0.99)	< 0.001	0.76 (0.62–0.91)	< 0.001
	4–6 years old	1.21 (1.05–1.39)	< 0.001	1.15 (0.98–1.35)	< 0.001
	7–9 years old	0.72 (0.61–0.84)	< 0.001	0.63 (0.53–0.76)	< 0.001
	10–15 years old	Reference			
Gender	Male	0.79 (0.67–0.94)	< 0.001	0.86 (0.71–1.04)	
	Female	Reference	-	-	-
Improved Drinking Water	Improved	Reference	-	-	-
	Unimproved	0.83 (0.73–0.94)	0.003	0.79 (0.68–0.92)	< 0.001
Distance to nearest drinking water source (Minutes)	1–30 min	Reference	-	-	-
	> 30 min	1.17 (1.04–1.32)	0.011	1.28 (1.13–1.45)	< 0.001
Improved Latrine	Improved	Reference	-	-	-
	Unimproved	0.83 (0.73–0.94)	0.003	0.79 (0.68–0.92)	< 0.001
Handwashing Station	Yes	Reference	-	-	-
	No	0.79 (0.67–0.94)	0.001	0.86 (0.71–1.04)	
Number of Children 1–9 per household	0–1	Reference	-	-	-
	2–5	1.15 (1.02–1.30)	0.023	1.12 (0.98–1.27)	
	6+	1.17 (1.04–1.32)	0.011	1.28 (1.13–1.45)	< 0.001

Discussion

Significant strides have been made in reducing the prevalence of trachomatous inflammation—follicular (TF) and trachomatous trichiasis (TT) in Ethiopia's Afar region (Fig. 1). Among the 26 surveyed woredas, TF prevalence was less than 5% in 18 woredas, and the prevalence of TT cases unknown to the health system was below the WHO elimination threshold of 0.2% in 14 woredas (Fig. 2).

