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An Impact Evaluation of Two Rounds of Mass Drug Administration on the Prevalence of Trachoma in Plateau and Nasarawa States of Nigeria: A Clustered Cross Sectional Survey

By

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Degree to be awarded: MPH

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By

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Doctor of Medicine

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1992

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An abstract of

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University

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Abstract

An Impact Evaluation of Two Rounds of Mass Drug Administration on the Prevalence of Trachoma in Plateau and Nasarawa States of Nigeria: A Clustered Cross Sectional Survey

By

Asrat Genet Amnie

Introduction: Nigeria is one of the major trachoma endemic countries in sub-Saharan Africa. The national program estimates that 75 million people are at risk for trachoma, with 28 million people living in the 11 Nigerian states known to be endemic. An impact evaluation survey was carried out in June 2012 after two annual rounds of mass drug administration with azithromycin to assess the impact of MDA on trachoma prevalence and to provide guidance to the trachoma control program for progress to achieve the ultimate intervention goals.

Methods: A two- staged cross-sectional clustered sample survey was used to assess impact in three Local Government Areas in Plateau State and four LGAs in Nasarawa State, Nigeria.

Results: A total of 1530 children, 808 (53%) boys and 704 (47%) girls, aged l-9 years from 793 households were screened for clinical signs of trachoma. A total of 2138 persons, 1014 (46%) males and 1124 (54%) females, above the age of 14 years were also examined for signs of trachoma. The state level impact of mass drug administration as measured by the changes in the prevalence of TF and TT are as follows. The baseline TF prevalence in Plateau was 13.9% and the baseline TF prevalence in Nasarawa was 12.1%. The follow up TF prevalence in Plateau was 4.85% and the follow up TF prevalence in Nasarawa was 1.6%. This indicates a 65% TF reduction for Plateau state and 86% TF reduction for Nasarawa State (differences in TF ($p<0.001$); differences in TT ($p=0.012$)). Household latrine coverage was 21.0% and 29.2% for Plateau State and 21.8% and 15.2% for Nasarawa State at baseline and follow up surveys respectively. Antibiotic coverage was 60.3% and 31.1% for Plateau State at baseline and follow up surveys respectively.

Conclusion: A significant reduction in the prevalence of TF has been registered after two annual rounds of MDA and the ultimate intervention goal (UIG) of reducing TF to below the threshold level of 5%has been achieved. The coverage with MDA has been consistently below 80% and latrine ownership has not improved yet deep reductions in TF have been observed. Two rounds of MDA may be as effective as three or more rounds in reducing TF prevalence if the 80% UIG of antibiotic coverage could be achieved in trachoma endemic areas but findings should be replicated in more robustly designed studies.

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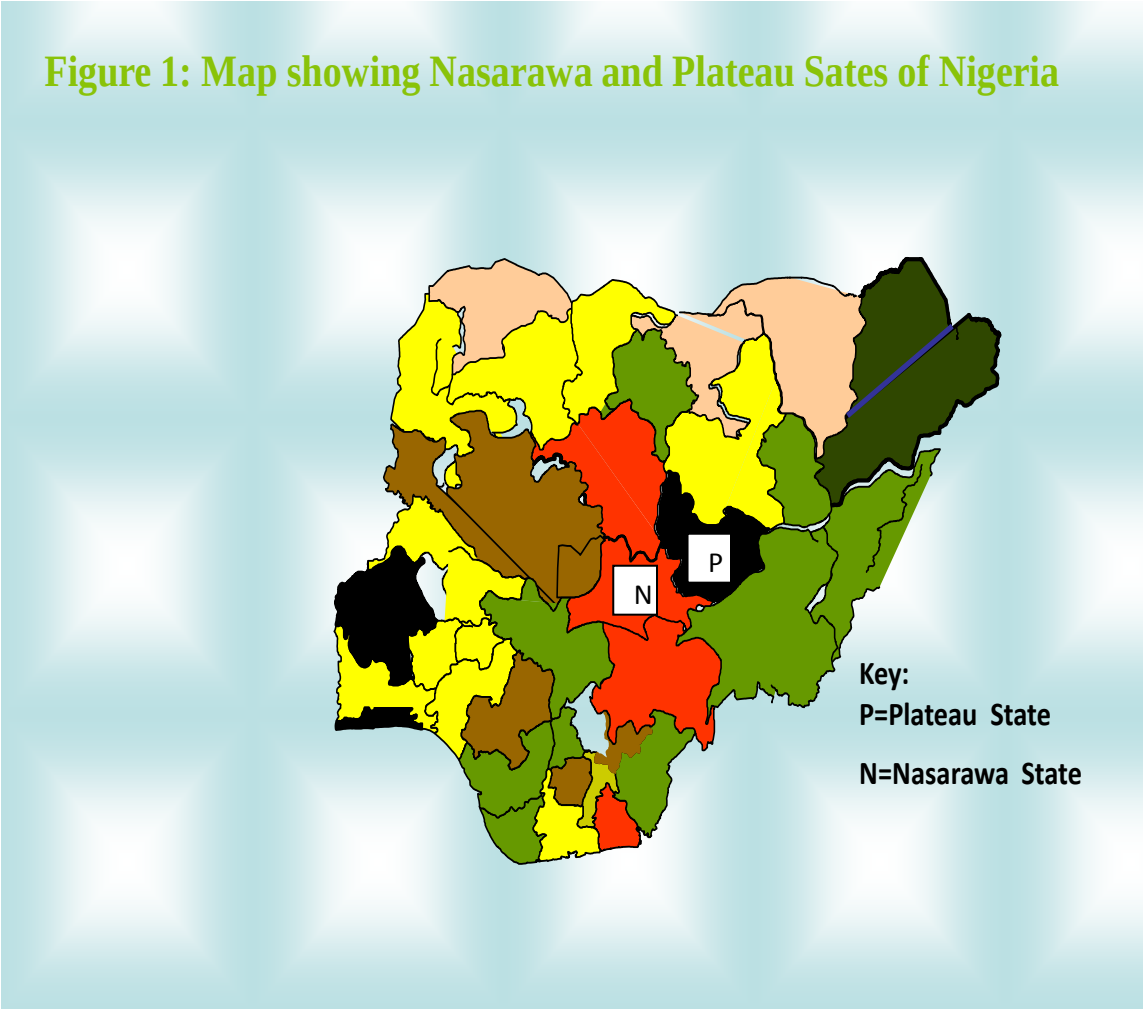
Chapter 1: Introduction and Rationale

1.1 Introduction

Among the World Health Organization Regions, the African Region has 71.2% of the global population estimated to be living in trachoma endemic areas and 55% of all endemic countries.[1] Among all the African nations, Nigeria has the greatest number of people infected with neglected tropical diseases including trachoma.[2] The national trachoma program estimates that 75 million people are at risk for trachoma, with 28 million people living in the 11 Nigerian states known to be endemic. This study is an interim impact evaluation of two rounds of mass drug administration (MDA) with antibiotics as part of an ongoing trachoma control program in Plateau and Nasarawa States of Nigeria. In Nigeria, trachoma, as many other blinding diseases, does not have a standardized reporting system and a chain of transmission of information in the health information system.[3] Any public health program will need a good monitoring and evaluation system to keep track of its progress. This study is an interim impact evaluation of an ongoing trachoma control program in Plateau and Nasarawa States of Nigeria (Figure 1).



Source:

Adapted from www.who.int/medicines/areas/quality.../Pilot_CEM_in_Nigeria.ppt

1.2 Statement of Problem

Prevalence surveys conducted in Nasarawa and Plateau States of Nigeria in 2008 and 2009 suggest that trachoma is of public health importance in parts of northern and central Nigeria. Seven of the total 30 LGAs in Plateau and Nasarawa States surveyed in

2009 had a prevalence of TF (Trachomatous inflammation, Follicular) among children one to nine years of age greater than 10%, qualifying for LGA-wide mass drug administration (MDA) of antibiotics for trachoma control.

International efforts to eliminate trachoma as a blinding disease are based on the strategy developed by WHO - a combination of interventions known by the acronym "SAFE" which stands for **S**urgery for trichiasis (inturned eyelashes), **A**ntibiotics, **F**acial cleanliness and **E**nvironmental improvement. These interventions are community-targeted and seek community involvement through the primary health care approach. WHO and its partners are supporting implementation of the SAFE strategy in the trachoma endemic countries that have decided to eliminate trachoma as a result of political engagement and technical capability.

Many public health programs have a monitoring and evaluation plan to keep programs on track and an impact evaluation plan but unfortunately not all plans get implemented. This survey is the result of a pressing need to understand the status of the different components of the trachoma control program, particularly the prevalence of trachomatous follicular inflammation after two rounds of MDA, through an interim impact assessment conducted in the trachoma endemic intervention areas of Nigeria. The evidence generated from the study will be utilized in decision making to determine the necessity of conducting additional rounds of MDA and to plan and prepare for further intervention.

1.3 Purpose of the Study

In the years 2010 and 2011 the Carter Center Assisted Trachoma Control program of the Ministry of Health of Nigeria conducted two rounds of MDA for control of trachoma [4].

An assessment of the interim impact of the interventions is necessary as part of the ongoing monitoring and evaluation of the trachoma control program for evidence-driven decision making and for better understanding of the status of implementation of the trachoma control program.

1.4 Research Questions

The interim impact assessment seeks to find out the prevalence of TF in children ages 1-9 years after two years of the implementation of SAFE strategy. It also seeks to find out if the prevalence of trichiasis in the population after intervention has improved from the baseline prevalence. The impact assessment also aims at finding out changes in latrine ownership and use and antibiotic coverage.

1.5 Significance of the Study

Monitoring and evaluation should be an integral component of public health program implementation. This midterm evaluation of the trachoma control intervention in Nasarawa and Plateau States of Nigeria was conducted in order to document the level of success, or lack thereof, in achieving objectives of the MDA; to identify areas of the program that need improvement; to decide how to allocate resources; to mobilize community support; to redistribute or expand the locations where the intervention is

carried out; to improve the content of the program's health promotion materials; to focus program resources on a specific population and possibly to plan more funds for additional activities.

1.6 Definition of Terms

Standard WHO definitions are utilized for definition of terms relevant to this study:

Trachoma defined as a public health problem when:

• TF (Trachomatous inflammation, Follicular) prevalence ≥ 10% in 1-9 year old children

• TT (Trachomatous Trichiasis) ≥ 1% in adults (≥ 15 years)

Elimination of blinding trachoma:

• TF prevalence < 5% in 1-9 year old children

• TT prevalence < 1 per 1000 in total population

Trachoma Awareness: Knowing that (1) trachoma is a cause of blindness and (2) at least one method for the prevention of trachoma

Clean Face: a child who did not have any ocular discharge or nasal discharge or a fly on the face at the time of visit.

