TRACHOMA RISK FACTORS AND CONTROL STRATEGY IN SOMALI REGIONAL STATE, ETHIOPIA

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Trachoma risk factors and control strategy in Somali Regional State, Ethiopia

A thesis submitted in partial fulfillment of the requirement for the degree of Master of Public Health

By

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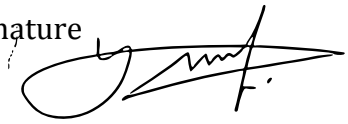
Signature 

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List of Abbreviation

BTR	Bilamellar Tarsal Rotation
CI	Confidence Interval
CO	Corneal Opacity
C.trachomatis	Chlamydial trachomatis
DHS	District Health System
DHS	Demographic and Health Survey
EU	Evaluation Unit
EDC	Electronic Data Collection
FMOH	Federal Ministry Of Health
FDRE	Federal Democratic Republic of Ethiopia
GET	Global Alliance for Elimination of Blinding Trachoma
GTMP	Global Trachoma Mapping Project
GPS	Global Positioning System
GDP	Gross Domestic Product
ICTC	International Coalition for Trachoma Control
IECW	Integrated Eye Care Worker
KIT	Royal Tropical Institute
MHT	Mobile Health Team
MDA	Mass Drug Administration
MDGs	Millinume Development Goals
MOFED	Ministry of Finance and Economic Development
NCPB	National Committee for prevention of Blindness
NTTC	National Taskforce for Trachoma Control
NTDs	Neglected Tropical Diseases
OR	Odds Ratio
PHCU	Primary Health Care Unit
PCT	Preventive Chemotherapy
PHEP	Pastoralist Health Extension Programs
PHEW	Pastoralist Health Extension Workers
SRS	Somali Regional State
SAFE	Surgery, Antibiotic, Facial cleanliness and Environmental sanitation
SRHB	Somali Regional Health Bureau
TF	Trachomatous Inflammation Folicular
TI	Trachomatous Intense
TS	Trachomatous Conjunctival Scaring
TT	Trachomatous Trichiasis
UIGs	Ultimate Intervention Goals
WHA	World Health Assembly
WASH	Water Hygiene & Sanitation
WHO	World Health Organization

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Abstract

Introduction

Trachoma is the leading infectious cause of blindness worldwide. Trachoma is endemic among the poorest of the poor communities of the world. The WHO target to eliminate blinding trachoma by 2020, mainly implementing the SAFE strategy. Identifying trachoma associated risk factors in Somali Regional State and best practice on implementing the SAFE strategy, will help to design context specific strategy to eliminate blinding trachoma from the region.

Objective

To identify risk factors associated with trachoma in Somali Regional State, in order to formulate context specific implementation of SAFE strategy to eliminate blinding trachoma.

Methods

Analysis of the regional population based survey for prevalence of trachoma. The survey was a multistage cluster sampling. For the analysis in this thesis those examined during the survey only used (N=31,352). In addition, literature review was done to identify best practice on implementing different components of the SAFE strategy.

Result

The prevalence of TF among children aged between 1-9 years old in the region were 13.2%. The prevalence of TT among adults aged 15 years and older in the region was 1.5%. However, the regional prevalence of both TF and TT were varied by evaluation unit. Childrens, aged between 1-3 years old (OR=3.3 95% CI [2.8-3.7] P<0.001), aged between 4-6 years old (OR=2.2 95% CI [1.9-2.6] P<0.001), with a dirty face (OR=3 95% CI [2.0-6.1] P<0.001), from a thatched roof household (OR=1.3 95% CI [1.2-1.6]P<0.001), from households that get drinking water from unimproved source (OR=1.6 95% CI [1.5-2]P<0.001), from households traveling more than 30 minutes to get water (OR=1.5 95% CI [1.3-1.6]P<0.001), from households that using the open field for defecation (OR=2.5 95% CI [2-2.6]P<0.001), and from households that located at altitude >1500 meters (OR=1.5 95% CI [1.2-2.1] P<0.001) were found associated with TF. Adults aged between 45-54 years old (OR=5.5 95% CI [2.4-12.6]P<0.001), adults aged 55 years and older (OR=17.7 95% CI [8.5-37] P<0.001), and female sex (OR=2.1 95% CI [1.5-3.1] P<0.001) were found associated with TT.

Conclusion and Recommendation

Trachoma is public health problem in SRS, and early start of implementing the SAFE strategy will help to achieve the target of blinding trachoma in 2020. Preparation of detail regional trachoma action plan with involvement of all stakeholders will help for successful implementation of the strategy. In addition, high political commitment, and involvement of the communities at all level is crucial for success of eliminating blinding trachoma from the region.

Key words: trachoma risk factors, surgery for trichiasis, antibiotic, facial cleanliness, and environmental sanitation, Ethiopia.

Word count: 12, 621

Introduction

I graduated from Adiss Abeba University Medical Faculty, with degree of medical doctors in 2008. I was assigned as a general practitioner to Karamarda Hospital, one of the Somali Regional State Hospitals. After serving for one year, I transferred to Regional Health Bureau office (SRHB), where I have been working untill I started the MPH class. At RHB I was working as coordinators of different health promotion and disease prevention programmes, which blindness prevention programs also part of it. During the population based survey for prevalence of trachoma, I was also in the team that coordinated the survey at regional level.

Trachoma is one of the neglected tropical diseases, which affect marginalized communities living in poverty, poor hygiene and sanitary condition. Trachoma is not only result of poverty, but it trap affected communities in deep poverty. Women become blind disproportionally from trachoma. It is not unusual to see in the street begging blind mother, which is directed by her children. Blindness from trachoma is not curable but can be prevented. I believe that prevention and control of Neglected tropical Diseases (NTDs), including trachoma, is one way of lifting up peoples from poverty cycle. With this backdrop I decided to write my thesis about trachoma risk factors and control strategy in Somali Regional State, Ethiopia.

The knowledge and skill I gained about public health principles, after I attend the MPH class at the Royal Tropical Institute (KIT), put me in a better position to contribute to the efforts made by Somali Regional Health Bureau, to eliminate blinding trachoma from the region. This thesis is organized into five chapters.

The first chapter gives background information, the second chapter contains problem statement, justification, objectives, and methodology, in third chapter results of survey data analysis and literature reviews are presented. The discussion part is in chapter four, and lastly conclusions and recommendations of the thesis presented in chapter five.

CHAPTER 1: BACKGROUND INFORMATION of ETHIOPIA, SOMALI REGIONAL STATE, AND TRACHOMA.

This chapter gives brief background information about Ethiopia and Somali Regional State Geography, Government and Administration, socio-economic condition, Water and Sanitation, and Health System. In addition general background about trachoma is also included in this chapter.

1.1 Geography and Demography

The Federal Democratic Republic of Ethiopia [FDRE] is an East African country that shares borders with Kenya in the south west, with Sudan and South Sudan in the north west, with Somalia and Djibouti in the north east, and with Eritrea in the north. The Ethiopian population is estimated at eighty million with 85% living in rural areas (Central Statistic Agency, 2007). The FDRE is made up of nine ethnically based Regional States and two City Administrations.

Somali Regional State [SRS] is one of the nine ethnically based regions of the FDRE. Geographically the region is located to the eastern part of the country. The SRS is located at 200 to 2000 meters above mean see level. Annual rainfall of the region range from 150mm to 660mm(Somali Regional State of Ethiopia, 2012). The total area of the region is 350,000Km2 (Somali Regional State of Ethiopia 2012).

The total population of SRS is estimated to be five million with 85% pastoralist and agro-pastoralist (Central Statistic Agency 2007). The average household size of the region is 6.6(Central Statistic Agency 2007). From the total population of SRS 44.4% were females and 55.6% were males (Central Statistic Agency 2011). 44% of the total population of the SRS is below 15 years of age (Central Statistic Agency 2007).

1.2 Government and Administration

The SRS is subdivided in to nine zones. The nine zones subdivided further into 68 Woredas (Districts) and four city administrations. The Woredas (Districts) and city administrations are the basic decentralization administrative units of the region.

1.3 Socio-economic situation

The economic policy of Ethiopia is market-based and agricultural led industrialization (MOFED 2011). Agriculture contributes

83.4% of employment and 43.2% of the Gross Domestic Product (GDP) of the country (MOFED 2011). Per capita income of Ethiopia is 550 USD (MOFED 2011), which is below the Sub-Saharan average. The main livelihood of the SRS population is pastoralism and agro-pastoralist (Stephen 2006).

The pastoralist community of the region lives by rearing cattle's, sheep, camels and goats. They move from one place to the other, continuously looking for water and grazing for their herds. The SRS pastoralist communities are homogenous by culture, language, and religion (Stephen 2006). The predominant religion is Islam: 95 percent of the population is Muslim.

1.4 Water and Sanitation

In the 1994 constitution of Ethiopia, Article 44 states, "All persons have the right to clean and healthy environment". This shows the legal support of the right to water and sanitation in the country.

In Ethiopia about 54% of the population gets drinking water from improved water source. The access to improved drinking water is two times higher in urban area compared to rural parts of the country (DHS 2011). Improved sources of drinking water include: piped water at yard; shared public tap; borehole; protected well; spring water and rain water (WHO and UNICEF Joint Monitoring Program for Water Supply and Sanitation, 2010).

Piped water is the common sources of drinking water for 87% of urban and 19% of rural residents of the country (DHS 2011). Whereas, according to DHS (2011) 53% of the households travel more than 30 minutes to get water. However, the number of households that travel more than 30 minutes to get water was high among rural residents. In addition, women are found responsible to collect water in 62% of the households participating in the survey (DHS 2011).

In Ethiopia 8% of all households use an improved toilet facility, which varies from 14% in urban to 7% in rural areas (DHS 2011). According to WHO and UNICEF (2010), an improved toilet facility is a structure used by household members only and able to separate waste from human contact. Nearly half of the rural households (45%) does not have any types of toilet facility. This shows the wide practice of open defecation in the country.

1.5 HEALTH SYSTEMS ORGANIZATION

The health system of the country follows the decentralization process of the government. The Federal Ministry of Health (FMOH),

Regional Health Bureaus, and Woredas (District) Health Offices have different decision power, duties and responsibilities (FMOH 2010). Management of the district health system is fully under the Woreda (District) Health Offices.

The District Health System (DHS) is the first level of the three-tier system for Ethiopian health care delivery. The DHS are designed to provide services for 100,000 populations (FMOH 2010). The DHS includes primary hospital, health center, and five-satellite health posts, which form a primary health care unit (PHCU) (FMOH 2010). The General Hospital and Specialized Hospital are in the second and third level of the health tier system, respectively.

According to the Somali Regional Health Bureau 2012/13 annual report, eight hospitals; 120 health centers; and 951health post were functional in the region. In addition, 24 mobile health teams (MHT) are providing basic health service to hard to reach areas, especially to pastoralist community. The MHT have two nurses, one community mobilizer, and basic medical supplies. Maternal service, child health service, consultation, health education, and referral services are the services provided by the MHT.

Secondary Eye care service is provided in two of the hospitals, and ten of the health centres in the region have primary Eye care services. Two ophthalmologists, three cataract surgeon, ten ophthalmic nurses are currently available in the region (Ahmed, personal communication).

1.6 National Trachoma Control Programme

The Ethiopian national trachoma control programmes were established in 2002 (Berhane et al. 2006). The main aim of the national trachoma control programme is to co-ordinate the different activities, which will help the country to eliminate blinding trachoma in the year 2020. The national trachoma control programs have 5-year strategic plan, and currently implementing the third strategic plan for the period 2011-2015 (FMOH 2012). The implementation of this plan coordinated by the National Committee for Prevention of Blindness (NCPB), and the National Taskforce for Trachoma Control (NTTC) (FMOH 2012). This committee established with involvement of all stakeholders.

The country has 840 woredas (Districts), of all woredas 232 of them are mapped for trachoma (FMOH 2012). The SAFE strategy has been implemented in 195 woredas, most of this woredas are in Amhara Regional State (FMOH 2012). The numbers of trachomatous trichiasis (TT) surgery were increased from 15,000/year in 2002 to 63,972/year in 2010. Over 20 million persons treated with azithromycin in 2011 (FMOH 2012). Activity of face washing and environmental sanitation component of the strategy is incorporated in the Health Extension Package. The national trachoma control programme are planning to start implementation of the SAFE strategy in full scale in all endemic district of

the country in 2015, which will help to achieve the elimination target in 2020 (FMOH 2012).

1.7 Background of Trachoma

Trachoma is a chronic follicular keratoconjunctivitis caused by the obligate intracellular bacteria Chlamydia trachomatis (Kuper et al. 2003). The ocular serovars A, B, Ba, and C of chlamydial trachomatis (c.trachomatis) are responsible for the eye infection in endemic communities (Mabey, Solomon & Foster 2003). C.trachomatis is mainly found in dry, dusty environments with poor water and sanitation condition (Emerson et al. 2000). These explain the existence of trachoma in communities with poverty, unhygienic and overcrowding living condition.