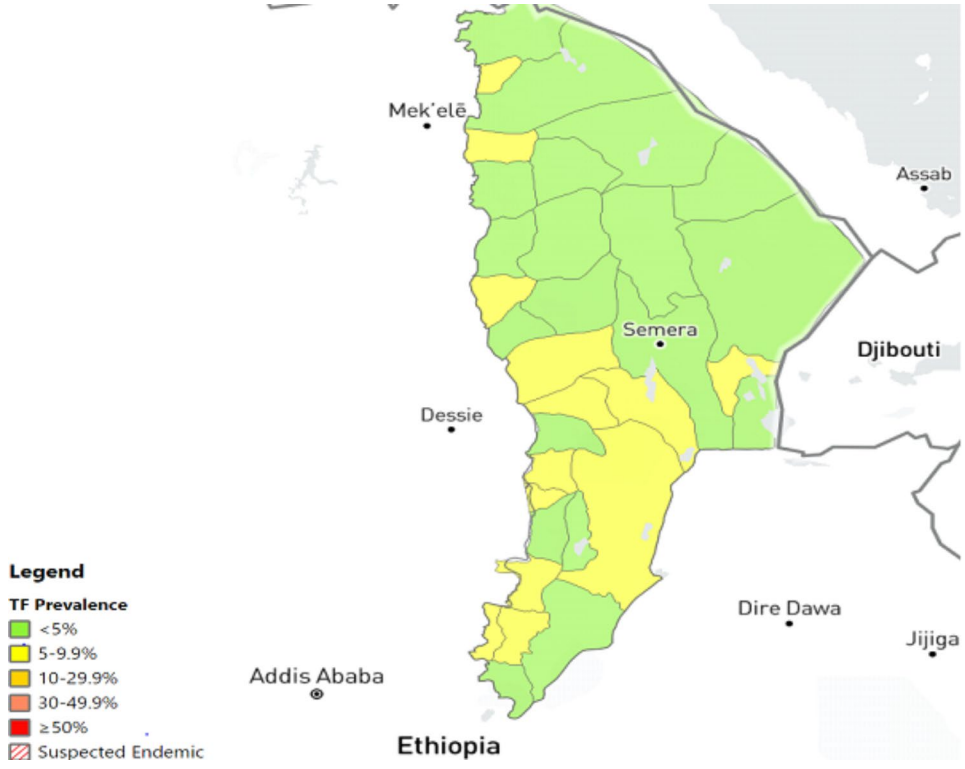

Fig. 1 Prevalence of trachomatous inflammation—follicular (TF) in 1–9-year-olds, in trachoma impact surveys, Afar region, Ethiopia, 2020–2023. The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the authors, or the institutions with which they are affiliated, concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries

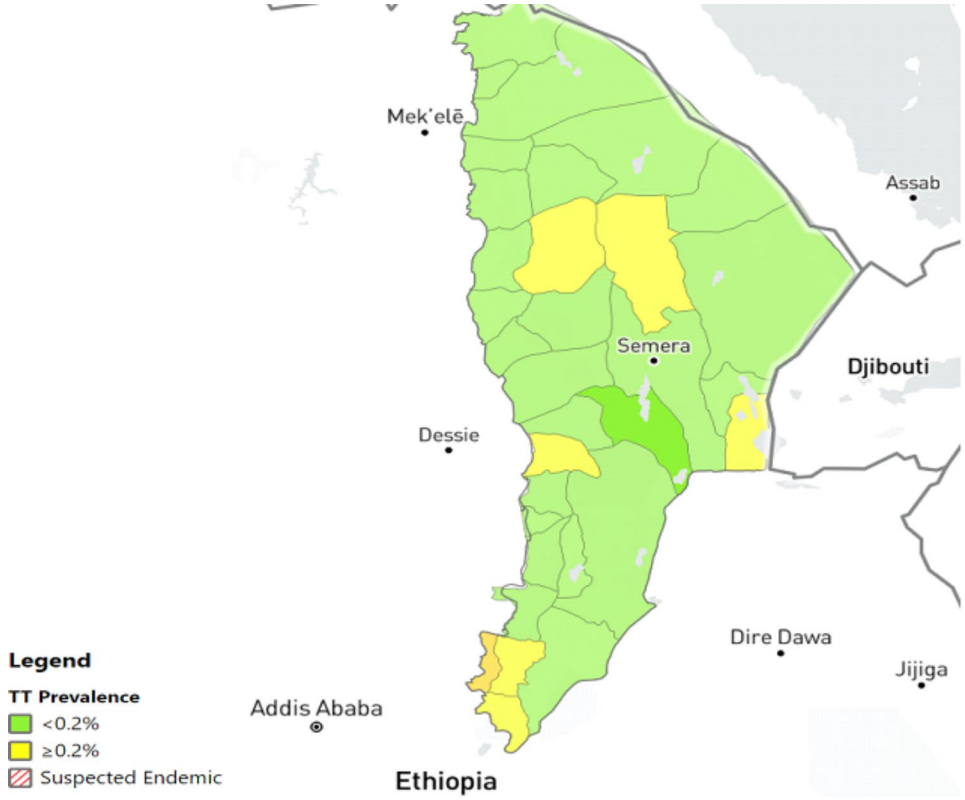

Fig. 2 Prevalence of trachomatous trichiasis (TT) in ≥ 15-year-olds, in trachoma impact surveys, Afar region, Ethiopia, 2020–2023. The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the authors, or the institutions with which they are affiliated, concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries

However, challenges persist in WASH (Water, Sanitation, and Hygiene) coverage. Only 17% of households have access to improved drinking water within a 30-minute round trip, and a mere 9% have access to improved latrines. Addressing these disparities remains critical to sustaining progress in trachoma control and elimination efforts across the region.