Latrine Use: Noted evidence of latrine use during house to house visits at the time of the survey by visual inspection of the latrine by a data collector.

Household: consists not only of the basic family unit of parents and their children but extends to include other adults and children living under the same roof. In cases where there have been second (and more) marriages with or without children, this is considered one household , regardless of whether the individuals live together in a single household

or separately as long as they live in the same compound. A household includes all the individuals who occupy a housing unit as their usual place of residence.

Program evaluation: the systematic collection, analysis and reporting of information about a program to assist in decision-making.

Outcome: Evaluates what occurred as a result of the program. It determines whether the objective has been achieved in the programs short-term and/ or long term.

Health Impact Evaluation: a combination of procedures, methods, and tools by which a policy, program, or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population.

Chapter 2. Literature Review

The literature review for the study is organized to provide a review of key studies on clinical as well as public health aspects of blinding trachoma including articles on the etiology, epidemiology, transmission, preventive public health interventions, and different designs for impact evaluation of public health programs for control of blinding trachoma particularly in resource poor settings.

2.1 Etiology of Trachoma

The gram-negative obligate intracellular bacterium *Chlamydia trachomatis* is responsible for a wide range of different diseases. Strains of serovars D to K primarily cause urogenital infections. Strains of serovars L1, L2 and L3 cause *lymphogranuloma venereum.* Unlike other serovars, strains of serovar A, B and C are transmitted primarily by infectious eye discharge. They cause a chronic eye disease called trachoma that occurs under poor hygienic conditions, the disease of focus for prevention by the SAFE strategy.[5]

2.2 Epidemiology of Blinding Trachoma

In 2011, it was estimated that 325 million people world-wide live in trachoma-endemic areas. Among the WHO Regions, only the European Region has no country with blinding trachoma. The African Region has 71.2% of the population estimated to be living in trachoma endemic areas and 55% of all endemic countries, making the African Region a priority for intervention. By 2011, Morocco, Oman, Myanmar, Viet Nam, the Gambia, and Ghana had reported to WHO that they have achieved the two proxy targets used for monitoring the elimination of blinding trachoma as a public health problem. The targets are achieving <1 cases of trichiasis per 1000 population and a prevalence of

active trachoma, grade 4, in children aged 1–9 years of <5%. These two targets are known as ultimate intervention goals (UIGs). These countries have moved into the post-endemic surveillance phase. Countries achieving UIGs report to WHO and the global organization known as the GET2020, an alliance working to eliminate blinding trachoma by the year 2020. Currently 16 countries are reporting to WHO on ongoing implementation of the elimination strategy.

Some countries have reported significant progress toward the UIGs. For example, Ethiopia has reported great success in both mass drug administration with azithromycin and tetracycline eye ointment and surgery, reporting treatment of >27 million people since 2001, and 573 000 trichiasis surgical treatments since 2001 (66 000 in 2011). Nevertheless, there are still countries where the initial planning for elimination of trachoma has yet to start. This poses a threat to the achievement of elimination within the timeframe set by the World Health Assembly. [6]

2.3 Natural History and Transmission of *Chlamydia Trachomatis* Infection

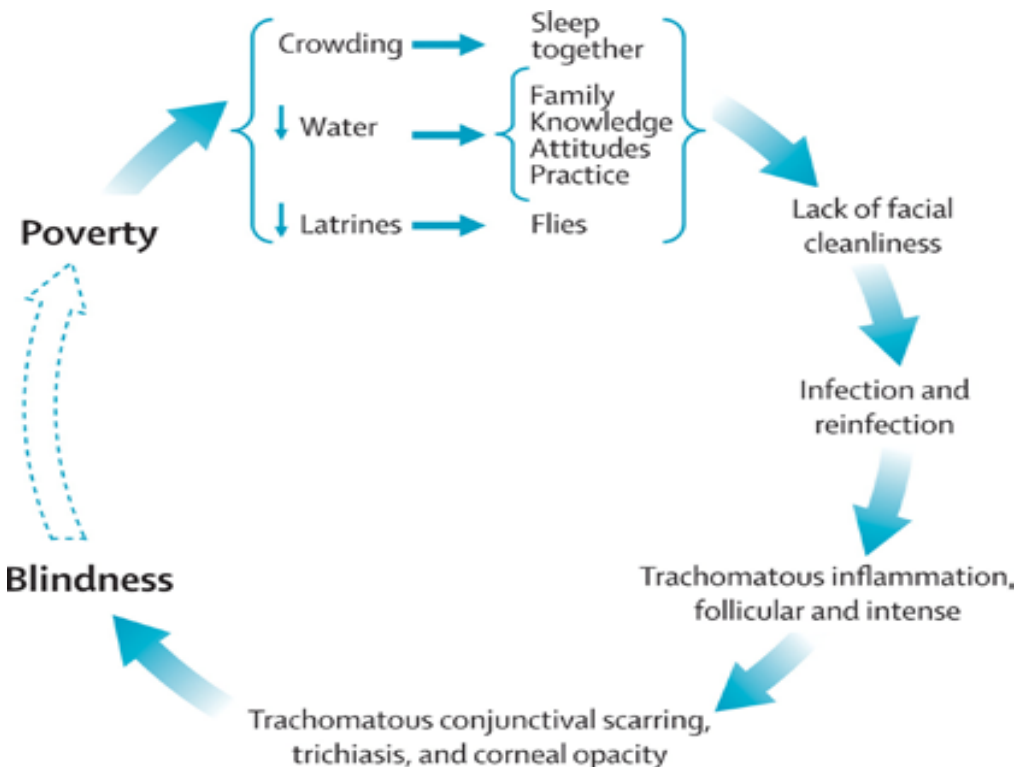
Poor facial cleanliness is the most important risk factor in the transmission of trachoma particularly amongst children. Facial cleanliness is important because it is readily modifiable. Children with unclean faces can spread infection to other children with their fingers or clothes, by all sleeping together in one bed. Small eye seeking flies can also spread trachoma.[7]

A prevalence study conducted in 11 districts in southern Sudan looking into trichiasis life expectancy found out that women were predicted to live longer and spend a greater proportion of their lives with disabling trichiasis, low vision, and blindness compared to men. If nothing is done to control trachoma, a substantial proportion of

remaining life expectancy of infected subjects would be spent with trichiasis and low vision or blindness for both men and women, with a disproportionate burden falling on women.[8] This is made possible because disease transmission occurs primarily between children and the women who care for them.

The interaction of the microbial, social and environmental trachoma risk factors in the host-agent-environment model of the epidemiological triangle are displayed in Figure 2.

Figure 2: Interaction of Trachoma Risk Factors



Source: Wright HR, Turner A, Taylor HR Trachoma Lancet 2008; 371: 1945-54

2.4 Clinical Assessment of Trachoma

The WHO has developed a simplified grading scheme which is used to report the prevalence of active trachoma and sequelae in a population. If at least five follicles of size 0.5 mm are present in the upper tarsal conjunctiva (within a defined area for grading), then follicular trachoma (TF) is graded as present. If there is inflammatory thickening sufficient to obscure at least 50% of the deep tarsal vessels, then inflammatory trachoma (TI) is graded as present. If there is easily visible scarring, then the conjunctiva is graded as trachomatous scarring or TS. If at least one lash is touching the globe or there is evidence of epilation then trachomatous trichiasis is graded as present (note that evidence of trachomatous scarring should also be present to be truly due to trachoma). A visible opacity over the cornea which may or may not obscure the margin of pupil is graded as CO. Each of these signs has meaning for trachoma control programs. The first two, TF and TI, are an indication of the extent and severity of active trachoma. Currently, the WHO recommends using the prevalence of TF to monitor the need for mass treatment with antibiotics and other SAFE interventions for trachoma control in the community. Scarring is an indicator of long-term risk of trichiasis. Data on the prevalence of trichiasis is needed for planning surgical services, and the prevalence of corneal opacity due to trachoma is an indicator of the public health burden of blindness attributable to trachoma (Figure 3 and Table 1). [9]

Figure 3: WHO Trachoma Grading

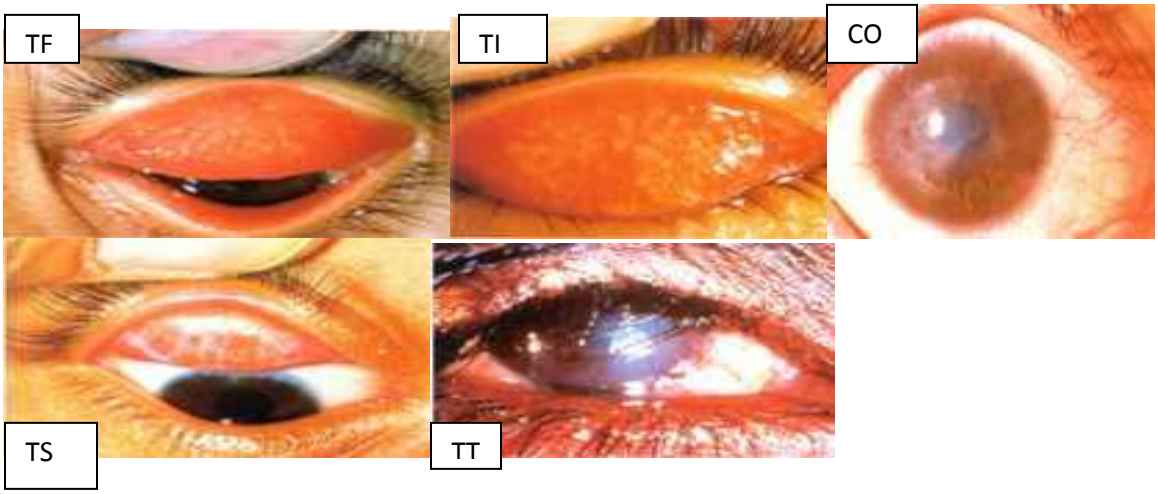


Table 1. The WHO simplified system for the assessment of trachoma

Grade	Abbreviation	Description
Trachomatous inflammation – follicular	**TF**	The presence of five or more follicles (.0.5 mm) in the upper tarsal conjunctiva
Trachomatous inflammation – intense	**TI**	Pronounced inflammatory thickening of the tarsal conjunctiva that obscures more than half of the deep normal vessels
Trachomatous conjunctival scarring	**TS**	The presence of scarring in the tarsal conjunctiva
Trachomatous trichiasis	**TT**	At least one lash rubs on the eyeball
Corneal opacity CO	**CO**	Easily visible corneal opacity over the cornea; does not need to include margin of pupil.

