

# Summary Proceedings

## Twenty-Fourth Annual Trachoma Control Program Review

### *The Trachoma End Game: The Power of Persistence, Partnership, and Passion*

THE  
CARTER CENTER



*Waging Peace. Fighting Disease. Building Hope.*

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## **Acknowledgments**

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**And to many others who may not be listed, our sincere gratitude.**

## **Acknowledging The Power of Persistence, Partnership, and Passion**

The Carter Center's Trachoma Control Program (TCP) celebrated another year of incredible achievements toward eliminating trachoma as a public health problem in the five Carter Center-assisted programs and for the global trachoma program. Through the power of persistence, partnership, and passion, and despite challenges brought forth by conflict and political strife, the programs in the Amhara region of Ethiopia, Mali, Niger, South Sudan, and Sudan significantly impacted the lives of those at risk of the debilitating pain and suffering that trachoma can cause. The Carter Center is proud to assist, in partnership with the ministries of health, the most mature and long-standing trachoma programs worldwide. These programs have historically been the largest of their kind, contributing to some of the most remarkable global SAFE (Surgery, Antibiotics, Facial cleanliness, and Environmental improvement) outputs and progress toward eliminating trachoma. In the World Health Organization (WHO) Weekly Epidemiological Record, published 14 July 2023, global 2022 data showed The Carter Center's TCP assisted in approximately 26% of the worldwide output of all Trichomatous Trichiasis (TT) surgeries and distributed 28% of trachoma mass drug administration (MDA).

In 2022, the programs demonstrated *The Power of Persistence, Partnership, and Passion*, to achieve these tremendous outputs and progress in the face of challenges such as increased insecurity across all Carter Center-assisted countries. An incredible example of such determination is that of Mali, which, despite ever-increasing insecurity, completed its final surveys to demonstrate achievement of elimination thresholds to be validated by the WHO as having eliminated trachoma as a public health problem from the entire country. It is because of the determination and passion of the entire global trachoma program, individuals coming together in partnership to stop unnecessary blindness, that progress is possible. In partnership with communities and ministries of health of Ethiopia, Mali, Niger, South Sudan, and Sudan, in calendar year 2022, The Carter Center's TCP assisted in providing TT surgeries to 33,427 individuals and distributed over 10.3 million doses of antibiotics. Cumulatively, since 1999 The Carter Center has assisted in providing 902,363 persons with sight-saving surgery and in distributing more than 232 million doses of antibiotics. The Center's partnerships have also contributed to health education programs and the training of 14,068 masons who have contributed to the construction of over 3.6 million latrines. Additionally, The Carter Center's TCP has profound and well-established relationships and partnerships with academia and other partners to conduct and assist in operational research toward policy change and programmatic improvements. These partnerships have contributed to greater understanding of the challenges towards the elimination of trachoma as a public health problem and how we may overcome these challenges.

The Carter Center's work and the achievements of the partnerships would not be possible without the significant support and committed advocacy of additional partners, such as the generosity and enthusiasm of donors, including Abbott, Alwaleed Philanthropies, Robert and Joan Blackman Family Foundation, Children's Investment Fund Foundation, Coalition for Operational Research on Neglected Tropical Diseases (COR-NTD), Joy and John DeHarpporte, The William H. Donner Foundation, Inc., The END Fund, Bill & Melinda Gates Foundation, Mr. Gregory Gerhard, Conrad N. Hilton Foundation, Himalayan Cataract Project Cureblindness, William R. Hoch Family Foundation, International Trachoma Initiative (ITI), Lions Clubs International Foundation, Lions Clubs of Ethiopia, Lions Clubs of Mali, Lions Clubs of Niger, Manaaki Foundation, Margaret A. Cargill Philanthropies, The P.D Merrill Charitable Trust, Dr. Ronald P. Ngayan & Sasha Guati-Ngayan, Noor Dubai Foundation, Orbis International, Pfizer Inc., The Francis I. Proctor Foundation for Research in Ophthalmology, Rock Paper Scissors Foundation, John and Kathleen Schreiber, SoapBox Soaps, The Task Force for Global Health (TFGH), United Nations International Children's

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## Table of Contents

<b>Acronyms</b> .....	1
<b>Executive Summary</b> .....	3
<b>Trachoma Control Country Program Summaries</b> .....	7
SAFE in Ethiopia.....	7
SAFE in Amhara, Ethiopia .....	10
Persistence in the End Game: Mali's Success.....	16
SAFE in Niger.....	20
SAFE in South Sudan.....	25
SAFE in Sudan.....	31
<b>Summary Tables &amp; Figures</b> .....	37
Table 1. Summary of National Data from Trachoma Control Programs (Carter Center-Assisted Countries) .....	37
Table 2. Carter Center-Assisted Implementation of SAFE (Carter Center-assisted output).....	38
Table 3. National Trachoma Control Program Annual Targets 2023 (Carter Center-Assisted Countries)..	39
Table 4. Cumulative Carter Center-Assisted Implementation of SAFE .....	40
Table 5. Summary of Carter Center Assisted Programs Activity Plans, Accomplishments, and Challenges 2022-2023 .....	41
Figure 1. Persons Operated for TT, Carter Center-Assisted Countries .....	42
Figure 2. Azithromycin Distribution, Carter Center-Assisted Countries .....	43
<b>Special Sessions</b> .....	44
Enhancing the 'A' in SAFE.....	44
Trachoma Photo Database and TT Photography .....	46
TT Photography.....	48
Photographic Grading for Conjunctival Scarring .....	50
SPET: Post-elimination surveillance study in Niger.....	52
International Trachoma Initiative Update .....	54
Eliminating Persistent Trachoma in Ethiopia: Adaptive Staggered Parallel Effectiveness – Implementation Hybrid Cluster Randomized Controlled Trial (Aspect) for Enhanced Monitoring of Child MDA .....	58
Kebele Elimination of Trachoma for Ocular Health Trial (KETFO).....	59
Changes in Ocular <i>Ct</i> Strains After 5 and 8 Rounds of MDA .....	60
Updates on ESPEN & Outcomes of the 3 <sup>rd</sup> Global Scientific Meeting on TT .....	63
Trichiasis With and Without Tarsal Conjunctival Scarring: a multi-centre observational study on burden, phenotype and morbidity .....	65

<b>Appendix Materials</b> .....	68
Appendix I: 2023 Trachoma Control Program Review Recommendations .....	68
Appendix II: Trachoma: The Disease .....	70
Appendix III: TT and TF Thresholds for Disease Elimination .....	71
Appendix IV: Trachoma Control Program Review Agenda .....	72

### Acronyms

<b>ARHB</b>	Amhara Regional Health Bureau
<b>CDD</b>	Community Drug Distributors
<b>CI</b>	Confidence Interval
<b><i>Ct</i></b>	<i>Chlamydia trachomatis</i>
<b>DBS</b>	Dried blood spot
<b>ETAG</b>	Ethiopia Trachoma Advisory Group
<b>ETAS</b>	Enhancing the A in SAFE
<b>ESPEN</b>	Expanded Special Project for Elimination of Neglected Tropical Diseases
<b>EU</b>	Evaluation Unit
<b>F&amp;E</b>	Facial Cleanliness (F), and Environmental Improvement (E) of the SAFE Strategy
<b>FGC</b>	Full Geographic Coverage
<b>FGD</b>	Focus Group Discussion
<b>FMOH</b>	Federal Ministry of Health
<b>GET2020</b>	WHO Alliance for the Global Elimination of Trachoma by 2020
<b>GSM</b>	Global Scientific Meeting
<b>ICTC</b>	International Coalition for Trachoma Control
<b>IDP</b>	Internally Displaced People
<b>IECW</b>	Integrated Eye Care Workers
<b>IGA</b>	Inter-grader Agreement
<b>ITI</b>	International Trachoma Initiative
<b>KETFO</b>	Kebele Elimination of Trachoma for Ocular Health
<b>LSHTM</b>	London School of Hygiene & Tropical Medicine
<b>MDA</b>	Mass Drug Administration
<b>MFTA</b>	More Frequent Than Annual
<b>MLVA</b>	Multiple Loci Variable Number of Tandem Repeat Analysis
<b>MOH</b>	Ministry of Health
<b>NPV</b>	Negative Predictive Value
<b>NTD</b>	Neglected Tropical Diseases
<b>OmpA</b>	Outer membrane protein A
<b>PCR</b>	Polymerase Chain Reaction
<b>PC-NTD</b>	Preventive Chemotherapy–Neglected Tropical Diseases
<b>PgP3</b>	High Plasmid Gene Protein 3
<b>PNSO</b>	Programme National de Santé Oculaire (National Eye Health Program)
<b>PTT</b>	Postoperative Trichomatous Trichiasis
<b>RCT</b>	Randomized Control Trial
<b>S1</b>	Stage 1
<b>S2</b>	Stage 2
<b>S3</b>	Stage 3
<b>S4</b>	Stage 4

<b>SAFE</b>	Surgery (S), Antibiotics (A), Facial Cleanliness (F), and Environmental Improvement (E)
<b>SANPLAT</b>	Sanitary Platform
<b>SPET</b>	Surveillance Post-Endémique du Trachome (Trachoma Post-Endemic Surveillance)
<b>STP</b>	School Trachoma Program
<b>TCP</b>	Trachoma Control Program
<b>TCS</b>	Tarsal Conjunctival Scarring
<b>TEC</b>	Trachoma Expert Committee
<b>TEO</b>	Tetracycline Eye Ointment
<b>TFGH</b>	The Task Force for Global Health
<b>TIS</b>	Trachoma Impact Surveys
<b>TSS</b>	Trachoma Surveillance Surveys
<b>TF</b>	Trachomatous Inflammation-Follicular
<b>TT</b>	Trachomatous Trichiasis
<b>UTT</b>	Unoperated Trachomatous Trichiasis
<b>VNTR</b>	Variable Number Tandem Repeats
<b>WASH</b>	Water, Sanitation, and Hygiene
<b>WGS</b>	Whole Genome Sequencing
<b>WHA</b>	World Health Assembly
<b>WHO</b>	World Health Organization



## Executive Summary

The 24<sup>th</sup> annual Trachoma Control Program Review was planned to be in person at The Carter Center in Atlanta, Georgia on March 6 & 7, 2023; however, due to the sudden news of former U.S. President Carter, the founder of The Carter Center, entering hospice care, the meetings pivoted to a virtual platform. The Carter Center thanks the partners and participants for their kindness, understanding and flexibility during this time and appreciates all the thoughtful messages received. In addition, the TCP greatly appreciated the camaraderie offered by ITI and TFGH in opening their doors so that many participants could attend, virtually, together in one room. To acknowledge the incredible dedication of the exceptional partners and teams in all the participating countries to eliminate trachoma as a public health problem, this year's program review theme was "The Trachoma End Game: The Power of Persistence, Partnership, and Passion." In attendance were representatives from the Ministries of Health and colleagues from The Carter Center offices in the five countries where the Center currently assists: Ethiopia, Mali, Niger, South Sudan, and Sudan. Partners and donors whose collaborative work make trachoma elimination possible also attended.

Similar to previous program reviews, this year provided an opportunity to evaluate the status of each national program and discuss progress toward reaching the elimination of trachoma as a public health problem. In 2022, the programs demonstrated persistence despite challenges related to several reoccurring themes: (1) political strife and conflict which caused programmatic suspension and access issues; (2) inflation across many countries due to COVID-19 and insecurity; (3) climate change with resultant flooding and famine in many areas; (4) access to extremely marginalized populations such as internally displaced people (IDP) and refugees; (5) funding and human resource deficits; and (6) donated antibiotic shortages. Despite these challenges, each Carter Center assisted country presented ambitious program plans for 2023. These plans position each country, uniquely, to mitigate risk and to achieve outputs in the implementation of each required component of the SAFE strategy to continue their progression towards achieving trachoma elimination thresholds.

In 2022, The Carter Center assisted programs provided TT surgery to 33,427 people, 23,059 of whom were women; distributed antibiotics to 10.3 million people; constructed 8,871 latrines; and trained 23,100 people to conduct health education.

The Amhara Program (Ethiopia), the largest of The Carter Center-assisted trachoma control programs, was greatly impacted by insecurity as well as the antibiotic shortage in 2022, yet still managed to distribute 9.1 million doses of antibiotic, provide 30,966 TT surgeries, and train more than 19,000 teachers and school directors to implement the School Trachoma Program in the estimated 8,700 primary schools in the region. In addition, they conducted 70 prevalence surveys to assess progress toward elimination and determine the need for additional intervention. Due to the tremendous efforts in the region, 59 districts in Amhara have achieved the elimination threshold for trachomatous inflammation-follicular (TF); this means that an estimated 6.6 million people, no longer require MDA to combat trachoma.

This past year, Mali completed its final two surveys in Douentza and Koro districts, in Mopti region, which are situated in one of the most insecure regions in central Mali. Results demonstrated that both districts achieved all WHO elimination thresholds, and the Mali National Program submitted a validation dossier to the WHO to demonstrate that all TF and TT thresholds have been reached and

that trachoma has been eliminated as a public health problem. This tremendous achievement is particularly impressive considering the high endemicity in the country at the start of the Program. The Carter Center began its partnership with Mali in 1998 and despite challenges throughout the years, the Program was able to provide TT surgery to more than 31,000 persons, distribute 818,878 doses of antibiotic, and train 7,775 masons who assisted in constructing 116,722 household latrines. To highlight this great feat Ms. Kelly Callahan, the TCP's Director, joined voices with many, many, many partners and Mr. Jason Carter, Board Chair of The Carter Center, in expressing congratulatory affirmations to Mali on their persistence over the past 25 years in eliminating trachoma as a public health problem!

Niger showed innovation and determination to overcome the end-game challenges to eliminate trachoma as a public health problem. They implemented the newly endorsed 'More Frequent Than Annual' (MFTA) MDA strategy in districts determined to be trachoma "persistent" and Niger conducted 22 surveys to assess the burden of disease and progress toward elimination, including in one refugee camp. They also finished data collection for the *Surveillance Post-Epidémique du Trachome* (SPET) collaborative study with The Carter Center; this study aimed to assess disease recrudescence in three previously hyperendemic districts (Bagaroua, Ilela and Malbaza) that have achieved TF elimination threshold of 5%.

In South Sudan, more people were treated during trachoma MDA and more prevalence surveys were conducted than any other year in program history. A new partnership between The Carter Center and the Himalayan Cataract Project that included the integration of both TT and cataract surgeries as well as other eye disease assessment services, allowed greater access to eye care services in areas The Carter Center supports.

The Sudan program, in collaboration with The Carter Center and Tropical Data, completed impact surveys in 11 evaluation units (EU) in 7 localities in the Darfur region. Eight of these surveys showed that TF was below WHO elimination thresholds and no longer require MDA. To ensure no one was left behind, MDA was conducted in 15 refugee camps.

The two-day review focused on the passion and persistence of country staff, ministries of health, and partners as we continue to strive toward the elimination of trachoma as a public health problem. The Carter Center's Chief Executive Officer Ms. Paige Alexander opened the program review by welcoming participants, reflecting on the 40<sup>th</sup> anniversary of The Carter Center's founding, and proudly expressed the decades-long commitment of staff and partners that make The Center a powerful beacon of hope. Ms. Alexander also highlighted the TCP's 25 years of progress toward the elimination of trachoma as a public health problem and noted through consistent collaboration, Mali was able to reach the elimination thresholds and is close to being validated by the WHO. This was followed by an encouraging message from Director General of the WHO, Dr. Tedros Adhanom Ghebreyesus, commending President Carter and The Carter Center for outstanding accomplishments in neglected tropical diseases elimination.

In her opening remarks, Ms. Callahan, highlighted the persistence, partnership, and passion that makes trachoma elimination possible. She highlighted what is possible with passion—it motivates and builds hope; it makes accomplishments of any size possible. Ms. Callahan referenced her favorite quote by President Carter, stating "I have one life and one chance to make it count for something...My faith

demands that I do whatever I can, wherever I can, whenever I can, for as long as I can with whatever I have to try to make a difference.” This quote brilliantly accentuates the definition of persistence coupled with passion as proven by the achievements made by Carter Center-assisted countries toward trachoma elimination over the years despite challenges. Ms. Callahan expressed The Carter Center’s pride and honor to be able to assist ministries of health on their road towards the elimination of trachoma as a public health problem, she shared her gratitude to partners and donors for the collaboration and support for making this progress possible, and emphasized how crucial that support will be in the years to come.

Throughout the program review, country-specific presentations were interspersed with multiple examples of ways The Carter Center and partners remain resolute in mitigating challenges and achieving the elimination of trachoma as a public health problem. Special topics included: Dr. Angelia Sanders, Associate Director of The Carter Center’s TCP, presented on *Enhancing the ‘A’ in SAFE* (ETAS), a joint study by the South Sudan Ministry of Health (MOH) and The Carter Center to determine feasibility, cost, and community acceptance of multiple rounds of MDA in a year. Dr. Emma Harding-Esch, Chief Scientist & Associate Professor at the London School of Hygiene and Tropical Medicine, and Dr. Emily Gower, Associate Professor at the University of North Carolina-Chapel Hill, presented on photography and innovations in global trachoma grading. Ms. Jaymie Bromfield, Graduate Assistant with the TCP and student at Emory University’s Rollins School of Public Health, presented on the photographic grading of the stages of conjunctival scarring. Ms. Kim Jensen, Associate Director of The Carter Center’s TCP, discussed the post-elimination surveillance study conducted in Niger, which assessed the risk of recrudescence using standard and enhanced indicators.

Miss Julie Jenson, Director of Product Access at Pfizer, Inc., and Dr. Paul Emerson, Director of the ITI, presented updates on Pfizer’s role in addressing trachoma internationally, catching up on manufacturing delays, and maintaining the Zithromax<sup>®</sup> supply chain. Mr. Oumer Shafi, Ph.D. Student and Research Project Manager at the London School of Hygiene and Tropical Medicine and The Fred Hollows Foundation, discussed *STRONGER SAFE*, a study that assesses enhanced MDA, face-washing campaigns, and supplying fly-repellent materials for trachoma elimination. Dr. Esmael Habtamu, Assistant Professor at the London School of Hygiene and Tropical Medicine and Director of Eyu-Ethiopia, presented two studies during the program review: the first was a proposed randomized control trial (RCT) to evaluate and monitor enhanced MDA in three regions of Ethiopia to combat “persistent” TF; and the second was an observational study in Ethiopia, Uganda, and Nigeria assessing the reliability of tarsal conjunctival scar grading in survey settings. Dr. Catherine Oldenburg, Associate Professor and Epidemiologist at the Francis I. Proctor Foundation at the University of California - San Francisco presented a study entitled *Kebele Elimination of Trachoma for Ocular Health* (KETFO), which examines quarterly MDA treatment for children and other core groups to fight against “persistent” trachoma. Dr. Anna Harte, Research Fellow at the London School of Hygiene and Tropical Medicine, presented changes in ocular chlamydial strains after 5 and 8-annual MDA rounds in Amhara. Dr. Amir Bedri Kello, Trachoma Medical Officer with the WHO Regional Office for Africa, discussed updates for the Expanded Special Project for the Elimination of Neglected Tropical Diseases (ESPEN) and the outcomes of the third Global Scientific Meeting (GSM) on TT. Mr. Tariku Wondie, Program Officer for Eyu-Ethiopia, presented a study on the effect of repeated epilation for minor trichiasis and its impact on surgical acceptance.

Dr. Kashef Ijaz, Vice President of Health Programs for The Carter Center, closed the program review with a summary of the two-day meeting. He congratulated the incredible persistence and passion of each country program and the power of partnership to advance the global program despite challenges faced. Dr. Ijaz commended the Amhara region for its achievements this past year, particularly the Amhara Program's *Wait-and-Watch* approach in addition to the impact of the School Trachoma Program (STP), a curriculum that promotes hand and face washing. Dr. Ijaz noted in Niger that strategizing TT case finding moving forward will ensure the country stays on track to join Mali in eliminating trachoma as a public health problem in the next three years. In Sudan, impact surveys continue to show the declining prevalence rates for TF and targets are being reached while the Program diligently persists toward the completion of baseline surveys in the Darfur region to achieve greater mapping. Also, Dr. Ijaz emphasized the historical record of people treated in South Sudan coupled with unprecedented surveys completed in 2022 with support from partners and donors. He further expressed excitement toward forthcoming results of the ETAS study on cost, feasibility, and community acceptance of enhanced MDA in South Sudan. Finally, on behalf of President and Mrs. Carter, The Carter Center, and all partners, Dr. Ijaz congratulated Mali for their accomplishments in trachoma elimination. This year's program review demonstrated that with persistence, partnership, and passion, incredible success can be accomplished despite global challenges. Emphasizing how partners of The Carter Center are constantly building a global program and addressing challenges with innovation and collaboration, Dr. Ijaz echoed the remarks made by Ms. Callahan, that The Carter Center remains proud of its partnerships that will eliminate trachoma as a global public health problem.

## **SAFE in Ethiopia**

*Presented by Mr. Fikre Seife, National NTD Program Coordinator,  
MOH – Ethiopia*

### **Background**

Ethiopia has the highest burden of trachoma in the world with approximately 72 million people at risk of trachoma, constituting nearly 50% of the global burden. The 2006 National Survey on Blindness, Low Vision, and Trachoma revealed that 2.8 million people in Ethiopia had low vision, and 1.2 million people were blind. It was estimated that 87% of this blindness was from avoidable diseases. This survey revealed that active trachoma was endemic in virtually all country regions, with more than 1.3 million people living with TT.

Ethiopia has shown great dedication to addressing the country's trachoma burden along with other neglected tropical diseases (NTDs). The mean prevalence of active trachoma in Ethiopia has reduced from 28.33% at the 2001 baseline to 12.81% in 2022; the mean prevalence of TT has decreased from 4% to 0.73%. Though Ethiopia has observed great progress, trachoma remains a public health problem in an estimated 63% of districts, thus requiring ongoing implementation of the SAFE strategy.

### **Surgery (S)**

Since 2003, over 1.6 million people have received corrective TT surgeries in Ethiopia. With the inception of the National Program's Fast Track Initiative in 2015, established to increase surgical outputs, through 2020, a total of 648,924 people received TT surgery in individuals 15 years and above. Despite this amazing success, there are still an estimated 342,800 TT cases that require management. The Program was unable to perform the planned number of TT surgeries in 2020-2021 due to the global pandemic and insecurity in Ethiopia however, in 2022, over 92,000 cases were operated, more than doubling the number of surgeries conducted in 2021. The National Program's TT elimination efforts have been bolstered by the integration of TT screening with MDA. This minimizes missed opportunities for TT detection, referral, and treatment. To enhance the strength and capacity for addressing the remaining TT cases, the National Program has implemented several training efforts in 2022, including the training of 1,400 integrated eyecare workers (IECWs) who were deployed to trachoma endemic districts; this is a 265% increase from the 383 IECWs trained in 2021. Additionally in 2022, 5,529 individuals were trained as trachoma case finders, and similar training efforts will continue in 2023.

### **Antibiotic Therapy (A)**

The TF prevalence in Ethiopia continues to decrease and approaches the 5% threshold for elimination in many districts. Baseline estimates showed that of Ethiopia's 800 districts, 352 had a TF prevalence of  $\geq 30\%$  (hyperendemic) and 154 districts were below the 5% elimination threshold. As of 2022, 296 districts were found to be below the 5% elimination threshold. These trends are largely due to the National Program's antibiotic administration efforts. The number of antibiotic doses distributed in Ethiopia has increased over time; and since trachoma MDA began in 2003, over 500 million doses of Zithromax<sup>®</sup> have been distributed. In calendar year 2022, the Ethiopia National Program provided over 26.5 million people with Zithromax<sup>®</sup>. Nationally, the mean TF prevalence has reduced from 28.33% at baseline to 12.81% in 2022, the equivalent of more than a 55% reduction overall from

baseline. As of January 2023, 296 districts and two refugee camps have fallen below the 5% TF elimination threshold; this equates to over 30 million people that no longer require MDA to fight trachoma. To improve field staff morale, peer influence, and provide technical and administrative support during implementation, text message groups were developed at the MOH, regional, and zonal levels to exchange information and provide timely feedback.

### **Facial Cleanliness (F) & Environmental Improvement (E)**

To enhance the success of mass antibiotic treatment, F & E strategies must be implemented. Ethiopia administered school-based interventions in 2022 through school trachoma clubs and the STP in Amhara, which incorporates trachoma lessons into the curriculum to teach hygiene promotion in a fun, educational way. Community-based interventions have improved trachoma education with Community Led Total Sanitation, Hygiene and Sanitation Marketing, the Health Extension program, which provides trachoma messaging door-to-door or during community gatherings.

Ethiopia integrates health education for trachoma prevention with MDA campaigns, promoting personal hygiene and raising awareness about MDA.

The National Program is also making improvements to water and sanitation facilities, rehabilitating non-functional water schemes for schools and communities, producing liquid soap with local associations as sanitation marketing, and constructing shallow water wells at school and community levels.