According to WHO recommendations, three additional rounds of annual antibiotic mass drug administration (MDA) are required in the woredas where the prevalence of trachomatous inflammation—follicular (TF) among children aged 1–9 years is ≥10%. One more round of MDA is needed in the six woredas where TF prevalence ranges from 5 to 9.9%.

Additionally, efforts to implement the Facial cleanliness (F) and Environmental improvements (E) components of the SAFE strategy, aimed at improving access to Water, Sanitation, and Hygiene (WASH), are essential across all surveyed areas [17]. These efforts are crucial not only for trachoma elimination but also for broader public health purposes [18, 19]. In the 18 woredas that have achieved the WHO-recommended TF elimination target (<5% prevalence), further rounds of antibiotic MDA are not necessary. However, surveillance surveys for trachoma should be conducted at least two years after the impact surveys to monitor for any potential resurgence [20].

There have been notable reductions in trachomatous inflammation—follicular (TF) prevalence compared to baseline levels [6] following previous rounds of mass drug administration (MDA) in a significant portion of the surveyed woredas. This outcome is encouraging because reducing TF prevalence helps minimize the risk of future trachomatous blindness by reducing the deposition of conjunctival scars. However, the effectiveness of MDA in Ethiopia has shown more variability compared to other regions in Africa [21–23]. Possible reasons for the relative success observed in the Afar region could include high MDA coverage, low baseline prevalence of trachoma [6], or other contributing factors. Further research would be necessary to confidently determine the primary reasons behind this positive outcome.

This study benefited from several strengths. We adhered to a standardized methodology aligned with WHO recommendations [9], incorporating rigorous quality assurance measures throughout the survey process [7, 8]. Additionally, we achieved the required sample size for trachomatous inflammation—follicular (TF) in children aged 1–9 years [9], enhancing the precision of

TF prevalence estimates across all woredas. However, there were also limitations. The minimum sample size requirement of 4 Woredas for trachomatous trichiasis (TT) in adults aged 15 years and older was not met in any woredas, despite surveying 30 clusters per woreda for the 22 woredas included in the 2021–2023 surveys. Statistical modeling has suggested that this approach provides sufficient precision around the TT prevalence estimate [14]. Additionally, challenges such as population movement and insecurity in the survey area were encountered during data collection.

Despite challenges such as population displacement and security concerns, these issues were mitigated through close communication with field teams to locate displaced populations and by replacing non-existent villages with newly selected clusters. However, insecurity caused delays in completing fieldwork, potentially biasing geographic representation.

In conclusion, In seven woredas, further rounds of antibiotic mass drug administration are required, complemented by initiatives to promote facial cleanliness and improve environmental conditions. Additionally, surgical campaigns for trachomatous trichiasis (TT) are needed in 12 woredas. There is a critical need to enhance access to improved Water, Sanitation, and Hygiene (WASH) facilities across all surveyed woredas to consolidate gains in trachoma control and achieve sustained public health improvements.

Conclusion

Substantial progress has been achieved in reducing trachomatous inflammation—follicular (TF) and trachomatous trichiasis (TT) prevalence in the surveyed woredas. Nonetheless, trachoma remains a public health issue in the Afar region. Continued implementation of the SAFE strategy, ongoing TF prevalence reduction efforts through behavioral interventions, establishment of systems for identifying and managing incident TT cases and conducting surveillance surveys every two years in woredas with TF prevalence below the elimination threshold are crucial for sustained program success and long-term health improvements.

Abbreviations

TI	Trachomatous inflammation—intense
TS	Trachomatous scarring (TS)
TT	Trachomatous trichiasis
TF	Trachomatous inflammation—follicular
WASH	Water, sanitation, and hygiene
NGO	Non—governmental organizations
WHO	World health organization
EUs	Evaluation units
SAFE	Surgery, antibiotics, facial clearness and environmental improvement
GTMP	Global trachoma mapping project
MDA	Mass drug administration
MOH	Ministry of health
RHB	Regional health bureau
IGA	Inter—grader agreement

Acknowledgements

We are very grateful to thank all survey participants, recorders, graders, and field supervisors for their time and hard work.