Source: WHO (2013). Prevention of Blindness and Visual Impairment: Priority eye diseases, Trachoma.

2.5 Elimination of Blinding Trachoma

Launched under the leadership of WHO in 1997, the Alliance for the Global Elimination of Blinding Trachoma by the Year 2020 (GET2020) is a partnership formed to support country implementation of the SAFE strategy. The Alliance is led by WHO and is open to members from all sectors – public, nongovernmental and commercial - willing to work with governments to implement the SAFE strategy. Alliance members include WHO, national governments, nongovernmental organizations, research institutions, foundations, and the pharmaceutical industry. Blinding trachoma can be eliminated by implementing the SAFE strategy which comprises four inter-related public health interventions: **Surgery** for individuals with trachomatous trichiasis, the late stage of the disease that leads to blindness if untreated; **Antibiotic** treatment to reduce the reservoir of Chlamydia infection within every family in an affected community; **Facial** cleanliness to reduce the risk of disease transmission; **Environmental** improvement via the safe management of animal and human excreta, promotion of living conditions that reduce crowding and ocular susceptibility, and improved access to water and sanitation.[10]

Ngondi *et al.* (2004) conducted a study of the effects and the impact of trachoma control interventions in five districts of Ethiopia and found out that a three-year implementation of the SAFE strategy resulted in 51 to 88% decline in TF prevalence from a baseline prevalence of 49-90% to an evaluation prevalence of 11 to 54%. Roba *et al.* (2011) conducted an analytical cross-sectional survey to study the effect of the SAFE strategy before and after three years of intervention on trachoma across Ethiopia on a total of 8358 children age 1-9 years as well as 4684 people ages 14 and above. They observed a considerable decline in the magnitude of trachoma and its risk factors in

areas where the SAFE strategy was implemented. All reductions related to antibiotic (TF), face washing (clean face) and environmental (latrine) components were statistically significant except for Surgery (TT).[11] Bamani *et al*. (2010)conducted population-based cluster surveys in Mali and examined 29,179 persons from 2,528 compounds, in 260 clusters in 2006 and 32,918 from 7,533 households in 320 clusters in 2009 and concluded that trichiasis surgery provision remains a need in all districts where the prevalence exceeded 1.0% in adults making surgery the most disproportionately under implemented component of the SAFE strategy.[12] Yayemain *et al.* (2008) in their study concluded that active trachoma is no longer a public health problem in Ghana after successful implementation of the SAFE strategy in that country since 200. To our knowledge, an impact evaluation study of a trachoma prevention and control program had not been conducted in Nigeria prior to our study.

Whereas most of the studies conducted to assess the impact of SAFE strategy on trachoma are clustered cross-sectional studies, there are several longitudinal studies as well in the literature on SAFE Strategy. A longitudinal study by Atik *et al.* (2006) was conducted in Viet Nam where 3186 people were examined and graded for trachoma followed by conjunctival sampling to detect *Chlamydia trachomatis* by commercial polymerase chain reaction. Grading and *Chlamydial* detection were repeated every 6 months for 3 years. Azithromycin was given to children aged 5 through 15 years with active trachoma and their household members in communities where the full SAFE strategy was implemented as well as communities where only the first two components (SA) of SAFE strategy were implemented at baseline and at 12 months; these communes were compared with the S-only control commune that did not receive azithromycin

targeted treatment. The authors concluded that antibiotic treatment may interrupt the duration of infection required for developing immunity, increasing the number of individuals susceptible to reinjection and adversely affecting disease prevalence over time.[13]

In a separate study, Astle WF *et al.* (2006) conducted an observational follow up study of the introduction of the SAFE strategy employing a collaborative approach and its impact on trachoma on 3892 persons in Southern Zambia. New, clean water wells were drilled under local supervision for each of 26 identified villages. All people living in villages near the wells were screened for trachoma and then treated with antibiotic if required. Education on personal and environmental hygiene was provided by trained volunteers. Patients affected by trichiasis and corneal scarring received surgery, locally if possible. The overall prevalence of trachoma in the area was 47% in 2001; however, the prevalence was 55% among children under 10 years. At two years' post intervention, the overall prevalence of trachoma was 7.6%, and 10.6% in children younger than 10 years of age, and 5.9% among adults.[14]

It is to be noted that even though the effectiveness of the SAFE strategy in reducing the transmission of Chlamydial eye infection and thus the incidence and prevalence of trachoma is well established, the contribution of each component of the SAFE strategy differs from community to community and depends on a number of factors including the resources available, determined government priorities, community needs and partner interests. The relative contribution of each component of the SAFE strategy in the prevention of blinding trachoma may depend on the extent, quality and duration of implementation of each component as well as socio -demographic and

environmental determinants. Roba et al (2011) in their study in Ethiopia found that the TF reductions related to antibiotic , face washing and environmental (latrine) components of SAFE Strategy were statistically significant except for surgery (TT).

2.6 Choosing an Evaluation Design for Trachoma Interventions.

The choice of an evaluation design for a trachoma control program or indeed any public health intervention depends on the objectives of the evaluation, the type of the indicators we want to measure and the type of inferences we want to make. The indicators can be used to measure service provision, utilization, coverage and impact. The inferences that can be made in program evaluations include adequacy assessment, plausibility assessment and probability assessment inferences.[15] Whereas plausibility and probability designs require a control group before the start of an evaluation program, with the probability designs also requiring both a control group and randomization; an adequacy evaluation design is a cross-sectional or a longitudinal design without a control group and without a randomization before the start of the evaluation program.[16] Recently, a number of studies have provided evidence on the cost-effectiveness of an integrated approach to the mapping, implementation and monitoring and evaluation of the neglected tropical diseases where a geographic overlap exists[17]. Hansen et al. (2012) have developed a "roll-out package" for effectively integrating and scaling up such programs to national scale which consists first of laying the groundwork, focusing on scaling up and aiming at ensuring effective management.[18] Monitoring and evaluation of these integrated programs presents particular challenges over and above those required for single disease vertical programs[19.] The design of the study reported in this manuscript is a cross-sectional survey, thus a prevalence study at a particular point in

time. A final impact evaluation of the trachoma prevention and control program in Plateau and Nasarawa States will be conducted after completion of the project period in the area.

Chapter 3. Study Design, Study Procedures and Methods

3.1 Objectives of the Study

The primary objective of the study is first to undertake an assessment of the impact of the ‘’A’’ component of SAFE strategy interventions by determining the level of reduction in the prevalence of trachomatous follicular inflammation from baseline levels in Nasarawa and Plateau States of Nigeria after two rounds of MDA (first round was in 2010 and the second round was in 2011). The second objective is to identify the impact of the trachoma control program interventions on latrine ownership and use and antibiotic coverage and the third objective is to recommend areas of improvement for future program intervention.

3.2 Informed consent and Ethical Approval:

This study was submitted for review and granted exemption by the Emory University IRB under Study Number 079-2006. The Plateau State Ministry of Health and Nasarawa State Ministry of Health approved the survey as an ongoing program monitoring activity and impact assessment survey. Standardized consent statements were read in the local languages to the village head by trachoma survey teams upon their arrival in the community. Permission was requested to enter the community. Verbal informed consent was obtained from the head of household prior to conducting interviews. No incentives were offered or provided to any participant.

3.3 Study Methods and Assessments:

Mass drug administration with azithromycin for trachoma control was conducted in 2010 and 2011 in all the trachoma endemic areas of Nasarawa and Plateau States which had baseline trachoma prevalences of 10% or above in the years 2008/2009. The intervention areas were three Local Government Areas (LGAs) in Plateau State and four LGAs in Nasarawa State of Nigeria. This cross-sectional clustered sample survey was designed as an interim assessment and included all the three Local Government Areas in Plateau State and four LGAs in Nasarawa State which were surveyed as a single domain. A random sample of 20 Enumeration Areas was randomly selected from each State with a total of 40 Enumeration Areas from both States. From each enumeration area, a specified number of segments based on assigned weights were selected randomly and all were surveyed (Appendix D). The evaluation survey was carried out during the month of June 2012 in collaboration with the Carter Center and the Nigerian Ministry of Health. The important evidence to be obtained from the survey is to find out the impact of two rounds of mass Azithromycin distribution in particular and the SAFE strategy in general in three local government areas of Plateau State and four local government areas of Nasarawa State of Nigeria. The study also aims at identifying patterns in the sociodemographic characteristics of households in the community who participated in these public health interventions. The findings are of importance for improving public health interventions for prevention and control of trachoma in Nigeria and other trachoma endemic countries. A comparison of baseline and follow up survey results is given in Table 2.

Table 2: Table of Study Area Characteristics at Baseline and Follow up Surveys, Nigeria, 2008 & 2011.		
COUNTRY : NIGERIA	Baseline Survey	Post Intervention Survey
States	2	2
Number of domains	30	2
Number of clusters per domain	20	20
Total number of HH	7,883	793
Total number of people examined	46,960	3,990
Total number of children 1-9 yrs examined	18,164	1,530

3. 4 Data Collection and Sampling Method

A two-stage cluster sampling was used to determine the sample from study population in Seven Local Government areas of the States of Plateau and Nasarawa in Nigeria. In the first stage, 40 clusters were identified by systematic random sampling The Bureau of Census provided maps of the selected EAs (Enumeration Areas). Survey teams divided the map into segments of approximately equal size (about 15 households) and one segment was randomly selected. The number of segments in each enumeration area varied. Therefore, we weighted differentially all data from surveys in these 7 local government areas according to selection probabilities. All households in selected

segments were surveyed, and all residents were examined by trained ophthalmic assistants and ophthalmologists. A follow-up visit was made to households with missing residents on the day of the survey, but households where no one was present were not replaced. About 800 households were selected from identified segments of the 40 clusters with each cluster contributing a number of households proportional to their population size. One of the clusters (cluster # 30) was missed because of security reasons that made it impossible to conduct the survey there. In each household, informed consent was obtained from the head of household (or his or her adult representative) before the interviews began. A standard pre-coded questionnaire was administered to each head of household to collect basic household demographic data and knowledge of trachoma disease, the SAFE strategy and the household-level interaction with the community directed distributor during MDA. The survey teams also documented the physical presence or absence of a household pit latrine and a visual inspection looking for evidence of the use of the latrine by the household was made if the household owned a latrine. After the head of household interview was completed, the members of the entire household were enumerated on a census form. Each member was asked to report their age, type of antibiotic taken (if any), and reason for not participating in the survey, if applicable. Children ages 1-9 years of age were clinically examined for trachoma using a 2.5 binocular under adequate light. Each eye was graded using the WHO standard grading scale and multiple grades of trachoma were recorded for each eye depending on the type of lesion identified by the clinical examination if present. Individuals were shown Zithromax® bottles and the pills to avoid confusion with other MDA programs.