In 2022, seven regions also launched the Woreda Level Water, Sanitation, and Hygiene (WASH)-NTD coordination toolkit, which promotes regional joint planning, monitoring, and assessments to enhance the role of WASH strategies in NTD elimination. To date, over 370 districts have received coordination training to establish a Technical Working Group and Taskforce, which will function at national and regional levels.

### **Programmatic Challenges**

The National Program has had to work through immense challenges to attain such high accomplishments. These challenges include:

- Security concerns which disrupted the provision of TT surgery in parts of Amhara, Afar, Oromia, and Tigray regions.
- Low TT surgical uptake, including increased rates of refusals in some areas.
- A “pass rate” for 2022 trachoma impact survey (TIS) of 28% and 192 districts persistent for trachoma (those not achieving TF <5% in 2 or more TIS).
- A “pass rate” for 2022 trachoma surveillance survey (TSS) of 9.5% with 62 recrudescence districts (those not achieving TF <5% after TSS).
- Inadequate household access to safe water supplies.
- Limited use of the District Health Information Software 2 platform for reporting and program management.

## **Programmatic Initiatives**

The MOH held its second annual Ethiopia Trachoma Advisory Group (ETAG) meeting in 2022 in Addis Ababa. ETAG was established in 2021 to provide scientific and technical guidance to the National Program. During the 2022 meeting, the ETAG discussed guidelines and rollout plans for full geographic coverage of TT case finding and service provision and recommended rapid implementation of the national Post-Operative TT (PTT) management guidelines currently approved by the MOH. The ETAG also discussed the districts that are struggling to achieve elimination thresholds and the importance of ensuring optimal MDA coverage for children, particularly in persistent and hyperendemic districts; they also suggested further investigation of districts that do not achieve the elimination threshold at survey, and identified alternative strategies that may help Ethiopia move toward elimination targets. The meeting also discussed the need for investment to improve implementation of WASH hardware/software and using WASH data to prioritize and monitor areas with low WASH coverage.

To address the challenges and reach the targets above, the National Program has several key initiatives planned. To address the hyperendemic, persistent, and recrudescing districts, the National Program plans to implement enhanced MDA (whereby districts receive multiple annual rounds of MDA). The implementation guide for enhanced MDA, also termed “child MDA” in Ethiopia, has been developed; seven districts have been selected to pilot enhanced MDA, one of which had already completed implementation. Additionally, where there is a justifiable expectation that TF will regress to <5%, MDA will be discontinued, and districts will remain under surveillance. The National Program also plans to strengthen F & E intervention packages by encouraging community engagement, using available resource materials to generate evidence on the intervention’s efficacy. Through operational research, the National Program aims to promote evidence-based decision-making in its work toward all these initiatives.

## SAFE in Amhara, Ethiopia

*Presented by Mr. Adisu Abebe, NTD Case Team Leader,  
Amhara Regional Health Bureau*

### Background

In 2007, a trachoma prevalence survey was conducted at the zonal level for the Amhara region of Ethiopia, to quantify the zonal prevalence of both active trachoma and TT. Based on the results, all zones in the Amhara region were eligible for the full SAFE strategy and an estimated 643,904 people required surgery to correct TT. Since 2001, the Amhara Regional Health Bureau (ARHB) has been working with The Carter Center to implement the full SAFE strategy, completing a total of more than 757,400 surgeries, and distributing over 211 million doses of antibiotics.

As of December 2022, 59 out of 166 districts in the Amhara region have reached the 5% elimination threshold for TF and are exempt from MDA. This leaves 107 districts with an estimated population of 16.3 million people still requiring MDA against trachoma. None of the 166 districts have reached the WHO 0.2% TT elimination threshold; currently there are an estimated 114,000 people who still require TT surgery to reach elimination threshold. To ensure nobody is left behind and TT cases are offered surgery, house-to-house case findings were conducted in 32 districts in 2022, resulting in 22,845 confirmed cases of TT and 18,094 individuals operated. The Amhara region remains focused on reaching the elimination of trachoma as a public health problem by intensifying TT outreach and ensuring good geographic coverage, while maintaining the focus on quality.

**Table 1. Program Achievements in 2022**

Indicator	Goal	Amhara Region (Carter Center-Assisted)	
		Target	Achieved
# of persons operated	141,978	38,981	30,966 (79%)
# of women operated			21,464
# of surgeons trained		40	112 (280%)
# of surgeons retrained		108	136 (126%)
Doses of Zithromax® distributed during MDA	16,838,165	16,838,165	8,929,541 (53%)
Doses of tetracycline distributed during MDA*	343,636	343,636	194,978 (56.7%)
# of impact surveys administered		78	70

### Surgery (S)

The burden of TT in Amhara remains above the 0.2% elimination threshold for all 166 districts in the region, though nearly 49% of all districts have fewer than 499 estimated TT cases remaining in each of these districts. Since 2001, 757,405 TT surgeries have been conducted in Amhara, though the annual surgical output had declined in recent years due to the global pandemic and insecurity. In 2022, however, 30,966 people received TT surgery across the Amhara region; of those operated, 21,464 (69%) were women. This is over 20,000 more surgeries in 2022 as compared to 2021, demonstrating



the dedication of the entire Amhara region. To support the ongoing need for quality surgical provision, in 2022, the program trained 112 new TT surgeons, known locally as IECWs, and re-trained 136 existing IECWs, or 280% and 126% of the 2022 target, respectively. In 2022, the ARHB also maintained its dedication to surgical quality by certifying 12 IECW trainers, auditing 50 IECWs, and providing supportive supervision to 71 IECWs.

### **Antibiotic Therapy (A)**

By the end of 2022, 59 of the 166 districts in the Amhara region reached the elimination target for TF and no longer require MDA for trachoma; this includes 48 districts that remained below the elimination threshold at surveillance survey. This achievement shows great progress throughout the region compared to the survey results through 2015, when only nine districts were below 5% TF. In 2022, Amhara conducted MDA in 62 districts, administering 9,124,519 doses of antibiotics, or 53% of the annual target. Due to delays related to insecurity and a shortage of Zithromax<sup>®</sup>, 50 districts, located largely in East Amhara, could not be completed and are planned for April 2023.

### **Facial Cleanliness (F) & Environmental Improvement (E)**

In 2022, Amhara's regional trachoma program remained focused on implementing F&E through health education activities in communities and in schools. To support the STP, 19,555 teachers and principals were trained on the STP curriculum, which provides lessons and supporting materials for teachers to implement health education related to trachoma prevention in primary schools. The STP reaches 8,576 primary schools in the region and has been implemented since 2017 with great success. On average, 88% of schools submit quarterly reports and nearly 84% conduct facial cleanliness assessments as a trachoma prevention activity. To enhance the STP, water points were constructed in 12 schools in the region and were monitored for functionality and maintenance. Due to the success of the STP in primary schools, the ARHB and The Carter Center, in collaboration with the Amhara Bureau of Education, created a pre-school level curriculum which is being piloted in 60 schools.

### **Surveys**

In 2022 the Program completed 70 surveys to assess disease burden and progress to elimination. Of the surveys completed, constituting 90% of the annual target, 67 were TIS and 3 TSS; the remaining eight surveys were not conducted due to insecurity. Of the districts surveyed, 13 fell below the elimination threshold for TF while 107 remained above the elimination threshold. Eight districts were not surveyed by TSS due to insecurity, and of the 166 districts surveyed by TSS, 42 achieved the TF elimination threshold.

### **Programmatic Challenges & Successes**

A shortage of Zithromax<sup>®</sup> and insecurity in some parts of the region affected program implementation, mostly the ability to conduct surveys and MDA. Low WASH coverage also continues to be a challenge in Amhara, which may delay the region's ability to swiftly eliminate trachoma as a public health problem. The region is also facing challenges of persistent and recrudescing trachoma—with 97 districts defined as persistent and 10 as recrudescing. To mitigate this challenge, the Program is considering alternative strategies, including expanding the Wait & Watch approach, initially implemented in Metema and Woreta Town; prioritizing districts with TF above 30%; and conducting more frequent than annual MDA where appropriate and feasible. It is this kind of alternative thinking

to address challenges that have resulted in great success in Amhara. In 2022 alone, despite insecurity, the Program completed nearly 31,000 surgeries, 62 MDAs, and 70 surveys; continued the implementation of the School Trachoma Program in more than 8,500 schools; conducted the pilot of the pre-school trachoma curriculum; collected ocular swabs to test for chlamydial infection at the regional lab; and used photographs from Amhara and collaborating countries to assess eyelids for signs of trachoma at the University of Gondar.

### **Program Plans for 2023**

#### *Surgery (S)*

- Operate 43,425 TT cases
- Train 50 new IECWs
- Retrain 70 IECWs

#### *Antibiotic Therapy (A)*

- Distribute 15,170,853 doses of Zithromax®
- Distribute 325,904 doses of Tetracycline Eye Ointment (TEO)

#### *Facial Cleanliness (F) & Environmental Improvement (E)*

- Target 8,576 schools for STP implementation and supervision
- Target 100% of schools to report F & E activities
- Improve latrine coverage to 30%

#### *Surveys*

- Conduct TIS in 28 districts
- Conduct TSS in 7 districts

Amhara, Ethiopia – TT Prevalence: Adults 15 ≥ Years

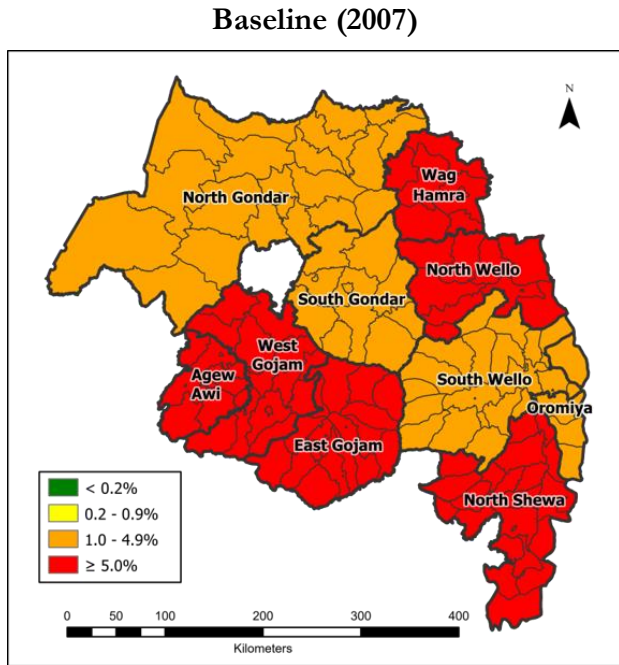


Figure 1 – Estimated TT prevalence at baseline

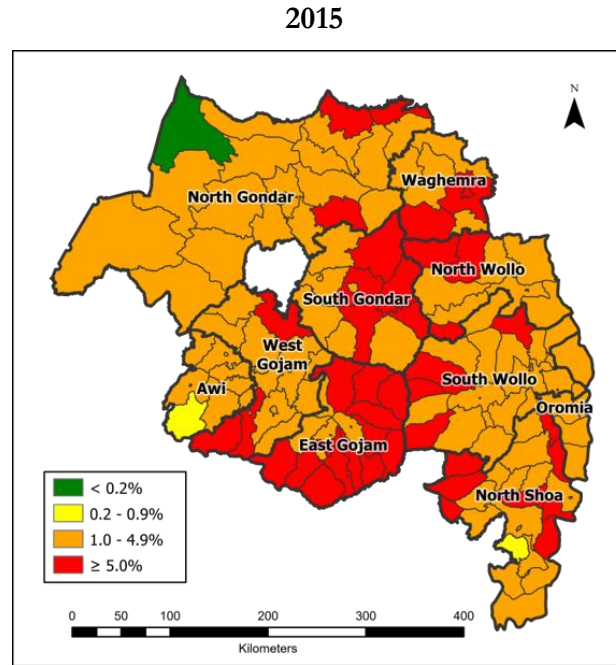


Figure 2 – Estimated TT prevalence through 2015

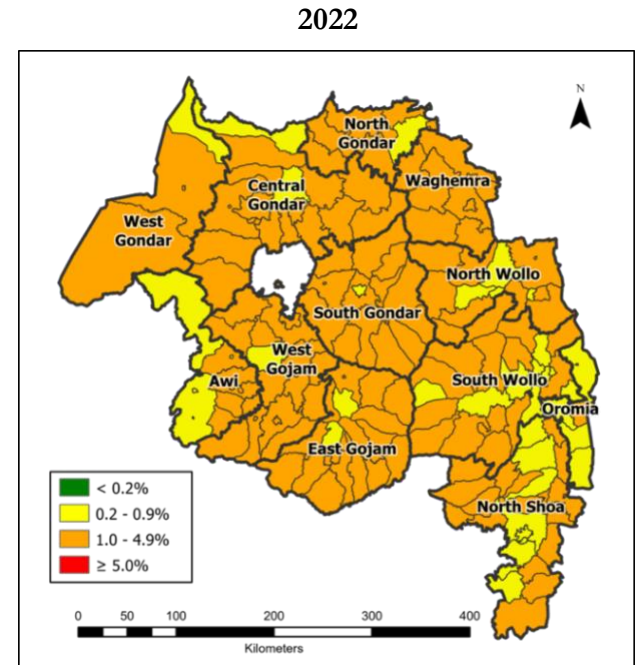


Figure 3 – Estimated TT prevalence through 2022

Amhara, Ethiopia – TF Prevalence: Children 1–9 years

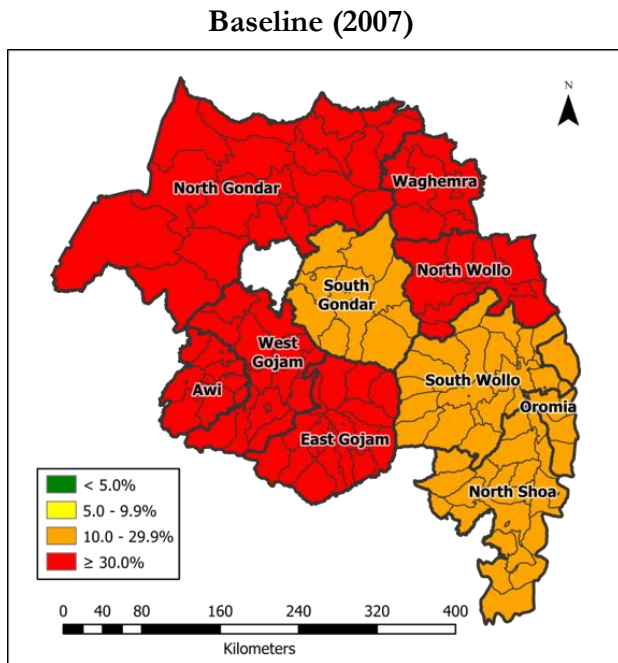


Figure 4 – Estimated TF prevalence at baseline

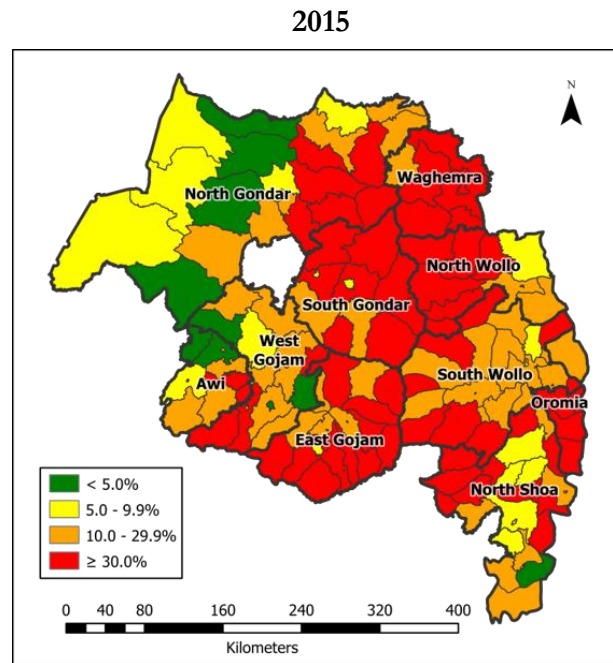


Figure 5 – Estimated TF prevalence through 2015

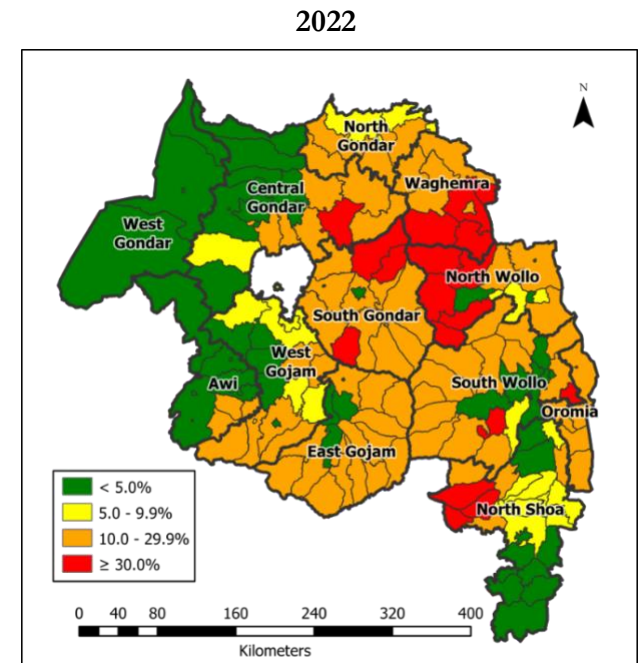


Figure 6 – Estimated TF prevalence through 2022

Amhara, Ethiopia – MDA and Survey Maps

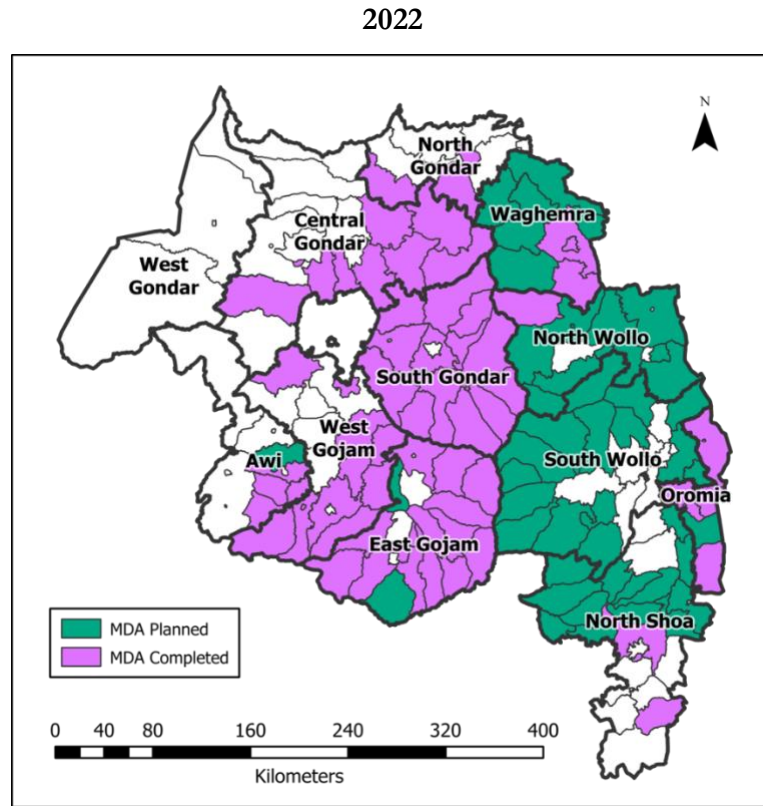


Figure 7 – Completed MDA in 2022

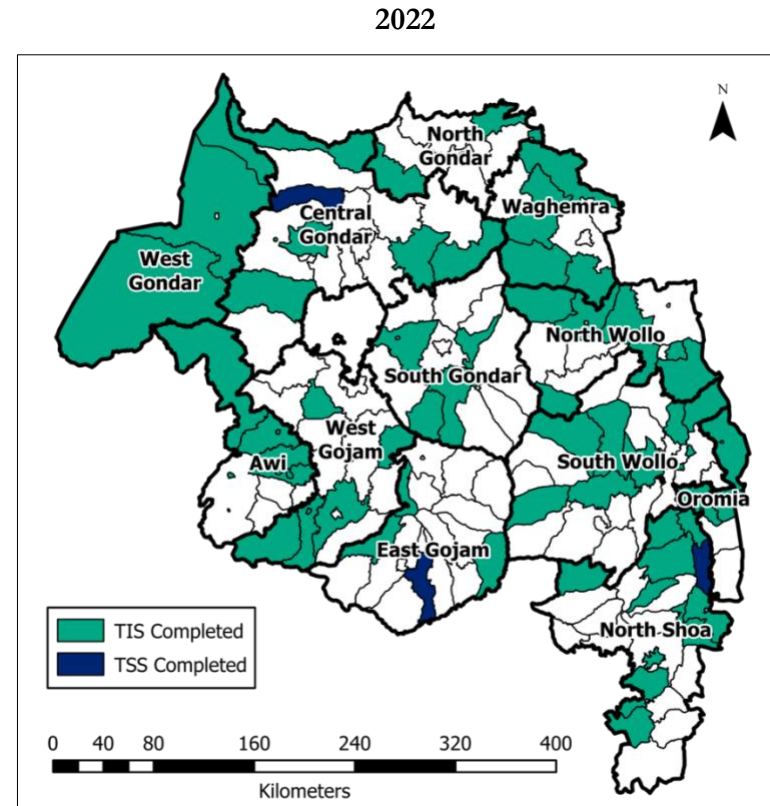


Figure 8 – Completed Surveys in 2022

## **Persistence in the End Game: Mali's Success**

*Presented by Professor Lamine Traoré, National Coordinator, Programme National de Santé Oculaire (PNSO),  
MOH – Mali*

### **Background**

Following prevalence surveys conducted in 1996-1997 which identified trachoma as a major public health issue, noting an estimated 85,000 persons with TT required surgery, the PNSO established the National TCP in 1999. To eliminate trachoma as a public health problem, Mali implemented the full SAFE strategy, with the support of The Carter Center (since the program's inception) and with other organizations such as Helen Keller International and Sightsavers, all of which continued to support the trachoma efforts through 2022. Mali conducted MDA, surgery for TT (including complete *ratissage*, or house-to-house case finding, to address the final cases), SANPLAT (Sanitary Platform) latrine construction, training of masons, and health education through radio and the support of community health workers.

To achieve the elimination thresholds for trachoma, the PNSO in Mali completed 89,821 TT surgeries, of which 53,883 (60%) were women; trained 200 new and retrained 105 existing TT surgeons; distributed 29,126,964 doses of Pfizer donated Zithromax<sup>®</sup> and 582,539 doses of TEO; and built 155,686 latrines. In addition, 7,576 villages received trachoma health education.

### **Route to Elimination**

The National Program conducted baseline surveys in 1996 and found the entire nation of Mali to be highly endemic of trachoma, with every district endemic for TF ranging from 23-30% in children ages 1-9; and most areas of Mali endemic for TT between 0.2-1%. Though the progress was hard-fought, the Program did see progress. By 2009 many districts had achieved the 5% threshold for TF and the estimated number of TT surgeries remaining had been reduced from 85,000 to less than 41,700. By the end of 2016, all districts in Mali reached the 5% TF elimination threshold for children ages 1–9 years and no further MDA was required yet TT was still a challenge in some districts. To address TT, in addition to surveys, the National Program implemented complete *ratissage*, in select areas to find the remaining TT cases and demonstrate that the burden of TT had been addressed. In total, Mali completed *ratissage* in nine districts and the data will be used as evidence of elimination for their WHO dossier for validation. In 2022, the National Program completed the final two surveys in Douentza and Koro districts in the Mopti region which demonstrated that the elimination threshold for TT had been reached, and ultimately the TF and TT elimination thresholds for all districts in Mali had thus been achieved. As such, in December 2022, the National Program submitted its trachoma elimination dossier to the WHO for validation.

### **Transition Planning Update**

To ensure incident cases of TT can be addressed once elimination is achieved, which is a requirement of elimination validation, the National Program developed a plan for transition. The eye health system in Mali is prepared to address TT, as trachoma and TT have been included in the eye health training program since 1978. The key trachoma indicators have also been included in the District Health Information Software 2 system, so the PNSO can document incident cases moving forward. Due to challenges related to human resources and funding, some additional activities have been delayed but

are planned for 2023. This includes training 52 TT trainers in Mopti, Segou, and Sikasso who will continue to conduct refresher training as required for TT surgery; training 400 nurses in Mopti and Sikasso to diagnose and refer cases of TT; and collaborate with the WASH community and revise radio messages to address preventive behaviors to ensure trachoma elimination after it has been achieved.

### **Insecurity**

On the path toward elimination, the Mali program faced significant challenges related to insecurity. From 2012 forward, Mali was engulfed in a multidimensional crisis that began with isolated attacks and accelerated to the movement of terrorist groups and multiple coup d'états. To continue key implementation in insecure areas while also ensuring the safety of teams and community members, the National Program employed various strategies which included targeted *ratissage*, partnering with local people with knowledge of the area to carry out activities, communicating with authorities and transiting through other countries to reach certain districts that are difficult to access.