Author contributions

GG has conceived of the study, carried out the overall design and execution of the study, performed data collection and statistical analysis and interpretation and developing the manuscript. KN, DW, MM, BD and MD have participated in the study implementation, drafting of the manuscript and assisted the design of the study and data analysis. AH participated in the study design and execution of the study and statistical analysis and interpretation of data including major contribution to writing. SA involved participated in the study implementation, CB and FT participated study implementation, the revision of the design of the study, data collection techniques and helped the statistical analysis, FS, GK and FK involved and participated in the study implementation, approval of final version, the revision of the design of the study and data collection.

Funding

This research was financially supported by Sightsavers' Accelerate Project.

Data availability

The datasets used and/or analyzed during this study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the principles outlined in the Declaration of Helsinki. Ethical approval was obtained from Afar Regional Health Bureau Ethical Clearance Committee and the London School of Hygiene & Tropical Medicine, and Before participation, each individual was informed about the objectives of the survey and provided verbal informed consent. For children, verbal informed consent was obtained from parents or guardians. Informed consent was recorded using an Android smartphone. All procedures involving human participants were carried out in compliance with appropriate national and international ethical guidelines.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Received: 11 July 2024 / Accepted: 26 December 2024
Published online: 02 January 2025

References

1. Solomon AW, Burton MJ, Gower EW, Harding-Esch EM, Oldenburg CE, Taylor HR, Traoré L, Trachoma. Nat Rev Dis Primers. 2022;8(1):32. https://doi.org/10.1038/s41572-022-00359-5. PMID: 35618795.
2. World Health Organization. (2021) Alliance for the Global Elimination of Trachoma: progress report on elimination of trachoma. https://www.who.int/publications/i/item/who-wer9731-353-364
3. Planning for the global elimination of trachoma (GET). Report of a WHO consultation, Geneva, Switzerland, 25 and 26 November 1996 (WHO/PBL/97.60). Geneva: World Health Organization; 1997.
4. Kuper H, Solomon AW, Buchan J, Zondervan M, Foster A, Mabey D. A critical review of the SAFE strategy for the prevention of blinding trachoma. Lancet Infect Dis. 2003;3(6):372 – 81. https://doi.org/10.1016/s1473-3099(03)00659-5. PMID: 12781509.
5. Solomon AW, Zondervan M, Kuper H, et al. Trachoma control: a guide for program managers. Geneva: World Health Organization; 2006.
6. Kassahun Negasha C, Macleodb Y, Adamud M, Ahmede M, Ibrahime M, Alid T, Haileselassie R, Willisg, Brian K, Chug M, Dejeneh A, Asrata RM, Flueckigerg AL. Pavluckg and Anthony W. Solomon. Prevalence of trachoma in the Afar Region of Ethiopia: results of seven population-based surveys from the