3.5. Statistical Analysis

Survey data were entered into electronic tablets at the time of data collection and validated using Microsoft Excel 2007. The analysis was conducted using SAS version 9.3 (The SAS Institute Cary, NC). The primary outcome of the study was to determine if there was a statistically significant difference in the prevalence of TF in children ages 1 to 9 years compared to baseline TF prevalence in the same age group after two rounds of MDA. The household-level questionnaires were analyzed using the SURVEYFREQ procedure to calculate frequencies weighted by cluster to adjust for differences in population between Enumeration Areas. Individual level responses from the census form were analyzed using SURVEYFREQ applying cluster-level weights. The main outcome measures of the study were to determine the prevalence of TF in children 1-9 years of age, prevalence of TT among adults 15 years and older, antibiotic coverage and proportion of households owning latrines. The percentage reduction in the prevalence of the outcomes was calculated, and comparison of baseline and follow-up proportions was made using 95% Confidence Intervals. The CHISQ is the test of significance in the SURVEYFREQ procedure. The difference between baseline and follow up prevalence or coverage was taken as statistically significant if the Confidence Intervals were not overlapping. A computational procedure , the Taylor series expansion method , was used to adjust for the design effects based on effective sample sizes to create adjusted estimates of confidence intervals using information on the strata of the sampling frame.

3.6 Training of Data Collectors

Training was provided to trachoma graders and other data collectors by qualified international and local professionals in Nigeria from June 5 to June 9, 2012. The recruitment of trachoma graders and data collectors was conducted according to criteria established by local health authorities of Nigeria. The training course included the purpose of the survey; protocol roles and responsibilities; trachoma overview and the SAFE strategy; basic, clinical and epidemiologic concepts such as anatomy of the eye, examination techniques and trachoma grading based on WHO clinical criteria; sampling including mapping, segmenting, data collection of both household characteristics and individual census through field exercise in Langtang South School Children; introduction to the use of the electronic device, the tablet, for data collection through role play. Information on the enumeration areas selected by systematic random sampling, the weights assigned for each cluster, the consent form, training of field workers, the household and census questionnaire used are provided at the end of the paper. (Appendices A to F).

Chapter 4: Results

4.1: Socio-demographic characteristics: More than two-thirds of heads of households, 625 (79%) were women. Thirty four percent of the respondents in Nasarawa and 29 percent in Plateau did not go to any formal or religious school. Sixty nine percent of the respondents in Nasarawa and 60% in Plateau State were farmers or cattle herders. These socio-demographic characteristics Major socio-demographic characteristics are detailed in Table 3.

Table 3: Demographic Characteristics of Heads of Households in Nasarawa and Plateau States After Two Rounds of MDA and Other SAFE Interventions, 2012

	Nasarawa State		Plateau State	
Gender				
Male	34	16.8	103	23.8
Female	280	83.2	345	76.2
Marital Status				
Single	4	1.1	14	3.0
Married	292	92.1	399	88.8
Divorced/Separatd	4	2.0	10	2.5
Widowed	15	4.9	25	5.8
Educational Status				
None	120	34.4	159	29.3
Primary	82	30.4	96	19.6
J. Secondary	20	7.0	42	11.8
S. Secondary	52	13.6	86	18.9
College	32	8.0	49	14.8
Religious	8	6.6	16	5.4
Occupation				
Farmer	206	69.3	334	59.8
Employed	2	1.1	29	13.3
Trade/ business	86	22.4	52	15.9
Daily Laborer	0	0.0	7	2.7
Housewife	20	7.2	24	7.7

4.2 Trachoma Prevalence: In the follow-up surveys, a total of 1530 children, 808 (53%) boys and 704 (47%) girls, aged l-9 years from 793 households were screened for clinical signs of trachoma. A total of 2138 persons, 1014 (46%) males and 1124 (54%) females, above the age of 14 years were also examined for signs of trachoma. The state level impact of intervention as measured by the changes in the prevalence of TF and TT are as follows. The baseline prevalence was 13.9% in Plateau State and 12.1% in Nasarawa State. The follow up prevalence was 4.85% in Plateau and 1.6% in Nasarawa, a 65% TF reduction for Plateau State and 86% TF reduction for Nasarawa State (differences in TF ($p<0.001$); differences in TT ($p=0.012$). The highest statistically significant reduction (96%) in TF prevalence was observed in Doma LGA of Nasarawa State from baseline prevalence of 13.6 (95% CI 9.7%, 17.5%) to follow-up prevalence of 0.5% 95% CI(0%, 1.5%) and the lowest reduction (58 %) in TF prevalence was observed in Langtang North LGA of Plateau State from baseline prevalence of 15.8% (95% CI 9.3%, 22.3) to 6.6% (95%CI 1.6%, 11.6%) which was also statistically significant ($p<0.05$). It is to be noted that prevalences at the individual State and LGA level, as well as the total for the seven LGAs of the two states are different. The details of the findings are displayed in Figure 2A& 2B and Tables 4 & 5.

Figure 4A &4B Trachoma TF and TT Prevalence in Plateau and Nasarawa States in Nasarawa and Plateau States, 2008/2012.

Figure 4A.