Young children are the main reservoir of chlamydia trachomatis (West et al. 1991). The infection causes an acute inflammation of the eyelid: Trachomatous Inflammation Folicular (TF) and/or Trachomatous Intense (TI)(West et al. 1991). Repeated infection by trachoma will cause scaring of the eyelid and entropion leading ultimately to in-turned eyelashes (Turner et al. 1993). When the in-turned lashes rub the eyeball it is called Trichiasis, mainly found in adults. Untreated trichiasis is painful, due to trauma to cornea each time a patient blinks. Corneal opacification develops as a result of super-infection on the traumatized cornea (Mabey, 2000). Blindness from corneal opacification is not reversible.

"Trachoma is, in general, a clinical diagnosis"(Mabey, Solomon & Foster 2003, pp, 34). The diagnosis made by inspecting the lashes, upper tarsal conjuctivae and cornea, with the aid of binocular loupes [magnification, 2.5x] (Mabey, Solomon & Foster 2003). The WHO developed trachoma grading systems for the assessment of trachoma. There are two grading systems: a specialized and a simplified grading system (Mabey, Solomon & Foster 2003). The simplified grading system for trachoma has been a key milestone to undertake trachoma assessment, by both professionals and non-professionals at community level (Thylefors et al. 1987) [see table 1].

Table 1. A table showing a simplified grading scheme for assessment of trachoma in communities

Grade of trachoma	**Characteristic to diagnose**
Trachomatous inflammation follicular (TF)	The presence of five or more follicles of at least 0.5 mm diameter in the central part of the upper tarsal conjunctiva.
Trachomatous inflammation, intense (TI)	Pronounced inflammatory thickening of the upper tarsal conjunctiva obscuring more than half the normal deep tarsal vessels.
Trachomatous	The presence of easily visible scars in the upper tarsal

conjunctival scaring (TS)	conjunctiva.
Trachomatous trichiasis (TT)	At least one eyelash rubbing on the eyeball, or evidence of recent removal of in-turned eyelashes.
Corneal opacity (CO)	Easily visible corneal opacity over the pupil, so dense that at least part of the pupil margin is blurred when viewed through the opacity.

Trachoma is the leading infectious cause of blindness (Lavett et al., 2013), and estimated to account for 1.3 million of blindness worldwide (WHO 2013). The poorest and most rural areas of 53 countries in Africa, Asia, Central America and South America, Australia and the Middle East are endemic for blinding trachoma (WHO 2013). Trachoma is eliminated from Europe and North America by socio-economic improvements (Mabey, Solomon & Foster 2003).

The year 1998 is an important year for effort of eliminating blinding trachoma. In this year the World Health Assembly (WHA) accepted a resolution to eliminate blinding trachoma as public health problem by the year 2020(WHO 1998). Following the resolution, the WHO established the Global Alliance for Eliminating blinding trachoma (GET 2020). GET 2020 was given the mandate to coordinate the trachoma elimination activity worldwide, and the alliance adopted and promoted full implementation of the SAFE strategy to eliminate blinding trachoma in endemic countries (Kuper et al. 2003).

The acronym 'SAFE' strategy stands for: **S**urgery for trachoma trichiasis; **A**ntibiotics to treat chlamydial infection and reduce the C.trachomaties reservoir; **F**acial cleanliness and **E**nvironmental sanitation to reduce transmission of C. trachomatis in the community (Kuper et al. 2003).

Research showed that well integrated implementation of the SAFE strategy could eliminate blinding trachoma, even in hyperendemic areas (West 2003; Emerson et al. 2006; Lavett et al. 2013). According to Emerson et al. (2006), the SAFE strategy combines both primary and secondary prevention. By combining different approaches the strategy will help to tackle trachoma holistically in different stages at community level (West 2003). Looking back, a tremendous progress has been made in the fight against blinding trachoma, since the SAFE strategy started to be implemented. Morocco, Mexico, and Oman are now controlling trachoma, by implementing all components of the SAFE strategy (Lavett et al. 2013).

CHAPTER 2: PROBLEM STATEMENT, JUSTIFICATION, OBJECTIVE AND METHODOLOGY.

2.1 Problem Statement

The intensive effort of the GET 2020 has successfully reduced the global burden of active trachoma from 84 million cases in 2003 to 21.4 million cases in 2012 (Lavett et al. 2013). This success has been partly due to the SAFE strategy. However, currently about 334,000 disability adjusted life years are lost due to trachoma (Murray et al., 2013). In addition blindness from trachoma and care of patients with trachoma slows down economic growth and leads to global productivity loss of $3 billion to $6 billion annually (Frick 2003). This loss is from the poorest community where trachoma is endemic. About 229 million people live in endemic areas, 176 million live in Africa, and 80% of the global burden is now limited to 14 countries (WHO 2013).

Ethiopia is one of the fourteen countries hyperendemic for trachoma (WHO 2013). According to Berhane et al. (2006) the national prevalence of active trachoma among children aged 1-9 years is 40.1%, and the national prevalence of trachomatous trichiasis among adult 15 years and older is 3.1%. In Ethiopia from all avoidable causes of blindness an estimated 1.5 million person were blind, out of it trachomatous corneal opacity was responsible for 11.5%(138,000 cases) (Berhane et al. 2006). However, without appropriate measure the blind cases caused by trachoma will continue to increase, due to increased number of people in trachoma endemic area (Deribe et al. 2012).

According to the 2006 national trachoma prevalence survey the prevalence of trachoma varied between different regions of the country. The SRS was estimated to have a prevalence of active trachoma among children aged 1-9 years of 22.6%, and a prevalence of trachomatous trichiasis among adult aged 15 years and older of 4.2% (Berhane et al. 2006). Although trachoma has been identified as the main causes of low vision, and blindness in the SRS, the SAFE strategy is not fully implemented there yet. The SAFE strategy was part of the VISION 2020 programme, which was launched in Ethiopia in September 2002 to eliminate preventable blindness by the year 2020(Berhane et al. 2006).

According to a Ministry of health report the SAFE strategy has been implemented in some regions of the country, like Amhara region. Amhara region is able to demonstrate promising success result in controlling trachoma by implementing SAFE strategy. Like, 14.7 million people in the region covered by azithromycin mass administration in 2010 (Deribe et al. 2012), and more than 89,000 latrines constructed in the region within one year (O'Loughlin et al. 2006). However, to scale up the intervention to other areas, the main problem is lack of data. According to International Coalition for trachoma control (ICTC) 2011 reports, about

46 million Ethiopians are living in trachoma suspected endemic areas. Smith et al. (2013) recommends Ethiopia as one of the priority countries that need urgent mapping of trachoma.

The Somali Regional Health Bureau (SRHB), in collaboration with Federal Ministry of Health and other non-governmental organization, are planning to launch the SAFE strategy implementation in the Region. According to the WHO criteria an up to date assessment of trachoma prevalence at district level is required to start the intervention (Solomon et al 2006). A population based survey of trachoma prevalence was done in the region from April to June 2013. In addition, data on possible risk factors associated with trachoma in the Region were collected.

According to Smith et al (2013), data of trachoma burden is important to prioritize resource allocation to reach trachoma elimination target by the year 2020. It is clearly important to improve the quality and availability of epidemiological data to guide the trachoma elimination programme of the Region.

Identifying the magnitude of trachoma and associated factors could therefore help to design context specific trachoma prevention and control intervention strategies.

2.2 Justification

Currently there is growing momentum within the international community, to save the poorest of the poor communities that suffer from one or more NTDs. Trachoma is one of the seven NTDs that are included in the priority list to be eliminated as public health problem from the world by 2020 (Hotez et al., 2009). This target can be achieved by fully scaling up of the SAFE strategy implementation to all endemic areas (Lavett et al 2013). The target to eliminate blinding trachoma in less than six years is, indeed, ambitious, but it is also achievable by implementing all component of SAFE strategy before 2015 in all endemic areas.

This thesis aims to identify risk factors associated with trachoma specific to the predominantly pastoralist community of the SRS, and to identify the best approach to implement the SAFE strategy in the context of the region. The ultimate goal is to eliminate blinding trachoma from the region by the year 2020, which will contribute to achieve the national and global target.

Trachoma is a localized disease and has different levels of risk factors both for individuals and for communities (Smith et al. 2013). A detailed analysis and understanding of the local trachoma epidemiology is critical, if scarce resources are to be allocated in the most effective way to eliminate blinding trachoma. In addition, identifying the risk factors

associated with trachoma specific to the SRS context will help to define priority areas for intervention. It will also serve as baseline to monitor the progress and the changes achieved following intervention. The associated risk factor will help for advocacy to enhance the trachoma elimination effort in the region.

2.3 General Objective

To identify risk factors associated with trachoma in Somali Region, in order to formulate a context specific SAFE strategy for the Somali Regional Health Bureau trachoma elimination programme.

2.3.1 Specific Objective

1. To describe the prevalence of trachoma in Somali Regional State
2. To determine individual risk factors associated with trachoma.
3. To determine association between trachoma and environmental risk factors.
4. To identify the best practice of implementing different components of the SAFE strategy for eliminating blinding trachoma.
5. To recommend the best approach to implement the SAFE strategy for Somali Regional Health Bureau Blinding trachoma elimination programme.

2.4 Methodology

To answer the first three objectives I analyzed primary data of the population based survey, done for prevalence of trachoma in Somali Region. In addition, literature reviews were done to answer the remaining objectives.

2.4.1 Study design

The study was a cross-sectional household based survey designed to obtained the prevalence of trachoma, defined by active trachoma in children aged 1-9 years, and by trichiasis in adults of 15 years and older. In addition, the associated risk factors were assessed.

2.4.2 Sample Size

The WHO recommended methodology for sample size calculation for trachoma survey used to calculate the appropriate sample size (Solomon et al. 2006). The parameters, which were used: the prevalence of active trachoma in children 1-9 years of age was taken 22%, a significant level of 5%, and design effect of 4. From each Evaluation Unit (EU) a total of 20 cluster and 35 households from each cluster was selected. Evaluation unit defined as area containing 100,000 people.

The primary sampling units for the survey were kebeles; each Kebele was taken as one cluster. Kebele is the last administrative unit with total population approximately 3000 persons in the woreda (district). The Kebeles were selected by simple random sampling, form the list of kebeles obtained from woreda or district officials.

The secondary sampling units were households in the kebeles. After identifying the centre of the Kebeles the team spinned a pencil on a clipboard to identify the direction to move, and they included the entire 35 households on a straight-line pattern of selected direction. All members of the households were enumerated for the survey; including those who were absent for less than six month form the home during the survey.

2.4.3 Data Collection

For data collection, teams comprised of ophthalmic nurse and data recorder was used. The teams trained for one week by an expert from global trachoma mapping project (GTMP). Trainees had both theoretical and practical demonstration. Only those who scored at least 80% inter-observer agreement in diagnosing trachoma compare to senior examiner were selected to participate in the survey. For the data collection electronic data collection (EDC) method was used. The simplified WHO trachoma grading system was used (Thylefors et al. 1987) to identify persons with trachoma. Both eyes were graded separately, either for active trachoma in children aged 1-9 years, and for trachomatous trichiasis in adults aged 15 years and older. After examining an individual, the examiners cleaned their hands with alcohol. Prior to the trachoma examination, the children's faces were briefly inspected for facial cleanliness, and presence of either nasal or ocular discharge was defined as dirty face.

Structured interviews with heads of households and observation were used to assess the risk factors. During the interview, the respondent asked about: the source of drinking water; their source of water for face washing during dry seasons; travel time to get water; place of defecation for adults; toilet facility. The roof construction material of the houses was recorded as a proxy indicator for socio-economic status. Altitude of each households surveyed was measured by using a Global Positioning System (GPS).

2.4.4 Data Analysis

I received clean data set from the SRHB. STATA version 13 (Stata Corp., College Station, TX, USA) was used for data analysis. Descriptive statistics were performed to describe characteristics of survey participant. Using binary logistic regression reporting odd ratio (OR), both Univariate and multivariate analysis were performed to identify factors associated with active trachoma in children less than 10 years old, and trichiasis in adult aged 15 years and older. Statistical significance was accepted when P-value <0.05.

For the data analysis I define:

- TF: those who have sign of TF either in one eye or both eyes.
- TT: those who have sign of TT either in one or both eyes.
- Improved source of water: source of water from piped water, public tab, borehole, protected dug well, and protected spring.
- Unimproved source of water: source of water from unprotected dug well, unprotected spring, rainwater collection, water vender, and surface water.

- Improved toilet facility: those who have pour flush to piped sewer systems, pour flush to septic tank, pour flush to pit latrine, pour flush to open drains, ventilated improved pit latrine, and pit latrine with slab.
- Unimproved toilet facility: those who had pit latrine without slab, composting toilet, bucket, hanging toilet, no facility or bush, and other.