Global Trachoma Mapping Project Global Trachoma Mapping Project, OPHTHALMIC EPIDEMIOLOGY 2018, 25, S1, 3–10 https://doi.org/10.1080/09286586.2017.1362008
7. Solomon AW, Willis R, Pavluck AL, Alemayehu W, Bakhtiari A, Bovill S, Chu BK, Courtright P, Dejene M, Downs P, Flueckiger RM, Haddad D, Hooper PJ, Kalua K, Kebede B, Kello AB, Macleod CK, McCullagh S, Millar T, Mpyet C, Ngondi J, Nwobi B, Olobio N, Onyebuchi U, Rotondo LA, Sarr B, Shafi O, Sokana O, West SK, Foster A. For The Global Trachoma Mapping Project. Quality Assurance and Quality Control in the global Trachoma Mapping Project. Am J Trop Med Hyg. 2018;99(4):858–63. https://doi.org/10.4269/ajtmh.18-0082. PMID: 30039782; PMCID: PMC6159583.
8. World Health Organization. Design parameters for population-based trachoma prevalence surveys: strategic and technical advisory group for neglected tropical diseases, working group on monitoring and evaluation. World Health Organ; 2018. https://apps.who.int/iris/handle/10665/275523. License: CC BY-NC-SA 3.0 IGO.
9. Courtright P, MacArthur C, Macleod CK, Dejene M, Gass K, Harding-Esch EM, Jimenez C, Lewallen S, Mpyet C, Pavluck AL, West SK, Willis R, Solomon AW. Tropical Data: training system for trachoma prevalence surveys. London: International Coalition for Trachoma Control; 2019.
10. Solomon AW, Kello AB, Bangert M, West SK, Taylor HR, Tekeraoi R, Foster A. The simplified trachoma grading system, amended. Bull World Health Organ. 2020;98(10):698–705. https://doi.org/10.2471/BLT.19.248708. Epub 2020 Sep 3. PMID: 33177759; PMCID: PMC7652564.
11. Macleod CK, Bailey RL, Dejene M, et al. Estimating the intra-cluster correlation coefficient in population-based trachoma prevalence surveys: results from a meta-regression of 261 standardized pre-intervention surveys in Ethiopia, Mozambique and Nigeria. Am J Epidemiol. 2020;189(1):68–76.
12. Federal Democratic Republic of Ethiopia Population Census Commission. Population and Housing Census 2007. Addis Ababa, Ethiopia: Central Statistical Agency; 2008.
13. World Health Organization. Design and validation of a trachomatous trichiasis-only survey. Geneva: World Health Organization; 2017. Licence: CC BY-NC-SA 3.0 IGO. WHO/HTM/NTD/PCT/2017.08.
14. Solomon AW, Le Mesurier RT, Williams WJ. A diagnostic instrument to help field graders evaluate active trachoma. Ophthalmic Epidemiol. 2018;25(5–6):399–402.
15. R Core Team. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria; 2021. URL https://www.R-project.org/
16. World Health Organization. Ending the neglect to attain the sustainable development goals: A Global Strategy on Water, Sanitation and Hygiene to Combat Neglected Tropical diseases 2021–2030. Geneva: World Health Organization; 2021.
17. Boisson S, Wohlgemuth L, Yajima A, et al. Building on a decade of progress in water, sanitation and hygiene to control, eliminate and eradicate neglected tropical diseases. Trans R Soc Trop Med Hyg. 2021;115(2):185–7.
18. World Health Organization Strategic and Technical Advisory Group on Neglected Tropical Diseases. Technical consultation on trachoma surveillance. September 11 – 12. 2014, Task Force for Global Health, Decatur, USA (WHO/HTM/NTD/2015.02). Geneva: World Health Organization; 2015.
19. Miecha H, Dejene M, Adugna D et al. Prevalence of Trachoma after Implementation of Trachoma Elimination Interventions in Oromia Regional State, Ethiopia: results of impact surveys in 131 evaluation Units Covering 139 districts. Ophthalmic Epidemiol 2022; 30 (6) :1–8.
20. Seyum D, Fetene N, Kifle T et al. Prevalence of Trachoma from 66 Impact Surveys in 52 Woredas of Southern Nations, Nationalities and Peoples' and Sidama Regions of Ethiopia, 2017–2019. Ophthalmic Epidemiol 2022; 30(6): 1–10.
21. Sata E, Nute AW, Astale T et al. Twelve-year longitudinal trends in Trachoma Prevalence among children aged 1–9 years in Amhara, Ethiopia, 2007–2019. Am J Trop Med Hyg 2021.
22. Validation of elimination. Of trachoma as a public health problem (WHO/HTM/NTD/2016.8). Geneva: World Health Organization; 2016.
23. Tropical Data Training system for trachoma. prevalence surveys version 4 (td-trainingmanual-dec23-v43-en-web.pdf (dyzz9obi78pm5.cloudfront.net).

Publisher's note