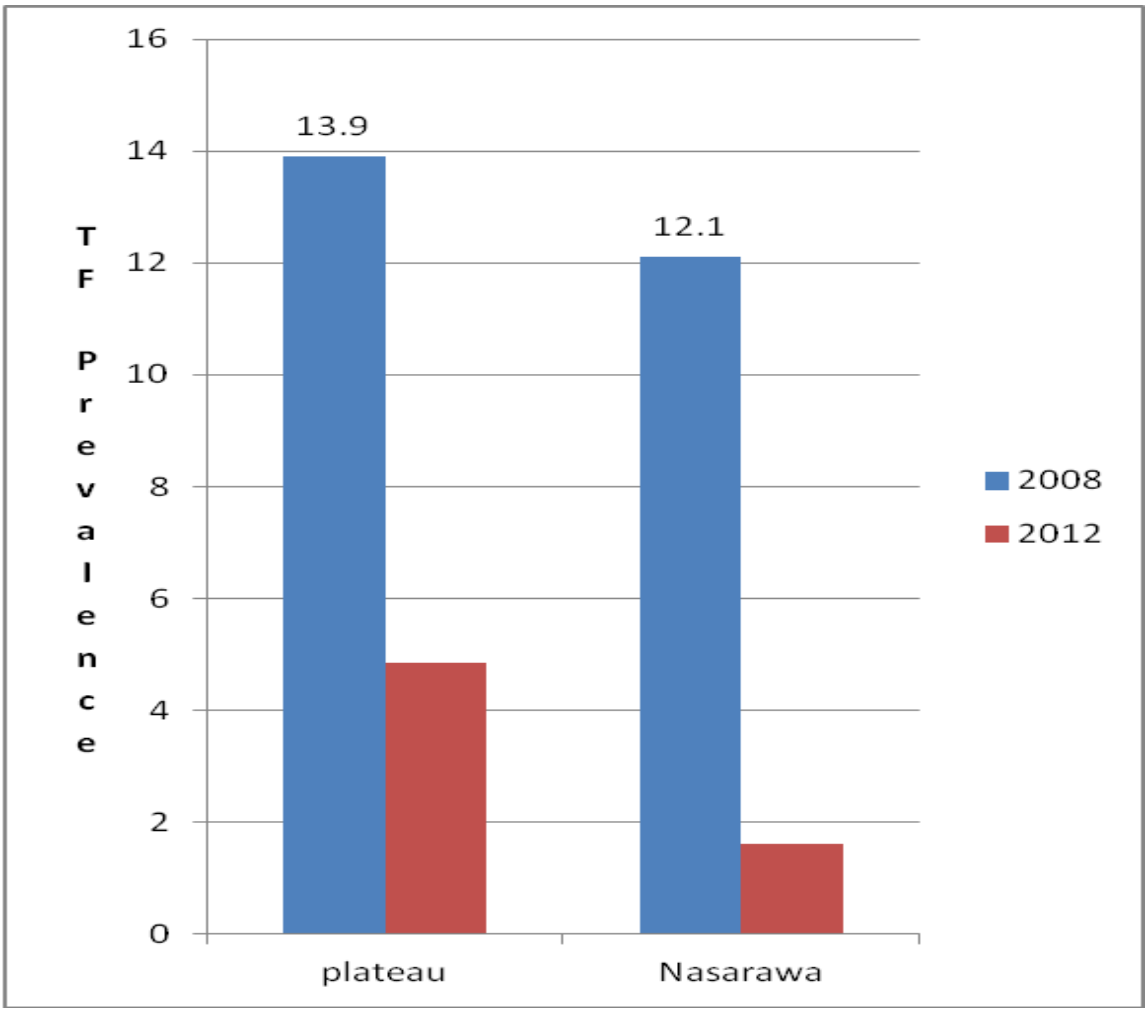


Figure 4B

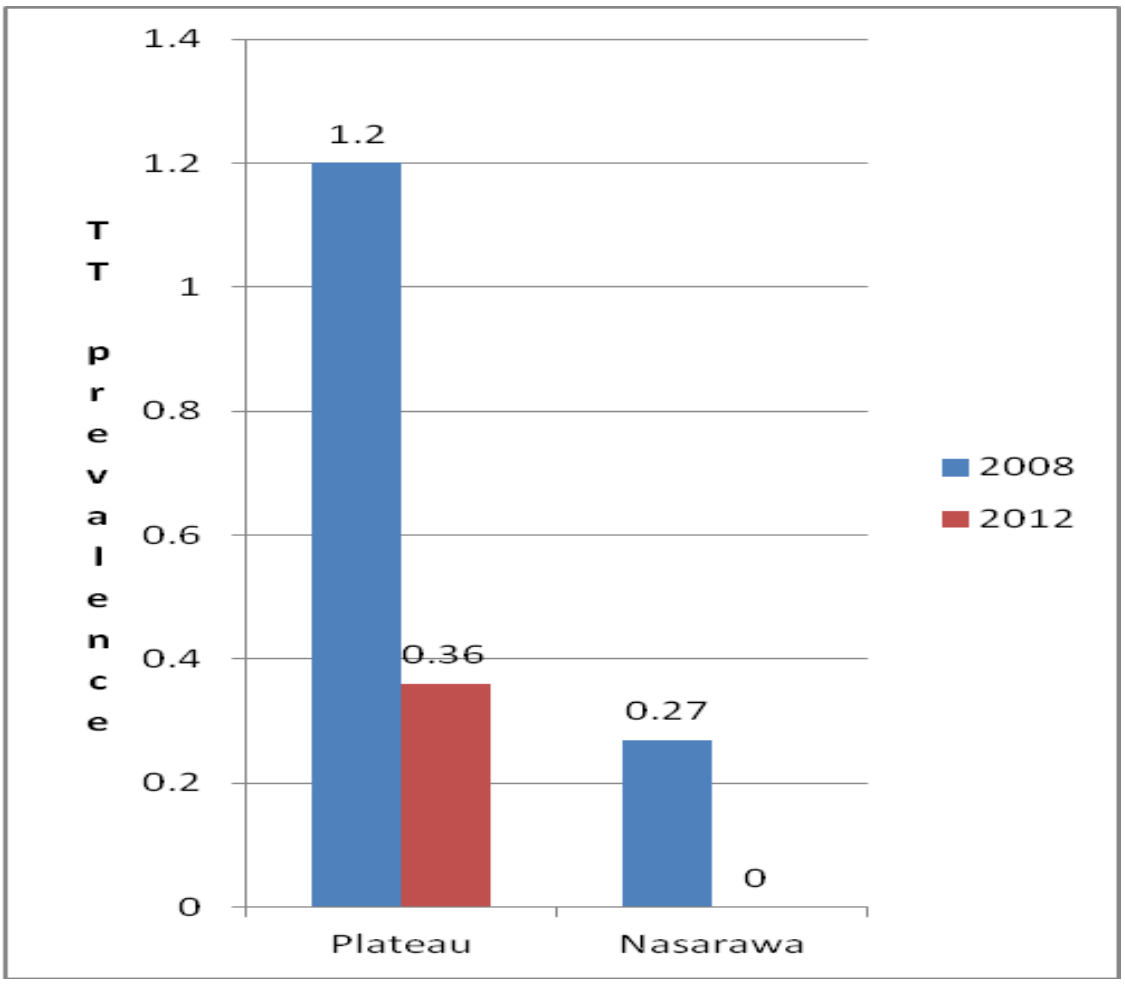

1.4
1.2
1
0.8
0.6
0.4
0.2
0
TT prevalence
1.2
0.36
0.27
0
Plateau
Nasarawa
2008
2012

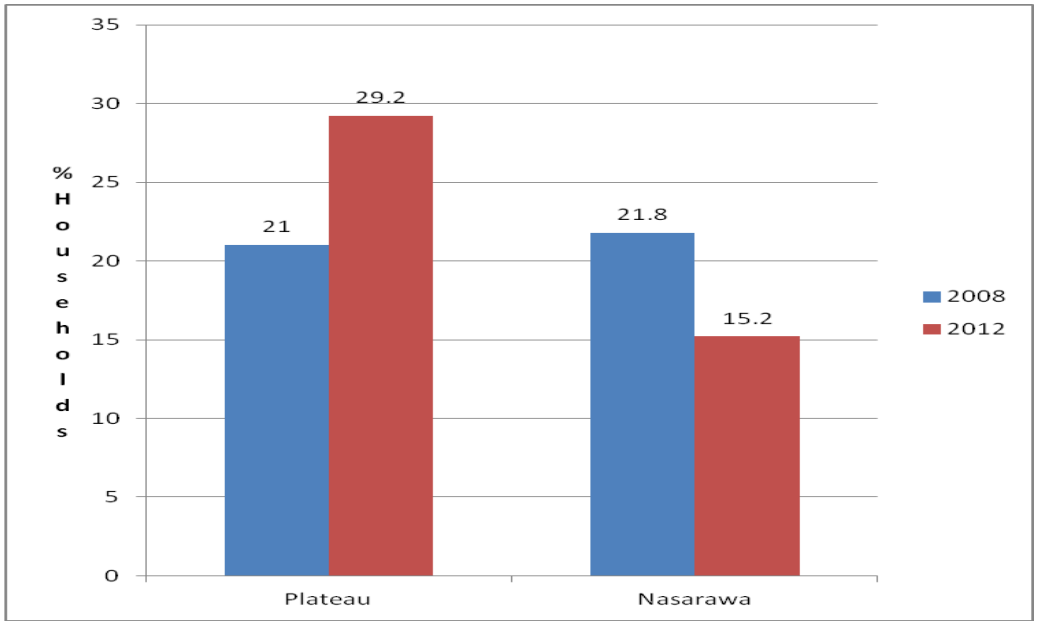
Table 4: Prevalence of Clinical signs of Trachoma in the LGAs of Nasarawa and Plateau States After Two Round of MDA and Other SAFE Interventions, 2012

	Children Age 1-9 years			**Adults Age 15 and Older**		
Program Area	Children age 1-9, N Prevalence of TF Baseline [95%CI]	Children age 1-9, N Prevalence of TF Follow up [95%CI]	Percent Change TF Reduction	Adults Age>=15,N Prevalence of TT Baseline [95%CI]	Adults Age>=15, N Prevalence of TT Follow up [95%CI]	Percent Change TT Reduction
Nasarawa	12.1	1.61	86	0.27	*	100
Awe	10.6 [6.6, 14.5]	3.9 (0.9, 6.9)	63	0.41 (0.0, 1.0)	*	100
Doma	13.6 [9.7, 17.5]	0.5 (0.0, 1.5)	96	0.41 (0.0, 0.42)	*	100
Keana	12.7 [7.8, 17.3]	3.3 (2.4, 4.10)	74	0.27 (0.0, 0.68)	*	100
Obi	11.3 (6.9, 15.8)	1.0 (0.0, 2.4)	91	0.28 (0.0, 0.67)	*	100
Plateau	13.9	4.85	65	1.2	0.36	70
Langtang N	15.8 (9.3, 22.3)	6.6 (1.6, 11.6)	58	2.1 (0.98, 3.2)	0. 1 (0.0, 0.4)	95
Shendam	12.1 (7,17.1)	3.7 (2.4, 5.1)	96	0.27 (0.0, 0.82)	0.1 (0.0, 0.4)	63
Wase	13.9 (8.1, 19.6)	4.5 (0.0, 9.0)	68	1.3 (0.7,2.0)	0.3 (0.1, 1.5	77
Total Prevalence 7 LGAS	12.86	3.40	74	. 0.69	0.21	70
Overall Prevalence Baseline 30 & Follow up 7	6.4 (5.8, 7.0)	3.4 (1.9, 4.9)	47	0.34 (0.25, 0..42)	0.21 (0.00, 0.47)	38

Table 5: Summary of key Findings in Trachoma Prevalence before and After Two Rounds of MDA, Plateau and Nasarawa States, Nigeria, 2009-2012				
State	**Indicator**	**Baseline%**	**Follow-up%**	**Percent Reduction**
Nasarawa				
	TF	13.9	4.85	65
	TT[1]	0.27	0	100
Plateau				
	TF	12.1	1.61	86
	TT	1.2	0.36	70

5.3 Latrine Ownership and Use: Household latrine coverage was 21.0% and 29.2% for Plateau State and 21.8% and 15.2% for Nasarawa State at baseline and follow up surveys respectively (Figure 5).

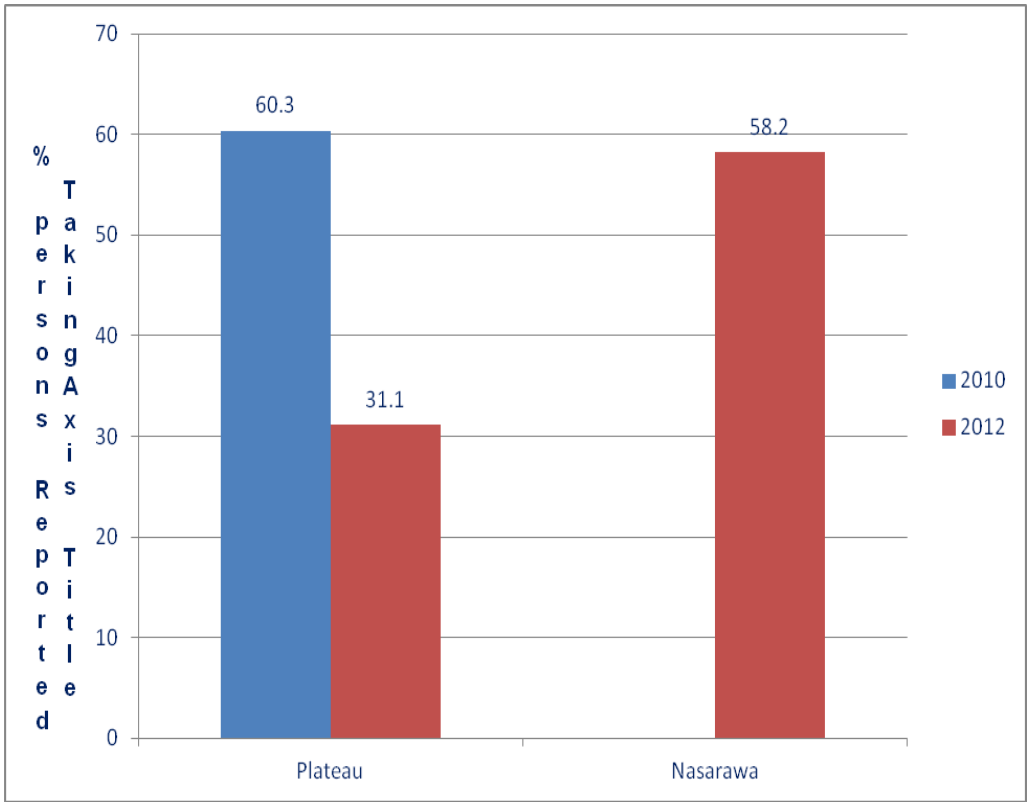
Figure 5. Household Latrine Ownership in Plateau and Nasarawa States of Nigeria 2008, 2012



Latrine use in the baseline survey was 100% for Nasarawa Sate and 97.5% for Plateau State. In the follow up survey, latrine use was 100% for Nasarawa State and 98.2% for Plateau State.