### **Dossier Transition Challenges and Lessons Learned**

The Program faced many challenges, however through resilience, the Program persisted and innovated in times when threats and constraints weighed heavily on elimination activities. Most notably, it is necessary to have a data manager with a plan for writing the dossier prior to the end of program activities and to develop a realistic transition plan before elimination. Good collaboration between stakeholders, program and administrative employees, and political authorities is also essential. Ultimately, is it necessary to persevere; persevere to the end, despite insecurity, challenges, and setbacks to elimination activities.

## Mali – TT Prevalence: Adults ≥ 15 years

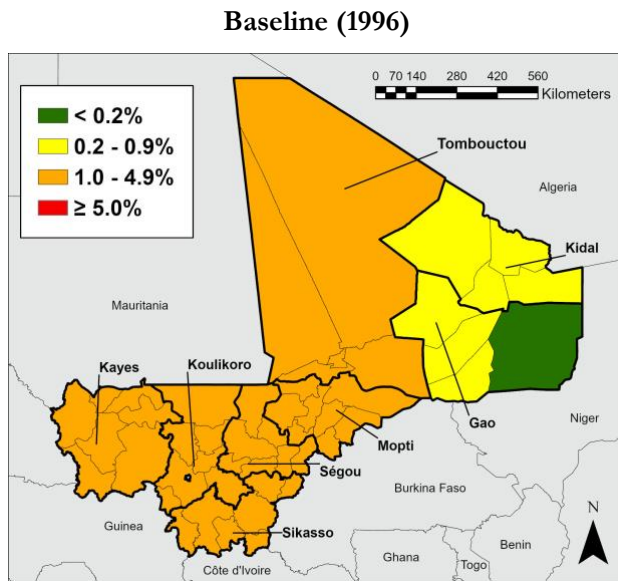


Figure 1 – Estimated TT prevalence at baseline

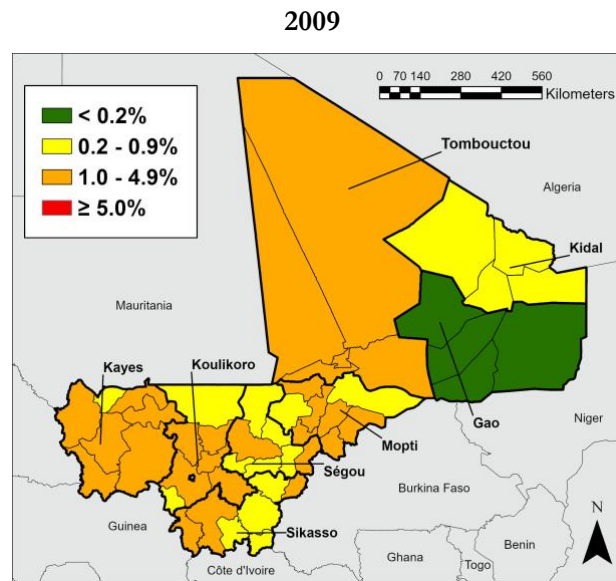


Figure 2 – Estimated TT prevalence through 2009

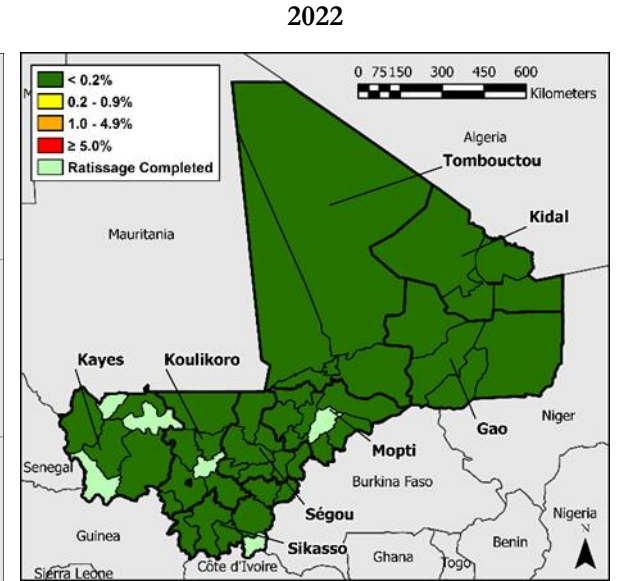


Figure 3 – Estimated TT prevalence through 2022



## Mali – TF Prevalence: Children 1–9 years

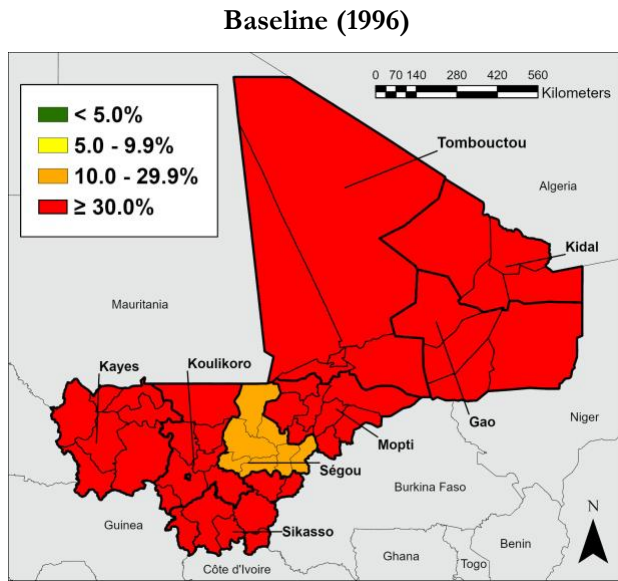


Figure 4 – Estimated TF prevalence at baseline

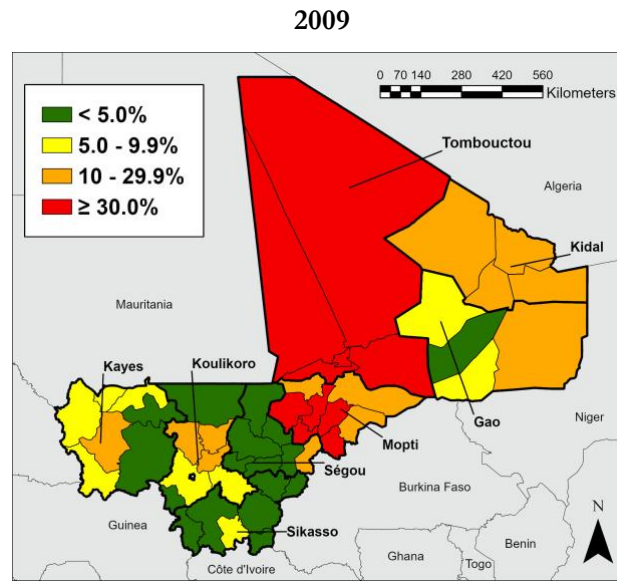


Figure 5 – Estimated TF prevalence through 2009

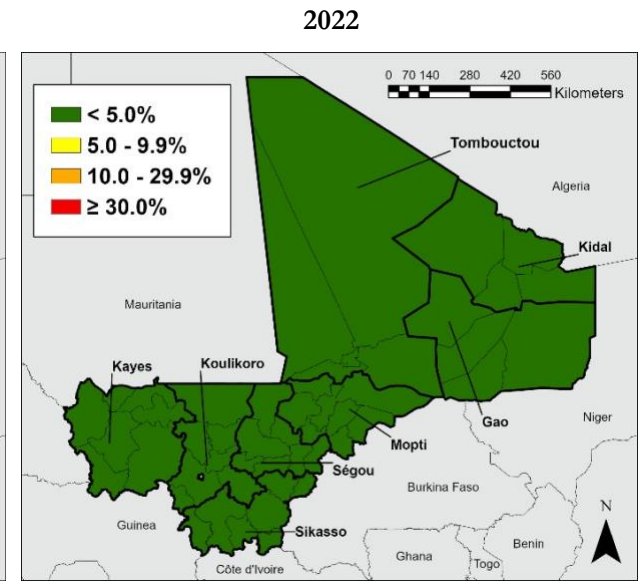


Figure 6 – Estimated TF prevalence through 2022

## SAFE in Niger

*Presented by Dr. Ibrahim Almon, Deputy Coordinator, PNSO, MOH – Niger*

### Background

The PNSO, formerly the Programme National de Lutte contre la Cécité, was established in 1987; results from national surveys at the time showed a prevalence of blindness of 2.2%, with 25% of the blindness due to trachoma. Baseline surveys conducted in various regions from 1997 to 1999 found that 1.7% of women over 15 years of age had TT and 44% of children ages one to nine years had active trachoma. To assist in further reducing the prevalence of trachoma in Niger, the PNSO formed the National Trachoma Task Force in 1999 and began district-level prevalence surveys in 2001. According to recent surveys, there are 12 EUs remaining to achieve the elimination threshold for TF (5%). The Program has targeted 2027 to eliminate trachoma as a public health problem in Niger.

**Table 1. Program Achievements in 2022**

Indicator	National		Carter Center-Assisted	
	Target	Achieved	Target	Achieved
# of persons operated	3,600	3,888	2,000	1,829
# of women operated		2,406		1,122
# of surgeons trained	26	16	10	00
# of doses of Zithromax® distributed during MDA	2,384,859	2,231,228	N/A	N/A <sup>1</sup>
# of doses of TEO distributed during MDA	73,758	73,891	50,000	80,000 <sup>2</sup>
# of villages with health education	550	388	550	388
# of household latrines built	20,000	40,595*	N/A	8,871**
# of radio messages broadcasted	N/A	55,152	N/A	33,192

*\*Includes the following types of latrines: Ventilated Improved Pit, Community-Led Total Sanitation, and Block*

*\*\*Includes the flowing types of latrines: SANPLAT and Block*

### Surgery (S)

Since 2000, Niger has completed over 160,000 surgeries; The Carter Center has assisted the PNSO to complete 90,193 of those surgeries since 2009. In 2022, the National Program performed 3,888 TT surgeries achieving 116% of the annual target. The Carter Center assisted the PNSO to complete 1,829 of the total surgeries, 61.3% of which were provided to women. The PNSO also trained 16 TT surgeons to support the efforts to provide surgery to the remaining individuals with TT. In 2022, a workshop was conducted, and health education and promotion materials were revised to enhance social mobilization and increase acceptance of surgery for those suffering from TT. According to recent provisional data, 47 EUs remain above the 0.2% elimination threshold. The National Program

<sup>1</sup> The Carter Center does not currently assist MDA implementation in Niger.

<sup>2</sup> The Carter Center does assist in purchasing tetracycline for MDA but does not participate in distribution activities.

plans to implement a series of *ratissage* and survey strategies to address this burden and demonstrate achievement of elimination thresholds.

### **Antibiotic Therapy (A)**

In 2022, the National Program distributed 2,231,228 doses of Pfizer-donated Zithromax<sup>®</sup> and 74,586 doses of TEO (provided by The Carter Center). This included a second round of MDA that was conducted in four districts determined to be persistent or recrudescing for trachoma.

### **Facial Cleanliness (F) & Environmental Improvement (E)**

In 2022, Niger broadcasted 55,152 radio messages about trachoma prevention to communities throughout the country; 33,192 of the radio messages were supported by The Carter Center. A total of 40,495 latrines were also constructed; 8,871 of the latrines were constructed with support from The Carter Center and consisted of household SANPLAT latrines and block latrines constructed for select schools.

To enhance WASH activities in Niger, the PNSO has formed a multisectoral coalition and has requested advocacy from the Social and Cultural Affairs Commission of the National Assembly of NTDs with specific action plans.

### **Surveys**

In 2022, the National Program completed 22 surveys, including nine TIS, 12 TSS, and one baseline at the Saya refugee camp. Niger has made great progress toward the elimination of trachoma as a public health problem, with only 12 EUs remaining that are above the 5% threshold.

### **Programmatic Challenges and Successes**

The National Program has faced challenges that may delay the achievement of elimination, if not mitigated. These challenges include insecurity and inaccessibility. To address the challenge of recrudescing districts, recently defined as districts that have fallen below the 5% threshold at TIS and return above 5% at TSS and persistent districts, defined as districts that have not achieved the 5% threshold despite years of MDA and multiple TIS rounds, the program implemented two rounds of MDA annually. To ensure access and manage safety concerns in insecure areas, the PNSO partnered with local agents when planning and conducting field interventions; given their knowledge of the terrain and communities, they could provide information about periods to conduct or postpone activities.

Due to unstable estimates for TT, and as Niger nears the elimination threshold for TT and the remaining cases become more difficult to locate, the organization of surgical camps has become more difficult, with diminishing surgeries at each camp. In response, the Program has organized two social mobilization workshops to develop health education and social mobilization messages for TT, to encourage those with TT to seek out and accept care. The program also plans to conduct complete *ratissage* in 2023 to find the remaining cases and demonstrate that the burden of TT has been addressed. Despite challenges the Program has faced, it has also seen success by strategizing with partners and creating innovative solutions to ensure that the country reaches the elimination thresholds by 2027.

### **Program Plans for 2023**

In 2023, the Program plans to conduct complete *ratisage* where appropriate to eliminate the backlog of TT and collect data for the WHO dossier to demonstrate that the burden of TT in each district has been addressed. The PNSO also plans to conduct MDA in six districts, TIS in six districts, and TSS in 15. An estimated 12 districts are also targeted for TT-only surveys, which are districts that have completed their TSS and achieved the elimination for TF but not for TT. As the elimination target is set for 2027, the Program is also taking steps to plan transition activities and begin developing the elimination dossier.

In 2023, the Program aims to distribute 1,343,434 doses of Zithromax<sup>®</sup> and 50,000 doses of TEO. Niger expects to conduct the final five TSS surveys in 2026. In addition, an estimated 5,169 people in Niger will require surgery thus reaching the end game and achieving the elimination of trachoma as a public health problem by 2027.

#### *Surgery (S)*

- Operate 3,600 TT cases, 1,800 with Carter Center assistance

#### *Antibiotic Therapy (A)*

- Distribute 1,343,434 doses of Zithromax<sup>®</sup>

#### *Facial Cleanliness (F) & Environmental Improvement (E)*

- Construct 50,000 household latrines, 10,000 with Carter Center assistance
- Construct 200 school block latrines, 20 supported with Carter Center assistance

#### *Surveys*

- Conduct 23 prevalence surveys, four (TT-only surveys) with Carter Center assistance

## Niger – TT Prevalence: Adults ≥ 15 years

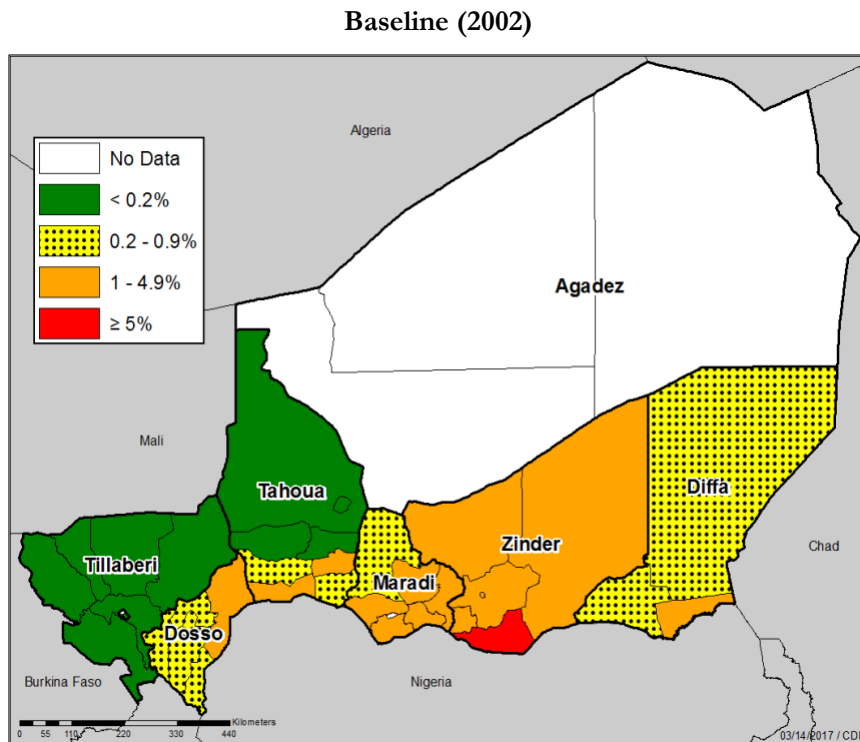


Figure 1 – Estimated TT prevalence at baseline

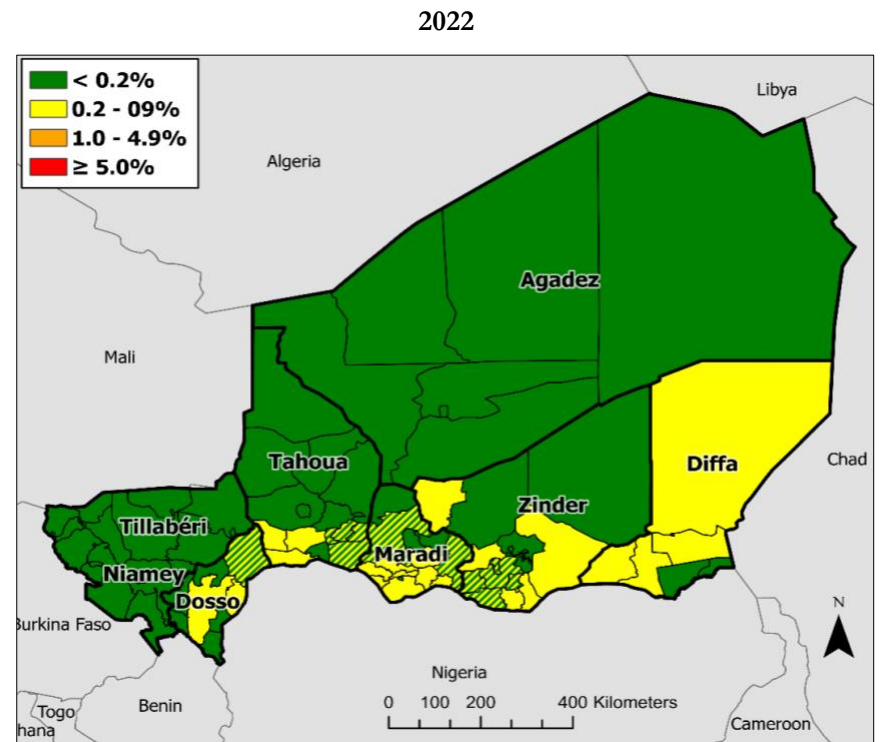


Figure 2 – Estimated TT prevalence through 2022

## Niger – TF Prevalence: Children 1–9 years

Baseline (2002)

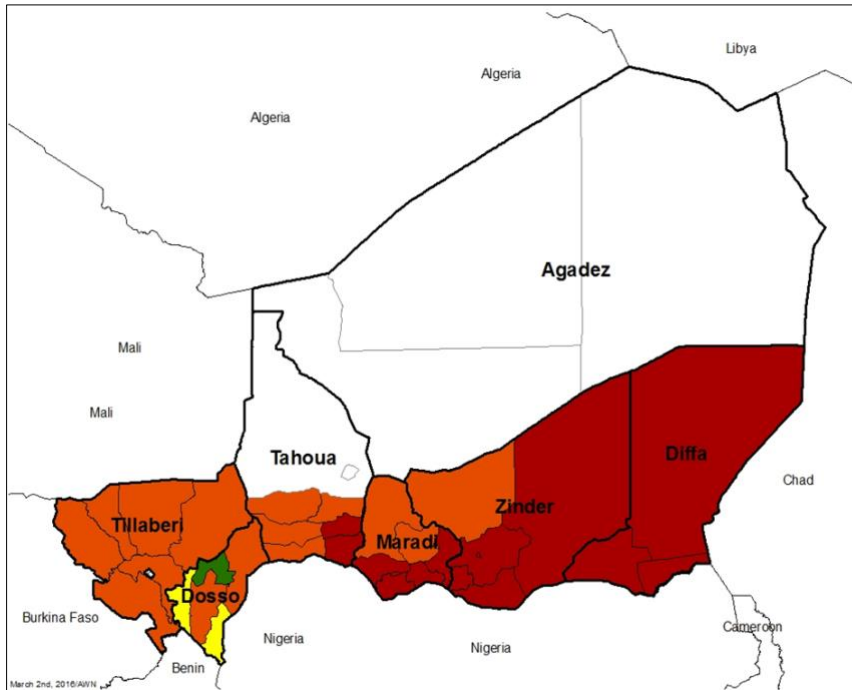


Figure 3 – Estimated TF prevalence at baseline

2022

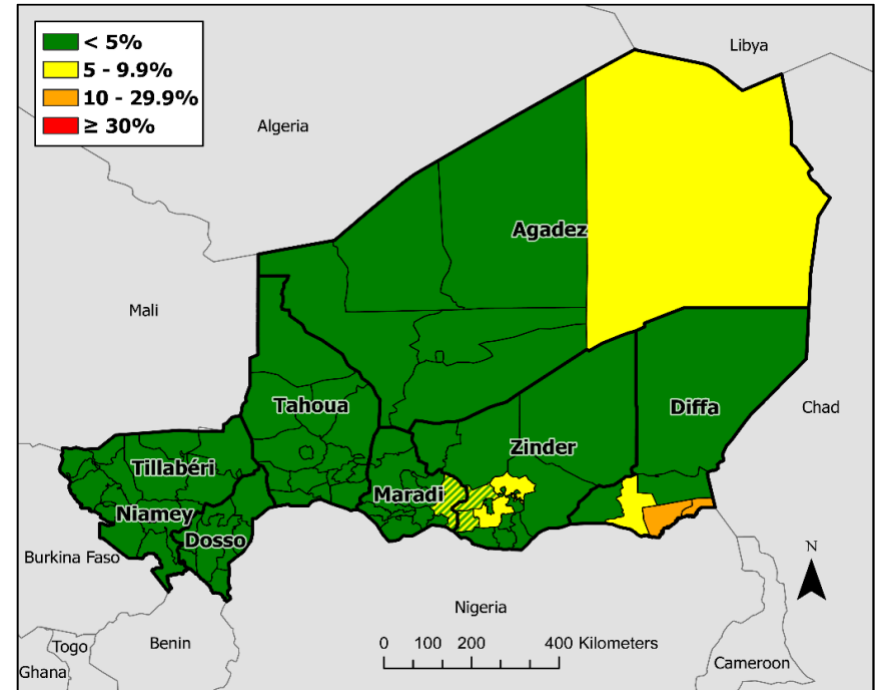


Figure 4 – Estimated TF prevalence through 2022

## SAFE in South Sudan

*Presented by Mr. Yak Yak Bol, Director for Preventive Chemotherapy (PC) – PC-NTDs,  
MOH, South Sudan*

### Background

In South Sudan, baseline prevalence surveys showed TF prevalence as high as 80% among children ages one to nine years old and TT prevalence as high as 15.1% among adults 15 years and older. Half of the country has not received baseline surveys, so the true magnitude of trachoma in South Sudan is unknown. The Program is making significant strides to reduce unknowns, and 2022 efforts yielded the highest number of trachoma surveys conducted in one year in South Sudan’s programmatic history. Additionally, more people were treated with antibiotics in 2022 than any other year in the national Program’s history. This past calendar year, the South Sudan MOH celebrated World NTD Day, received funding from the Accelerate Resilient, Innovative, and Sustainable Elimination (ARISE) of NTDs Fund, Phase II, and developed an NTD master plan to address trachoma and other endemic NTDs.

**Table 1. Program Achievements in 2022**

Indicator	National		Carter Center-Assisted	
	Target	Achieved	Target	Achieved
# of persons operated	1,500	1,875 (125%)	500	62 (12%)
# of women operated		1,379		50
# of surgeons trained/retrained	12	12 (100%)	-	-
# of doses of Zithromax <sup>®</sup> distributed during MDA	1,320,410	1,072,927 (81%)	316,828	381,876 (120%)
# of doses of TEO distributed during MDA	164,164	71,826 (44%)	23,568	20,574 (87%)
# of villages with health education	3,276	3,263 (99.6%)	2,916	3,263 (112%)

### Surgery (S)

Since 2001, the National Program has provided 24,568 TT surgeries across South Sudan. A total of 1,875 surgeries were conducted in 2022, 62 of which were assisted by The Carter Center. Of the surgeries undertaken, 74% were provided to women. Surgical interventions increased in 2022, nearly doubling the number of surgeries conducted in 2021. Surgical activities conducted by the MOH in South Sudan include planning meetings with the state MOH, County Health Department, and recruitment for TT case finders to be trained and deployed in villages. The MOH is also sponsoring community awareness and sensitization meetings with local leaders across villages including church leaders, female groups, teachers, and health staff. In 2022, the National Program conducted TT and cataract integrated camps, increasing surgery acceptability and TT uptake in a cost-effective manner, with maximized resources for the project. This integrated approach will continue in 2023.