2.4.5 Ethical Clearance

For the survey ethical clearance was obtained from Somali Regional Health Bureau ethical committee. Verbal consent was taken from the participant and in case of children from the parents. During the survey the team was also treating those who have trachoma on spot, but those with severe problems were referred to the nearest health facility. To use the data for my thesis I got permission from the Somali Regional Health Bureau. The letter of permission is attached in the annex.

2.5 Search Strategy

A literature review was conducted to get evidence for best practice of implementing different component of SAFE strategy, and to support discussion of survey result. Both unpublished and peer reviewed literature were used for this thesis. Search engines like PubMed and Google scholar were used to retrieve some of the literature. In addition, databases of the World Health Organization, Ethiopian Ministry of Health, International Coalition for Trachoma Control, were also used.

Key words used were; Trachoma prevalence, Trachoma Risk factors, trichiasis surgery, mass drug administration, face washing, environmental sanitation, Azithromycin, Ethiopia, Somali Regional State, pastoralist.

2.6 Study Limitation

- The study is a cross-sectional survey, which does not show the cause and effect relationship for the risk factors.
- Risk of observer bias: especially when documenting facial cleanliness of children.
- Excluding two zones from sampling frame due to security reason my bias the estimate of regional prevalence of trachoma, if there was a difference of trachoma prevalence in thes two zones.

CHAPTER 3: STUDY RESULT

This chapter is divided into two sections. The first section presents results of the population-based survey, and in the second section literature review result about the SAFE strategy are presented.

3.1: Quantitative Result

In this section I will present the findings of the quantitative analysis. First subsection are characteristics of the survey participants, second subsection prevalence of both active trachoma & trachomatous trichiasis, third subsection risk factors associated with active trachoma, and fourth subsection risk factors associated with trachomatous trichiasis.

3.1.1 General Characteristic of Survey Participant

A total of 34,589 peoples were enumerated in the household survey. Among those enumerated 9% (N=3,237) were not present at the time of the survey. From the absentees, 76% (N=2,453) were male and 24% (N=784) were female. In addition, 85% of unexamined were adults aged 15 years and older.

Those examined during the survey is use for the analysis in this thesis. From the total number of peoples (N=31,352) examined during the survey, 48% (N=15,049) were children aged between 1-9 years old. Among children aged 1-9 years old, Male were 51% (N=7,675), and Female were 49% (N=7,374). Adults aged 15 years and older were 43% (N=13,481) of the total peoples examined during the survey. Among the adults aged 15 years and older Females were 61% (N=8,223), and Males were 39% (N=5,258). The remaining 9% (N=2822) among the total examined peoples were between aged 10-14 years old. The mean age of the participants was 19 years with [95% CI, (18.6- 19.0)].

The main source of water for drinking, and for face washing during the dry season was from unimproved water source for 73% of households participated in the survey. Of all households surveyed 67% mentioned the round-trip time to collect water was more than 30 minutes. 73% of those surveyed reported that the adults use the open field for defecation. In addition, by observation 72% of those have toilet were unimproved toilet facility. Less than one percent of the households that had toilet facilities have hand washing facility and soap within 5 meters of the toilet during the survey.
Below is a graphic presentation of some individual characteristics, on availability of water and sanitation facilities.

Figure 1. Histogram showing the age distribution of survey participant

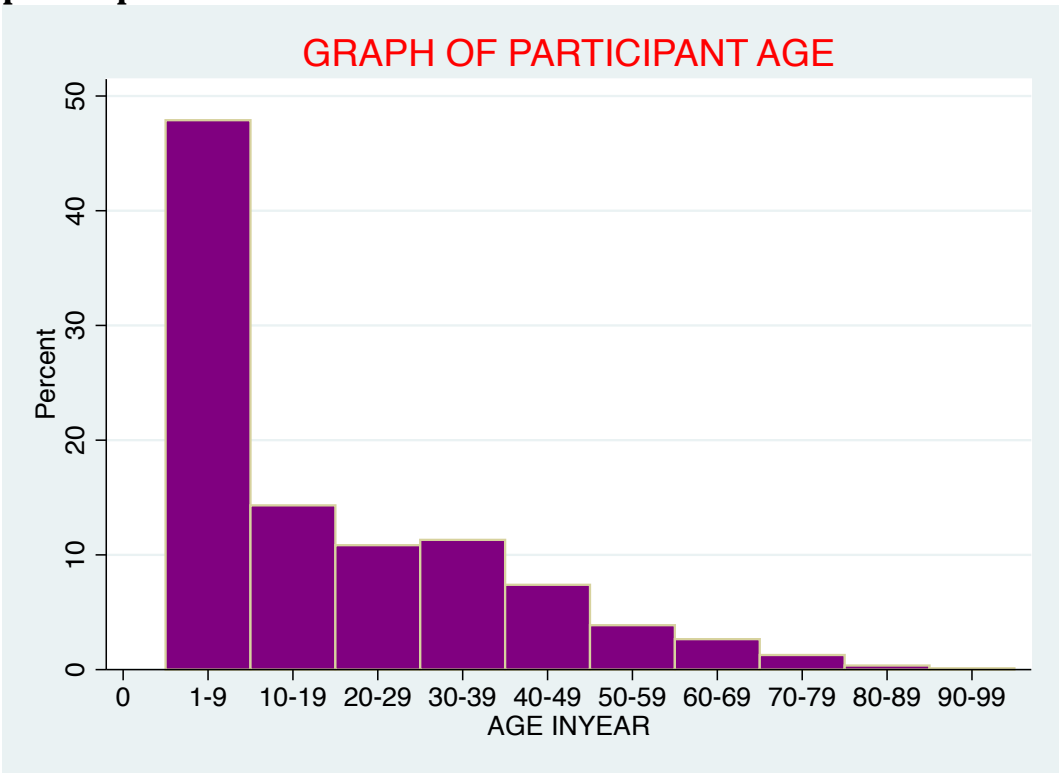


Figure 2. Pie chart showing sex of total survey participants

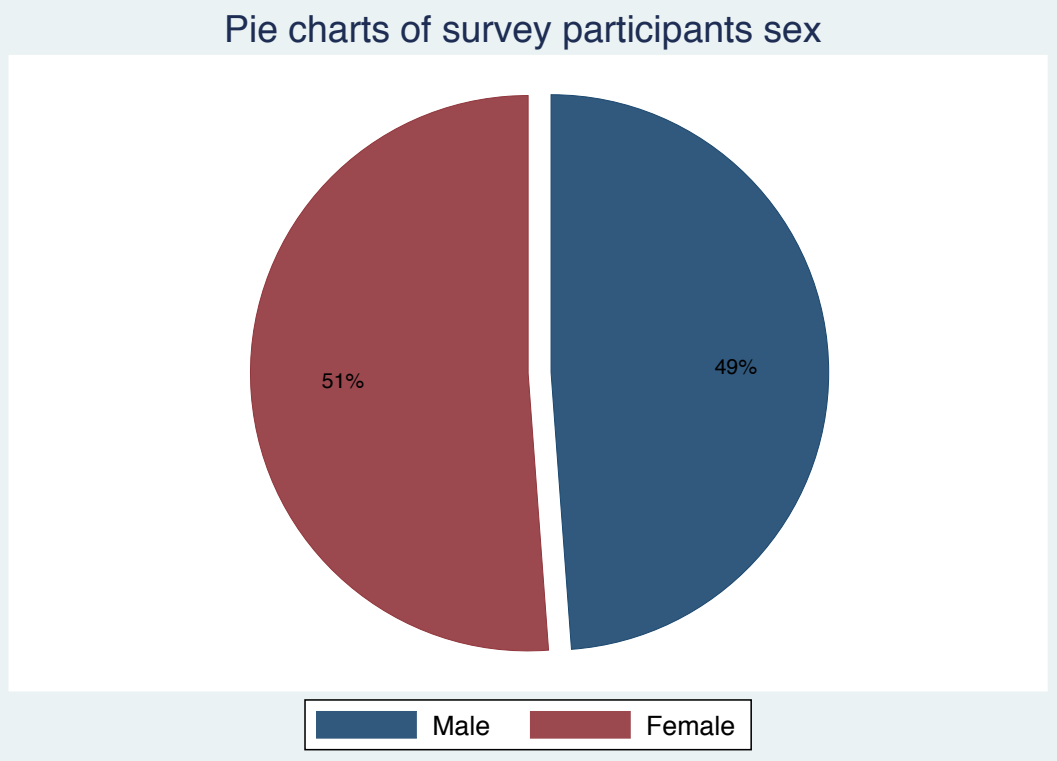


Figure 3. Pie charts showing survey participants water source

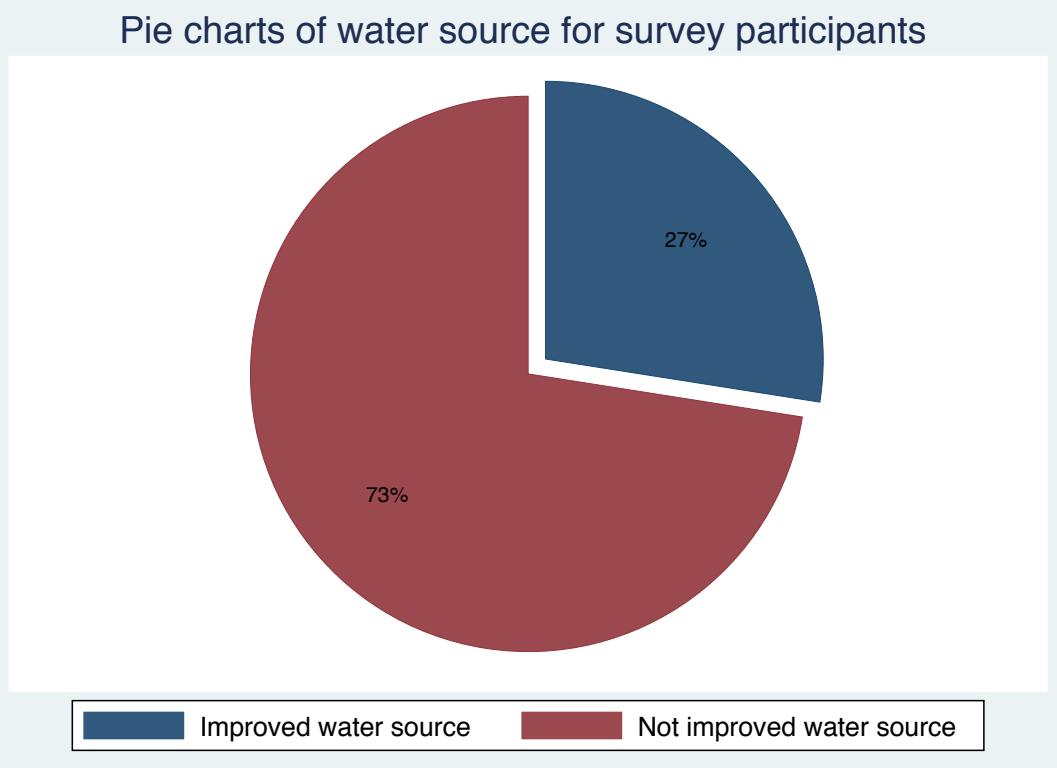


Figure 4. Pie chart showing time travel to get water source for survey participant