5.4 MDA and Antibiotic Coverage: Antibiotic coverage was 60.3% and 31.1% for Plateau State at baseline and follow up surveys respectively. The follow up antibiotic coverage for Nasarawa was 58.2%. The baseline survey did not capture antibiotic coverage in Nasarawa state despite the conduct of MDA in that State in 2010 (Figure 4).

Figure 6: MDA Coverage at Baseline and Follow up Surveys in the Two Sates of Nigeria, 2010, 2012



Chapter 5: Discussion and Conclusions

Trachoma is a disease of entire communities in Plateau and Nasarawa States of Nigeria and the pool of infection resides largely in children but the blinding effect impacts mainly the adult population. The WHO defines elimination of blinding trachoma as prevalence of TT <0.1% in the total population (<1% in people age 14 and older) and a prevalence of TF less than 5% in children 1-9 years of age.[20] Communities with TF prevalence above 5% require mass antibiotic treatment. The Ultimate Intervention Goal for the F and E components is attaining 80% coverage in facial cleanliness (unclean faces <20%) and environmental hygiene markers (no latrine use <20%). [21]

5.1. Sociodemographic Characteristics

There have not been any major socio-demographic events during the intervention period in both Plateau and Nasarawa States such as internal displacement of people or immigration of populations from neighboring states or countries. This is important because changes in public health status can be reasonably attributed to the effect of the intervention. Consistent with findings at baseline survey, the majority of heads of household 625 (79%) were women. Thirty four percent of the respondents in Nasarawa and 29% in Plateau did not go to any formal or religious school and 69% of the respondents in Nasarawa and 60% in Plateau State were farmers or cattle herders basically depending on subsistence agriculture. The presence of a relatively high proportion of respondents who are unable to read and write should be considered in any trachoma awareness and health education messaging.

5.2. Trachoma Prevalence:

According to the World Health Organization guidelines, mass treatment with antibiotics annually for at least 3-5 years should be carried out in trachoma endemic communities[20]. Mass drug administration for control of trachoma was carried out in LGAs that met the guidelines for treatment in Nasarawa and Plateau States of Nigeria in the years 2010 and 2011 based on the findings of the baseline surveys. The prevalence of trachoma follicular inflammation at baseline which was high enough to justify the introduction of mass treatment was reduced (statistically significant) following two rounds of MDA as well as the implementation of other components of the SAFE strategy. In a similar study by Roba et al (2010) [11] the prevalence of trachoma inflammation-follicular (TF) dropped from 36.7% (95%CI: 33.9% to 39.6%) to 18.4% (95% CI:15.4% to 21.8%), an overall prevalence reduction of 49.9% after three years of intervention compared to a drop from 6.4 % (95% CI, 5.8% to 7.0%) to 3.4% (95% CI 1.9%, 4.9%) which is a 47% prevalence reduction for the seven LGAs after two years of intervention in our study. Ngondi *et al* reported 32% reduction in TF and 45% drop in TT in Amhara Region of Ethiopia where the SAFE strategy was enhanced through bi-annual mass-mobilization campaigns.[8]

The reduction in the prevalence of blinding trachoma (TT) for the seven LGAs from 0.69 %, (95% CI 0.48%, 0.90%) to 0.21%, (95% CI: 0%, 0.47%) is statistically significant. This finding is similar to findings by Roba *et al* where there was a decrease in prevalence of trachoma trichiasis (TT) from 4.6% (95% CI: 3.6% to 5.8%) to 2.9% (CI: 2.1% to 3.9%) but the decrease in that study was not statistically significant even though the intervention included all the SAFE components including back-log clearing

Surgery. It is remarkable that significant and meaningful reductions in both TF and TT levels were achieved in both in Plateau and Nasarawa states after two rounds of MDA. A third round of MDA should be conducted in line with World Health Organization recommendations that at least three rounds of annual MDA need to be carried out in trachoma endemic communities with the expectation of a further decline in TF prevalence. A full scale SAFE impact evaluation addressing all the components of the SAFE strategy should be conducted in order to be able to declare that trachoma control in each LGA has been achieved.

5.3. MDA and Antibiotic Coverage: Drug distribution to a household is strongly associated with reduction in active trachoma in our findings and is consistent with findings in other studies. The low antibiotic coverage in the study areas could be explained by the fact that 16/40 enumeration areas studied were not in the MDA list of the States. Enumeration Areas where community directed drug distributers (CDD) are not deployed do not have the health promotion and others services given by CDD.

Antibiotic coverage was 60.3% and 31.1% for Plateau State at baseline and follow up surveys respectively. The follow up antibiotic coverage for Nasarawa was 58.2%. Baseline survey did not capture antibiotic coverage for Nasarawa state despite the conduct of MDA in that State in 2010. The reasons for this oversight are not known. These antibiotic coverage rates are significantly lower compared to the WHO ultimate intervention goal at least 80% coverage, suggesting that factors other than antibiotic treatment could be at play that account for the significant TF reductions .

5.4. Household Latrine ownership : The remarkably low latrine coverage (baseline and follow-up rate of 21.0 % and 29.2 % for Plateau and 21.8 % and 15.2% for Nasarawa respectively) are associated with the temporary nature of latrine infrastructure. Sometimes the latrines fall apart and the sanplats sink to the pit during the rainy season as explained by Dr F. Nimzing (Nigeria Field Office) at the 14th Annual Trachoma Control Review Meeting of The Carter Center held in Atlanta, USA, when the findings of this survey were presented (March 2013). The lack of significant improvement in latrine ownership in Plateau State and the decline in ownership observed in Nasrawa State are indicative of the need for strengthening the environmental component of the SAFE Strategy in the program areas. The inherent weaknesses of cross-sectional designs limit the ability to establish a total attribution of the impact to the intervention. The existence of confounding and counterfactual non- program factors which could significantly alter the outcome of the study could be minimized by the use of prospective longitudinal designs which employ control groups. These could provide better evidence in terms of how much of the outcome could be attributed to the intervention but would require a longer time and higher costs.

A significant reduction in the prevalence of TF has been registered after two rounds of MDA in the two States of Nigeria. The threshold prevalence by which mass antibiotic interventions to control trachoma is not needed is below 5%. Our finding of post intervention TF prevalence was below 5% in the two States. Thus two rounds of MDA may be as effective as three or more rounds in reducing TF Prevalence where there is a sustained implementation of the F & E components of the SAFE strategy and adequate antibiotic coverage. These findings need to be replicated in more robust designs

before policy recommendations can be made to decision makers. If these findings are reproducible, resources used for conducting the third and subsequent rounds of MDA could be shifted to other much needed areas, for instance to Strengthen the 'FE' components of the SAFE Strategy and for capacity strengthening to ensure local ownership and sustainability of trachoma control programs with equal focus on environmental measures. The coverage with MDA has been consistently below the 80%, yet deep reductions in TF have been observed which is indicative of the need to enhance close monitoring and strengthen the distribution mechanism to ensure adequate coverage in the future, because the findings of TF reduction in this study may not be generalized to areas beyond the study population. Only 16 of the 40 enumeration areas have CDDs; training and deployment of CDDs in areas where they have not been deployed is needed. Capacity strengthening should ensure local ownership and sustainability of operations for trachoma control programs with equal focus on environmental measures and assist the state governments of Nigeria and partners to reach more communities living in trachoma endemic areas.

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Appendix A: Questionnaire: Nigeria MDA Coverage Survey June 2012

Serial Number:	|__|__|__|__|__|	Data Entry 1 *(initials)*	|__|__|	Date:
Cluster Number (1-40):	|__|__|	Data Entry 2 *(initials)*	|__|__|	Date:
Latitude	|__|__| |__|__|__|__|__|	Longitude	|__|__|__| |__|__|__|__|__|	
Village name		Survey Date (DD/MM/YYYY) |__|__|/|__|__|/|__|__|__|__|		
Household number:	|__|__|	Household interview consent given? No= 0 Yes= 1 *(if no, END)*		

Household Demographics			
Compound	Describe this household in relation to the compound.	First malaria HH where more than one malaria HH per MDA HH (includes head of MDA HH)=1 Other malaria HH where there	
RD1	Name of respondent		
RD2	Description of Respondent	Head of household=1 Wife of head of household=2 Other=99	
RD3	Gender of Respondent	Male= 1 Female=0	
RD4	How old are you? *(in years, round months down)*		

RD5	What is your ethnicity? *Write name of ethnicity*	_____	
RD8	What is your current marital status? *Do not read list*	Single & Never Married……...1 Married…….2 Not Married Now-- Divorced or Separated……..….. .3 Widowed……..4	
RD9	What is the highest level of school anyone in your household has attained (started)?	None..... .....0 Primary .....……..1 Junior secondary.....……..…2 Senior secondary.....……...3 College / University…….....4 Religious school.....5	

RD11	What is the main occupation of the head of the household? **NOTE: this is the occupation of the head of the malaria HH (wife in most cases)**	Farmer/cattle rearing.....1 Formal employment (salary).....2 Trade (business).....3 Daily laborer.....4 Housewife.....5 Other.....99 *(specify)*:_____	
RD12	Does this household own any land?	No……...……..0 Yes, but only lease.....1 Yes, and own outright.....2 Do not know……..…..……88	
Household Possessions			
HP3	Does your household have a functioning radio set?	No=0; Yes=1	
HP4	Does your household have working electricity?	No=0; Yes=1; Yes, generator=2	
HP5	Does your household have a functioning mobile phone?	No=0; Yes=1	

MDA Knowledge and Participation			
M1	What disease do these drugs treat? *(show Zithromax and Tetracycline)* **NOTE: Recorders showed measuring stick, pink pills and empty pos bottle. Clearly differentiated between pink pills and other white pills distributed. If person described trachoma but did not know the name, it was counted as trachoma. Just saying eye disease should have been marked as other.**	Trachoma=1 Lymphatic Filariasis=2 Onchocerciasis=3 Schistosomiasis=4 I do not know=88 Other =99 (specify)_____	
M2	Did your household get these drugs from a CDD?	No=0; Yes=1	
M3	Prior to the day of distribution, were you informed that these drugs would be given out?	No=0; Yes=1	
K4	What can happen to a person who has trachoma? *(multiple response)* (*Do not read list. After each response ask 'anything else?' and indicate all responses given.)*	Nothing happens=1 Blindness=2 Reduced vision=3 I do not know=88 Other=99 (*specify*)_____	
K5	How can someone protect him/herself from trachoma? *(multiple response)* (*Do not read list. After each response ask* 'anything else?' and *Indicate all responses given)*	Face washing/hygiene=1 Take antibiotics or medicine=2 Trichiasis surgery=3 Keeping environment clean=4 Using pit latrines=5 I do not know=88 Other =99 (*specify*)_____	
K6	Do you believe that trachoma is a problem in your community?	No=0; Yes=1; I don't know=88	
Water and Sanitation			