## **Antibiotic Therapy (A)**

Of the annual MDA target for 2022, the Program reached 1,144,753 million people with azithromycin and TEO across 13 South Sudan counties—four in Eastern Equatoria state (Kapoeta East, Kapoeta South, Budi, and Lopa-Lafon) supported by The Carter Center, and nine in Unity state supported by the Christian Blind Mission. Protection of civilian and IDP camps were included as part of MDA in Unity state. Conducting MDA requires selecting community drug distributors (CDDs) from their respective communities, ensuring women are involved in the CDD team for outreach. MDA campaigns are launched by local leaders, requiring joint planning and cross-border coordination to account for every individual during MDA.

## **Facial Cleanliness (F) & Environmental Improvement (E)**

The National Program provided health education activities in 3,276 villages in 2022. Health education efforts—critical to the F&E components of the SAFE strategy—are conducted continuously throughout surgery and MDA campaigns. Drug distributors, TT case finders, supervisors, county authorities, and local chiefs are all trained to use the trachoma flipchart.

The National Program recognizes that a concerted effort needs to be made to reinforce the E aspect of the SAFE strategy, including the renewed inclusion of WASH partners in NTD-Trachoma activities. Fully addressing F&E requires additional funding, and programs must strengthen cross sector collaboration across NTDs, health, nutrition, education, and WASH. Understanding social norms and values helps programs design proper F&E approaches for given communities. These components of SAFE are the root of a sustainable path towards the elimination of trachoma as a public health problem in South Sudan.

## **Surveys**

Despite accessibility challenges, the South Sudan Program achieved the highest number of trachoma surveys with 31 surveys completed of the 28-survey target. In Eastern Equatoria, many of the cattle camps moved long distances; this movement necessitated long travel times (2–3 days) for distributors, leading to an increased number of porters and teams, thus incurring more costs.

## **Programmatic Challenges & Mitigation Efforts**

There were several obstacles affecting activities in 2022. Lack of funding for SAFE activities across the country, limited trachoma elimination efforts. Shortages of TT surgeons and Trachoma Graders impacted the ability to conduct surveys and surgeries simultaneously across South Sudan. Although 81% of the target for Zithromax<sup>®</sup> MDA doses were met, mitigating drug delays will allow the MOH to achieve MDA targets in the future. With unclear sources of population data estimates, determining specific targets for SAFE interventions has proven difficult. Extensive flooding in the Greater Upper Nile Region has consistently impacted planned surveys, surgeries, and MDA.

To mitigate challenges moving forward, the MOH-NTD department will continue to coordinate surgery and survey plans with the Directorate of Eye Care and Ophthalmological Association of South Sudan. To account for unclear population data estimates, the MOH will continue to adopt 2008



Census figures with a 3% annual increase. To account for flooding in some areas, the Program will continue to plan MDA and TT surgery campaigns during drier months.

### **Program Plans for 2023**

#### *Surgery (S)*

- Operate 2,100 TT patients, 600 with Carter Center assistance
- Train 12 TT surgeons

#### *Antibiotic Therapy (A)*

- Distribute 1,100,785 doses of Zithromax<sup>®</sup>, 337,561 doses with Carter Center assistance
- Distribute 68,971 doses of TEO, 20,254 doses with Carter Center assistance

#### *Facial Cleanliness (F) & Environmental Improvement (E)*

- Conduct health education in 4,441 villages, 2,817 with Carter Center assistance

#### *Surveys*

- Conduct 33 surveys, five with Carter Center assistance

#### *Operational Research*

- Complete research connected to the ETAS study
- Finalize and launch the NTD Master plan and M&E Framework

# South Sudan – TT Prevalence: Adults ≥ 15Years

## Baseline (1999)

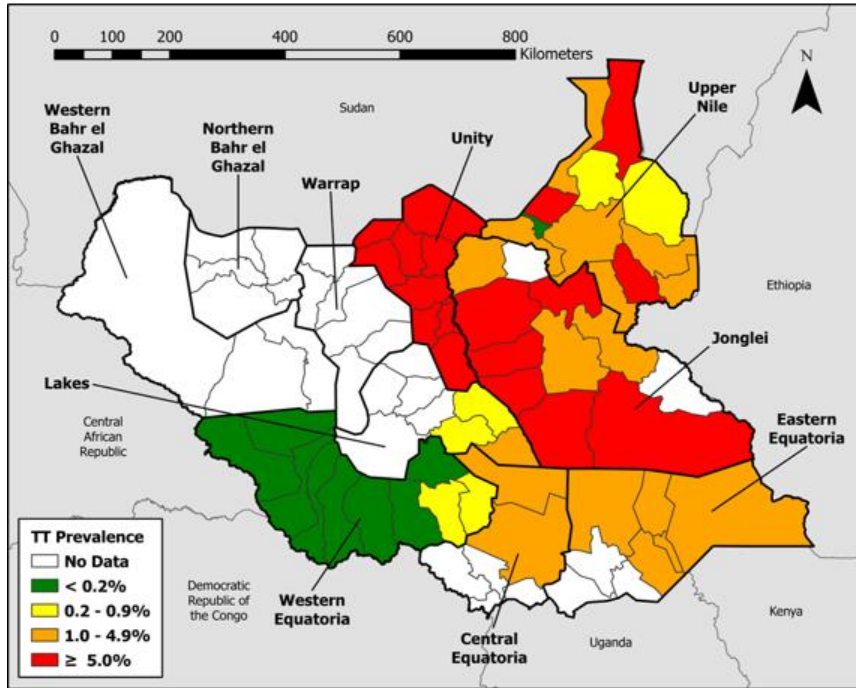


Figure 1 – Estimated TT prevalence at baseline

## 2022

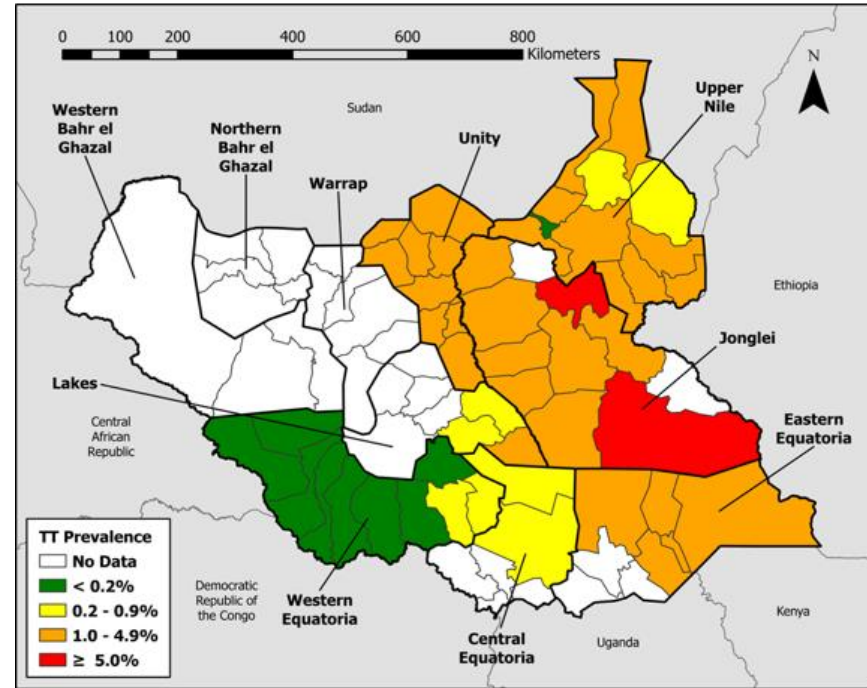


Figure 2 – Estimated TT prevalence through 2022

## South Sudan – TF Prevalence: Children 1–9 years

Baseline (1999)

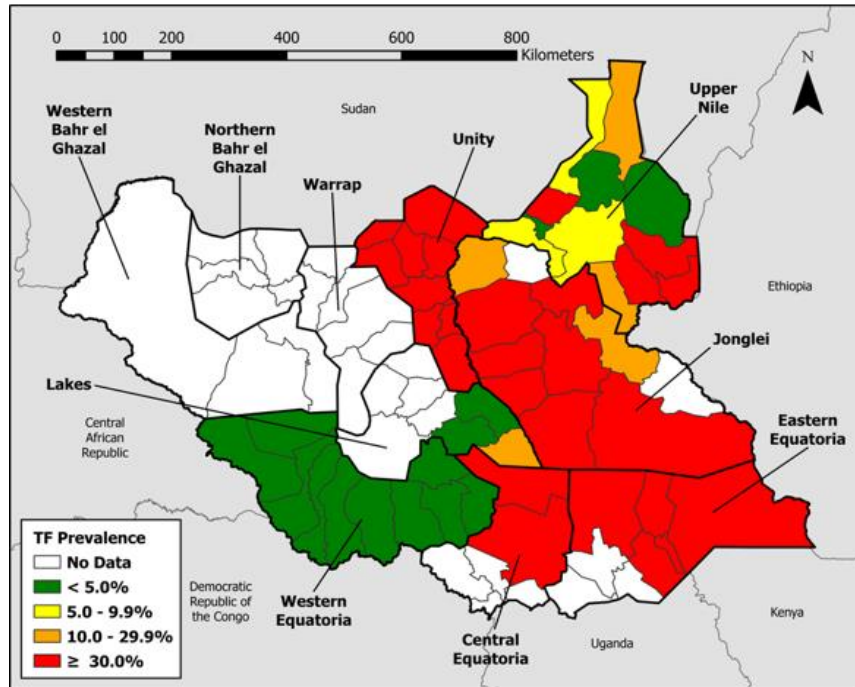


Figure 3 – Estimated TF prevalence at baseline

2022

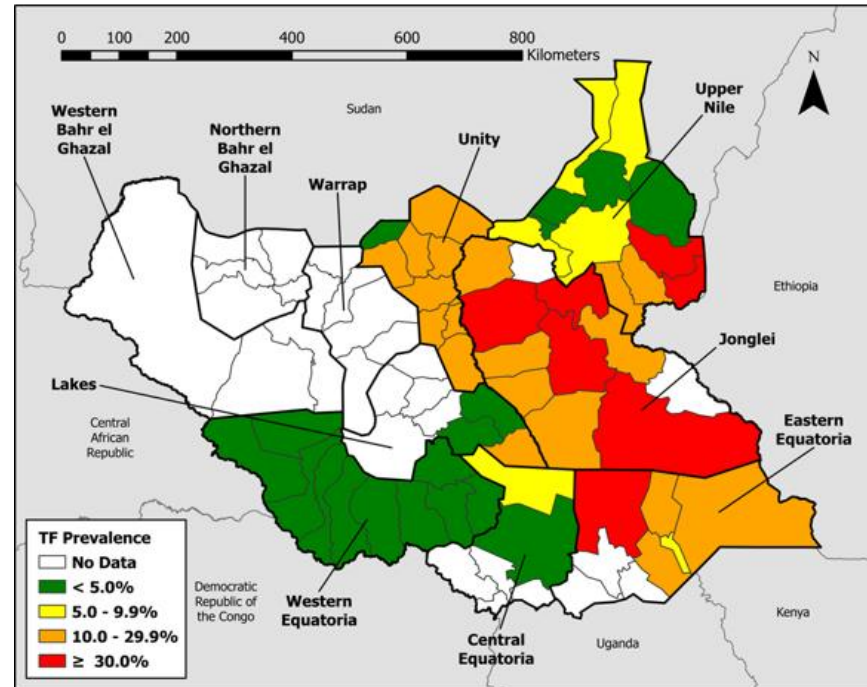


Figure 4 – Estimated TF prevalence through 2022

# South Sudan – Survey Activities and Survey Plans

## Survey Activities 2022

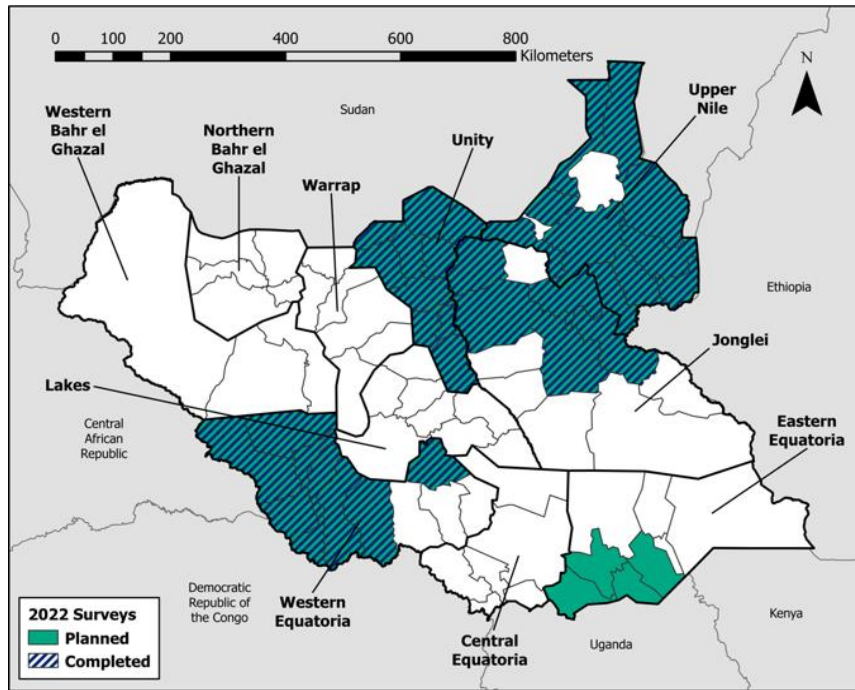


Figure 5 – Survey activities in 2022

## Survey Plans 2022

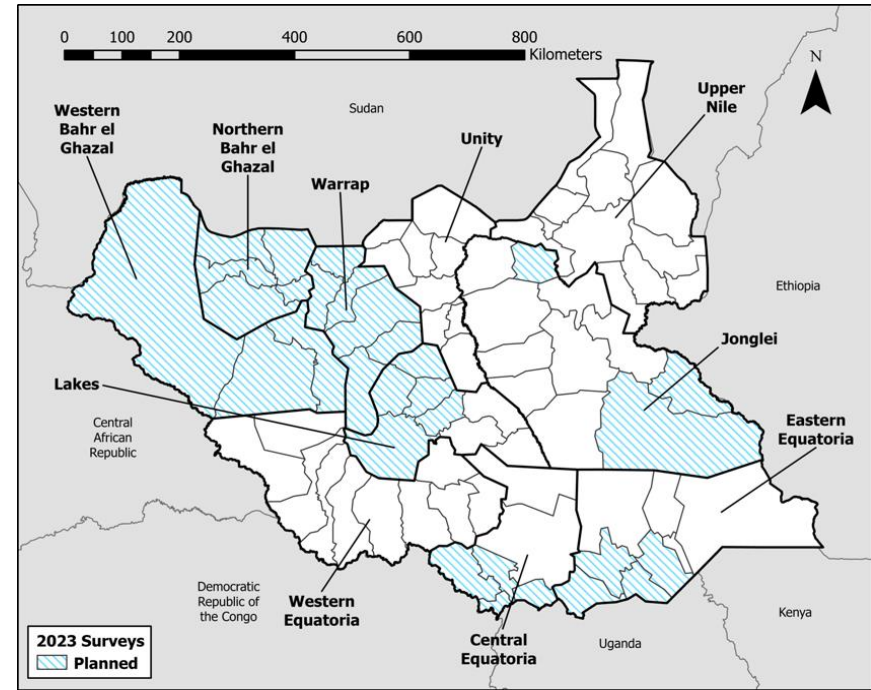


Figure 6 – Survey plans for 2023

## SAFE in Sudan

*Presented by Dr. Balgesa Elshafie, National Coordinator, Trachoma Control Program,  
Federal Ministry of Health, Sudan*

### Background

The Federal Ministry of Health (FMOH) has been working to eliminate trachoma as a public health problem in Sudan for decades. In 1999, the FMOH and The Carter Center developed a formidable partnership to tackle the disease and further reduce the burden of trachoma for the people of Sudan. In 2012, the government committed 1.5 million USD to help support The Carter Center's partnership for trachoma control over the course of five years thus exemplifying the power of partnership between the FMOH and The Carter Center in persistence to rid the nation of the blinding disease.

Across the country, all but 11 localities in Darfur have received baseline mapping. The FMOH, with support from The Carter Center, conducts S, A, and F elements of the SAFE strategy. The United Nations International Emergency Children's Fund and other generous organizations support the implementation of the E intervention alongside federal and state ministries. In addition to implementation of SAFE at the locality level, the program has implemented S, A, and health education activities in multiple refugee camps. The elimination target is 2030.

**Table 1. Program Achievements in 2022**

Indicator	National		Carter Center-Assisted	
	Target	Achieved	Target	Achieved
# of persons operated	7,400	1,045 (14%)	2,100	578 (27%)
# of women operated		668		416
# of surgeons trained/retrained	30	35 (117%)	-	-
# of doses of Zithromax® distributed during MDA	994,019	828,827 (83.4%)	994,019	828,827 (83.4)
# of doses of TEO distributed	20,286	9,164 (45%)	20,286	9,164 (45%)
# of villages with health education	490	490 (100%)	490	490 (100%)

### Surgery (S)

The National Program conducted 1,045 TT surgeries during calendar year 2022, 668 of which were performed on women. The Carter Center supported the National Program in conducting 578 TT surgeries, of which 416 were women.

In 2022, more than 530,00 people were screened for TT as part of TT case finding activities. A total of 902 people were identified by case finders as possibly having TT, and 691 individuals were confirmed to have TT, 399 of which received sight saving surgery. This activity highlights the challenge of identifying and operating on TT patients since of the number screened, only 0.1% were confirmed with TT, and only 58% of those accepted surgery.

## **Antibiotic Therapy (A)**

Through MDA in 2022, The Carter Center assisted the National Program in distributing 828,827 doses of Zithromax® and 9,164 doses of TEO. These MDAs included treatments in South Sudanese and Ethiopian refugee camps in White Nile and Gedaref states.

## **Facial Cleanliness (F) & Environmental Improvement (E)**

The National Program diligently implemented F&E activities in 2022 during TT camps, surveys and MDA activities. Although the TCP had no direct interventions related to water and latrines in Sudan, more than 3,000 community volunteers were trained to spread trachoma awareness and facial cleanliness education. Group discussions were carried out with women groups, men, and school children. Thousands of posters, flipcharts, leaflets, T-shirts and bags were distributed. The Program also supported the broadcasting of radio messages and live television health programs using the local language for announcements of programmatic activities.

## **Surveys**

In 2022, impact surveys were conducted in seven localities (representing 11 EUs given the large populations of several of the localities). Results from the impact surveys showed that eight of the 11 EUs considered endemic achieved WHO elimination thresholds for TF in children one to nine years. An EU comprised of multiple IDP camps was found to be greater than 10% TF and will require three rounds of MDA. In 2023, the Program plans to conduct the remaining 11 baseline surveys in Darfur, though this will be dependent on security and access.

## **Programmatic Challenges**

Sudan has been challenged in various ways over the years thus impacting the implementation of SAFE activities in all endemic areas. The country continues to experience political unrest which in turn has led to economic hardships with the rise of inflation. Insecurity in neighbouring countries has brought an influx of refugees to Sudan. Other challenges directly affecting the Program's ability to conduct trachoma elimination activities include lack of funding to complete planned interventions, high turnover of staff at the ministry of health, high cost of TT case finding activities, outdated TT prevalence data, shortage of TEO in the local market and the projected shortage of azithromycin.

## **Program Plans for 2023**

### *Surgery (S)*

- Operate 7,400 TT patients, 2,100 with Carter Center assistance
- Train 30 TT surgeons

### *Antibiotic Therapy (A)*

- Distribute 637,110 doses of azithromycin with Carter Center assistance
- Distribute 13,002 doses of TEO with Carter Center assistance

### *Facial Cleanliness (F) & Environmental Improvement (E)*

- Conduct health education in 562 villages with Carter Center assistance

## *Surveys*

- Conduct 10 impact surveys, six surveillance surveys, and 11 baseline surveys

Sudan – TT Prevalence: Adults ≥ 15 years

Baseline (1999)

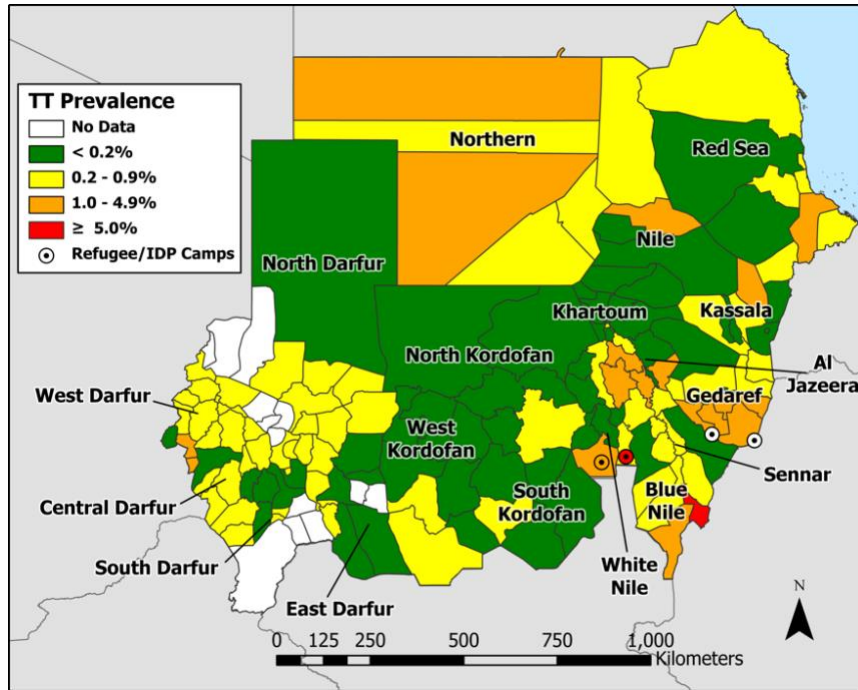


Figure 1 – Estimated TT prevalence at baseline

2022

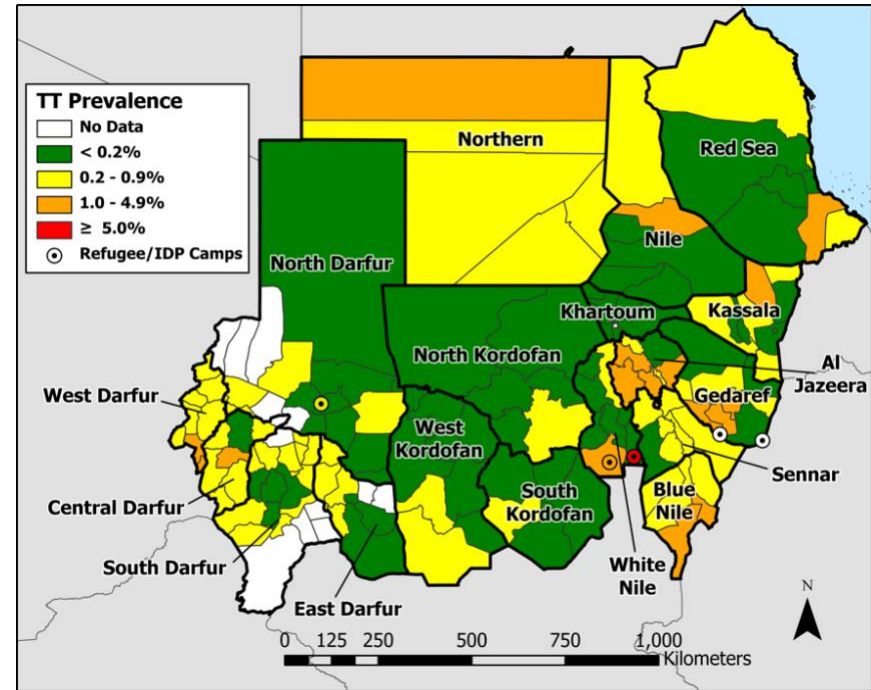


Figure 2 – Estimated TT prevalence through 2022



Sudan – TF Prevalence: Children 1–9 years

Baseline (1999)