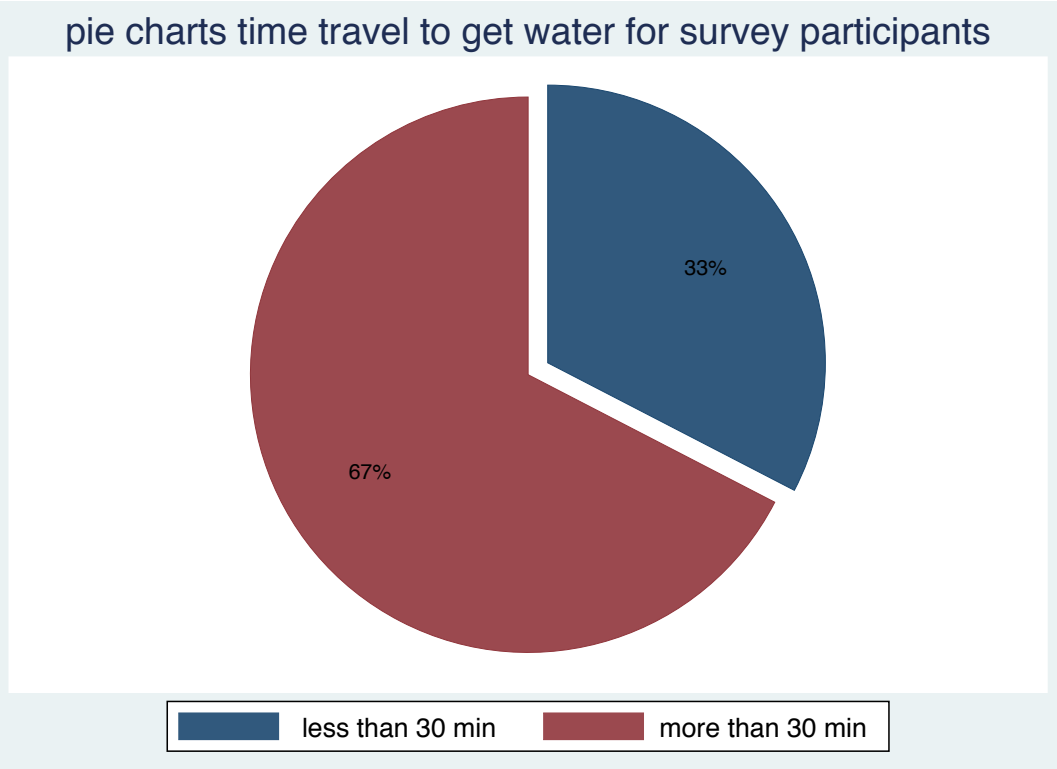
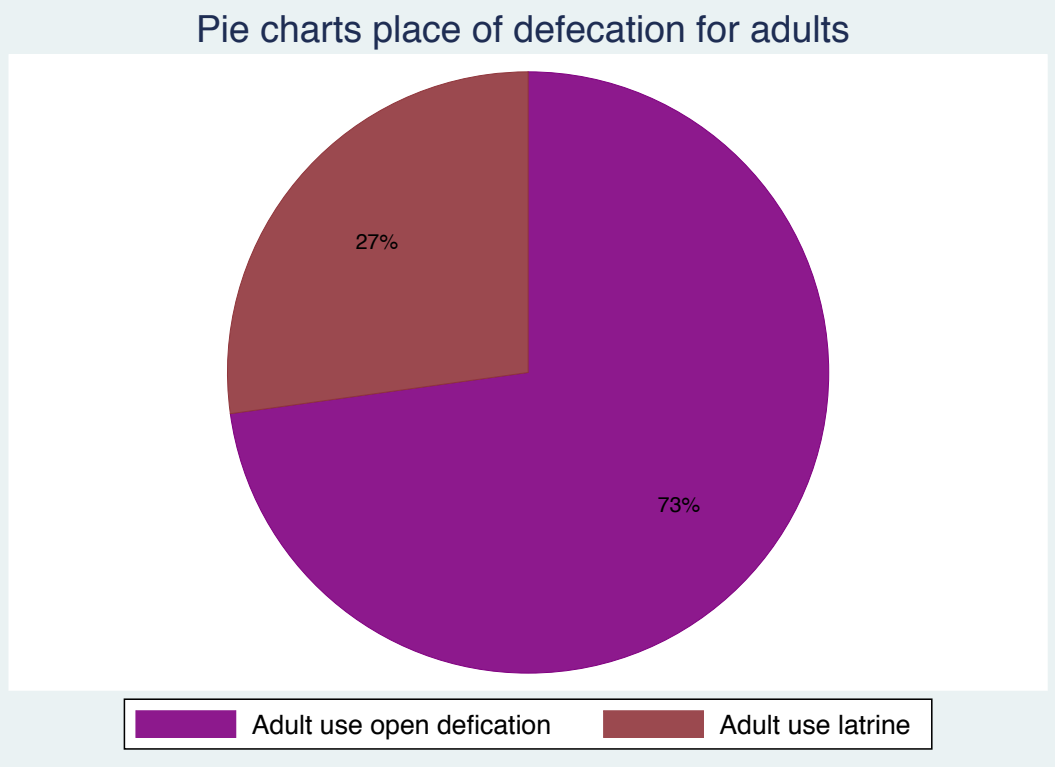


Figure 5. Pie chart showing place of defecation for adult



3.1.2 Prevalence of Trachoma

The overall prevalence of TF among childrens aged between 1-9 years old in the region is 13.2%. The prevalence of TF in childrens aged between 1-9 years old varied from 4.7% to 42% by EU. The prevalence of TF was not different between males and females childrens aged between 1-9 years old.

The overall regional prevalence of TT among adults aged 15 years and older was 1.5%. Point estimate by EU of TT prevalence in adults aged 15 years and older were ranged from 0.13% to 2.6%. The prevalence of TT is 1.5 times higher among females than male adults aged15 years and older: 1.14% and 0.72% respectively. This difference is statistical significant.

3.1.3 RISK FACTORS ASSOCIATED WITH ACTIVE TRACHOMA (TF)

3.1.3.1 INDVIDUAL RISK FACTORS

Univariate Analysis

In the Univariate analysis of association between TF and individual factors were done for children aged between 1-9 years old (see table 1). Children in the age group 1-3 and 4-6 years old were 3.2(OR=3.2 95% CI [2.8-3.7] P<0.001) and 2.2 (OR=2.2 95% CI [1.9-2.6] P<0.001) times more likely associated with TF, than children in the age group of 7-9 years old. The odds of having a child with TF among the male children aged between 1-9 years old were 1.3 (95% CI [1.2-1.4] P<0.001) times, compared to the odds among the female children aged between 1-9 years old.

Children with a dirty face were found 2.3 (OR=2.3 95% CI [1.9-5.8] P<0.001) times more associated with TF, compared to with clean face children. Children from households with a thatched roof were 1.5 (OR=1.5 95% CI [1.3-1.9] P=0.002) times more likely associated with T F, compared with children from households with a tin roof.

MULTIVARIATE ANALYSIS

In the multivariate analysis after adjusting for other covariate age, a dirty face, and a thatched roof type were found to be significantly associated with TF [see table 1].
Children in the age group between 1-3 and 4-6 years old were 3.3(OR=3.3 95% CI [2.8-3.7] P<0.001) and 2.2(OR=2.2 95% CI [1.9-2.6] P<0.001) times more associated with TF respectively, compared to children in the age group between 7-9 years old. Children with a dirty

face were found to have associated with active trachoma (TF) 3 (95% CI [2.0-6.1] P<0.001) times more, compared to children with a clean face. Children from a thatched roof household were found to have 1.3 (95% CI [1.2-1.6] P<0.001) times more associated with TF, than children from a tin roof household.

Table 2. A table showing the association between individual variable and TF

	Univariate		**Multivariate**	
Variable	OR (95% CI)	P-value	OR (95% CI)	P-value
AGE				
1-3	3.2(2.8-3.7)	<0.001	3.3(2.8-3.7)	<0.001
4-6	2.2(1.9-2.6)	<0.001	2.2(1.9-2.6)	<0.001
7-9	1		1	
SEX				
Male	1.3(1.2-1.4)	<0.001	1(0.9-1.1)	0.736
Female	1		1	
Facial Cleanliness				
Clean	1		1	
Dirty	2.3(1.9-5.8)	<0.001	3 (2-6.1)	<0.001
House roof type				
Tin	1		1	
Thatch	1.5(1.3-1.9)	0.002	1.3 (1.2-1.6)	<0.001

3.1.3.2 ENVIROMENTAL RISK FACTORS

UNIVARIATE ANALYSIS

The Univariate analysis of association between environmental risk factors and TF shows [see table 2]. The odds of getting a child aged between 1-9 years old with TF among those use unimproved water source were 1.5(OR=1.5 95% CI [1.2-1.8] P<0.001) times, than the odds among those use improved source of water for drinking. Children aged between 1-9 years old from households that travel >30 minutes to get water source were 1.2(OR=1.2 95% [1.1-1.4] P<0.001) times more likely associated with TF, than childrens aged between 1-9 years old from households that travel <30 minutes to get water. Children aged between 1-9 years old from households that use unimproved water source for face washing during the dry season were found to have 1.4(OR=1.4 95% CI [1.2-1.8] P<0.001) times more likely associated with TF, compared to children aged between 1-9 years from households that use improved source of water.

The odds of getting a child between 1-9 years old with TF among those households mentioned adult use the open field for defecation were 2 (OR=2 95% CI [1.8-2.3] P<0.001) times, compared to the odds among those households mentioned adult use latrine only. The odd ratios of those children aged between 1-9 years old from households use unimproved toilet were 2(OR=2 95% CI [1.8-2.2] P<0.001). Children aged 1-9 years old from households located at altitude above 1500 meter were 1.6 (OR=1.6 95% CI [1.3-2.0] P<0.001) times more likely associated with TF, than children aged between 1-9 years old from households located at altitude below 1500 meter.

MULTIVARIATE ANALYSIS

In the multivariate analysis source of water for drink, distance travel to get water, place of defecation, and altitude were found significantly associated with TF [see table 2]. Source of water for face washing during the dry season and type of toilet was excluded from multivariate analysis, due to colinearity.

The odd ratios of those children aged between 1-9 years old from households that get drinking water from unimproved source were 1.6(OR=1.6 95% CI [1.5-2] P<0.001). The odds of getting a child aged between 1-9 years old with TF among households that travel >30 minutes to get water were 1.5(OR=1.5 95% CI [1.3-1.6] P<0.001) times, than odds among households that travel >30 minutes.

The odd ratios of children aged between 1-9 years old from households that mentioned adults use the open filed for defecation were

2.5(OR=2.5 95% CI [2-2.6] P<0.001). Children aged between 1-9 years old from households that located at altitude above 1500 meter have odds ratio of 1.5 (95% CI [1.2-2.1] P<0.001).

Table 3. A table showing the association between environmental variables and TF

	Univariate		**Multivariate**	
Variable	OR (95% CI)	P-value	OR (95% CI)	P-value
Source of Drinking water				
Improved source	1		1	
Not improved source	1.5(1.2-1.8)	<0.001	1.6(1.5-2)	<0.001
Time to get water				
Less than 30 mint	1		1	
More than 30 mint	1.2(1.1-1.4)	<0.001	1.5(1.3-1.6)	<0.001
Source of water for face washing during dry seasons				
Improved source	1			
Not improved source	1.4(1.2-1.8)	<0.001		
Place of defecation for adults				
Adult use latrine	1		1	
Adult practice open defecation	2(1.8-2.3)	<0.001	2.5(2-2.6)	<0.001
Type of latrine				
Improved toilet	1			
Unimproved toilet	2(1.8-2.2)	<0.001		
Altitude				
<1500 meter	1		1	
>1500 meter	1.6 (1.3-2.0)	<0.001	1.5 (1.2-2.1)	<0.001

3.1.4 RISK FACTORS ASSOCIATED WITH TRACHOMATOUS TRICHIASIS (TT)

3.1.4.1 INDVIDUAL RISK FACTORS

UNIVARIATE ANALYSIS

In the Univariate analysis of association between TT and individual risk factors were done for adults aged 15 years and older [see table 3]. The odds of having TT were 5.1 (OR=5.1 95% CI [2.2-11.4] P<0.001), and 17(OR=17 95% CI [8.2-35] P<0.001) among adults aged between 45-54 years old, and adults aged 55 years and older respectively, compared to adults aged between 15-24 years old. Adults aged between 25-34 years old were 0.9(OR=0.9 95% CI [0.3-2.3]) times more likely associated with TT, than adults aged between 15-24 years old, but this were not statistically significant. The odds of getting adults aged 15 years and older with TT among adult females were 2(OR=2 95% [1.4-2.7] P<0.001) times, compared to the odds among males.

MULTIVARIATE ANALYSIS

In the multivariate analysis increasing age and female sex were found significantly associated with TT [see table 3]. The odd ratio of adults aged between 45-54 years old and adults aged 55 years and older were 5.5(OR=5.5 95% CI [2.4-12.6] P<0.001) and 17.7(OR=17.7 95% CI [8.5-37] P<0.001), respectively. The odds of getting adults aged 15 years and older with TT among adults female were 2.1(OR=2.1 95% CI [1.5-3.1] P<0.001) times, compared to the odds among the adult males.

Table 4. A table showing the association between individual variable and TT

	Univariate		Multivariate	
Variable	OR (95% CI)	P-value	OR (95% CI)	P-value
AGE				
15-24	1			
25-34	0.9(0.3-2.3)	0.802		
35-44	2.2(0.9-5)	0.070		
45-54	5.1(2.2-11.4)	<0.001	5.5(2.4-12.6)	<0.001
55+	17(8.2-35)	<0.001	17.7(8.5-37)	<0.001
SEX				
Male	1		1	
Female	2(1.4-2.7)	<0.001	2.1(1.5-3.1)	<0.001
House roof type				
Tin	1			
Thatch	1.3 (1.0-1.4)	0.3		

3.1.4.2 ENVIROMENTAL RISK FACTORS

UNIVARIATE ANALYSIS

In the univariate analysis of association between environmental risk factors and TT [see table 4], The odds of getting adults aged 15 years and older with TT were 0.5(OR=0.5 95% CI [0.4-0.7] P<0.001) times

among those use unimproved water source for drinking, than among those use improved water source for drinking. The odd ratios of adults 15 years and older from households that travel >30 minutes were 0.9(OR=0.9 95% CI [0.6-1.2] P=0.437). But this is not statistically significant.