WS1	What is the main source of water your household uses for drinking?	Unprotected spring=1 Protected spring=2 Unprotected dug well=3 Hand pump/tube well/borehole=4 Surface water (river, dam, lake, stream, canal)=5 Public piped water/tap/standpipe=6 Private piped into yard/dwelling=7 Rainwater collection=8 Other=99 *(Specify)*_____	
WS2	How long does a roundtrip take for you to collect water used for drinking – including time to walk there, collect water and return?	Less than 30 min=1 30 min to 1 hour=2 More than one hour=3	
WS3	Is the water source you use for drinking the same you use for bathing?	No=0; Yes=1	If WS3=1, go to ES7
WS4	If no, how long does a roundtrip take for you to collect water used for bathing – including time to walk there, collect water and return?	Less than 30 min=1 30 min to 1 hour=2 More than one hour=3	
Mosquito nets			
MN1	How many dependents do you have who are living with you here?	_____	
MN2	How many sleeping spaces do you have for you and your dependents?	_____	
MN3	Do you have any mosquito nets in this household?	_____	If MN3=0 then skip to ES7
MN4	How many total mosquito nets do you	_____	

	have for you and your dependents?		
MN5	How many of these nets were given to you during a campaign Dec 2010/Jan 2011?	_____	
MN6	How many nets are hanging now?	_____	
MN7	How many nets were used last night?	_____	
MN8	How many of the reported nets did you observe?	_____	
Observations			
ES7	What is the main construction material for the roof? **NOTE: If there were multiple materials, the "highest ses" selected. E.g. if most thatch and one iron, iron selected.**	Thatch=1 Stick and mud=2 Corrugation iron/metal=3 Other=99 *(specify)*_____	
ES8	Are cattle kept within 10 meters of the living spaces in this HH?	No=0; Yes=1; Do not keep cattle=2	
PL1	Is there a household latrine (*observed*)? **NOTE: If latrine was collapsed, marked "no"**	No=0; Yes=1	If PL1=0, skip next two questions
PL2	Evidence of latrine usage observed (*faeces in pit)?*	No=0; Yes=1	
PL3	What type of latrine is present	Pit latrine without slab or open pit.....1 Pit latrine with slab.....2 Ventilated improved pit latrine (VIP).....3 Flush or pour flush toilet.....4 Public or shared sanitation facilities.....5 Other.....99	

ID #	FIRST NAME	SEX	AGE In years/ write 0 if <1yr/	PRESENT	SLEPT UNDER BED NET LAST NIGHT?	ANTIBIOTICS FOR TRACHOMA: HAVE YOU EVER TAKEN THESE DRUGS TAKEN TO YOU BY THE CDD?NO=0 YES=1 **ZITHROMAX TAB/SYRUP(ZMX)** **TTC EYE OINTMENT(TEO)**				CLEAN FACE		RIGHT EYE					LEFT EYE				
						ZMX	TEO	WHY NOT REFUSED=1 MISSED=2 NOT DISTRIBUTED=3	VERI-FIED NO=0 YES=1 NO RECORD=3	OCULAR No=0 YES=1	NASAL No=0 YES=1	TF	TI	TS	TT	CO	TF	TI	TS	TT	CO
1																					
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					

Appendix B: Hubert Department of Global Health Thesis Concept Paper Clearance Form

This completed form and attached one-page concept paper is due to your ADAP by March 30, 2012 (Dec/May 2013 graduates).

We understand that your project will likely change in the next year- but we want to make sure you are beginning to frame the project and have secured faculty support in advance of your summer practicum.

As you know, many of you will be submitting a GFE funding proposal on March 7, 2012 and others will need to submit your research proposals to IRB in early spring for review. The first step is to begin to frame your thesis project and secure faculty support. This is the purpose of this form/paper.

Name: ASRAT GENET AMNIE

ID: 1935479

Thesis Chair: Deborah McFarland

Committee members (if any): Paul Emerson, Jonathan King

Proposed Type: [X] Research Thesis [ ] Special Study Project

[ ] Systematic Review of the Literature

Proposed Topic/Title: The Impact of Two Years *S.A.F.E.* STRATEGY on the Prevalence of Trachoma in Plateau and Nasarawa States of Nigeria

Attach a one page concept paper to this form. /attached/ Your concept paper is an overview of your proposed project and should address the following things:

Introduction or Overview of Topic: (Statement of need or a knowledge gap that you will address in your thesis)

Goals of your project, research questions or hypothesis to be tested

Overview of Methods (e.g. Data Set or case study to be used or developed, proposed type of data analysis to be completed, etc)

IRB consideration: Does your proposed research include human subjects? YES. Have you discussed the need for IRB approval with your chair and/or the staff of Emory's

IRB? YES. Please see the Emory IRB website- it is very helpful.
http://www.irb.emory.edu/

I have read the thesis guidelines on BlackBoard and understand that failure to meet these guidelines may result in failure to get final approval for my project, and ultimately, to graduate. I understand that any changes in my proposed thesis plans will require the approval of my thesis advisor and committee.

Student Signature ASRAT G. AMNIE Date August 24, 2012

Thesis Advisor Approval: PAUL EMERSON

_____

Signature Institution Date

Other Committee Members Approval:

I(We) have read the proposed research concept paper and agree to work on this project/thesis as a committee member.

Deborah McFarland

_____

Signature Institution Date

Jonathan King

_____

Signature

Institution Date

Appendix C: List of LGAs and Enumeration Areas of the Study Area and Assigned Cluster Numbers.

Serial	State	LGA	Locality code	Locality Name	EA No.	cluster no
64	Plateau	Shendam	000075001	TENGZET(GUNG)	0132	1
207	Plateau	Shendam	000056018	ANG.NBUAB(SHENDAM	0480	2
350	Plateau	Shendam	000038000	RINGLONG	0652	3
492	Plateau	Shendam	000029000	YELWA	0954	4
635	Plateau	Shendam	000074001	NGRAS (DANGAT)	1240	5
778	Plateau	Shendam	000032007	DUNGKAKSAK	1524	6
921	Plateau	Shendam	000004010	KADONG	1810	7
1064	Plateau	Shendam	000084001	ANGWAN MUSA	2092	8
1206	plateau	Langtang N	000065000	LANGAN	0116	9
1349	plateau	Langtang N	000029004	GUNUNG (ZABAI LAKA)	0414	10
1492	plateau	Langtang N	000038002	WARRANG	0698	11
1635	plateau	Langtang N	000020000	PISHE	0986	12
1778	plateau	Langtang N	000011000	LANGTANG	1272	13
1920	plateau	Langtang N	000010000	BALLZE	1556	14
2063	plateau	Langtang N	000013000	INYERGBRMAN	1862	15
2206	Plateau	wase	000063014	ANG TUDUN SAFIYO	0248	16
2349	Plateau	wase	000016004	DAURA	0528	17
2492	Plateau	wase	000027015	MALLAN ADAMA	0808	18
2634	Plateau	wase	000017002	NAKIRAINA(BANGALALA)	1084	19
2777	Plateau	wase	000028000	DEMSUN	1362	20
42	Nasarawa	Doma	000014000	ANGWAN YARA	0092	1
158	Nasarawa	Doma	000043000	ACHALAGU	0888	2
275	Nasarawa	Doma	000066006	AKPOKWU GBEJI	1248	3
391	Nasarawa	Doma	000073016	ZEVER	1442	4
507	Nasarawa	Doma	000092000	IGBABO	1750	5
623	Nasarawa	Obi	000013003	RUGAN USMAN KICHEME	0100(PARTIAL)	6

740	Nasarawa	Obi	000022000	AGYARAGU	0332	7
856	Nasarawa	Obi	000045000	OME	0564	8
972	Nasarawa	Obi	000059000	DADDARE	0834	9
1088	Nasarawa	Obi	000066000	OBI	1026	10
1205	Nasarawa	Obi	000095003	PETER AKAHA	1266	11
1321	Nasarawa	Obi	000130000	GBERWUA	1498	12
1437	Nasarawa	Keana	000024000	ANGWAN DOGO	0196	13
1553	Nasarawa	Keana	000096000	AGBARAGBA	0544	14
1670	Nasarawa	Awe	000003000	JANGWA	0008	15
1786	Nasarawa	Awe	000006000	AZARA	0240	16
1902	Nasarawa	Awe	000062000	ADUNIYA	0470	17
2018	Nasarawa	Awe	000084000	TUNGA	0654	18
2135	Nasarawa	Awe	000118000	KEKURA	0798	19
2251	Nasarawa	Awe	000132001	USSER	0996	20

Appendix D: List of 40 Enumeration Areas selected By Systematic Random sampling and number of Segments in Each enumeration Area (Used in Weighting).