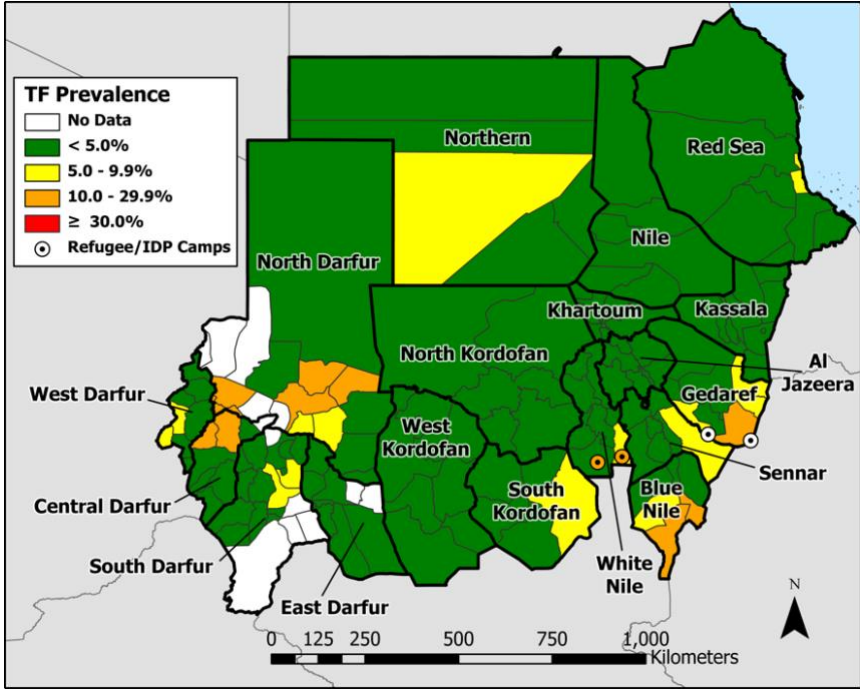


Figure 3 – Estimated TF prevalence at baseline

2022

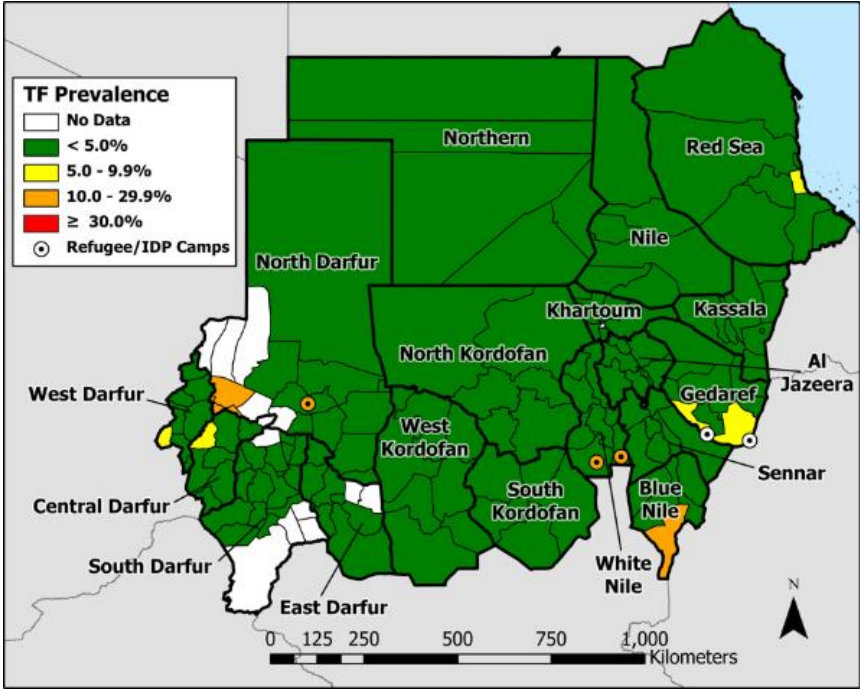


Figure 4 – Estimated TF prevalence through 2022

Sudan – Survey Coverage 2022

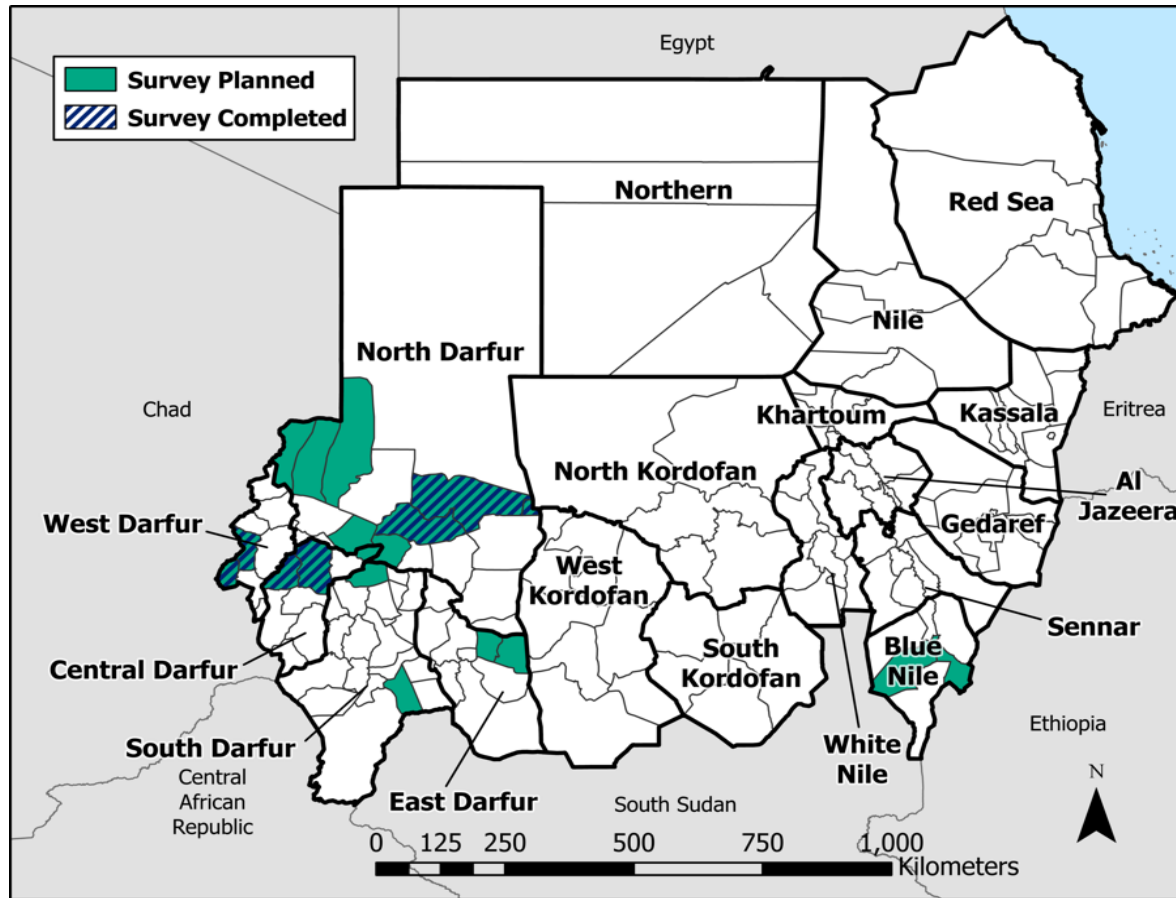


Figure 5 – Survey Coverage in 2022

<b>Table 1. Summary of National Data from Trachoma Control Programs (Carter Center-Assisted Countries)</b>						
<i>National Data as Reported for 2022</i>						
<b>Indicators</b>	<b>Mali</b>	<b>Niger</b>	<b>Sudan</b>	<b>South Sudan</b>	<b>Ethiopia</b>	<b>Total</b>
<b>Surgery</b>						
Surgeries	N/R	3,888	1,045	1,875	N/R	<b>6,808</b>
2022 Target	N/R	3,600	7,400	1,500	N/R	<b>12,500</b>
Percent Coverage	N/R	108.0%	14.1%	125.0%	N/R	<b>54.5%</b>
<b>Antibiotics</b>						
<i>Azithromycin</i>						
Doses	N/A	2,231,228	828,827	1,072,927	N/R	<b>4,132,982</b>
2022 Target	N/A	2,384,859	994,019	1,320,410	N/R	<b>4,699,288</b>
Percent Coverage	N/A	93.6%	83.4%	81.3%	N/R	<b>87.9%</b>
<i>Tetracycline Eye Ointment</i>						
Doses	N/A	73,891	9,164	71,826	N/R	<b>154,881</b>
2022 Target	N/A	73,758	20,286	164,164	N/R	<b>258,208</b>
Percent Coverage	N/A	100.2%	45.2%	43.8%	N/R	<b>60.0%</b>
<b>Facial Cleanliness and Health Education</b>						
Villages with Health Education	N/R	388	490	3,263	N/R	<b>4,141</b>
2022 Target	N/R	550	490	3,276	N/R	<b>4,316</b>
Percent Coverage	N/R	70.5%	100.0%	99.6%	N/R	<b>95.9%</b>
<b>Environmental Improvements</b>						
Latrines	N/R	40,595	N/A	N/A	N/R	<b>40,595</b>
2022 Target	N/R	20,000	N/A	N/A	N/R	<b>20,000</b>
Percent Coverage	N/R	203.0%	N/A	N/A	N/R	<b>203.0%</b>
N/A=Not Applicable						
N/R=Not Reported						
Totals only include countries and districts where data are available						
*TCC Supports the Amhara region of Ethiopia. Ethiopia National data are not reported here						

<b>Table 2. Carter Center-Assisted Implementation of SAFE (Carter Center-assisted output)</b>						
<i>Summary of Interventions per Country, January - December 2022</i>						
<b>Indicators</b>	<b>Mali</b>	<b>Niger</b>	<b>Sudan</b>	<b>South Sudan</b>	<b>Ethiopia-Amhara*</b>	<b>Total</b>
<b>Surgery</b>						
Persons operated for TT	N/R	1,829	578	62	30,966	<b>33,435</b>
2022 Target	N/R	2,000	2,100	500	38,981	<b>43,581</b>
Percentage	N/R	91.5%	27.5%	12.4%	79.4%	<b>76.7%</b>
<b>Antibiotics</b>						
Doses of antibiotics distributed	N/A	80,000*	828,827	381,876	8,929,541	<b>10,140,244</b>
2022 Target	N/A	50,000	994,019	340,396	16,838,165	<b>18,222,580</b>
Percentage	N/A	N/A	83.4%	112.2%	53.0%	<b>55.6%</b>
<b>Facial cleanliness and health education</b>						
Villages with ongoing health education	N/R	388	490	3,263	N/R	<b>4,141</b>
2022 Target	N/R	550	490	2,916	N/R	<b>3,956</b>
Percent Coverage	N/R	70.5%	100.0%	111.9%	N/R	<b>104.7%</b>
<b>Environmental improvement</b>						
Household latrines constructed	N/R	8,871	N/A	N/A	N/R	<b>8,871</b>
2022 Target	N/R	10,000	N/A	N/A	N/R	<b>10,000</b>
Percentage	N/R	88.7%	N/A	N/A	N/R	<b>88.7%</b>
N/A=Not Applicable						
N/R=Not Reported						
Totals only include countries and districts where data are available						
*TCC does not assist MDA implementation and distribution activities but TCC does assist in purchasing TEO for MDA						

**Table 3. National Trachoma Control Program Annual Targets 2023 (Carter Center-Assisted Countries)**

Targets<sup>§</sup> as Reported, March 2023

Indicators	Mali	Niger	Sudan	South Sudan	Ethiopia	Total*
<b>Surgery</b>						
Persons to operate for TT	N/A	3,600	7,400	2,100	N/R	<b>13,100</b>
<b>Antibiotics</b>						
Doses of azithromycin to distribute during MDA†	N/A	1,343,434	637,110	1,100,785	N/R	<b>3,081,329</b>
Doses of TEO to distribute during MDA	N/A	50,000	13,002	68,971	N/R	<b>131,973</b>
<b>Facial cleanliness</b>						
Villages to reach through health education	N/A	N/R	562	4,441	N/R	<b>5,003</b>
<b>Environmental improvement</b>						
Household latrines to construct	N/A	50,200	N/A	N/R	N/R	<b>50,200</b>

N/A=Not Applicable

N/R=Not Reported

<sup>§</sup>All targets are subject to change

†Antibiotic targets do not reflect ITI-approved allocations of Zithromax®

\*Totals only include countries where data are available

**Table 4. Cumulative Carter Center-Assisted Implementation of SAFE***Cumulative Interventions per Country, 1999-2022*

<b>Indicators</b>	<b>Mali</b>	<b>Niger</b>	<b>Sudan</b>	<b>South Sudan</b>	<b>Ethiopia- Amhara*</b>	<b>Total</b>
Persons operated for TT	31,095	89,473	12,919	11,018	757,405	<b>901,910</b>
Doses of antibiotic distributed (MDA)	818,878	4,331,365	9,053,129	4,955,940	210,786,420	<b>229,945,732</b>
Villages with ongoing health education	3,959	550	490	2,831	3,447	<b>11,277</b>
Household latrines constructed	116,722	188,018	N/A	646	3,336,513	<b>3,641,899</b>

N/A=Not Applicable

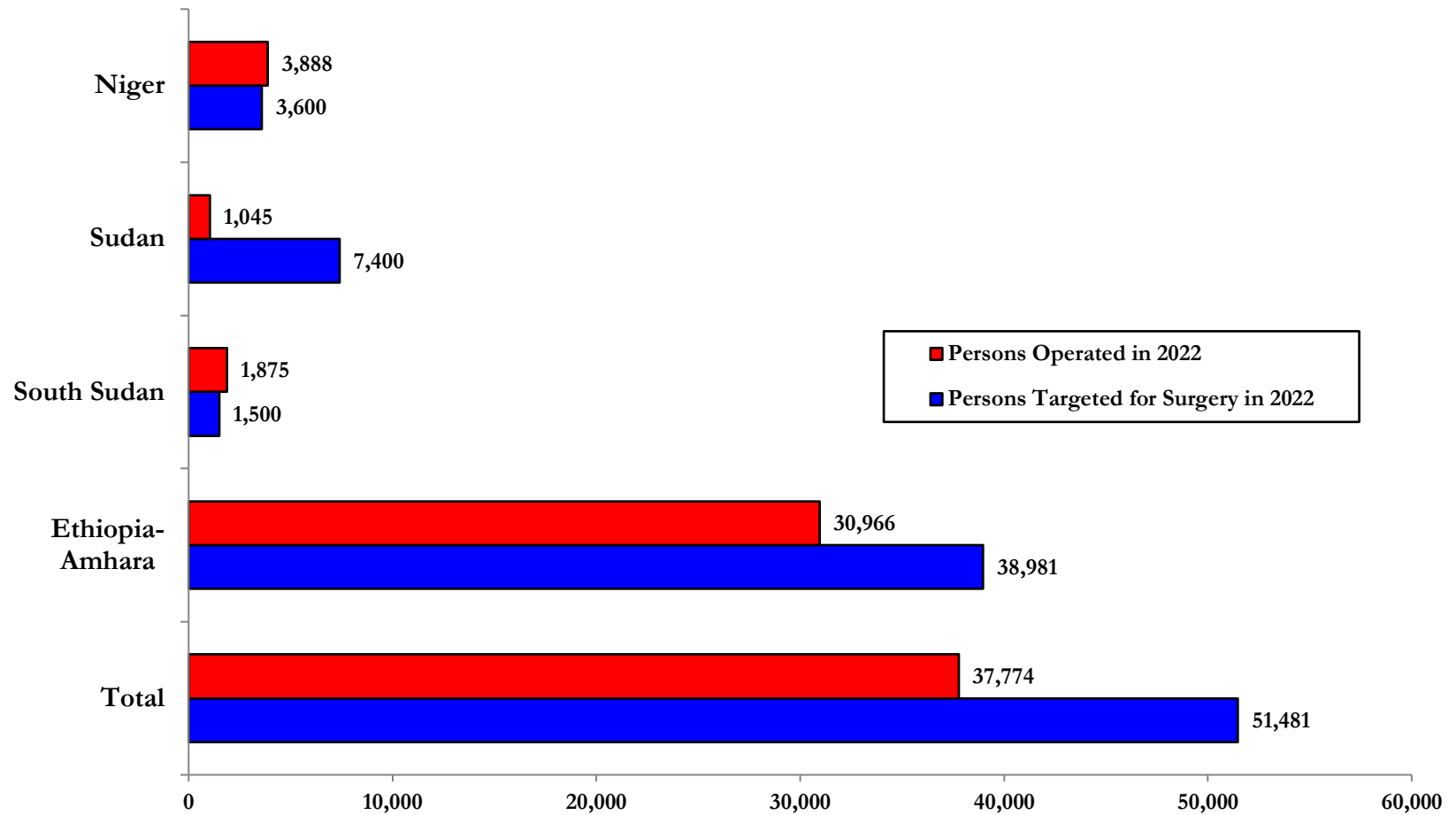
\* TCC only supports the Amhara region of Ethiopia

**Table 5. Summary of Carter Center-Assisted Programs Activity Plans, Accomplishments and Challenges 2022-2023**

Country	2022 Plans	2022 Accomplishments	Challenges	2023 Plans
<b>Ethiopia (Amhara)</b>	<ul style="list-style-type: none"> <li>•38,981 TT surgeries</li> <li>•Train 24 TT surgeons</li> <li>•Retrain 108 TT surgeons</li> <li>•Distribute 16,838,165 doses of Zithromax®</li> <li>•Distribute 343,636 doses of TEO</li> <li>•Health education in 3,447 villages</li> <li>•Implement STP</li> <li>•Conduct 57 prevalence surveys</li> </ul>	<ul style="list-style-type: none"> <li>•30,966 TT surgeries</li> <li>•40 new TT surgeons trained</li> <li>•108 IECW's retrained</li> <li>•Distributed 8,929,541 does of Zithromax®</li> <li>•Distributed 194,978 doses of TEO</li> <li>•STP 8,576 schools</li> <li>•Constructed 12 water points</li> <li>•Conducted 70 prevalence surveys</li> </ul>	<ul style="list-style-type: none"> <li>•Insecurity</li> <li>•Drug shortage</li> <li>•Low surgical uptake</li> <li>•Persistence and recrudescence</li> <li>•Access to safe water</li> </ul>	<ul style="list-style-type: none"> <li>•43,426 TT surgeries</li> <li>•Train 50 new TT surgeons</li> <li>•Retrain 70 TT surgeons</li> <li>•Distribute 15,170,853 doses of Zithromax®</li> <li>•Distribute 325,904 doses of TEO</li> <li>•STP in 8,576 Schools, 100% F&amp;E reporting</li> <li>•Increase latrine coverage by 30%</li> <li>•Conduct 35 prevalence surveys</li> </ul>
<b>Mali</b>	<ul style="list-style-type: none"> <li>•Conduct final 2 surveys</li> <li>•Draft and submit elimination dossier</li> </ul>	<ul style="list-style-type: none"> <li>•Conducted final 2 surveys</li> <li>•Completed and submitted elimination dossier to WHO</li> </ul>	<ul style="list-style-type: none"> <li>•Insecurity</li> <li>•Human resources</li> <li>•Lack of funding</li> </ul>	<ul style="list-style-type: none"> <li>•Program transition activities</li> </ul>
<b>Niger</b>	<ul style="list-style-type: none"> <li>•4,000 TT surgeries, 2,000 with Carter Center assistance</li> <li>•Train 10 TT surgeons</li> <li>•Distribute 50,000 doses of TEO</li> <li>•Health education in 550 villages</li> <li>•Construct 20,000 latrines, 10,000 with Carter Center assistance</li> <li>•Conduct 7 prevalence surveys</li> <li>•Continue implementation of ARRET and AVENIR studies</li> </ul>	<ul style="list-style-type: none"> <li>•1,829 TT surgeries</li> <li>•Provided 80,000 doses of TEO</li> <li>•Health education in 388 villages</li> </ul>	<ul style="list-style-type: none"> <li>•Insecurity</li> <li>•Inaccessibility</li> </ul>	<ul style="list-style-type: none"> <li>•3,600 TT surgeries, 1,800 with Carter Center assistance</li> <li>•Distribute 1,343,434 doses of Zithromax®</li> <li>•Construct 50,000 latrines, 10,000 with Carter Center assistance</li> <li>•Construct 200 block latrines, 20 with Carter Center assistance</li> <li>•Conduct 23 prevalence surveys, 4 TT-only surveys with Carter Center assistance</li> </ul>
<b>South Sudan</b>	<ul style="list-style-type: none"> <li>•1,500 TT surgeries, 500 with Carter Center assistance</li> <li>•Train 12 TT surgeons</li> <li>•Distribute 1,320,410 Zithromax®, 316,828 with Carter Center assistance</li> <li>•Distribute 164,164 TEO, 23,568 with Carter Center assistance</li> <li>•Health education in 3,276 villages</li> <li>•Conduct 30 prevalence surveys</li> <li>•ETAS study in Kapoeta North</li> </ul>	<ul style="list-style-type: none"> <li>•62 TT surgeries</li> <li>•Distributed 381,876 doses of Zithromax®</li> <li>•Distributed 20,574 doses of TEO</li> <li>•Health education in 3,263 villages</li> <li>•Conducted 31 prevalence surveys</li> </ul>	<ul style="list-style-type: none"> <li>•Unclear population data</li> <li>•Flooding</li> <li>•Lack of funding</li> </ul>	<ul style="list-style-type: none"> <li>•2,100 TT surgeries, 600 with Carter Center assistance</li> <li>•Train 12 TT surgeons</li> <li>•Distribute 1,100,785 doses of Zithromax®, 337,561 with Carter Center assistance</li> <li>•Distribute 68,971 doses of TEO, 20,254 with Carter Center assistance</li> <li>•Health education in 4,441 villages, 2,817 with Carter Center assistance</li> <li>•Conduct 33 prevalence surveys, 5 with Carter Center assistance</li> <li>•Complete ETAS study</li> <li>•Final and launch NTD Master Plan and M&amp;E Framework</li> </ul>
<b>Sudan</b>	<ul style="list-style-type: none"> <li>•7,400 TT surgeries, 2,100 with Carter Center assistance</li> <li>•Train 30 TT surgeons</li> <li>•Distribute 994,019 doses of Zithromax®</li> <li>•Distribute 20,286 doses of TEO</li> <li>•Health education in 490 villages</li> <li>•Conduct 22 prevalence surveys</li> </ul>	<ul style="list-style-type: none"> <li>•2,100 TT surgeries, 578 with Carter Center assistance</li> <li>•Distributed 828,824 doses of Zithromax®</li> <li>•Distributed 9,164 doses of TEO</li> <li>•Health education in 490 villages</li> <li>•Conducted 7 prevalence surveys</li> </ul>	<ul style="list-style-type: none"> <li>•Insecurity</li> <li>•Inflation</li> <li>•Accessing IDPs &amp; refugees</li> <li>•Lack of funding</li> </ul>	<ul style="list-style-type: none"> <li>•7,400 TT surgeries</li> <li>•Train 30 TT surgeons</li> <li>•Distribute 637,110 doses of Zithromax®</li> <li>•Distribute 13,002 doses of TEO</li> <li>•Conduct health education in 562 villages</li> <li>•Conduct 27 prevalence surveys</li> </ul>

**Figure 1. Persons Operated for TT, Carter Center-Assisted Countries**

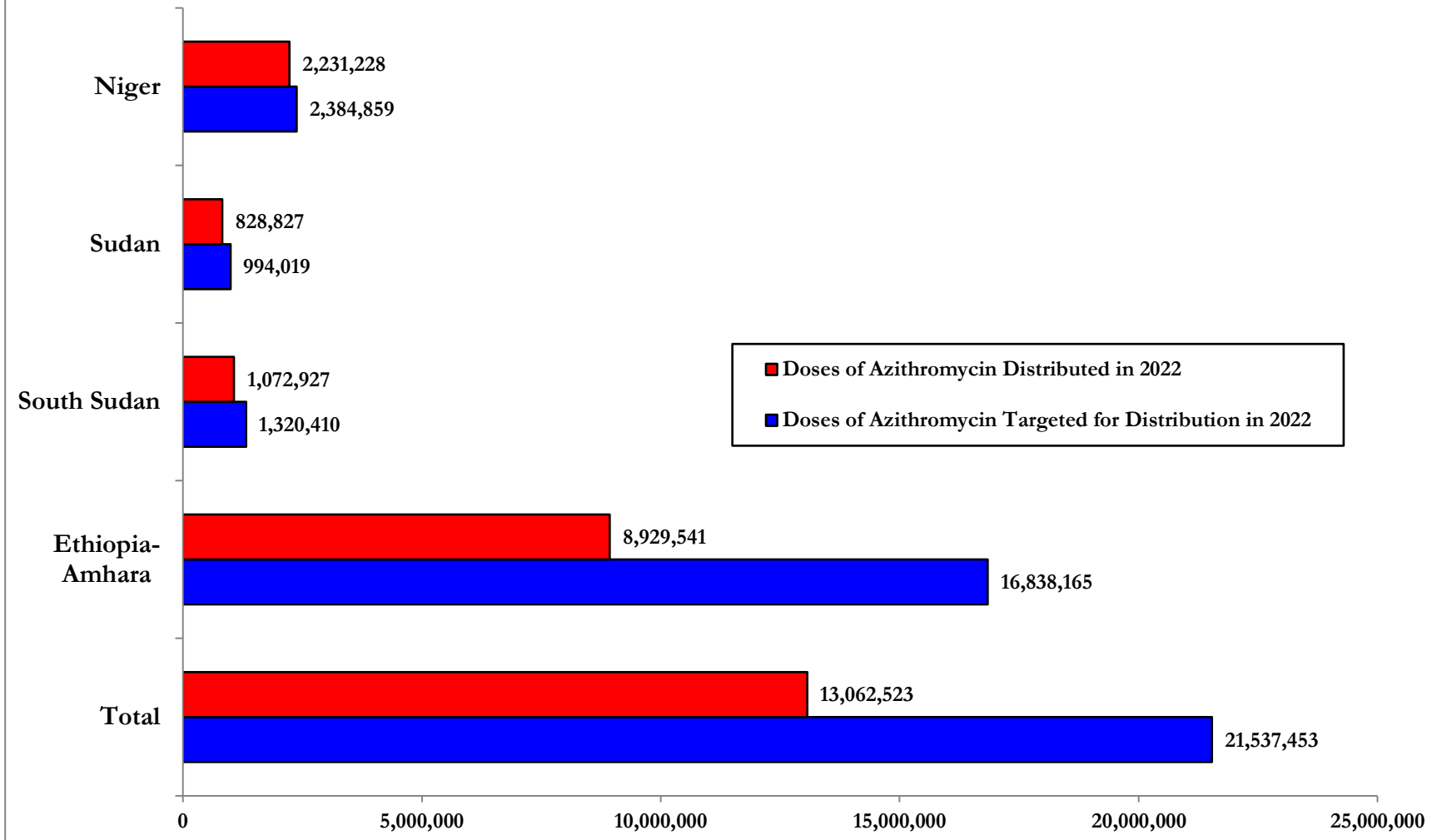
*National Program data as presented for January - December 2022*





**Figure 2. Azithromycin Distribution, Carter Center-Assisted Countries**

*National Program data as presented for January - December 2022*



## **Enhancing the ‘A’ in SAFE**

*Presented by Dr. Angelia Sanders, Associate Director, Trachoma Control Program, The Carter Center*

### **Background**

Reaching trachoma elimination thresholds by the year 2030 in the Republic of South Sudan will be a considerable challenge, as the country currently has many counties considered hyper-endemic (> 30% TF) that have yet to receive interventions. Evidence from randomized trials, modeling, and population-based surveys suggests that enhancements may be needed to the standard-of-care annual MDA to reach elimination thresholds in a timely manner within highly endemic areas.