MULTIVARIATE ANALYSIS

In the multivariate analysis source of water for drinking were found significantly associated with TT [see table 4]. The odds of getting adult aged 15 years and older with TT among those households that mentioned unimproved source of water for drinking were 0.6(OR=0.6 95% CI [0.4-0.8] P=0.001) times, compared to the odds among those households that mentioned improved source of water for drinking. Source of water for face washing during dry season were removed from multivariate analysis for colinearity.

Table 5. A table showing the association between environmental variables and TT

	Univariate		Multivariate	
Variable	OR (95% CI)	P-value	OR (95% CI)	P-value
Source of Drinking water				
Improved source	1			
Not improved source	0.5(0.4-0.7)	<0.001	0.6 (0.4-0.8)	0.001
Time to get water				
Less than 30 mint	1			
More than 30 mint	0.9(0.6-1.2)	0.437		
Source of water for face washing during dry seasons				
Improved source	1			
Not improved source	0.5(0.4-0.7)	<0.001		
Place of defecation for adults				
Adult use latrine	1			
Adult practice open defecation	1.1(0.8-1.7)	0.523		
Type of latrine				
Improved toilet	1			
Unimproved toilet	1.1(0.7-1.6)	0.649		
Altitude				
<1500 meter	1			
>1500 meter	1.2 (0.9-1.5)	0.06		

3.2 Literature Review

In this section I will provide for each components of SAFE strategy first scientific evidence that shows effectiveness of the component, and then available best practice of different activities required to implement individual components of the strategy. According to WHO (2008, pp,2)

Guide for documenting and sharing Best practice is "Knowledge about what works in specific situation and context, without using inordinate resource to achieve the desired result". In addition, I include the challenges and possible solutions proposed during implementation of the SAFE strategy. For selecting the best practice I use the WHO best practice selection criteria, mainly effectiveness; efficiency; and possibility of duplication to the regional context (WHO 2008).

3.2.1 Surgery for trichiasis (S)

The first priority of the SAFE strategy is to treat patients with trichiasis, because they are in immediate danger of incurable blindness (Yorston et al. 2006). There are surgical and non-surgical methods of treating trichiasis. Non-surgical treatment, like epilation and eyelid taping, is recommended as a temporary treatment before a patient gets surgical treatment (Yorston et al. 2006). But the eyelash that grow after epilation were found more abrasive to the cornea. According to Bog, Yorston, & Foster (1993), trachoma trichiasis can be successfully treated by upper eyelid surgery.

The Cochrane review of intervention for trachoma trichiasis done by Yorston et al. (2006), they included seven randomized control trials and their primary outcome with recurrence of trichiasis after surgery. They concluded that surgery of the full thickness of the tarsal plate that enables to rotate the lash away from the cornea is most effective to treat trichiasis. Unilamellar or bilamellar lid surgery can be used to treat trichiasis successfully. Kuper et al. (2003) highlight that; the most effective surgical treatment for trichiasis is the one with the lowest recurrence rate. The WHO recommends bilamellar tarsal rotation [BTR] for the treatment of trichiasis (Solomon et al. 2006). Different systematic review showed availability of strong scientific evidence to treat trichiasis cases by surgery (Kuper et al. 2003; Yorston et al. 2006). The ultimate intervention goal (UIGs) for trichiasis surgery is reducing trichiasis case to less than 1 case per 1,000 people in a district (Emerson et al. 2006b). Having said this about the scientific background of trichiasis surgery, in the following I will discuss available best practices that require to deliver TT surgery service.

How the Service delivery should be structured

WHO recommends two broad methods for provision of TT surgical service: facility based (health centre based), and community based (outreach or campaign) (Solomon et al. 2006). In the facility based method, TT surgical service is delivered routinely by the facility to the catchment population. However, in the community-based method service delivered by temporarily established sites especially in remote area. In this method usually massive community mobilization is done. According to Ethiopian National Trachoma Action plan TT surgery is provided in the country by both methods. However, the question is which method is effective to clear the backlog of TT cases.

A random cluster sampling study done in 8 pairs of villages in the Gambia, compared the uptake of Village verses health center-based trichiasis surgery by Bowman et al. (2000), found that 45% higher acceptance rate when the surgery was provided at village, than when the surgery was provided at health centre. They added in follow up no significant difference in rates of surgical complications and recurrence of trichiasis, between patients operated in both arms. The indirect costs for the patients were significantly lower for those who got the services at the villages (Bowman et al., 2000). The authors were not compared the differences in costs, logistics, and manpower's needed to deliver TT surgery, either at community level or at health facility. Both methods have it is own advantage and disadvantage. According to Rajak, Collin & Burton (2012) facility based TT surgery service provision is more sustainable, but need strong health systems. The sustainability may be with possibility of integrating with preexisting service delivery. Whereas, community based TT surgery service provision give access to remote areas, and enable programs to clear backlog of TT cases with short period of times. In addition, availability of qualified professional also play role in determining the effective way to organize service delivery.

Human Resource

Trachoma endemic areas are usually remote and hard to find for ophthalmologist who can provide the service. To solve this problem the WHO endorsed training of low-level health professionals as integrated eye care workers, to provided TT surgery in remote areas where trachoma is endemic (Solomon et al. 2006). Low-level health professionals includes, nurses, community health workers. This low-level health professional receives additional TT surgical skill training, for six weeks. Ethiopian Federal Ministry of Health also endorsed provision of trichiasis surgery service by Integrated Eye Care Workers in the country (FMOH).

A randomized control trial done in Ethiopia by Alemayehu et al. (2004), to compare out come of surgery done by Ophthalmologist versus

generalist integrated Eye Care Workers (IECW), found that no statistical different in recurrence rates of TT, between patients operated by ophthalmologist and by IECW. They concluded TT surgery task can be safely shifted to IECW. They are very effective and efficient for trachoma control programs. But the study compares only two ophthalmologists and two IECWs at hospital level. Programs face not only shortage of TT surgeons, but also high attrition and low performance.

Habtamu et al. (2011) in their study done on trichiasis surgeons (IECW) retention and productivity in 24 districts of West Amhara Region, Ethiopia, in this districts total of 247 IECWs were trained and deployed from 2001 to 2009. Out of this 234 were interviewed for the study, 60% of them were not working in a position to perform TT surgery. Those still working as TT surgeons during the survey performed 10 cases/ surgeon/year (95% CI 5.7-15.1) on static site surgical service, but when the surgery done during campaign included the average case performed increases to 64cases/surgeon/year (95% CI 42-87). This was less than the national standard of 200-cases/ surgeon/ year (FMOH).

The most important reason cited by the IECWs for the low performance were: shortage of consumables, shortage of time due to additional tasks, patients are not coming for the service, lack of support from the managers, and equipment problems (Habtamu et al. 2011). To reach the elimination target programme managers should give special focus to increase productivity of TT surgeons. Service availability only will not ensure the utilization of the affected communities.

Community Mobilization

Lack of awareness about the available service and misconception about the surgical procedure, were found for not utilizing the service among Ethiopian patients (Rajak et al. 2012). This warns the need for effective way of community mobilization. A prospective cohort study done by Mahande et al. (2007) in Tanzania, found that 52% uptake of trichiasis surgery in a village promotion about TT surgery done by village-leaders, than 36% uptake of trichiasis surgery in a village promotion about TT surgery done by schoolteachers. In addition, they found that village leaders were better in convincing women for surgery. This may be because village leaders are more accepted within the community, and they delivered the message according the cultural norms and value. However, lack of baseline was the limitation of this study, which might help them to compare the change.

3.2.2 Antibiotic (A)

Since 1950, topical or orally administered antibiotics are introduced to treat active trachoma (Mabey, Fraser-hurt & Powell 2005). Topical antibiotic recommended by WHO is 1% tetracycline ointment twice daily for six weeks for treatment of active trachoma. However, temporal blurred vision after application and longtime treatment regimen cause poor compliance to topical antibiotic (Mabey, Fraser-hurt & Powell 2005). This poor compliance to topical antibiotic makes it a less effective choice for both individual treatment as well as mass treatment in endemic community. Oral antibiotics are considered more effective in the treatment of trachoma (Mabey, Fraser-hurt & Powell 2005).

The current oral antibiotic recommended by WHO, for treating active trachoma is azithromycin as a single dose of one gram in adult and 20 milligrams / kilogram of body weight in children (Mabey, Fraser-hurt & Powell 2005). Mass treatments of a community with single dose of oral azithromycin were found to be effective in reducing the prevalence of active trachoma (Schachter et al. 1999). Different systematic reviews found strong scientific evidence for the effectiveness of this component of the SAFE strategy to control trachoma (Kuper et al. 2003; Evans & Solomon 2011). The UIGs for this component is reducing prevalence of active trachoma less than 5% among children aged 1-9 years old in a district (Emerson et al. 2006b). Having said this about the scientific evidence, in the following I will discuss the available best practice to implement successful mass drug administration.

Who should be treated?

The first issue in mass drug administration (MDA) is the question who should be treated. The WHO recommend distribution of antibiotic for at least 80% of the community in a district with prevalence of active trachoma >10% among children aged 1-9 years old, once per year for three consecutives years (Solomon et al. 2006). However, the question is this WHO recommendation is cost effective at all area with different trachoma prevalence.

In a cluster-randomized clinical trial of mass azithromycin study done in 40 villages of Ethiopia by Lakew et al. (2009), they examined on average 54 children per village, and the pretreatment infection prevalence were 48.9% (95% CI 42.8-55%) among childrens aged 1-5 years old. Their mean treatment coverages were 91% (95% CI 88.9%-92.2%). The infection prevalence reduced to 5.4% at two months after treatment, however the prevalence increased to 7.9% at six months. The baseline trachoma prevalence levels were found to be main predictor for increase of infection rate after treatment. They concluded that in low to moderate

trachoma prevalence area resources should not be wasted in an effort to increase antibiotic coverage to more than 80% (Lakew et al. 2009). One limitation to generalize this finding is they examined children aged between 1-5 years old. After deciding this, the next crucial step is planning.

Planning for MDAs

The main determinants for successful implementation of MDAs were found to be preparation of detail plan, by involving all stakeholders (Rono 2013). The implementation plan should contain the methods of drug distribution, the cost required for MDA, manpower required, monitoring and evaluation.

The International Coalition for Trachoma Control recommends endemic country to develop context specific distribution method. According to ICTC preferred practices for Zithromax mass Drug Administration guideline, settlement pattern of the community, previous local experience of mass drug administration, and community members perception of drug distribution; should be taken into consideration when planning to method of drug distribution. Experience from Amhara Region, Ethiopia (unpublished report) show that, the MDA in the region were done in center based. But, the population of Amhara Region settles closely.

In addition, the other issue for planning mass drug administration is who should distribute the drug. A study done by Lynch et al. (cited by West et al. 2004), found that better coverage of mass drug distribution for trachoma in village the MDA were done by community volunteers, than in a village MDA were done by local government leaders. Especially the community volunteers were found better mobilizing women and children. Which are the main target groups. Programme manager must put in place monitoring and evaluation mechanism, that help them to assure the quality of MDA.

The main problem of every programme is to get accurate performance reports. Currently in Ethiopia the blindness prevention programme at regional level is reliant on administrative reports from the districts [Andualem, personal communication]. A population based cluster random survey done in Northern Nigeria by Cromwell et al. (2013), found that overestimation of the MDA coverage, which was calculated from the administration report collected from the community direct distributer registry. They recommend in addition to the administrative report, household survey is an effective tool to assure exact success of the MDA coverage. The study was done in single district and the researcher did not mention the cost implication of doing this household survey. Indeed, cost is not only for the survey, but program managers should plan a head the cost required for implementing the MDA.

Ethiopia is one of the countries that get Azithromycin by donation from Pfizer Inc., through the International Trachoma Initiative. However, the cost for the distribution of the drug to the affected communities should be cover by the government or other implementing partners. By different groups for advocacy they estimate the cost for mass drug administration USD 0.5 per person treated ().

According to Kolaczinski, Robinson & Finn (2011) in their cost estimation study for the first mass drug treatment for trachoma in remote area of South Sudan, they found the cost for treating a person USD 1.53 without including the cost of the drug. They added most of the costs were recurrent costs, like personal (41%), travel/ transport (29%), and others. They use an ingredient approach for their study. This cost is three times of previous estimation. The inflation may be due to the distribution was conducted in rainy season. However, nowadays there is a growing idea to integrate mass drug administration of NTDs to reduce the cost.

Integrating trachoma MDA with other NTDs preventive chemotherapy (PCT)

The WHO has encouraged integrated distribution of preventive chemotherapy for NTDs in endemic area (WHO 2009). This will in able to make the drug distribution more cost-effective (Hanson et al., 2012). Ethiopia is endemic for multiple NTDs, but the country was found to have less experience of implementing integrated control program for NTDs (Deribe et al. 2012). In Ethiopia, Amhara region, there is one experience of integrating azithromycin distribution for trachoma, with onchocerciasis control program (Deribe et al. 2012). The author did not mention details of the outcome.