Serial	State	LGA	Locality code	Locality Name	EA No.	Cluster no	CDD present	On MDA List	No. Segments
64	Plateau	Shendam	00007 5001	TENGZET(GUNG)	0132	**1**	No	same as Gunglong or dungung?	2
207	Plateau	Shendam	00005 6018	ANG.NBUAB(SHENDAM	0480	**2**	yes	same as PHC Shendam	3
350	Plateau	Shendam	00003 8000	RINGLONG	0652	**3**	yes	no	2
492	Plateau	Shendam	00002 9000	YELWA	0954	**4**	Yes	same as Market Yelwa?	2
635	Plateau	Shendam	00007 4001	NGRAS (DANGAT)	1240	**5**	no	no	1
778	Plateau	Shendam	00003 2007	DUNGKAKSAK	1524	**6**	no	no	1
921	Plateau	Shendam	00000 4010	KADONG	1810	**7**	no	no	1
1064	Plateau	Shendam	00008 4001	ANGWAN MUSA	2092	**8**	yes	same as Ung. Musa?	1
1206	plateau	LangtangN	00006 5000	LANGAN	0116	**9**	yes	no	1
1349	plateau	LangtangN	00002 9004	GUNUNG (ZABAI LAKA)	0414	**10**	yes	yes	1
1492	plateau	LangtangN	00003 8002	WARRANG	0698	**11**	no	no	1
1635	plateau	LangtangN	00002 0000	PISHE	0986	**12**	yes	yes	1
1778	plateau	LangtangN	00001 1000	LANGTANG	1272	**13**	yes	no	4

1920	plateau	LangtangN	000010000	BALLZE	1556	**14**	yes	yes	1
2063	plateau	LangtangN	000013000	INYERGBRMAN	1862	**15**	yes	yes	3
2206	Plateau	wase	000063014	ANG TUDUN SAFIYO	0248	**16**	no	yes	1
2349	Plateau	wase	000016004	DAURA	0528	**17**	no	yes	1
2492	Plateau	wase	000027015	MALLAN ADAMA	0808	**18**	yes	yes	5
2634	Plateau	wase	000017002	NAKIRAINA(BANGALALA)	1084	**19**	yes	yes	3
2777	Plateau	wase	000028000	DEMSUN	1362	**20**	yes	no	3
42	Nasarawa	Doma	000014000	ANGWAN YARA	0092	**21**	no	no	1
158	Nasarawa	Doma	000043000	ACHALAGU	0888	**22**	No	no	1
275	Nasarawa	Doma	000066006	AKPOKWU GBEJI	1248	**23**	No	no	
391	Nasarawa	Doma	000073016	ZEVER	1442	**24**	No	yes	
507	Nasarawa	Doma	000092000	IGBABO	1750	**25**	No	yes	2
623	Nasarawa	Obi	000013003	RUGAN USMAN KICHEME	0100(PARTIAL)	**26**	No	no	2
740	Nasarawa	Obi	000022000	AGYARAGU	0332	**27**	yes	no	6
856	Nasarawa	Obi	000045000	OME	0564	**28**	yes	yes	3
972	Nasarawa	Obi	000059000	DADDARE	0834	**29**	yes	yes	1
1088	Nasarawa	Obi	000066000	OBI	1026	**30**	yes	yes	1
1205	Nasarawa	Obi	000095003	PETER AKAHA	1266	**31**	No	no	3
1321	Nasarawa	Obi	000130000	GBERWUA	1498	**32**	yes	no	2
1437	Nasarawa	Keana	000024000	ANGWAN DOGO	0196	**33**	yes	no	1
1553	Nasarawa	Keana	000096000	AGBARAGBA	0544	**34**	yes	yes	3
1670	Nasarawa	Awe	000003000	JANGWA	0008	**35**	yes	yes	2
1786	Nasarawa	Awe	000006000	AZARA	0240	**36**	yes	yes	1
1902	Nasarawa	Awe	000062000	ADUNIYA	0470	**37**	No	no	
2018	Nasarawa	Awe	000084000	TUNGA	0654	**38**	yes	yes	
2135	Nasarawa	Awe	000118000	KEKURA	0798	**39**	yes	yes	1
2251	Nasarawa	Awe	000132001	USSER	0996	**40**	No	no	1

Appendix E: Informed Consent

Title of Project: An Impact Assessment of Two rounds of MDA on trachoma Prevalence In Nasrawa and Plateau States of Nigeria: A clustered Cross Sectional Survey

Introduction: You are being asked to volunteer for a research study to assess the impact of two rounds of MDA on trachoma prevalence in Plateau and Nasarawa States in Nigeria. We want to determine the impact of only two rounds of MDA on trachoma prevalence. You are being asked to participate in this project because you are involved in the delivery of mass drug administration or clinical examination for trachoma grading in Plateau or Nasarawa States. Your participation in this research is voluntary. You may choose not to participate at any time without penalty.

Procedures: Participation in this project consists of responding to questions about your involvement in trachoma and the drugs used for trachoma treatment. You may also be requested to have your children, if any, examined for trachoma. The questions will be posed by the PI and/or the study coordinator using a structured questionnaire. The interview should take approximately 15 minutes. The clinical examination of a child's eyes will take about five minutes. You will be expected to respond honestly to questions asked, but all answers are considered correct and appropriate. Children younger than ten years old will have their eyes examined by a trained and qualified professional. You may come into contact with the following research team members: Carter Center district and country staff members, trained field investigators, and the principal investigator.

Risks: There are no foreseeable risks to you or your child from participation in this project.

Benefits: Taking part in this research study may not benefit you personally, but we may learn new things that will help the Ministry of Health (MOH) in Nigeria, the Carter Center and the affected communities to achieve more efficient and effective trachoma interventions in order to eliminate and control these diseases in Nigeria. After the information has been collected and analyzed, the MOH will be provided with feedback on the results of the study.

Confidentiality: Your responses to interview questions will be kept confidential and will not be shared. People other than those doing the study may look at the study records. Agencies that make rules and policies about how research is done have the right to review these records. So do agencies that pay for the study. Those with the right to look at your study records include people at Emory University Rollins School of Public Health, the Emory University Institutional Review Board, and staff members of The Carter Center. Records can also be opened by court order. We may use a study number or your name on study records as may be appropriate. Your name will not be used in any data analysis. Your name and other facts that might point to you will not appear when we present this study or publish its results.

Voluntary Participation and Withdrawal: Your participation is voluntary and you have the right to refuse to be in this study. You and other subjects have the right to withdraw from the study at any time without penalty.

(Permission message)

I understand all the explanations and commitment above and therefore grant permission to the scientists and health workers from the MOH, Emory University and The Carter Center to work hand and hand with us in order to control trachoma in our community. We will give you a copy of this consent form to keep. I agree to participate in this study voluntarily.

Person giving consent

Signature _____ Date _____

Person obtaining consent

Signature _____ Date _____

Contact Persons: If you have any questions about this project, please contact the Principal Investigator, Dr Asrat Amnie, asrat.amnie@emory.edu or (+1 404 784 4796) or Dr Paul Emerson, pemerson@emory.edu .If you have any questions about your rights in this research, please contact Dr. James Keller, Chair of the Emory University Institutional Review Board, at (jim@radonc.emory.org) or (+1 404 712 0720)

Appendix F: Agenda: Trachoma Impact Evaluation Plateau and Nasarawa States

Tuesday 5 June

8:30 Registration

9:00 Welcome and Introductions **Dr. Nimzing**

9:15 Opening Remarks **Dr. E S Miri**

9:30 Purpose of training **Lisa Dickman**

9:45 Trachoma overview and SAFE strategy

Dr. Nimzing

10:15 Purpose of Surveys – describe protocol, define roles and responsibilities

Lisa /Dr. Nimzing

10:30 Tea break

10:45 Sampling, Village Protocol, Interviewing Best Practices

Distribute selected cluster list and discuss guidelines for household sampling to Recorders

Time	1. Trachoma Graders –Pateh Makalo/Nimzing	2. Recorders – NAME Lisa/Nimzing
11:00 – 1:00	Anatomy of Eye WHO Simplified Grading	Intro to data collection tools – Household survey and census

	Practice Slides	Discuss question translation
1:00 – 1:45	Lunch	Lunch
1:45 – 3:45	Examination Techniques Practice Slides Concretions Practice Slides	Role play (Demonstration (or consent/assent) and discussion then break into pairs for each person to conduct 2 full interviews)
3:45 – 4:00	Tea	Tea
4:00 – 5:30	Reliability exam – slides	Continue role play exercises

Wednesday 6 June

8:30 Assembly

Time	1. Trachoma Graders – Lisa	2. Recorder – Lisa
8:30 – 1:00	Introduction to Tablets Describe hardware, battery chargers, case Care / handling, on/off, home screen, buttons	
10:00– 10:15	Tea	
10:15— 1:00	Power management Describe GPS	
1:00 – 1:45	Lunch	
1:45 –	Demo survey: discuss question types	

3:45	How to lightly touch and select; How to scroll Entering text, editing text Using absent list Common user errors
3:45 – 4:00	Tea
4:00 – 5:30	Role play: practice using the survey with tablets (each person enters 4 HH surveys in two clusters)

Thursday 7 June

7:00 AM Assembly – discuss field exercises

Time	1. Trachoma Graders – Pateh Makalo	2. Recorders Lisa
9:00-12:30	Field exercise: trachoma grading in school children in Langtang South (in HH if school is not accessible)	Field exercise: mapping, segmenting, practice HH surveys and census (1 Tablet per team. Recorders fill both paper and electronic survey alternating at each household)
1:00 – 1:45	Lunch	Lunch

1:45-5:30	Field exercise (1 Tablet per team. Recorders fill both paper and electronic survey alternating at each household) Each team does 8 households Discussion of today's field exercise. Any difficulties or operational issues?

Friday 8 June

7:00AM Graders assemble

8:30AM Recorders assemble

Time	1. Trachoma Graders – Pateh Makalo	2. Recorders Lisa/Nimzing
8:30-10:00	Field exercise: Practice grading at school Kanam (in HH if school is not accessible)	Discussion of field exercises How to remain connected to the interview respondent
10:00-10:15		Tea
10:30-1:00		More role play in pairs, each person completes 5 HH survey forms and census forms
1:00-1:45	*Lunch*	Lunch

1:45 – 4:00	Field exercise: examining household members as will be done in actual survey Discuss field exercise	Skills Exam – An interview will take place; each recorder must complete the survey (entered data will be reviewed for correctness and completeness)
4:00 – 4:15		Tea
4:15 – 5:30		Discussion of skills exam

Saturday 9 June (open for additional training and organization of survey teams):

Time	**1. Trachoma Graders – Pateh Makalo**	**2. Interviewers / Recorders**
8:30-10:00	Discussion of field experience Selection of teams Distribution of materials	
10:00-10:15	Tea	
10:15-1:00		
1:00-1:45	Lunch	
1:45 – 3:45	Open for discussion	
3;45 –	Tea	

4:00	
4:00 – 5:30	Open for discussion

Sunday 3 June

3:00 PM Organization and deployment of survey team

Time	1. Trachoma Graders – Pateh Makalo	2. Recorders Lisa
9:00-12:30	Field exercise: trachoma grading in school children in Langtang South (in HH if school is not accessible)	Field exercise: mapping, segmenting, practice HH surveys and census (1 Tablet per team. Recorders fill both paper and electronic survey alternating at each household)
1:00 – 1:45	Lunch	Lunch
1:45-5:30	Field exercise (1 Tablet per team. Recorders fill both paper and electronic survey alternating at each household) Each team does 8 households Discussion of today's field exercise. Any difficulties or operational issues?	