### **Study Overview**

The Enhancing the ‘A’ in SAFE (ETAS) study is a community randomized intervention study conducted by the South Sudan Ministry of Health and The Carter Center to assess cost, feasibility, and community acceptability of more frequent than annual MDA. In 2022, following a population-based trachoma prevalence survey in Kapoeta North County, Eastern Equatoria state, South Sudan, 30 communities were randomized 1:1 to receive one of two enhanced MDA interventions, with the remaining communities receiving standard-of-care annual MDA. The first intervention strategy (study arm one) consisted of a community-wide MDA followed by two rounds of targeted treatment to children ages six months to nine years, two weeks and four weeks after the community MDA. The second strategy (study arm two) consisted of a community-wide biannual MDA approximately six to eight months apart. Community acceptability was assessed through MDA coverage monitoring and mixed-methods research involving community stakeholders. The costing analysis will use a payer perspective and identify the total cost of the enhanced interventions and annual MDA. A second trachoma-specific survey will be conducted 12 months following the original survey.

### **Activities Conducted**

All planned MDA activities were implemented in 2022. Between May and June, a community wide MDA was conducted for all Kapoeta North County. In June the second and third targeted treatments for children were implemented in study arm one. In November, the bi-annual community wide treatment was implemented in study arm two. Community awareness surveys and treatment validation activities were conducted in both study arms. Throughout 2022 and early 2023, focus group discussions (FGDs) were held with various stakeholders who were involved in the study as either implementers or recipients. This resulted in six FGDs with drug distributors, three FGDs with MDA supervisors, six FGDs with mothers, and two FGDs with chiefs. Costing data was collected throughout all activities.

### **Next Steps and Conclusion**

The study team next steps include grading of photos; assaying swabs; transcribing and translating FGD audio files; analysis of FGD data; working with health economists on costing data; analyzing coverage and compliance data; conducting an impact survey; and generating manuscripts and reports.

The study’s results will provide information to trachoma programs on whether enhanced interventions are programmatically feasible, affordable, and acceptable to communities. These results will further help in the design of future trachoma-specific antibiotic efficacy trials. Enhanced MDA approaches

could help countries recover from delays caused by conflict or humanitarian emergencies and could also assist countries such as South Sudan in reaching trachoma elimination as a public health problem by 2030.

For further information on the study protocol please see:

Sanders et al. Cost and community acceptability of enhanced antibiotic distribution approaches for trachoma in the Republic of South Sudan: Enhancing the A in SAFE (ETAS) study protocol. *BMC Ophthalmology* (2023) 23:51 <https://doi.org/10.1186/s12886-023-02783-x>

## **Trachoma Photo Database and TT Photography**

*Presented by Dr. Emma Harding-Esch, Chief Scientist and Associate Professor  
London School of Hygiene & Tropical Medicine*

Dr. Emma Harding-Esch, from the London School of Hygiene & Tropical Medicine (LSHTM), started by explaining why there has been increased activity around the use of photography for trachoma diagnosis recently, and to introduce the two main talks for this session.

As countries are moving towards the elimination of trachoma as a public health problem, and trachoma prevalence declines in districts and countries, we are becoming the victims of our own success, with it becoming increasingly difficult to train new field graders and to recertify existing graders with live cases. The existing Tropical Data training system uses photography for classroom training, but this does not overcome the issue of field inter-grader agreement (IGA) certification. We therefore proposed a workshop to bring partners together to look at how photography was currently being used for trachoma, and to discuss if it could help us to future-proof trachoma diagnosis in trachoma prevalence surveys. However, these discussions extended beyond training, to include supervision and replacing field TF grading through image capture and grading. This led to a series of different meetings, workshops and working groups, which have taken place since July 2020. Following the workshops, we produced a report on photography for support of trachoma grading. The report is available on the International Coalition of Trachoma Control (ICTC) website: <https://www.trachomacoalition.org/resources/use-photography-support-trachoma-grading-progress-report>. This report represents the work of many individuals and organisations, and we thank everyone who participated and provided input.

Several actions and next steps were identified, including a manual on Training Photographers for Trachoma Surveys coordinated by Sheila West, which will be finalised in the coming months. This session focused on two other actions: the trachoma photo database, and TT photography.

In the working groups, there was consensus that photographic images can help to overcome increasing challenges for training and supervision of trachoma graders. One of the key activities agreed was the development of a photo library, including an in-built grading tool for photos, to help establish a new standardised training system that does not rely on live cases. We determined that this database would have the following characteristics: 1. Photos from all over the world, so trainees learn to grade trachoma irrespective of what geographical region they're working in; 2. Borderline photos, to be more representative of what graders will see in the field; 3. Consensus grading of each photo from multiple Tropical Data principal graders; 4. A large set of photos so IGA sets can be created, to avoid graders become familiar with a limited number of photos and sets and "learning" the correct diagnosis; 5. Different types of IGA sets to test different competencies. We also plan to have data linked with the photos, so that this database becomes a resource for the whole trachoma community to support education and research efforts for trachoma elimination and long-term surveillance.

Cristina Jimenez provided a walkthrough of how to use the database: <https://trachomaphotos.tropicaldata.org/>. We have LSHTM ethics approval for the database (ref: 28168). For each database section, there are link to online forums where you can input your personal contact details, which are used to create logins. There is a section for those who have photos to submit, where the photos and associated metadata (with only photo identification and country where the photo was taken being mandatory). There is a section for those invited to grade photos. For each image, the grader must confirm if it is of good quality or not, and they must then confirm whether the eyelid is everted, which will dictate the subsequent sequence of questions. If the eyelid is everted, they

will be asked to grade the photo on a sliding scale for TF, TI, and TS. If not everted, they will be asked to grade for both upper and lower eyelid trichiasis. A sliding scale is being used, which will inform analyses that we hope will help us make better use of borderline case photos for training purposes. Once the images have been consensus graded by the group of expert graders, a final grade will be assigned to each, which will be accessible to all future users of the photo.

We ask that anyone who has photos to please kindly share them with us. Please contact [admin@tropicaldata.org](mailto:admin@tropicaldata.org) who will support you through the process.

## **TT Photography**

*Presented by Dr. Emily Gower, Associate Professor, University of North Carolina – Chapel Hill*

Dr. Emily Gower, from the University of North Carolina at Chapel Hill, presented updates about the use of photography to assess TT. She started by describing some challenges in detecting and treating TT cases.

Identifying cases of TT who need surgery can be difficult. A leading strategy is training community members as screeners who look for cases by going house to house. The success of this approach, however, has varied widely. As the burden of TT is reduced, training TT cases finders will become increasingly challenging because there will be fewer cases on which to train TT finders. Improvements in smartphone technology offer opportunities to enhance TT screening. Most smartphone cameras are adequate for taking analytic photos of the eyelid. Our research in Ethiopia and Mozambique has shown that smartphone-naïve users can rapidly learn how to take high-quality images. The TT Finder smartphone app that our team has developed with RTI is a simple way to take images of the eyelid and have them processed by a machine learning algorithm.

Next, Dr. Gower provided a walkthrough of the TT Finder app and described its application in the field. Once the app is open, the user starts a new record, which opens the phone's camera. The user can take a picture, review it to determine if it is appropriately angled, and confirm by clicking the check mark on the bottom of the screen. Upon confirmation that an image was taken for the right eye, the user would then repeat this for the left eye. After the photo has been taken, the machine learning algorithm divides the picture to be able to target the eyelid margin. The goal of the app is to determine the location of the eyelid margin and then to look along small segments to determine whether an eyelash is touching the globe. The snippets of each segment are processed to determine whether any lashes exhibit signs of TT like epilation or in-turned lashes touching the globe. The algorithm then makes an overall decision for the lid about whether TT is present. Eventually, as more individuals are screened, the app will display a list of ID numbers and report whether each person has TT.

In Mozambique, we conducted feasibility testing to see if community members could successfully take pictures with adequate quality for the algorithm to process them. We observed that five out of six community members could learn the technology. In Ethiopia, we conducted a TIS and screened over 10,000 eyes. We then went back to Mozambique and did a TIS-like activity where we screened over 17,000 eyes. From these results, we found that about 1.5% of the eyes had a blurry image that makes it hard to assess whether TT was present. About 1.3% of eyes images were taken at the wrong angle, which makes it hard to see whether any lashes are touching the globe.

Overall, the model performed well. Finding indicated that 95% of normal cases classified were as normal by the algorithm and 95% of TT cases classified as TT cases. There were a few scenarios when the app over-called TT: 1) When the lashes are turned in but not yet touching, 2) mild TT cases, which allowed us to look closely to determine if lashes are touching, and 3) when most of the eyelid is epilated, which is likely because TT is present.

Photographer training takes roughly a full day, but the training could be split over two days. Training includes time in the classroom to practice, taking photos out in the field, and discussing the images as a group. Photographers have reported that the app is very easy to use and that they did not have problems understanding how to take pictures. They did request that we improve the wait time for

image processing. Now there is an option in the app that allows you to wait until later in the day to process the images.

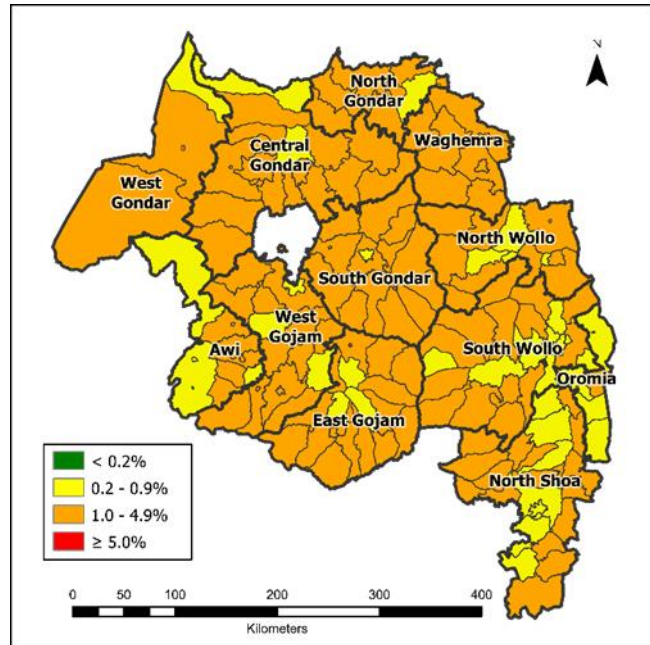
Dr. Gower concluded by discussing the app's use cases for helping to reach elimination goals.

The TT Finder app would provide support during TT case finding, tracking, and future impact surveys. The phones are GPS enabled, which would allow us to identify where the images were taken allowing us to examine those individuals as needed.

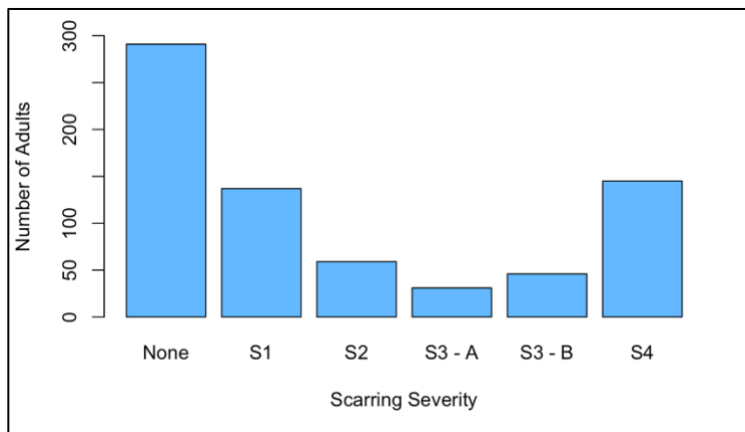
## Photographic Grading for Conjunctival Scarring

*Presented by Jaymie Bromfield, Graduate Assistant, Trachoma Control Program, Emory University*

Amhara remains a region of epidemiological significance regarding Trachoma. We can observe, based on the number of yellow and orange districts in Figure 1, that the region remains well above the threshold for trichiasis elimination as defined by the WHO. To remind us, trichiasis is a site-threatening consequence of scarring. Scarring data, though rarely reported in many prevalence methodologies, could provide insight into the history of exposure experienced by a population. Based on the previously mentioned population-based study of Amhara, we observed that each of the ten zones has at least one district, with scarring prevalence in the highest category being greater than 15%. Infield grading is considered the gold standard for validation and impact surveys as it allows the examiner to visualize the grading area from all angles. In addition, it may allow others to regrade previous data sets of photographs or allow multiple graders to visualize the same grading area of an individual. However, challenges include the lack of standardization for photography and photography tools to be used for conjunctival photographs.



*Figure 1. District level TT prevalence 2022*



*Figure 3. Distribution of trachomatous scarring and severity among adults (> 15 years), Amhara, Ethiopia*

within the grading area. However, if we compare that to the photograph of S2 (Stage 2), where, if we look directly under the thumb of the grater, can observe larger patches of lines, bands, and sheets. However, these areas of scarring do not necessarily comprise more than 1/8th of the eye. Beyond the S2 stage for scarring diagnosis, we observe clinical signs more comparable to that of the who

In addition, a very large challenge with photographs is that it eliminates the potential for infield graders to examine the grading area at a three-dimensional angle. Photograph data collection methods are reported previously. The adjudication and aggregation process for the photographs includes a grading program which selects all eligible photographs that have been graded by the two individuals. If we start with the S1 (Stage 1) stage photograph, we can visualize a healthy conjunctiva with only a minor line of scarring visible



definition. Figure 3 describes the overall distribution of scarring severity across adults included in the study.

As expected, most adults included do not experience a level of scarring. However, it is interesting to note that the levels of S1 and the most severe stage of S4 (Stage 4) are comparable in Figure 3. Figures 4 and 5 then provide age and gender-specific distributions of scarring severity across the adults included in the study. It is interesting to note that although youngest, the age group of 15- to 19-year-olds still experience levels of severe scarring. With the changes in fill colors of Figure 4, we can observe an increased prevalence percentage of more severe stages of scarring such as S3 (Stage 3) and S4 in older age groups and particularly those older than 60. Figure 5 produces a striking contrast in the distribution of scarring prevalence by sex and severity. While early stages of scarring such as S1 may be more comparable in men and women, women are observed with a significant disparity in the more severe clinical stages of scarring, such as the S4 and S3 categories. These preliminary results have shown that scarring and its progression to TT in Amhara and other hyperendemic communities may present a unique challenge to efforts aiming to eliminate trachoma as a public health problem. Long after thresholds for TT and TF have been reached, figures on age and sex distributions have shown that scarring magnitude disparities in women and older age groups may be masturbated by the progression to come. As for my next steps, I will be continuing to explore the potential correlates of severity within this area of epidemiological importance to Trachoma. In the future, there is potential to compare this sample with other Trachoma endemic communities that have been previously evaluated using this four-point scarring scale.

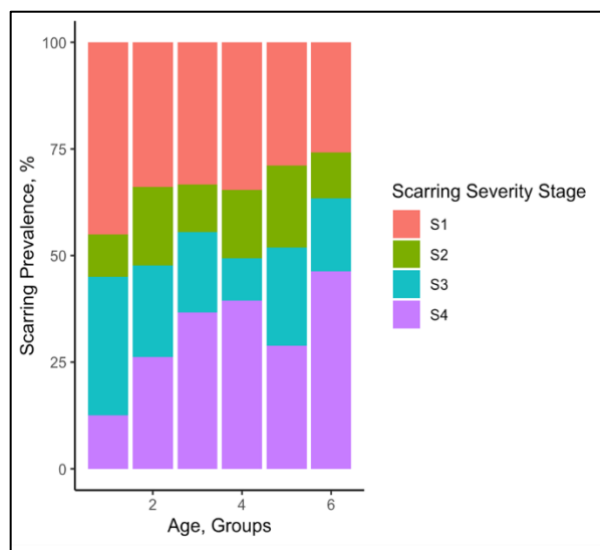


Figure 4. Age- specific distribution of trachomatous scarring severity among adults (> 15 years), Amhara, Ethiopia

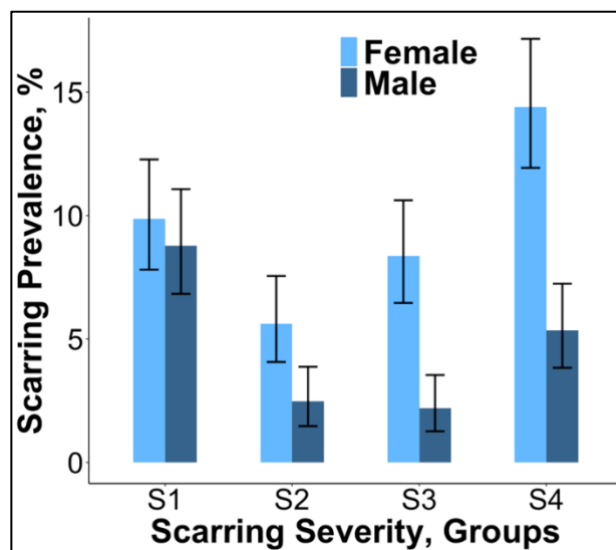


Figure 5. Gender- specific distribution of trachomatous scarring severity among adults (> 15 years), Amhara, Ethiopia

## **SPET: Post-elimination surveillance study in Niger**

*Presented by Ms. Kim Jensen, Associate Director, Trachoma Control Program, The Carter Center*

There has been great progress toward the elimination of trachoma as a public health problem in Niger since the inception of the trachoma program in 2002 and implementation of the SAFE (surgery, antibiotics, facial cleanliness, environmental improvement) strategy; only 12 districts remain to demonstrate the achievement of the elimination threshold for TF. According to the National Eye Health Program of Niger or PNSO, Niger expects to eliminate trachoma as a public health problem by 2027. While Niger moves toward elimination, they (and all trachoma programs) must consider the risk of recrudescence of disease, after elimination has been achieved. Recrudescence has recently been defined as districts or evaluation units that have had at least one TSS showing TF has risen above 5%. While there is attention on districts that are actively working to achieve the elimination threshold, districts that remain below the 5% elimination threshold at TSS have received less attention and may pose a risk to the long-term sustainability for programs.

The SPET study, a collaborative project between the PNSO and The Carter Center, assessed the long-term threat of recrudescence using standard and enhanced indicators in three districts in Niger, which were previously hyperendemic but remained below the 5% threshold at TSS. The selected districts (Bagaroua, Ilela, and Malbaza) in the Tahoua region began with baseline estimates above 30% TF; Ilela and Bagaroua fell below the 5% threshold at TIS in 2010 with a subsequent TSS in 2016; Malbaza fell below the elimination threshold at TIS in 2014 followed by TSS in 2018.

A population-based cluster-randomized survey was conducted in each district using certified graders with previous experience supporting trachoma surveys in Niger. Data collection was done on smart phones equipped with data collection software and a 3D printed CellScope, which permitted quality photos of the conjunctiva to be taken with and stored on the phone. A clinical exam and conjunctival photos were completed and dried blood spot (DBS) taken for all individuals six months to 15 years and a conjunctival swab was also taken from children ages six months to nine years. A total 3,690 children ages one to nine years were examined for trachoma, including photographs of the conjunctiva and conjunctival swabs; 4,910 children ages six months to 15 years provided a dried blood spot.

The conjunctival photos are graded at the Gondar Grading Center at the University of Gondar in Amhara, Ethiopia and the conjunctival swabs will be assayed at the Amhara Public Health Institute in Bahir Dar, Amhara, Ethiopia. The dried blood spots have been tested at the U.S. Centers for Disease Control and Prevention in Atlanta, Georgia, USA using a multiplex bead assay.

Initial analyses reveal that all three districts remained below the 5% elimination for TF in children ages one to nine years, even after at least 12 years since the last round of MDA. The photo grading is incomplete, with only 17 of the 88 identified TF cases fully graded. However, of the 17 that have been graded, only eight (47%) were confirmed as TF cases, though additional analysis will be required. All three districts also showed low antibody response to PgP3 (High Plasmid Gene Protein 3), with most found to be below the positive threshold. The seroprevalence was also found to be very low and did not increase with age for children ages one to nine years. A similar pattern was observed with CT694 (*Chlamydia trachomatis* protein), though higher than PgP3.

Based on the information to date, trachoma recrudescence has not been observed in these 3 formerly hyperendemic districts, after at least 12 years without MDA. Further testing and analysis are required to help characterize the trachoma, confirm the low trachoma prevalence, and assess the recently uncovered clustering of TF observed in the surveyed districts.

While district-level recrudescence was not observed, Niger will need to establish long-term post-elimination surveillance plans. The Carter Center and PNSO have begun discussing the potential for conducting a landscape analysis to assess the existence of opportunities within the health system and national surveillance platforms where serologic monitoring for trachoma could be incorporated.

## International Trachoma Initiative Update

*Presented By Dr. Paul Emerson, Director, International Trachoma Initiative*

The annual metrics reported by the ITI follow our program year, which allows for MDA scheduled in the calendar year to be delayed or postponed by up to six months. This means that performance metrics for the program year 2022 will be compiled and available after June 2023. In the calendar year 2022 ITI donated and shipped 31 million doses of Zithromax® to 18 countries, bringing the total shipped to 1,015,000,000. The billionth dose is a tremendous milestone towards the elimination of trachoma and reflects the hard work of 40 separate countries and their partners.

The principal reason that the volume of Zithromax® shipped was not back to pre-pandemic levels was the production shortage from Pfizer, Inc. Forecasts for the demand and supply of Zithromax® for the unshipped balance for 2022 distributions is around 16M doses and the demand for 2023 is an additional 46M which indicates that there will be a continued shortage of supply through 2024. In response to this situation, the independent Trachoma Expert Committee of ITI (TEC) has made the following recommendations to ITI:

- Reduce Zithromax® shipments to 80% of the amount requested by all countries (but not yet shipped), effective immediately
- Prioritize requests initially scheduled for shipment in 2022, but do not ship a second dose to those districts in 2023 unless drug becomes available in late 2023
- Ship 95% of all operational research allocations and for trichiasis surgeries

In addition to the recommendations to ITI, the TEC suggested several options for national trachoma programs to consider as they decide how best to manage their reduced allocations. They are, not ordered by importance or other hierarchy:

- o Consider prioritizing high prevalence districts ( $TF_{1-9} \geq 30\%$ )
- o Consider prioritizing districts with persistent or recrudescing trachoma
- o Consider early TIS for any district currently in the last round of MDA (i.e., round three of three; five of five; or seven of seven)
- o Consider delaying or skipping treatment in districts with  $TF_{1-9}$  5-9%

ITI has shared these recommendations with all affected countries and partners to ensure transparency and remain available to assist programs in their decision-making around the reduced quantity of their shipments but note that the decision of how to manage the reduced allocation ultimately belongs with the national programs – not with ITI.

## **STRONGER-SAFE: Understanding Transmission and Optimizing Interventions for an Enhanced S.A.F.E. Strategy for Trachoma Elimination**

*Presented by Oumer Shafi, Ph.D. Student and Research Project Manager, London School of Hygiene & Tropical Medicine, and The Fred Hollows Foundation*

### **The Challenge of Eliminating Trachoma**

Trachoma remains the commonest infectious cause of blindness worldwide. It is caused by repeated ocular infection with *Chlamydia trachomatis* (*Ct*). Active trachoma begins in childhood with recurrent episodes of TF, causing chronic inflammation, which results in conjunctival scarring and in-turned eyelashes scratching the eye (trichiasis). Eventually sight is lost from irreversible damage to the cornea. Children are the main reservoir of infection, and TF prevalence in one to nine year olds is the key indicator of this Neglected Tropical disease.