To plan implementation of integrated mass drug administration, first full burden and distribution of all NTDs in the area must be known (Hanson et al. 2012). A study evaluating best experience from 13 countries implemented integrated mass drug administration for NTDs done by Hanson et al. (2012), found that high political commitment, strong implementation capacity, and integrated monitoring and evaluation systems as determining factors for successful implementation of integrated mass drug administration for NTDs. However the author did not mention the details.

3.2.3 Face Washing (F)

The WHO incorporated face washing as one of the SAFE strategy components to eliminate blinding trachoma (WHO 1998). Face washing is included in the strategy to reduce c. trachomatis transmission in the community by maintaining clean face (Ejera et al. 2004). Children with clean faces are found to attract less of the flies that are responsible for

transmitting the bacteria in endemic communities (Kuper et al. 2003). The SAFE strategy is promoting face washing, both through awareness creation and provision of water (Kuper et al. 2003). The UIGs for this component is to have 80% of children clean face at any given time within a community (Emerson et al. 2006b)

In Randomized control trial study done in the Gambia by West et al. (1995) they found that a reduced prevalence of sever trachoma in area received health education on face washing, than control area. In systematic review done by Stocks et al. (2014), they did a meta-analysis of 35 publications reporting on facial cleanliness, and they found that having a clean face was strongly protective against active trachoma (OR 0.42 95% CI 0.32-0.52). In addition face washing once per day was found to be more protective of active trachoma, than washing of face at least twice a day. Most of the study they include in their meta-analysis was cross-sectional study, which may lower the quality. But, others also argued that no enough scientific evidence to support effectiveness of face washing (Kuper et al. 2003; Lavett et al 2013). Having said this about the scientific evidence of face washing, in the following I will discuss the available best practice method to promote face washing.

Promoting Face Washing

Trachoma control programme is looking for cost effective ways to reach more people in trachoma endemic area to promote face washing. The WHO recommends promoting face washing message in endemic area by using different methods (Solomon et al., 2006). From my observation, in Ethiopia face-washing message is promoted by radio using different language. In Amhara region, Ethiopia, school base promotions were started in 19 districts in collaboration with the Carter center (Andualem, personal communication).

In a cross sectional study done in Mali to evaluate the effectiveness of trachoma message broadcast by radio, found that 60% of survey participant were heard about trachoma from the radio (Bamani et al. 2012). 61% of children with clean face caretaker reported they heard the message from radio. In addition, using radio broadcast to deliver message were found to be cost effective, with $0.57 per each trachoma message broadcasted (Bamani et al. 2012). This study was done in two districts only, and there were no baseline data to compare the change. This result also may confounded by health education done in other methods, like by health professionals, schools.

3.2.4 Environmental Sanitation (E)

Environmental sanitation is included as one component of the multifaceted SAFE strategy, to eliminate trachoma by targeting the favorable environmental conditions for trachoma transmission (Rabius & Abiose 2001). According to Pruss & Marriotti (2000), environmental

sanitation intervention includes: provision of safe water; latrine construction; appropriate garbage disposal system; fly control measures; separating animal from human residency; and awareness creation at individual and household environmental hygiene improvement. However improving of water access and provision of latrine are the two most important components currently promoted by trachoma control program.

In a systematic review done by Stocks et al. (2014) they did a meta-analysis of 38 publication reported on association of active trachoma and distance to water source, they found no significant association between active trachoma and distance to water source less than 1Km (OR 0.97 95% CI 0.83-1.11). They added this lack of association may be due to the 1Km cutoff point used by most of study, may not important with respect to trachoma control. In addition, most of the studies included in the meta-analysis were cross-sectional studies, which may have poor quality that biases the result.

Access to sanitation facility was found to be protective (OR=0.85 95% CI [0.75-0.95]) from active trachoma (Stocks et al 2014). So far the evidence available showed that limited effectiveness of this component (Kuper et al. 2003), but still recommended being part of trachoma control programme. After having said this about the scientific evidence available, in the following I will discuss the available best practice on implementing the intervention of this component, especially provision of water and latrine.

Provision of Water

Provision of water to trachoma endemic community is beyond the capacity of trachoma control programme. So there is no best practice on implementing this component, but there is suggestion by different researcher to trachoma control programme managers to work closely with water hygiene & sanitation sector (WASH) (Emerson et al. 2002).

Promotion of Latrine Construction

One intervention provided under the environmental sanitation component of the SAFE strategy is provision and/or promotion of latrine construction and usage. In Amhara Regional state, Ethiopia, a successful community mobilization programme resulted in the construction of more than 89,000 latrines within one year, especially in one district the coverage of household latrine increased from less than 6% to more than 50% (O'Loughlin et al. 2006). "This programme consisted of training community leaders & health workers, educating & mobilizing the community to build their own latrine, and constructing demonstrating latrines for the community to view and copy. No cash or materials were provided by the programme to subsidize construction." (O'Loughlin et al. 2006 pp 1407).

CHAPTER 4: DISCUSSION

The discussion guided by the objective of my study, the discussion is divided into three parts; individual risk factors, environmental risk factors, and context specific SAFE strategy.

4.1 Individual Risk Factor

In the individual risk factors age, dirty face, and a thatch roof were found independently associated with TF. An increasing age of children was found associated with a reduced risk of active trachoma. Children aged between 1-3 years old and children aged between 4-6 years old have three times and two times risk of TF, respectively, compared to children aged between 7-9 years old. This result is similar with study done in Ankober, Ethiopia, that found the risk of active trachoma were three times among children age between 1-3 years old, than children age between 7-9 years old (Golovaty et al. 2009). Other study done in Mali also found high prevalence of active trachoma among children less than three years of age (Schemann et al. 2002). Young children are the main reservoir of chlamydia trachomatis (West et al. 1991). Young children play together closely to each other's, which facilitates the transmission of the bacteria among themselves. Trachoma infections were found less symptomatic, and short duration as age increase (Bailey et al. 1999). This may explain the low risk of older children in our study. The evidence suggests that, active trachoma is highly associated with preschool children in the Region and the need to focus on them during mass drug administration.

As evidence by the analysis of survey data after adjusting for other variable, children with a dirty face were found to have three times risk of TF in this study. This result is similar with result of other study (Ngondi et al. 2008). A dirty face was found to attract the flies M.sorbens, which act as a vector for the bacteria (Emerson et al. 2000). This increase contact between child with dirty face and the fly facilitate transmission of the infection. But the cause and effect of active trachoma and dirty face is not clear (West 2003). This evidence is important for the advocacy to incorporate face-washing promotion with hand washing promotion done by WASH sectors. Which recommended benefiting trachoma control programmes (Stocks et al. 2014).

Children from households live in houses made of thatch roof were found to have 30% risk of TF. Trachoma is a disease of the poorest of the poor. People with low socio-economic status are live in poor hygiene and sanitation condition, and overcrowding situation. In Somali Region there are ethnically minority groups who are usually marginalized and live relatively in low socio-economic status compare to the majority. This evidence is an important during MDA special focus should be given to

cover them. This result is similar with finding in other study (Schemann et a.l 2002; Ngondi et al. 2008).

As evidence by the analysis of survey data increasing age, and female sex were found independently associated with TT. Adults aged between 45-54 years old and adults aged 55 years & older were found to have 5.5 times and 17.7 times risks of TT, respectively, compared to adults age between 15-24 years old. This result is similar with the study done in Amhara Region, Ethiopia, which found increase risk of TT as age increase (Ngodi et al. 2008). In five-year longitudinal follow up study done in Tanzania, they also found increase risk of TT as age increase (Wolle et al. 2009). TT develops with exposure to repeated infection by the bacteria. This is an important finding for planning surgical service in the region, as much as possible the service should be subsidized for older people. Financial barriers were the factor mentioned most by older people not accessing TT surgical service (Rajak et al. 2012). However, TT was found in teenage children in Ethiopia (Ngondi et al. 2008). This is due to the children live in trachoma hyperendemic area, which exposed them to repeated infection early in their life.

As evidence by the analysis after adjusting for other covariates, Females were found to have two times risk of TT. This result is similar with other study (Berhane et al. 2006; Ngondi et al. 2008; Wolle et al. 2009). This high risk among women is due to their gender role in endemic communities. Traditionally in Somali community women are the caregivers of young children. The close contact with children predisposes women to repeated infections, which subsequently lead to trachomatous scaring. This finding is worrying considering the low health seeking behavior of women in the Region. It will be important to ensure that trachomatous trichiasis case finding and surgical service strategies should accommodate the need of local women (West et al. 2004).

4.2; Environmental Risk Factors

As evidence by the analysis of survey data water source for drinking, time travel to get water, practicing open defecation, and Altitude >1500 meters were found independently associated with active trachoma.

Children from households mentioned unimproved source of water for drinking were found to have 60% risk of active trachoma in this study. This result is similar with study done in other places (Schemann et al. 2002; Ngondi et al. 2008; Golovaty et al. 2009). Active trachoma was associated with quantity of water allocated for hygiene (Bailey et al. 1991), rather than quality of water source. So this result may be due to household using unimproved water source, were allocating a small amount of water for hygiene. This may confound the result. However,

more than 70% of households participated in the survey were getting water from unimproved water source, The Regional government and other stakeholders working in WASH sector should enhance their effort to increase coverage of improved water source. An increasing number of people that have access to improved water source is one of the Millenium Development Goals (MDG).

As evidence by the multivariate analysis children from households that travel >30 minutes to get water were found to have 50% risk of active trachoma. This result is similar with result found in other study (Schemann et al. 2002; Mahander et al. 2012). As the distance to get water increases, the less is the quantity of the water brought to the house (West 2003). This will force the household to allocate less water for hygiene purpose. Less amount of water for hygiene was allocated among the case group, than the control group in case control study of active trachoma (Bailey et al. 1991). But, in study done in Amhara Region, Ethiopia, traveling >30 minutes to get water were not associated with active trachoma (Ngondi et al. 2008). This difference may be due to more than 70% of the survey participant of Amhara region get water source in <30 minutes walk, whereas in this study only 33% of participant get water source in <30 minutes walk.

Childrens from households that mentioned adults use the open field for defecation have 2.5 times risk of active trachoma in this study. This result is similar with result found in study done in Ankober, Ethiopia (Golovaty et al. 2009). Human feces that located in open filed is a breading site for flies Musca Sorbens (Emerson et al. 1992). But, the flies cannot bread in feces located in latrine (Emerson et al. 1992). Musca Sorbens is the main type of fly associated as acting as a vector of the bacteria from person to person. In this study the density of the fly were not captured. Efforts that reduce the number of people practicing open defecation would not only benefit trachoma control program, but also help the Region to achieve one of the Millenium Developments Goals (MDGs). However, Children feces and animal excreta in residential area also found to act as breading site for the flies (Emerson et al. 1992). So awareness creation activities also include proper disposal of children feces and animal excreta.

After adjusting for other variable children from households located above 1500 meters were found to have 50% risk of TF. This result is similar with study done in Amhara Region, Ethiopa, that found increasing altitude associated with increasing risk of active trachoma (Ngondi et al. 2008). But, in other study done in Gurage Zone, Ethiopia, were found increasing altitude associated with low risk of active trachoma (Alemayehu et al. 2005). This difference may be due to the difference ranges of altitude between the two study areas. The Gurage Zone study areas were ranged from 1800m to 3000m, whereas in this study the areas ranged from 209m to 2220m. Lowlands of the SRS are very hot,

which may limit the breed of the fly. Low risks of trachoma were found in areas with high daily temperature (Koukounari et al. 2011 cited by Ramesh et al. 2013). This may explain the low risk in lowland areas of SRS. However, the association between altitude and active trachoma need further study.

4.3 SAFE strategy Implementation

4.3.1 Surgery for Trichiasis (S)

The overall regional prevalence of trachomatous trichiasis among adults aged 15 years and older were 1.5%. But the prevalence ranged from 0.13 to 2.6% by evaluation unit. This evidence shows the overall regional prevalence of trachomatous trichiasis is above the WHO cut of point (1%) to start TT surgery service in the region.

TT surgery service provision should be context specific. The SRHB should plan to provide TT surgery service facility based, especially in area with high prevalence. However, out reach campaign should also plan by taking into consideration, the current low coverage of health facility and sparse settlement pattern of the pastoralist community. Community based TT surgical service provision was found more effective in reaching more patient in short period of time (Bowman et al. 2000; Alemayehu et al. 2004). But logistically and financially it will be challenging to provide the service in this way extensively. This challenge can be solved by integrating TT surgery campaign, with the current MHT operating in the region to provide basic health service to hard to reach areas. But availability of service will not ensure the utilization of it.

Financial barrier were found the main reason not to utilize the service (Rajak et al. 2012). The current health care financing systems of the region underpin user fee as main resource generation for health facilities. As evidence from the analysis of risk factors elderly and females were found highly affected, this group of the community has limited access to resources. Care should be taken not to create financial barriers for this highly affected group to access the service. In addition, a lack of awareness about the service and fear of the surgical procedure were cited not to utilize the service (Rajak et al. 2012).