In 2022, trachoma is known to be a public health problem in 44 countries. More than 80% of the burden of active trachoma is concentrated in 14 countries in sub-Saharan Africa. Around 1.9 million people are estimated to be blind, or vision impaired from trachoma and 136 million live in areas requiring programs to control active trachoma. Around three million people have trichiasis and need interventions to manage this.

In 1998 the World Health Assembly (WHA) passed a resolution calling for the global elimination of trachoma as a public health problem by 2020, using the **SAFE Strategy**. This is comprised of **Surgery** (to correct trichiasis), **Antibiotics** (annual mass treatment with the antibiotic azithromycin to treat *Ct* infection), **Facial** cleanliness and **Environmental** improvements (to suppress transmission of ocular *Ct* infection). Great progress has been made in the past 20 years. More than 800 million doses of azithromycin have been given, ten countries have been validated by WHO as having met the elimination targets and a further four countries report having met the targets. The number of people requiring the SAFE intervention has been reduced from an estimated 232 million in 2013 to 136 million in 2021.

However, in Ethiopia and some other highly endemic countries, full implementation of the SAFE Strategy for more than 10 years has had only limited impact on the prevalence of trachoma. The Stronger SAFE research program aims to find a clear, evidence-based understanding of the biology of transmission and its socio-behavioral determinants; and to develop and evaluate the impact of new interventions that are more likely to be effective.

### **STRONGER SAFE: Summary**

Stronger-SAFE is a Wellcome Trust funded program that started in September 2017. It is designed to increase our understanding of how trachoma is transmitted, leading to the development and testing of new, more effective intervention approaches for trachoma control, particularly for regions where the disease is highly endemic. The program is based in the Oromia Region of Ethiopia. It is a collaboration between LSHTM, the Fred Hollows Foundation Ethiopia, the Ethiopian Federal Ministry of Health, the Oromia Regional Health Bureau, the Wellcome Sanger Centre and the WHO.

The Stronger SAFE program is based around a framework of enhanced mass azithromycin antibiotic treatment and enhanced measures to suppress *Ct* transmission. We have previously modelled this

approach which indicates a substantially increased probability of long-term infection control for populations with highly endemic trachoma.<sup>1</sup> The antibiotic schedule involves distribution of a second dose, two weeks after the first, delivered on an annual basis, which both increases the population coverage and has a higher probability of clearing high-load infections.

The work is divided into three main phases. Phases 1 and 2 have now been completed. Links to several peer-reviewed publications arising from this are provided on page 5. The start of Phase 3, a large cluster RCT had to be put on hold in early 2020 due to the COVID-19 pandemic. It commenced in mid-2021 and is now about one third complete.

### **Summary of the three phases:**

**Phase 1: Understanding Transmission:** We have conducted a unique set of ground-breaking studies that have, for the first time, thoroughly investigated the routes and mechanisms of trachoma transmission. We have conducted cross-sectional and longitudinal studies of human contact and behavior observational, observation of fly-eye contact and *Ct* transmission network mapping. This study systematically mapped extraocular *Ct* in a trachoma endemic community to try to identify and quantify potential routes for transmission.<sup>2</sup> This provides a rational basis for more targeted interventions to suppress transmission. Of note, in addition to the detection of *Ct* on faces, hands and some clothing, we found that a relatively high proportion of flies caught from faces of people in households with active trachoma carried the organism, indicating the importance of specific interventions to suppress fly-eye contact. We have also identified chemicals that influence relevant fly behavior.<sup>3</sup>

Through a series of laboratory experiments we have investigated the relative ease of retrieval and duration of viability of *Ct* in extraocular sites, which we believe to be very relevant to understanding transmission.<sup>4</sup> Subsequently, we have gone on to follow a group of 70 households every two weeks throughout a whole year, mapping the *Ct* infection and investigating how it moves within and between households.

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<sup>1</sup> Enhanced antibiotic distribution strategies and the potential impact of Facial cleanliness and Environmental improvements for the sustained control of trachoma: a modelling study. A. Pinsent, M.J. Burton and M. Gambhir. *BMC Medicine*, 2016, 14(1):71

<sup>2</sup> Detecting extra-ocular *Chlamydia trachomatis* in a trachoma-endemic community in Ethiopia: identifying potential routes of transmission. A. Last, B. Versteeg, O.S. Abdurahman, A. Robinson, G. Dumessa, M.A. Aga, G.S. Bejiga, N. Negussu, K. Greenland, A. Czerniewska, N. Thomson, S. Cairncross, V. Sarah, D. Macleod, A.W. Solomon, J. Logan, M.J. Burton. *PLoS Neglected Tropical Diseases*, 2020, 14(3):e0008120

<sup>3</sup> Responses of the putative trachoma vector, *Musca sorbens*, to volatile semiochemicals from human faeces. A. Robinson, J. Bristow, M.V. Holl, R.L. Bailey, D. McLeod, M.A. Birkett, J.C. Caulfield, V. Sarah, J.A. Pickett, S. Dewhirst, V. Chen-Hussey, C.M. Woodcock, U. D'Alessandro, M.J. Burton, A. Last, S.W. Lindsay, J.G. Logan. *PLoS Neglected Tropical Diseases*, 2020, 14(3):e0007719

<sup>4</sup> Viability PCR shows that non-ocular surfaces could contribute to transmission of *Chlamydia trachomatis* infection in trachoma. Bart Versteeg, Hristina Vasileva, Joanna Houghton, Anna Last, Oumer Shafi Abdurahman, Virginia Sarah, David Macleod, Anthony W.

**Phase 2: Interrupting Transmission:** This involved several pilot trials of small-scale, contextually appropriate, public health interventions to suppress transmission.<sup>5</sup> These were co-developed with members of the communities where the work was conducted to ensure their contextual relevance and acceptability.<sup>6+7</sup>

This has involved detailed development work of a new intervention package to promote improved facial hygiene. We have also developed a new dual “push-pull” strategy to control fly-eye contact. This combines wearable fly repellent clothing - caps and scarfs<sup>8</sup> which we have demonstrated leads to >35% reduction in fly-eye contact - with a simple design (made from local available materials) of fly traps baited with effective lures.<sup>9</sup>

**Phase 3: Cluster Randomized Trial:** In Phase 3 we are comparing alternative approaches to trachoma control. This is a parallel group, four-arm cluster randomized controlled trial of Stronger-SAFE, combining an enhanced double-dose MDA and the new transmission suppression intervention packages developed through the work in Phases 1 and 2.

The cluster randomized trial began in May 2021. We have recruited and randomized 68 clusters, each about 100 households. At baseline we examined and sampled 4412 children for trachoma. We found 29% active trachoma and 15% were positive for C by Polymerase Chain Reaction (PCR). The whole study region in which the study clusters are scattered has been enumerated and mass treated with azithromycin (total 49,945 people). Of these 26,854 also received a second azithromycin dose as part of the trial protocol. Following the MDA, we have rolled out the entomology and WASH program. We have completed the baseline, two-month, 12-month and 14-month clinical / infection assessment and delivered the second years MDA. There will be a third annual round of azithromycin MDA in mid-2023. The final clinical and infection outcome will be collected in mid-2024, with lab work and analysis taking about six months (to the end of 2024).

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<sup>5</sup> Comparison of face washing and face wiping methods for trachoma control: a pilot study. A. Czerniewska, A. Versteeg, O. Shafi, G. Dumessa, M.A. Aga, A. Last, D. MacLeod, V. Sarah, S. Dodson, N. Negussu, B.K. Sori, M. Kirumba, A. Biran, S. Cairncross, M.J. Burton, K. Greenland. *American Journal of Tropical Medicine & Hygiene*, 2020, 102(4): 740-43

<sup>6</sup> Selecting behaviour change priorities for trachoma ‘F’ and ‘E’ interventions: a formative research study in Oromia, Ethiopia Katie Greenland, Sian White, Katina Sommers, Adam Biran, Matthew Burton, Virginia Sarah, Wondu Alemayehu *PLoS Neglected Tropical Diseases*, 2019, 13(10):e0007784

<sup>7</sup> Seasonal variation in water use for hygiene in Oromia, Ethiopia, and its implications for trachoma control: An intensive observational study. Greenland K, Czerniewska A, Guye M, Legesse D, Ahmed Mume A, Shafi Abdurahman O, Abraham Aga M, Miecha H, Shumi Bejiga G, Sarah V, Burton M, Last A. *PLOS Neglected Tropical Diseases*, 2022, 16(5):e0010424

<sup>8</sup> Evaluation of the efficacy of insecticide-treated scarves to protect children from the trachoma vector *Musca sorbens*: a phase II randomized controlled trial in Oromia, Ethiopia. A. Robinson, L.R.O. Gomes, O.S. Abdurahman, W. Alemayehu, G. Shuka, E. Melese, M. Guye, D. Legesse, E. Elias, K. Temam, K.H. Koro, D. Adugna, F. Seife, M.A. Aga, V. Sarah, S.M. Lambert, S.L. Walker, E. Habtamu, A.W. Solomon, A. Last, D. Macleod, M.J. Burton, J.G. Logan. *eClinicalMedicine* 2022, *In Press*

<sup>9</sup> Towards an odour-baited trap to control *Musca sorbens*, the putative vector of trachoma. A. Robinson, J. Bickford-Smith, O.A. Shafi, M.A. Aga, G. Shuka, D. Debela, G. Hordofa, W. Alemayehu, V. Sarah, A. Last, D. McLeod, M.J. Burton, J.G. Logan. *Scientific Reports*, 2021, 11(1):14209

**Eliminating Persistent Trachoma in Ethiopia: Adaptive Staggered Parallel Effectiveness – Implementation Hybrid Cluster Randomized Controlled Trial (Aspect) for Enhanced Monitoring of Child MDA**

*Presented by Dr. Esmael Habtamu, Assistant Professor, London School of Hygiene & Tropical Medicine*

The Ethiopia Trachoma program is planning a phased implementation of MFTA azithromycin MDA to accelerate elimination in districts with persistent and recrudescing trachoma. This entails repeating MDA for children in the age group of one to nine years (referred as “child MDA”) one month after community-wide annual MDA. The rationale for this is that children form the core group for *Ct* infection transmission. However, there is no concrete evidence that child MDA will result in more rapid trachoma elimination than the standard annual community-wide treatment. In addition, acceptability, true coverage, logistics and cost of child MDA will be assessed. A question that needs answering is ‘will additional MDA targeting children aged one to nine years one month after the standard annual community wide treatment result in more rapid trachoma elimination than the standard annual MDA only in districts with persistent and recrudescing active disease in Ethiopia?’

We plan to conduct an adaptive staggered parallel effectiveness-implementation hybrid cluster randomized trial to evaluate both the effectiveness of child MDA and its implementation process as compared to standard annual MDA. About 84 districts (42 per arm) with persistent or recrudescing trachoma will be enrolled in a 1:1 ratio in three separate cohorts staggered in a 6-month period in alignment with programmatic implementation of annual Azithromycin MDA for trachoma elimination. The unit of randomization is district (average population ~100,000). Districts randomized to the control arm will receive the standard annual community wide MDA, while districts randomized to the intervention arm will receive the standard annual community wide MDA plus child MDA, where children one to nine years old will be additionally treated about a month after the community wide MDA. The eligibility criteria include: i) districts with persistent trachoma defined as those where there have been two or more TIS in which the prevalence of TF in one to nine year-old children has never been below 5% and with current TF prevalence of  $\geq 10\%$ , ii) districts with recrudescing trachoma defined as those where the result of at least one TSS has come back  $\geq 5\%$  TF in one to nine year-old children and with current TF prevalence of  $\geq 10\%$ , and iii) slow progressor districts with a baseline TF prevalence of  $\geq 30\%$  and currently with  $\geq 10\%$  TF prevalence after one TIS.

Outcome assessment will be conducted in ~1200 children one to nine years of age per district at baseline, and 12, 24 and 36 months after enrollment. Ocular examinations for trachoma, conjunctival swab samples to detect *Ct* infection by PCR, DBS to test for *Ct* antibody, and other implementation process outcomes will be collected at each time point. Primary outcome is the relative difference in prevalence of *Ct* infection in children one to five years of age between the control and intervention districts in three years. The difference in TF prevalence in one to nine years old children by arm in three years is among the key secondary outcomes.

The trial is planned to start in 2024 and completed by the end of 2028.

**Funding Disclosure:** The adaptive trial protocol and other related deliverables are funded by Bill & Melinda Gates Foundation Design, Analyze and Communicate Program. Esmael Habtamu is funded by Wellcome Trust, UK.



## **Kebele Elimination of Trachoma for Ocular Health Trial (KETFO)**

*Presented by Dr. Catie Oldenburg, F.I. Proctor Foundation, University of California, San Francisco*

Quarterly treatment of children with azithromycin for trachoma has been shown to decrease infection more than annual treatment of the entire community, and it also decreases infection prevalence in untreated older children and adults. Additionally, the TANA study in Ethiopia showed that communities receiving annual or biannual MDA did not meet WHO control goals over three years, and those that stopped MDA saw increased chlamydia prevalence.<sup>1</sup>

KETFO is designed to determine (1) whether an intensive elimination strategy targeting a core group is more effective than annual MDA at achieving complete elimination of trachoma after three years, and (2) the minimum core group required for trachoma elimination. This cluster-randomized controlled trial has four arms with 20 communities in each arm: (1) Core group A receives annual MDA for all residents; (2) Core group B receives annual MDA plus quarterly treatment of children ages two to nine years; (3) Core group C receives annual MDA plus quarterly treatment of a PCR-based cohort (children ages two to nine years); and (4) Core group D receives annual MDA plus quarterly treatment of children aged two to nine years with TI. The trial is set in the Merhabete District, North Shoa Zone, Amhara Region of Ethiopia.

The primary outcome for the study will be the prevalence of ocular chlamydia at 36 months as assessed by PCR. Secondary outcomes include ocular chlamydia prevalence at 12 and 24 months, clinical signs of trachoma as assessed by field exam and photography, and serologic markers of trachoma (dried blood spots are collected at baseline and 36 months).

At baseline, 120 gotts were randomly selected to be sentinel communities within each kebele. Baseline exams were conducted in May 2022. From these 120 gotts, 8,765 children ages six months to nine years were examined, which included photography and conjunctival swabs. Mean prevalence of TF was 46%, and mean prevalence of TI was 17% as assessed by clinical field grading. For PCR testing, conjunctival swabs were five-pooled. Prevalence of ocular chlamydia as assessed by PCR was 34%. All gotts with five-pool prevalence of 100% were retested as three-pools, and those results are currently being analyzed.

Primary outcome results are expected during the summer of 2025.

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<sup>1</sup>Mass azithromycin distribution for hyperendemic trachoma following a cluster-randomized trial: A continuation study of randomly reassigned subclusters (TANA II). Keenan JD, Tadesse Z, Gebresillasie S, Shiferaw A, Zerihun M, Emerson PM, Callahan K, Cotter SY, Stoller NE, Porco TC, Oldenburg CE, Lietman TM. PLoS Med. 2018 Aug 14;15(8):e1002633.

## Changes in Ocular *Ct* Strains After 5 and 8 Rounds of MDA

Presented By Dr. Anna Hart, Research Fellow, London School of Hygiene & Tropical Medicine

This presentation will discuss a project that investigated changes in ocular *Ct* after five and eight rounds of MDA in Amhara, Ethiopia. This project was conducted in collaboration with the Amhara Ministry of Health, LSHTM, Coalition for Operational Research on NTDs (COR-NTD) and The Carter Center.

In this presentation, Dr. Anna Hart will give a brief background on trachoma in Amhara, and the rationale for the study. Then explain the study aims, and the two methods sections; the first, employing a novel technique to determine *Ct* strain, and the results of this, and the second, investigating the relationship between *Ct* strain, trachoma clinical signs and MDA, and the results of this. Lastly, give a brief conclusion.

The TCP distributed >124 million doses of antibiotics from 2007 to 2015 in Amhara. In the figures you can see that the TF prevalence in this region of TF has increased from between 10-29% in 2007 to above 30% in 2014-2015. Treatment coverage was close to or above the minimum WHO-recommended threshold of 80%. Districts in South Gondar received 3 additional rounds of MDA due to persistently high TF. Despite an average of five years of these interventions, trachoma remained hyperendemic in many districts, with considerable levels of *Ct* infection.

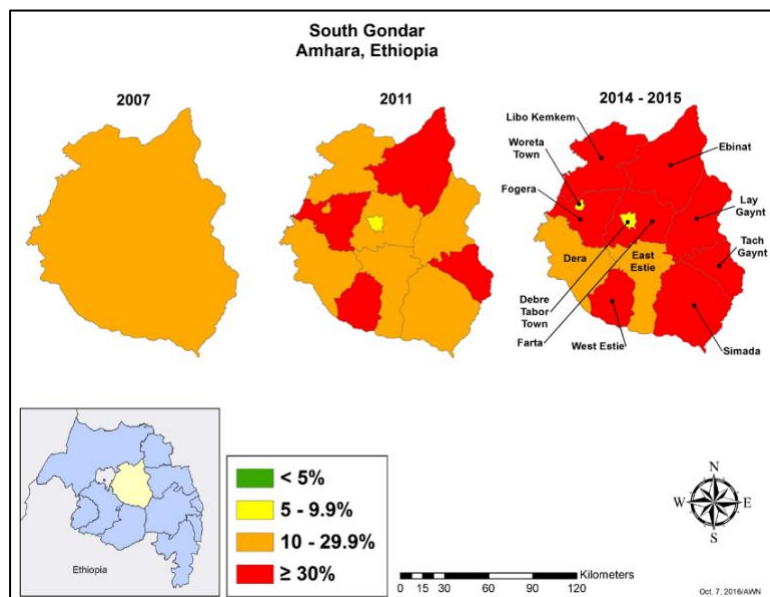


Figure 1. Increased Prevalence of TF in South Gondar despite MDA

The rationale for this study is based on the need for surveillance of *Ct* strain for determining the efficacy of treatments and the potential resistance of *Ct* strains to antibiotics. Current molecular epidemiological monitoring of *Ct* infection often focuses on the outer membrane protein A (ompA) gene, as this codes for the major outer membrane protein (MOMP), a key chlamydial antigen. However, previous work has shown that ompA genotyping has insufficient discriminatory power. Whole genome sequencing (WGS) is the highest level of variant identification, but has high costs, is technically demanding and requires specialist centers and expertise. Its application for clinical specimens in large scale epidemiological studies is still not routine. Several straining typing methods have been developed, and this is where two or more loci located in relatively stable regions are amplified and the products sequenced by a simpler method for each individual *Ct* sample.

The swabs for this study were collected between 2011-2015. Multistage cluster randomized methodology was used to select villages, with the first 25 children aged one to five swabbed for the

presence of infection. Conjunctival swabs from each district were pooled and tested using the Abbot real-time *Ct* PCR assay at the Amhara public health institute. Positive pools were separated, and 300 positive individuals were sent to LSHTM for further analysis.

There are two main study aims; the first was to apply a novel strain typing technique to determine ocular *Ct* diversity, and then to use this information on *Ct* diversity to Investigate the relationship between different *Ct* strains and clinical signs of trachoma and determine the effect of 5 vs 8 rounds of MDA on *Ct* diversity.

The methods that we tested in this study to determine the individual *Ct* strain is known as the multiple loci variable number of tandem repeat analysis which is shortened to MLVA. This uses variable length strings of repeat bases to define different variants; if you look at the three images at the bottom of the slide you will see they are labelled CT1291, CT1299 and CT1335. This is the name of three different loci within the *Ct* genome which are located within stable housekeeping genes. They were identified by a group led by Pedersen in 2008, as having high mutability and variation. If you look at the highlighted regions where it says repeat Cs in the first image, there are a variable number of Cs for each individual; this is how we identify variants, but we use three loci instead of just one. Some of the variants have repeat cs and some such as CT1335 has repeat Ts and repeat As. The logic behind using these particular regions is because variable number tandem repeats (VNTR) have a high rate of mutation caused by error prone DNA polymerase over repeat nucleotide regions and it is an alternative and useful identifier of novel strains for local epidemiological studies. These three regions are combined with serovar for greater variation.

The samples we used to test this method out are described here. 525 samples collected in Amhara were positive, 300 of these with the highest load of *Ct* were sent to LSHTM. 99 of these were whole genome sequenced for a different project that I will explain in the next slide. 201 were ompA sequenced using sanger, and all 300 were VNTR sequenced.

The 99 that were whole genome sequenced were the basis of a genomic analysis project published by Dr Pickering, and we used the WGS sequences to extract ompA from these 99 samples. This is why only 201 samples were sanger sequenced for ompA. Of these 201, 146 were successfully sequenced for ompA. All 300 samples underwent VNTR sequencing, and there was a total of 205 individuals who had successful sequencing for all three VNTRs.

The results of the three VNTRs are shown here. CT1299 had a range of variants from 8C to 14C with a fairly even split; for CT1291 the majority of individuals had 9C, and for CT1335 the vast majority had 10T/8A. When this data is combined with the serovar, there are over 60 variants, which the top three having a frequency of around 10, but many variants only being present in 1 or two people.

While the previous slide stated that CT1299 had up to 14 repeat Cs, this may not be accurate, as individuals with Cs repeated more than 14 times experienced the issue shown in the image here known as polymerase slippage, where the quality of sequencing is drastically reduced after repeat regions and the exact number of repeats cannot be called. 11 samples had to be removed from the dataset due to this issue.

This polymerase slippage issue meant our total numbers sequenced dropped from 205 to 194 as shown in the table. This is something that affects typeability, which is the proportion of samples that are able

to be typed, and this can be due to any reason- whether polymerase slippage or simply the quality of the sample. The overall message of this table is that the discriminatory power of MLVA-OMPA is 0.969 which is above the 0.95 threshold required for epidemiological monitoring.

We used the information gained from the VNTR analysis to look at the relationship between variant and trachoma clinical signs such as TF and TI (trachomatous trichiasis intense). As a large proportion of the variants had a frequency of one, we created two groups for analysis; low frequency for rare variants present in six or less people, and high frequency variants where they were present in seven or more people. We ran mixed effects models to determine whether the variant group affected the likelihood of the presence or absence, or prevalence of TF or TI, and the *Ct* load, adjusted for age and gender.

The results of the analysis showed there was no significant relationship between clinical signs and variant groups. As shown in the graphs, the number of people positive for TF or TI was broadly similar in both high and low frequency groups, and *Ct* load was also similar.

The next test was to compare *Ct* diversity between five and eight rounds of MDA in South Gondar. Hutcheson's t-test was used to determine if there was any significant difference.

The results showed a significant reduction in diversity after eight rounds of MDA relative to five rounds. There was also a marked switch in serovar, where the original mix of A, B, and Ba changed to mostly as after treatment.

The final point to make is regarding the cost effectiveness of sanger sequencing over WGS. While WGS provides more information, for the purposes of epidemiological monitoring, sanger provides sufficient information for identifying ocular *Ct* variants, at a much lower cost and with significantly easier analysis and interpretation. This MLVA-ompA sanger typing method can be done by any lab capable of performing PCR and sent off for sequencing at low cost.

This is the first application of MLVA-ompA to ocular *Ct*. The results of this study show that the method has sufficient resolving power for molecular epidemiology studies, with a discriminatory power above 0.95. The technique is straightforward and cost-effective, with minimal training needed for analysis. With regards to the Amhara variants, this study showed a marked reduction in diversity after an extra three rounds of MDA, and a change in serovar from a mix of A, B, and Ba to predominantly A.

Thank you to The Carter Center and COR-NTD for funding this work and thank you to all the collaborators involved.

## **Updates on ESPEN & Outcomes of the 3<sup>rd</sup> Global Scientific Meeting on TT**

*Presented by Dr. Amir B Kello, Medical Officer Trachoma, WHO/AFRO ESPEN*

The ESPEN was established in 2016 by WHO/AFRO as a public-private partnership in collaboration with Member States, donors, pharma and NTD partners. Its mission is to contribute towards disease burden reduction through control and elimination of the five most prevalent NTDs amenable to preventive chemotherapy (PC-NTDs). These are lymphatic filariasis, onchocerciasis, schistosomiasis, soil-transmitted helminthiasis, and trachoma. The five PC-NTDs account for nearly 90% of the NTD burden in the African Region.

ESPEN is focusing on five main strategic priorities:

1. Scaling up MDA to achieve 100% geographic coverage.
2. Scaling down MDA toward PC-NTD elimination when elimination thresholds are reached.
3. Strengthening information systems for evidence-based, implementation-level decision-making.
4. Promoting effective use of donated medicines through improved supply chain management.
5. Advancing progress on sustainability through efforts to enhance country ownership and strengthen health systems.

ESPEN covers 47 countries in the WHO African Region and five countries in EMRO (Djibouti, Egypt, Somalia, Sudan and Yemen). About 63% of countries are co-endemic for four to five PC-NTDs.

There has been significant progress in trachoma control in the WHO African Region. Currently, the number of countries known to require intervention is 22. Angola recently joined this group of countries after baseline mapping conducted in 2022 demonstrated the fact that the country is endemic for trachoma. Baseline mapping was also conducted in Botswana and results are expected soon. Four countries (Benin, Burundi, Mali and Mauritania) are thought not to require interventions and claimed to have eliminated trachoma as a public health problem. Benin, Burundi and Mali have already officially submitted their trachoma dossiers to WHO/AFRO for validation. To date, four countries have achieved elimination of trachoma as a public health problem in the WHO African Region: Ghana (June 2018), Gambia (April 2021), Togo (May 2022) and Malawi (September 2022).

ESPEN's support for trachoma control includes provision of technical and financial support to surveys, MDAs as well as trachoma elimination dossier development and finalization.

### **OUTCOMES OF 3<sup>rd</sup> GSM ON TT**

The Third GSM on TT was held from December 7 – 9, 2022 in Cape Town, South Africa. This meeting was convened by the WHO and hosted by the WHO Collaborating Centre for Trachoma at the University of Cape Town. It brought together WHO, ICTC partners, academic experts, and representatives from national trachoma programs.

Key discussion points at the GSM included the following themes: 1) documenting the elimination of trichiasis as a public health problem; 2) trichiasis phenotypes, diagnosis and grading; 3) TT in the post-elimination phase; and 4) the management of TT and PTT.

The following draft conclusions and recommendations were reached:

- Globally, at least 852 EUs with TT prevalence  $\geq 0.2\%$  but with TF < 5% at baseline or TSS. Demonstration of elimination of TT as a PHP requires either results of surveys, full geographic coverage (FGC) or geospatial analysis. Using program data on TT surgery service delivery in the absence of appropriately documented FGC will not provide evidence of elimination.
- There is currently some uncertainty regarding the definition of “*unknown to the health system*” as it relates to cases of TT, and in particular, what defines a “*health worker*” in the question, “*Have you been offered management by a health worker?*”. Each country should decide what is meant by “health worker” for this purpose; all stakeholders need to take the patient’s response at face value.
- As agreed at the 4 GSM on Trachoma, TS should not be included as a requirement for diagnosis of TT.
- The TT screener app shows some promise as an aid to TT diagnosis, but further testing is needed to improve accuracy & assess practicality.
- There are various trichiasis phenotypes and causes in trachoma endemic communities. Further research to understand phenotypes of trichiasis in trachoma endemic areas is warranted.
- Start transition planning & explore strategies for provision of sustainable services early rather than after transitioning.
- Countries should consider (or reconsider) who should be trained as TT surgeons, based on who will be providing TT surgery well into the future.
- Evidence generated since the last TT scientific meeting provides additional support for the WHO recommendation that newly trained surgeons be trained on Trabut and surgeons already using BLTR should not be required to change to the Trabut procedure.
- Epilation is viable management for minor trichiasis, and it is recommended that national trachoma programs review and, if indicated, refine their policies to include epilation as a management option.
- Surgeon audit guidelines should be revised to include, among PTT cases, the recording of number of eyelashes and the presence of entropion.

## **Trichiasis With and Without Tarsal Conjunctival Scarring: a multi-centre observational study on burden, phenotype and morbidity**

*Presentation 2 By Dr. Esmael Habtamu, Assistant Professor at the London School of Hygiene & Tropical Medicine*

### **Background**

There has been a discussion about whether the diagnosis of trichomatous trichiasis (TT) for the purposes of defining prevalence targets for “elimination as a public health problem” should include the presence of tarsal conjunctival scarring. However, there are concerns that identification of conjunctival scarring, particularly those with mild disease, in survey settings is probably difficult, and that this may lead to an underreporting of tarsal conjunctival scarring, resulting in an underestimate in prevalence of TT.

### **Methods**

A multi-center comparative cross-sectional study has been conducted in four study sites with varying trichiasis burden in Ethiopia (two regions), Uganda and Nigeria, to evaluate reliability of TS (refers to the WHO simplified tarsal conjunctival scarring sign) data collected from trichiasis cases in a trachoma survey by comparing with an independent expert in-field and photographic grading of tarsal conjunctival scarring (TCS) of the same cases using a detailed grading system which quantifies the amount of scarred eyelid and severity. Un-operated trichiasis cases were identified in surveys for whom TS grading data were available; and frequency matched (age, sex, and location) trichiasis-free individuals (controls) were randomly selected from the same survey population for comparison. Independent experts masked to the previously graded TS status of the cases, examined both the selected case and control eyes in their villages with magnifying loupes and torch. Eligible eyes were used for analysis after excluding those who had surgery or PIT. The primary outcome measure was the proportion of eyes who were originally graded in the surveys as “No TS”, but who had some degree of TCS: negative predictive value, (NPV).

### **Results**

In Ethiopia, Uganda, and Nigeria 438, 156, and 352 trichiasis cases, and 107,100, and 116 controls were enrolled respectively. In Ethiopia among 111 (18.7%) trichiasis eyes that were graded as having no TS in the survey, 92.8% were found to have TCS (false negative rate) in the expert photographic grading, giving a NPV of 7.2%. The Sensitivity was 82%, while specificity was 50.0%. In Uganda, among the 28 (24.3%) eyes that were graded as having no TS in the survey grading, 67.9% were found to have TCS in the expert photographic grading, giving a NPV of 32.1%. Sensitivity was 88.2% while specificity was 16.7%. In Nigeria among the 111 (24.3%) eyes that were graded as having no TS in the survey grading, 90.1% were found to have TCS in the expert photographic grading, giving a NPV of 9.9%. Sensitivity was 76.0% while specificity was 34.4%. The majority of eyes that were misdiagnosed as not having TS in the survey grading across the three settings had pronounced scarring. For instance, 76.5% in Ethiopia and 75.4% in Nigeria diagnosed as not having TS were diagnosed with extensive TCS in the expert photographic grading. TCS was also common in people without trichiasis particularly in Ethiopia (72.2%) and Nigeria (53.1%). However, as a limitation, graders in tropical data surveys are not adequately trained to accurately diagnose TS. A discrepancy between survey and photo grading regardless of who grades it is not uncommon both in this and other studies.

## **Conclusions**

Tarsal conjunctival scarring is common in these study sites even in trichiasis-free individuals. Conjunctival scarring may not be “easily visible” as defined in the simplified grading system resulting difficulty to diagnose under standard survey conditions. However, a significant proportion of trichiasis cases with extensive TCS were also graded as having “No TS” in the trachoma surveys. In these settings, including TS in the definition could result in an underestimate of TT.

## **Financial Disclosures**

This multicentre study is funded by Sightsavers International, UK. Esmael Habtamu is supported by the Queen Elizabeth Diamond Jubilee Trust. Funder had no role in design, data collection and analysis.



## **Effect of repeated epilation for minor trichomatous trichiasis on lash burden, phenotype and surgical management willingness: a cohort study**

*Presented by Tariku Wondie, Program Officer, Eyu-Ethiopia*

### **Background**

WHO endorsed the use of epilation as an alternative treatment to surgery for the management of both minor unoperated TT (UTT) and PTT. However, some trachoma control programmes hesitated to implement epilation citing concerns that it would hamper TT surgical acceptance and result in larger numbers of and stiffer trichiatic eyelashes than the original TT lashes. We investigated the burden and phenotypes of post-epilation trichiatic eyelashes, and willingness to accept surgical management separately in unoperated and postoperative TT cases.

### **Methodology/Principal Findings**

We recruited cases with minor ( $\leq 5$  eyelashes from the upper eyelid touching the eye or evidence of epilation in  $< 1/3^{\text{rd}}$  of the upper eyelid) UTT (170) and PTT (169) from community-based screenings in Amhara Region, Ethiopia. Participants' eyes were examined and data on present and future willingness to accept surgical management collected at baseline and every month for 6-months. Eyelashes touching the eye were counted and their phenotypes documented. Participants were trained on how to epilate. Epilation was done by the participants at home and by the examiner during follow-ups when requested by the participant. Follow-up rates were  $\geq 97\%$ . There was evidence of a significant reduction in the burden of trichiatic eyelashes in unoperated (mean difference =  $-0.90$  [ $-1.11$ – $-0.69$ ]; RR=0.50 [95% CI (Confidence Interval), 0.40–0.62];  $p < 0.0001$ ), and postoperative (mean difference =  $-1.16$  [ $-1.36$ – $-0.95$ ]; RR=0.38 [95% CI, 0.31–0.48];  $p < 0.0001$ ) cases 6-month after frequent epilation. Post-epilation trichiatic eyelashes at 6-months had higher odds of being thin (40.2% vs 55.8%, OR=1.88 [95% CI, 1.21–2.93];  $p = 0.0048$ ), weak (39.8% vs 70.8%, OR=3.68 [95%CI, 2.30–5.88];  $p < 0.0001$ ), and half-length (30.9% vs 43.3%, OR=1.71 [1.09–2.68];  $p = 0.020$ ) than the pre-epilation trichiatic eyelashes in unoperated cases. There was a significant increase in the proportion of weak trichiatic eyelashes (OR=1.99 [95% CI, 1.03–3.83;  $p = 0.039$ ) in postoperative cases. In all 6 follow-up time points, 120/164 (73.2%) of unoperated and 134/163 (82.2%) of postoperative cases indicated that they would accept surgery if their trichiasis progressed.

### **Conclusions/Significance**

In this study setting, frequent epilation neither hampers surgical acceptance nor results in more damaging trichiatic eyelashes than the pre-epilation lashes; and can be used as an alternative to the programmatic management of minor unoperated and postoperative TT cases.

### **Financial Disclosures**

This work received financial support from COR-NTD, which is funded at the TFGH primarily by the Bill & Melinda Gates Foundation, by the United States Agency for International Development through its NTD Program, and with UK aid from the British people. EH and MJB are supported by Wellcome Trust, UK. The funder had no role in the conduct and analysis of the study.

## 2023 Trachoma Control Program Review Recommendations

### General Recommendations:

1. Supported by the flexible guidelines from the WHO informal meeting in December 2021, Programs should consider, if financially and logistically feasible, and considering availability of drug, utilizing MFTA MDA in areas with persistent or recrudescing TF; Programs should use existing evidence to determine where, how, and how much additional drug would be suitable.
2. Programs should continue to be data driven and utilize data on clinical trachoma; serology; WASH; and *Ct* infection to help identify which districts should be prioritized for MFTA. Programs should work with implementing partners to make decisions using best available data and any funding constraints.
3. As appropriate, Programs should investigate associations between infection, clinical markers, and serology to better understand trachoma transmission in persistent and recrudescing districts.
4. As trachoma continues to disappear, it will be harder to find clinical signs for training purposes. In that, Programs should consider incorporating the use of photography for training and participating in the collection of photography as part of survey data collection.

### Country-Specific Recommendations:

#### Ethiopia

1. The National Trachoma Program should ensure TT case finding within house-to-house searching is well documented. This well documented and organized case finding could establish that targeted district(s) have addressed the TT burden despite the prevalence estimates.
2. The *Wait and Watch* approach utilized in the Amhara Region should be considered by the National Trachoma Program for expansion in the Amhara Region, as well as other regions in Ethiopia, to ultimately reduce survey costs, use of drug, and human resources over time.
3. The National Trachoma Program should consider epilation as a viable case management approach for minor TT.
4. Operational research focusing on improving program performance is vital for program improvement. The Ministry of Health is encouraged to advocate for swift ethical approval processes with the appropriate national institutions.

#### Amhara Regional State, Ethiopia

1. The Amhara Regional Trachoma Program should utilize the MFTA MDA pilot planned for three districts in Amhara to inform a feasible scale-up to other districts in the region, considering human and financial resources required, while also focusing on monitoring and evaluation processes.
2. The Amhara Regional Trachoma Program should consider concentrating the school water provision activities in known hyperendemic areas to maximize and assess impact on trachoma.
3. The Amhara Regional Trachoma Program should ensure TT case finding is implemented and completed with full geographic coverage to “finish” each targeted district; specific data should

be collected to document these activities, so the information may be utilized as evidence in the elimination dossier that TT thresholds have been met.

4. The Amhara Regional Trachoma Program should consider implementing epilation as a minor TT case management tool – with appropriate follow up measures, over time, to ensure proper management.

### **Niger**

1. As the National Trachoma Program nears the elimination of trachoma as a public health problem, they should begin collating the necessary data and historical program information required for inclusion in the elimination dossier to draft the dossier. The National Trachoma Program should now begin to involve various stakeholders who have years of experience with the Program to benefit from their tremendous knowledge of this decades long program.
2. The National Trachoma Program should ensure TT case finding is implemented and completed systematically, targeting full geographic coverage, to “finish” each targeted area; detailed case finding data should be collected to document these activities, so they can be utilized in the elimination dossier as evidence for the targeted areas that TT thresholds have been met.

### **South Sudan**

1. The National Trachoma Program should consider advocating for closer collaboration between the NTD and WASH sectors.
2. The National Trachoma Program should consider exploring opportunities to conduct MFTA MDAs, if such MDAs are financially and logistically feasible and there is an appropriate drug supply.
3. The National Trachoma Program should consider continuing with integrated cataract and trachoma surgical camps where financially and programmatically feasible.

### **Sudan**

1. The National Trachoma Program should undertake a TT case finding costing analysis to determine the cost of proving that TT is below elimination thresholds in localities that were non-endemic at baseline but had greater than 0.2% TT in individuals 15 years and above.
2. The National Trachoma Program should consider establishing a regional office in Darfur to enhance the effective implementation of the full SAFE strategy in the region.

## Trachoma: The Disease

Trachoma, the world's leading cause of infectious blindness, is caused by repeated infections of the conjunctiva (the lining of the eye and eyelid) by the bacterium *Ct*. As of April 2023, the WHO estimates that 1.5 million people, the majority of whom are women, are blind due to trachoma, and another 115.7 million people are at risk of blindness or severe visual impairment due to trachoma in 40 countries.<sup>1</sup> The early stage of the disease is called inflammatory trachoma and is most common among children. Inflammatory trachoma can present as either the formation of whitish follicles, on the conjunctiva under the upper lid or around the cornea, or as an intense painful or uncomfortable inflammation with thickening of the conjunctiva. Women are repeatedly exposed to inflammatory trachoma in their role as primary caretakers of children. It is therefore not surprising to find that women develop chronic trachoma twice as often as men. Trachoma is transmitted through discharge from the eyes and nose of infected individuals: i) by contact with hands, towels, and clothing or ii) by flies, which are attracted to ocular and nasal discharge. As individuals are repeatedly infected with *Ct*, subsequent scarring of the conjunctiva deforms the eyelid margin, resulting in eyelashes turning inward and rubbing against the cornea. This condition, called trichiasis, causes disabling pain, physically abrades the cornea, and can lead to corneal opacity and blindness if not corrected.

In 1987, eye care experts and the WHO developed a simplified trachoma grading scale, which facilitated and standardized the diagnosis and identification of all stages of trachoma. In 1997, the WHO established the GET2020 (Global Elimination of Trachoma 2020) Alliance, which brought international non-governmental development organizations, donors, and researchers together to work collectively in controlling trachoma. The WHA adopted resolution WHA51.11 in 1998, targeting the global elimination of trachoma as a public health problem. In addition, with support from the Edna McConnell Clark Foundation and WHO, the SAFE strategy was created to control trachoma through community-based interventions. In 2004, ICTC, a coalition of non-governmental organizations, donors, academic institutions, and other partners, was created to support the GET2020 Alliance and to advocate for the implementation of the SAFE strategy. The SAFE strategy stands for: Surgery to correct TT, the advanced, blinding stage of the disease; Antibiotics to clear *Ct* infection; and Facial cleanliness as well as Environmental improvement to reduce transmission.

Another important development was the finding that the oral antibiotic, azithromycin, taken once or twice annually, is as effective in preventing chronic trachoma as six weeks of daily treatment with TEO, the previously recommended therapy. Pfizer Inc., manufacturer of Zithromax®, maintains a commitment to supporting the GET2020 Alliance goal of eliminating trachoma as a public health problem by the year 2025. Since the beginning of the donation in 1998, more than 980 million doses of Zithromax® have been donated by Pfizer Inc. and managed by ITI. The existence of the donation program has served to invigorate national trachoma programs and reinforce global support for the elimination of trachoma. In 2016, WHO published the dossier template for the validation of the elimination of trachoma as a public health problem. Since 2017, 13 countries fulfilled the criteria to be validated by WHO to have eliminated trachoma as a public health problem. In 2018, the global trachoma community celebrated three 20th anniversary milestones: The Carter Center began its pioneering work in 1998; WHA 51.11 called for the elimination of blinding trachoma; and Pfizer Inc. created ITI to lead the drug donation program.

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<sup>1</sup> WHO, Weekly Epidemiological Report, Published July 14<sup>th</sup>, 2023.

### TT and TF Thresholds for Disease Elimination

The achievement of the *elimination of trachoma as a public health problem* is defined by the WHO through two proxy indicators:

- 1) a prevalence of TT “unknown to the health system” of <0.2% in adults ages  $\geq 15$  years (approximately one case per 1,000 total population); and
- 2) a prevalence of TF in children ages one to nine years of <5% in each (formerly) endemic district.

Through WHA resolution 51.11, trachoma can be eliminated as a public health problem through the implementation of the WHO-endorsed SAFE strategy. The surgery, or S component, should be offered to any individual that is diagnosed with TT to benefit from the surgical treatment. The surgery component also include case finding activities, which are recommended when prevalence of TT is  $\geq 0.2\%$  among individuals who are  $\geq 15$  years old. The A, F, and E components of the strategy are recommended for areas in which TF prevalence is  $\geq 5\%$  in children of ages one to nine.

To meet the criteria mentioned above, population-based prevalence surveys, amongst other activities, must be conducted in districts (enumeration units) suspected of being endemic at baseline and then at specified intervals after the start of interventions. Below are the success indicators and procedures often used to determine whether a district or region has achieved thresholds for the elimination of trachoma as a public health problem:

**Trachoma Impact Survey:** Must be conducted at least six months after final implemented MDA. If the TF prevalence threshold has been met, the district enters a two-year hold period (no MDA required).

**TT activities:** If TF prevalence threshold is met, but not TT threshold, then the program must conduct case searching and management activities.

**Trachoma Surveillance Survey:** At the conclusion of the two-year hold period, after the final impact survey, a surveillance survey is undertaken. If TT and TF thresholds are met, then the district is considered as “transitioned” and no longer warrants interventions. If thresholds are not met, then the district is re-enrolled in TT activities and MDA as appropriate.

# The Trachoma End Game: The Power of Persistence, Partnership, and Passion

The Twenty-Fourth Annual Trachoma Control Program Review

The Carter Center

March 6 – 7, 2023

Monday, March 6

<b>08:00 – 08:10</b> Meeting Management, <i>10 mins</i> Chairperson Welcome	MYT & Ms. Kelly Callahan Director, Trachoma Control Program The Carter Center
<b>08:10 – 08:15</b> Opening Meditation <i>05 mins</i>	Dr. David Addiss Director, Focus Area for Compassion and Ethics The Task Force for Global Health
<b>08:15 – 08:17</b> Welcome Remarks <i>02 mins</i>	Ms. Paige Alexander CEO, The Carter Center
<b>08:17 – 08:20</b> World Health Organization Message <i>03 mins</i>	Dr. Tedros Adhanom Ghebreyesus Director-General World Health Organization
<b>08:20 – 08:30</b> Trachoma Control Program Overview <i>10 mins</i>	Ms. Kelly Callahan Director, Trachoma Control Program The Carter Center
<b>08:30 – 09:00</b> Sudan SAFE Update (Q&A) <i>30 mins</i>	Dr. Balgesa Elshafie National Coordinator for Trachoma Control Program Federal Ministry of Health – Sudan
<b>09:00 – 09:30</b> South Sudan SAFE Update (Q&A) <i>30 mins</i>	Mr. Yak Yak Bol Director, PCT-NTDs Ministry of Health – South Sudan
<b>09:30 – 09:45</b> Enhancing the ‘A’ in Safe (Q&A) <i>15 mins</i>	Dr. Angelia Sanders Associate Director, Trachoma Control Program, The Carter Center and Chair, International Coalition for Trachoma Control
<b>09:45 – 10:00</b> Stretch Break <i>15 mins</i>	
<b>10:00 – 10:25</b> Photo Database & TT Photography <i>25 mins</i> (Q&A)	Dr. Emma Harding-Esch & Dr. Emily Gower Chief Scientist and Associate Professor, London School of Hygiene & Tropical Medicine & Associate Professor, University of North Carolina – Chapel Hill
<b>10:25 – 10:40</b> Photographic Grading for Conjunctival <i>15 mins</i> Scarring (Q&A)	Ms. Jaymie Bromfield Graduate Assistant, Trachoma Control Program Emory University
<b>10:40 – 11:10</b> Niger SAFE Update (Q&A) <i>30 mins</i>	Dr. Ibrahim Almou Deputy Coordinator, National Eye Health Program Ministry of Health – Niger
<b>11:10 – 11:20</b> Stretch Break <i>10 mins</i>	
<b>11:20 – 11:30</b> Surveillance Post-Epidémique du Trachome <i>10 mins</i> (Q&A)	Ms. Kim Jensen Associate Director, Trachoma Control Program The Carter Center
<b>11:30 – 11:45</b> Persistence in the End Game: Mali's Success <i>15 mins</i>	Professor Lamine Traoré National Coordinator, National Eye Health Program Ministry of Health – Mali
<b>11:45</b> Mali Congratulations & Day 1 Closing Remarks	Ms. Kelly Callahan Director, Trachoma Control Program The Carter Center

# The Trachoma End Game: The Power of Persistence, Partnership, and Passion

The Twenty-Fourth Annual Trachoma Control Program Review

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Tuesday, March 7

<b>08:00 – 08:05</b> Meeting Management & <i>05 mins</i> Chairperson Welcome	MYT & Ms. Kelly Callahan Director, Trachoma Control Program The Carter Center
<b>08:05 – 08:10</b> Grounding Meditation <i>5 mins</i>	Dr. David Addiss Director, Focus Area for Compassion and Ethics The Task Force for Global Health
<b>08:10 – 08:30</b> Pfizer & International Trachoma Initiative <i>20 mins</i> Updates (Q&A)	Miss Julie Jenson & Dr. Paul Emerson Director, Product Access Pfizer & Director, International Trachoma Initiative
<b>08:30 – 09:00</b> Ethiopia SAFE Update (Q&A) <i>30 mins</i>	Mr. Fikre Seife National NTD Program Coordinator Ministry of Health – Ethiopia
<b>09:00 – 09:15</b> Stronger SAFE (Q&A) <i>15 mins</i>	Mr. Oumer Shafi Ph.D. Student and Research Project Manager London School of Hygiene & Tropical Medicine and The Fred Hollows Foundation
<b>09:15 – 09:30</b> Stretch Break <i>15 mins</i>	
<b>09:30 – 09:45</b> Adaptive Staggered Parallel Trial for <i>15 mins</i> Enhanced Monitoring of Child MDA in Ethiopia (Q&A)	Dr. Esmael Habtamu Assistant Professor London School of Hygiene & Tropical Medicine
<b>09:45 – 10:15</b> Amhara SAFE Update (Q&A) <i>30 mins</i>	Mr. Adisu Abebe NTD Case Team Leader Amhara Regional Health Bureau
<b>10:15 – 10:30</b> KETFO (Q&A) <i>15 mins</i>	Dr. Catherine Oldenburg Associate Professor & Epidemiologist University of California, San Francisco – Francis I. Proctor Foundation for Research in Ophthalmology
<b>10:30 – 10:45</b> Changes in Ocular <i>Ct</i> Strains <i>15 mins</i> After 5 and 8 Rounds of MDA (Q&A)	Dr. Anna Harte Research Fellow London School of Hygiene & Tropical Medicine
<b>10:45 – 11:00</b> Stretch Break <i>15 mins</i>	
<b>11:00 – 11:15</b> Updates on ESPEN and Outcomes of the 3 <sup>rd</sup> <i>15 mins</i> GSM on TT (Q&A)	Dr. Amir Bedri Kello Medical Officer, Trachoma World Health Organization – Regional Office for Africa
<b>11:15 – 11:30</b> Trichiasis +/- Tarsal Conjunctival Scarring: A <i>15 mins</i> Multi-centre Observational Study (Q&A)	Dr. Esmael Habtamu Assistant Professor London School of Hygiene & Tropical Medicine
<b>11:30 – 11:45</b> Effect of Repeated Epilation for Minor <i>15 mins</i> Trichiasis: A Cohort Study in Ethiopia (Q&A)	Mr. Tariku Wondie Program Officer Eyu – Ethiopia
<b>11:45 – 11:50</b> Closing Remarks <i>05 mins</i>	Ms. Kelly Callahan Director, Trachoma Control Program The Carter Center