Community involvement is crucial to achieve the target, clearing the current backlog of TT cases. Promotion about the TT surgery by community leader was found to increase the uptake of the service (Mahande et al. 2007). From my personal experience, Somali community has clan and sub-clan leaders which are very influential decision maker for the community. So special consideration should be given to use these traditional leaders for identification of TT cases, and/or promotion of the service up takes. This should be done according to local culture and gender norms, which will help to increase the uptake of service by women's.

Availability of trained professional that can provide the service is fundamental, to deliver the service. Currently in the Region there are

only two Ophthalmologists who can provide TT surgical service (Ahmed, personal communication). This would not be enough to clear the current burden; there is a need to train more professional who can provide TT surgery service in the Region. By recruiting motivated and interested low level health professionals from more affected areas, they can be trained as IECW to provide the service. IECW were found to perform TT surgery effectively (Alemayehu et al. 2004). Standard training guidebooks and videos for use in training of IECW can be found at the WHO (Reacher, Foster & Huber 2002). In addition, regular monitoring and use of the WHO certification process for TT surgeons were found to improve the quality of the training. The problems of TT surgeons are not only their number, but also maintaining them in the programme.

High attrition and low productivity were the main problems of IECW (Habtamu et al. 2011). To reduce the attrition, trainees can be recruited from rural areas, placing the training institution outside big towns, giving recognition to well performing staffs were found effective (WHO 2008). To increase the performance of IECW, strengthen supportive supervision, and continuous provision of consumables were also found effective (Habtamu et al. 2011).

4.3.2 Mass Drug Administrations (MDA)

The Overall regional prevalence of active trachoma among children aged between 1-9 years old is 13.2%. This is above the WHO cut of point (10%) that recommends mass drug administration (Solomon et al 2006). However, as evident from analysis there are some areas, which need to be given more priority depending on active trachoma prevalence by evaluation unit. The first issue in MDA is who should be treated.

The WHO recommends treat at least 80% of the community, in a district with prevalence of active trachoma >10% among children aged 1-9 years, for three years (Solomon et al. 2006) [see detail in Annex 1]. However, in hypo-endemic are 80% of coverage were found to be enough to control the infection (Lakew et al. 2009). The Regional prevalence is hypo-endemic. In addition, the frequencies of treatments in hypo-endemic area once per year for three years were recommended (Lakew et al. 2009). People from low socio-economic status, and preschool children should be give special focus during MDA in the Region. Successful implementations of MDA depend on good planning.

Preparation of detail micro-plan and involvement of all stakeholder during the planning process were found the base for success full MDA (Rono 2013). During planning first the distribution method should be identified. Drug distribution methods should be contextualized to district or even sub district level. The patterns of settlement are different between pure pastoralist, agro-pastoralist, and other communities of the Region, by district and sub district. In area of pure pastoralist it may be good to consider house-to-house type of drug distribution, but in agro-pastoralist area both center based and house to house can be combined.

After identifying the appropriate method of drug distribution, then who should distribute the drugs.

Community volunteers were found to be more effective in distributing drugs, especially reaching women and children (Lynch et al. cited by West et al. 2004). These are the main target groups for trachoma control programmes. For selection of community volunteers, local traditional leaders can be consulted to enhance the acceptance of the community volunteers. In addition to this local traditional leaders can be used for mobilizing the community.

Re-introduction of infection was found in treated communities from having contact with untreated communities (Burton et al. 2005). This evidence is important when considering highly mobile pastoralist community of the region. Treating wide geographical areas and any individual immigrate to the village after mass treatment was recommended to control re-infection (Burton et al. 2005).

Strong monitoring mechanism should be placed for controlling possible reinfection after treatment, and ensure the correct coverage level. Most of the expenses required for MDA were recurrent cost (Kolaczinski et al. 2011). The Regional Health Bureau can reduce the personal cost by using health extension worker, and community volunteers for drug distribution, but strong supervision should be placed to ensure the coverage of MDA.

Integrated implementations of distributing prophylactic chemotherapy for NTDs were recommended to reduce the cost. But, lack of epidemiological data about other NTDs that exist in the region will make the integration less feasible currently. From my experience there is mass deworming program in the region for children, however the different target population will make it more challenging to integrate. In addition, the experiences to integrate implementation of NTDs control programs were hardly found even at national level (Deribe et al. 2012). Further study is recommended in this area.

4.3.3 Face Washing (F) and Environmental Sanitation (E)

This two component of the SAFE strategy are usually combined due to their primary purpose is interrupting transmission of infection at community level (Emerson et al. 2000). As evidence from the survey majority of the household have poor access to safe water and sanitation. This shows the importance of implementing this component of the intervention to sustained result gained by MDA. Sustained reduction of active trachoma prevalence was found by combined implementation of AFE component of the SAFE strategy (Ngondi et al. 2009).

Conducting face washing promotion through radio was found to be cost effective (Bamani et al. 2012). In addition, using schools, health facility, market place, and other were recommended for promoting face washing. But, the message should be clear and according to the local cultural context. Care should be given to the felt need of the community,

if the priority of the community is access to water, then first effort should be given to provide water than promoting face washing. The SRHB can use effectively to create awareness of the community about hygiene and sanitation, by using the pastoralist health extension workers (PHEW). Currently 1967 PHEW are trained and deployed to the community.

The cost of implementing water projects is beyond trachoma control program (Emerson et al. 2006). Therefore, there is a need to closely work with other stakeholder working in WASH in the region. In Gahanna this component was planned by WASH sector during planning of National Trachoma Action plan (ICTC 2011). The Regional Health Bureau need to do strong lobby to establish regional task force, which involve Regional Water Bureau, Regional Education Bureau, and others stakeholder. Community involvement is important for sustainability of water projects. In addition, to provision of water, the SRHB should strongly mobilize the community the benefit of allocating water for hygiene and sanitation.

Strong community mobilization, which is according to local cultural norms and practice, were found to be effective in increasing household latrine ownership (O'Loughlin et al. 2006). Considering the wide practice of open defecation among the survey households, the community mobilization to promote latrine construction should be given special attention. In addition, to awareness creation building demonstration latrines from local material, which community can copy, were found effective (O'Loughlin et al. 2006).

CAPTER 5: CONCLUSION AND RECOMMENDATION

5.1 Conclusion

In conclusion, trachoma is a public health problem in the SRS: the prevalence of both active trachoma, and trachomatous trichiasis are above the WHO cut of point to consider trachoma as public health problem. However, as evident from the analysis there are pocket areas in the region, which are affected highly by the disease. There are individual and environmental risk factors associated with trachoma in the region.

Active trachoma in children was found independently associated with age, dirty face, thatch roof, unimproved water source, distance to water source, practicing open defecation, and altitude. Whereas, trachomatous trichiasis was found associated with increasing age, and female sex. The above evidence was used to recommend context specific SAFE strategy to control trachoma.

The first component of the strategy is surgery for individual with trachomatous trichiasis. Combining facility based, and community based TT surgical service provision recommended, to clear the current backlog and to reach the hard to reach communities: pastoralist community of the region. IECW can be trained and deployed to provide the service in the region. The Regional Health Bureau should ensure recruiting appropriate trainee, the quality of the training, and certification process of IECW. This will improve the surgical technique of IECW. Establishing strong supportive supervision system, and continues provision of consumable and equipment were found to improve the productivity of IECW. The remaining three components of the strategy are for controlling active trachoma.

Azithromycin is currently recommended for MDA. The SRHB can get it from the donation given to the country by ITI. The Region were there is found to be hypo-endemic for trachoma, and treating 80% of the community with azithromycin, once per year for three years were found enough. To achieve good quality MDA context specific distribution method should be developed. House to house drug distribution method may be more effective in pastoralist area. Community volunteers can be trained and use for drug distribution. But strong monitoring mechanism should be put in place to ensure the quality of the drug distribution. Involving all stakeholders starting from the planning process should be underpin by the SRHB. Risk of reinfection of treated community was found, which need caution by considering the highly mobile nature of pastoralist community. Sustainable effects were found by implementing antibiotic component of the strategy, with facial cleanliness and environmental sanitation component of the strategy.

Promotion of facial cleanliness and environmental sanitation are found to be more effective, by working closely with other sectors, like stakeholders working in WASH, Regional Education Bureau, Regional Mass media agency. The RHB need to do high-level advocacy, especially to establish a regional trachoma task force that involves all stakeholders. In addition, affected community commitment and involvement are crucial for successful implementation of the SAFE strategy.

By using community leaders effectively to mobilize the community, TT surgical uptake, coverage of MDA, personal hygiene, and household latrine ownership, were found to increase. Community involvement will also create ownership, which leads to sustainability of the result achieved by implementing the strategy. The RHB should underpin effective utilization of the traditional community leaders in all steps of implementing the strategy.

5.2 Recommendation

- Trachoma is found to be a public health problem in the region. The RHB should start implementation of all components of the SAFE strategy as early as possible, in order to achieve the planned elimination goal in 2020.
- Regional trachoma task force should be establish, chaired by the president office. This will help to gain high political commitment for the program. Which would facilitate integration of stakeholders contribution for success full implementation of the strategy. In addition, district level trachoma task force also should be established.

- The recruitment, training, and certification of IECW should be done according to the WHO recommendation.

- Systems for continuous supportive supervision of IECW and supply of consumables should be in place by the SRHB. If possible supervision by senior ophthalmologist is recommended, this will help to do surgical audit, and give on job training for the IECW.

- Provision of TT surgery service should be free of charge, or subsidizing mechanism should be planned. This will help to solve financial barriers to access the service, especially for elderly and women.

- Integrating TT surgery with current MHT is recommended to reduce the logistic challenge of providing community based TT surgical service.

- In the region 80% of coverage for MDA is enough, so there is no need to enhance the effort to increase the coverage above it.

- The SRHB should prepare a detailed regional trachoma action plan, which will act as a base for annual plan preparation. The detail implementation plan preparation also recommended at district level. All the plans should be revised depending on the lesson learned from implementing the strategy.

- Promotion of personal and environmental hygiene should be done. For the promotion different method can be used, like mass media, schools, PHEP, market place, and different community association. But the message should be according to the local cultural values and norms, in addition the felt need of the community should be given priority.
- Community involvement has paramount contribution for the successful implementation of the strategy. The RHB should plan to provide the necessary knowledge and skill to the community that will enable to prevent themselves from trachoma infection. Special focus should be given to convince traditional community leaders to make them a role model, and mobilize their community.

- The regional government and stakeholders working on WASH should increase their effort, to increase the number of people in the region that have access to improved water source and sanitation facility.

- Further studies recommended on effects of altitude on trachoma, and integrated distribution of prophylactic chemotherapy for NTDs.

Reference

Alemayehu, W, Melese, M, Bejiga, A, et al., 2004, Surgery for trichiasis by Ophthalmologist versus integrated eye care workers: a randomized trial. Ophthalmology; 111:578e84

Alemayehu, W, Melese, M, Fredlander, E, Worku, A, Courtright, P, 2005, Active trachoma in children in central Ethiopia: association with altitude. Trans. R. Soc. Trop. Med. Hyg. 99, 840-843

Bailey, R, Downes, B, Downes, R, & Mabey, D,1991, Trachoma and water use; a case control study in a Gambian Village. Transaction of the Royal Society of Tropical Medicine and Hygiene 85, 824-828

Bailey, RL, Arullendran, P, Whittle, HC, Mabey, DC, 1993, Randomised controlled trial of single-dose azithromycin in treatment of trachoma. Lancent;342(8869):453-6

Bailey, R, Duong, T, Carpenter, R, Whittle, H, Mabey, D, 1999, The duration of human ocular chlamydia trachomatis infection is age dependent. Epidemiol Infect 123: 479-486

Bamani, S, Toubali, E, Diarra, S, Gpita, S, Berte, Z, Coulibaly, F, Sangare, H, Tuinsma, M, Zhang, Y, Dembele, B, Melvin, P, & MacArthur, C, 2012, Enhancing community knowledge and health behaviors to eliminate blinding trachoma in Mali using radio message as a strategy. Health Education Research vol.28 no.2; 360-370

Berhane, Y, Worku, A, Bejiga, A, Adamu, L, Alemayehu, W, Bedri, A, Haile, Z, Ayalew, A, Adamu, Y, Gebre, T, Kebede, T, West, E, West, S, 2006, National Survey on Blindness Low Vision and Trachoma in Ethiopia: Methods and Study Clusters Profile. , Ethiop J Health Dev ;21(3):185-203

Bog, H, Yorston, D, Foster, A, 1993, Result of community based eyelid surgery for trichiasis due to trachoma. British journal of ophthalmogy;3;77(2):81-3

Bowman, RJ, Soma, OS, Alexander, N, Milligan, P, Rowley, J, Faal, H, Foster, A, Bailey, RL, Johnson, GJ, 2000, Should trichiasis surgery be offered in the village? A community randomised trial of village vs. health centre-based surgery, Trop Med Int Health, Aug;5(8):528-33.

Burton, M, Holland, M, Makalo, P, Aryee, E, Alexander, N, Sillah, A, Faal, H, West, S, Faster, A, Johnson, G, Mabey, D, Bailey, R, 2005, Re-emergency of Chlamydia trachomatis infection after mass antibiotic treatment of a trachoma-endemic Gambian community: a longitudinal study. The Lancet 365:1321-28

Central Statistical Agency-Ethiopia, 2007,Suvey Report. Addis Abeba, Ethiopia. Viewed on 8 May 2014, http://www.csa.gov.et/index.php/2013-02-20-14-51-51/2013-04-01-11-53-00/census-2007.

Central Statistic Agency, 2011, Ethiopian Demographic and Health survey. Central Statistic Agency, Addis abeba, Ethiopia.

Cromwell, EA, King, JD, McPherson, S, Jip, FN, Patterson, AE, et al.,2013, Monitoring of Mass Distribution for Trachoma in Plateau State, Nigeria. PLos Negi Trop Dis 7(1); e1995, doi:10.1371/journal.pntd.0001995

Deribe, K, Meribo, K,Gebre, T, Hailu, A, Ali, A, Aseffa, A, Davey, G, 2012, The burden of neglected tropical disease in Ethiopia, and opportunities for integrated control and elimination. Parasites & Vector 5;240 doi:10.1186/1756-3305-5-240

Ejere, H, Alhassan, MB, Rabiu, M, 2004, Face washing promotion for preventing active trachoma. Cochrane Database of systematic Review, Issue 3. [DOI:10.1002/14651858.CD003659.pub2].

Emerson, P, Burton, M, Solomon, A, Bailey, R, Mabey, D, 2006, The SAFE strategy for trachoma control: using operational research for policy, planning and implementation. Bulletin of the World Health Organization.;84:613.

Emerson, P, Frost, L, Bailey, R, Mabey, D, 2006b, Implementing the SAFE strategy for Trachoma Control. The Carter Center available on http://www.cartercenter.org accessed on May, 24, 2014.

Emerson, P, Cairncross, S, Bailey, R, & Mabey D, 2000, Review of the evidence base for the 'F' and 'E' components of the SAFE strategy for trachoma control. Tropical Medicine & International Health, 5(8), 515-527.

Emerson, P, Lindsay, S, Walraven, G, Faal, H, Bogh, C, Lowe K, & Bailey, R,1999, Effect of fly control on trachoma and diarrhea. The Lancet, 353, 1401-1403

Evans, JR, Solomon, AW, 2011, Antibiotics for trachoma. Cochrane Database of systematic Reviews, Issue 3.Art.No:CD001860. DOI: 10.1002/14651858.CD001860.pub3.

Federal Democratic Republic of Ethiopia Ministry of Health, 2013, HSDP iv Annual performance report. Version I. Addis Abeba, p, 14.

Federal Democratic Republic of Ethiopia Ministry of Health (FMOH), 2012, National Trachoma Action Plan. Federal Ministry of Health of Ethiopia. Addis Abebe, Ethiopia

Golovaty, I, Jones, L, Gelaye, B, Tilahun, M, Belete, H, et al, 2009, Access to water source, latrine facility and other Risk Factors of Active trachoma in Ankober, Ethiopia. PLoS ONE 4980:e6702. Doi 10.1371/journal pone. 0006702

Habtamu, E, Rajak, SN, Gebre, T, Zerihun, M, Genet, A, et al, 2011, Clearing the backlog: Trichiasis Surgeon Retention and productivity in Northern Ethiopia. PLoS Negl Trop Dis 5(4): e1014. Doi:10.1371/journal.pntd.0001014

Hanson, C, Weaver, A, Kathryn, L, Zoerhoff, Kabore, A, Linehan, M, Doherty, A, Engels, D, Savioli, L, & Ottesen, E, 2012, Integrated Implementation of Programs Targeting Neglected Tropical Diseases through Preventive Chemotherapy: Identifying Best Practice to Roll Out Programs at National Scale. Am. J. Trop. Med. Hyg., 86(3), pp 508-513

Hotez, P., Fenwick, A., Savioli, L., Molyneux, D., 2009. Rescuing the "bottom billion" through neglected tropical disease control. Lancet, 373: 1570-1576

International Coalition for Trachoma Control, 2011, 2020 INSight: A Global Strategy to Eliminate Blinding Trachoma. ICTC available on http://www.trachomacoalition.org/resources/2020-insight-global-strategy-eliminate-blinding-trachoma accessed on June 20, 2014

Kuper, H, Solomon, A, Buchan, J, Zondervan, M, Foster, A, Mabey, D, 2003, A critical review of the SAFE strategy for the prevention of blinding trachoma. The LANCET infectious disease:vol 3.

Kolaczinski, JH, Robinson, E, Finn, TP, 2011, The Cost of Antibiotic Mass Drug Administration for Trachoma Control in a Remote Area of South Sudan. PLos Negi Trop Dis 5(10): e1362. Doi:10.1371/journal.pntd.0001362

Lakew, T, Alemayehu, W, Melese, M, Yi E, House, JI, et al., 2009, Importance of coverage and Endemicity on the Return of infectious Trachoma after a single Mass Antibiotic Distribution. PLos Negi Trop Dis 3(8): e507, doi:10.1371/journal.pntd.0000507

Lavett, D, Lansingh, V, Carter, M, Eckert, K, Silva, J, 2013, 'Will the SAFE strategy Be

Sufficient to Eliminate Trachoma by 2020? Puzzlements and possible solutions', Hindawi Publishing Corporation, The Scientific World journal, vol 2013, Article ID 648106,pp,18
Mabey, D, Solomon, A, Foster, A, 2003, Trachoma. The Lancet ; 362:223-29
Mabey, D, Fraser-hurt, N, Powell, C, 2005, Antibiotics for trachoma. Cochrane database of systematic Review
Mahande, M, Tharaney, M, Kirumbi, E, Ngirawamungu, E, Geneau, R, Taper, L, Coutright, P, 2007, Uptake of trichiasis surgical service in Tanzania through two village-based approaches. Br J Ophthalmol;91:139-142. Doi:10.1136/bjo.2006.103374.
Ministry of Finance and Economic development (MOFED), 2011, Ethiopian Economy. Ministry of Finance and Economic Development, addis Abeba, Ethiopia, Available on http://www.mofed.gov.et/English/Information/Pages/EthiopianEconomy.aspx Accessed on June 22, 2014
Murray, CJ, Vos, T, Lozano, R, Naghavi, M, Flaxman, AD, et al., 2013, Disability-adjusted life years (DALYs) for 291 disease and injuries in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease study 2010. Lancet 380: 2197-2223
Ngondi, J, Gebre, T, Shargie, E, et al., 2009, Estimation of effects of community intervention with Antibiotics, Facial Cleanliness, and Environmental Improvement (A,F,E) in five district of Ethiopia hyperendemic for trachoma. Br J Ophthalmol 94:278-281 doi: 10.1136/bjo.2009.168260
O'Loughlin, R, Fentie, G, Flannery, B, Emerson, P, 2006, Follow-up of a low cost latrine promotion programme in one district of Amhara, Ethiopia: characteristics of early adopters and non-adopters, Tropical Medicine and International Health, doi;10.1111/j.1365-3156.
Pruss, A, & Mariotti, S, 2000, Preventing trachoma through environmental sanitation: a review of the evidence base. Bulletin of the World Health Organization, 78(2).
Rabius, M, & Abiose, A, 2001, Magnitude of trachoma and barriers to uptake of lid surgery in a rural community of northern Nigeria. Ophthalmic Epidemiology, 8(2), 181-190
Rajak, S, Collin, R, Burton, M, 2012, Trachoma Trichiasis and its Management in Endemic Countries. Surv Ophthalmo 157: 105-135
Rajak, SN, Habtamu, E, Weiss, HA, Bedri, A, Zerihun, M, et al, 2012, Why Do People Not Attend for treatment for Trachomatous Trichiasis in Ethiopia? A Study of Barriers to Surgery. PLos Negl Trop Dis 6(8):e1766. Doi: 10-1371/ journal. Pntd 0001766
Ramesh, A, Kovats, S, Haslam, D, Schmidt, E, Gilbert, CE, 2013, The impact of climatic risk factors on the prevalence, distribution, severity of acute and chronic trachoma. PLos Negi Trop Dis 7(11): e2513. Doi:10.1371/journal.pntd.0002513
Reacher, MH, Munoz, B, Alghassany, A, Daar, AS, Elbualy,, M, Taylor HR, 1992, A controlled trial of surgery for trachoma trichiasis of the upper lid. Archives of ophthalmology;110(5):667-74
Reacher, M, Foster, A, Huber, J, 2002, Trichiasis Surgery for Trachoma: The Bilamellar Tarsal Rotation Procedure. Geneva: World Health Organization WHO/PBL/93.29
Rono, KH, 2013, Mass treatment for trachoma: how does it all work?, Community Eye Health Journal
Schachter, J, West, S, Mabey, D, Dawson, CR, Bobo, L, Bailey, R, Vitale, S, Quinn, TC, Sheta,

A, Sallam, S, Mkocha, H, Mabey D, Faal, H, 1999, Azithromycin in control of trachoma. Lancet 354: 630-635
Schemann, JF, Sacko, D, Malvy, D, et al., 2002, Risk factors for trachoma in Mali. Int J Epidemiol;31:1994-201
Smith, J, Flueckiger, R, Hooper, P, Polack, S, Cromwell, E, Palmer, S, Emerson, P, Mabey, D, Solomon, A, Haddad, D, Brooker, S, 2013, The Geographical Distribution and Burden of Trachoma in Africa, PLOS Neglected Tropical Diseases, vol,7, issue 8, e2359
Solomon, AW, Zondervan, M, Kuper, H, Buchan, JC, Mabey, DCW, Foster, A, 2006, Trachoma control: a guide for programme managers, WHO, Geneva, Switzerland.
Somali Regional State of Ethiopia ,2010, Good practice Guidelines for Water Development. Office of the President, Somali Regional State of Ethiopia, Jijiga, Ethiopia, pp 89.
Stephen, D,2006, Vulnerable Livelihoods in Somali Region, Ethiopia, Report 57, the institute of Development Studies, Brighton UK.
Stocks, ME, Ogden, S, Haddad, D, Addiss, DG, McGuire, C, et al., 2014, Effect of Water, Sanitation, and Hygiene on the Prevention of trachoma: A Systematic Review and Meta-Analysis. PLos Med 11(2): e1001605. Doi:10.1371/journal.pmed.1001605
Thylefors, B, Dawson, CR, Jones, BR, West, SK, Taylor, HR, 1987, A simple system for the assessment of trachoma and its complication. Bull world health organ;65:477-83
Turner, V, West, S, Munoz, B, Katala, S, Taylor, H, Halsey, N, Mmbaga, B,1993, Risk factors for trichiasis in women in Kongwa, Tanzania: A case control study. International Journal of Epidemiology, 22(2), 341-347.
West, S, Munoz, B, Turner, V, Mmbaga, B, & Taylor, H, 1991, The epidemiology of trachoma in central Tanzanian children. Ophthalmic Epidemiology, 20(4), 1088-1092
West, S, Munoz, B, Lynch, M, Kayongoya, A, Chilangwa, Z, Mmbaga, BB, et al., 1995, Impact of face-washing on trachoma in Kongwa, Tanzania. Lancet;345:155-8
West, S, Nguyen, MP, Mkocha, H, Holdsworth, G, Ngirwamungu, E, et al., 2004. Gender equity and trichiasis surgery in the Vietnam and Tanzania national trachoma control programmes. Br J Ophthalmol 88: 136-1371.
West, S, 2003, Blinding trachoma: prevention with the SAFE strategy. The American Journal of Tropical Medicine and Hygiene, 69(5), 18-23
Wolle, M, Munoz, B, Mokocha, H, West, K, 2009, Age, Sex, and Cohort effects in a Longtudinal Study of Trachoma Scarring. Invest Ophthalmol Vis Sci. 50(2): doi;10.1167/iovs, 08-2414
World Health Organization, 1998, FIFTY-FIRST WORLD HEALTH ASSEMBLY Global elimination of blinding trachoma, Geneva, Switzerland Accessed on May 15, 2014 http://apps.who.int/gb/archive/pdf_files/WHA51/ea1r1.pdf
World Health Organization, 2009. Neglected Tropical Disease, Hidden Successes, Emerging opportunities. Available at http://whqlibdoc.who.int/publications/2009/9789241598705_eng.pdf. Accessed July 14, 2014
World Health Organization, 2008, Guide for Documenting and Sharing “Best Practices” in Health programmes. World Health Organization Regional Office for Africa. Brazzaville.
WHO & UNICEF Joint Monitoring Programme for water supply and sanitation, 2010,

Progress on sanitation and drinking water: 2010 updated. World Health Organization available on http://www.unicef.org/eapro/JMP-2010Final.pdf accessed on June 22, 2014.

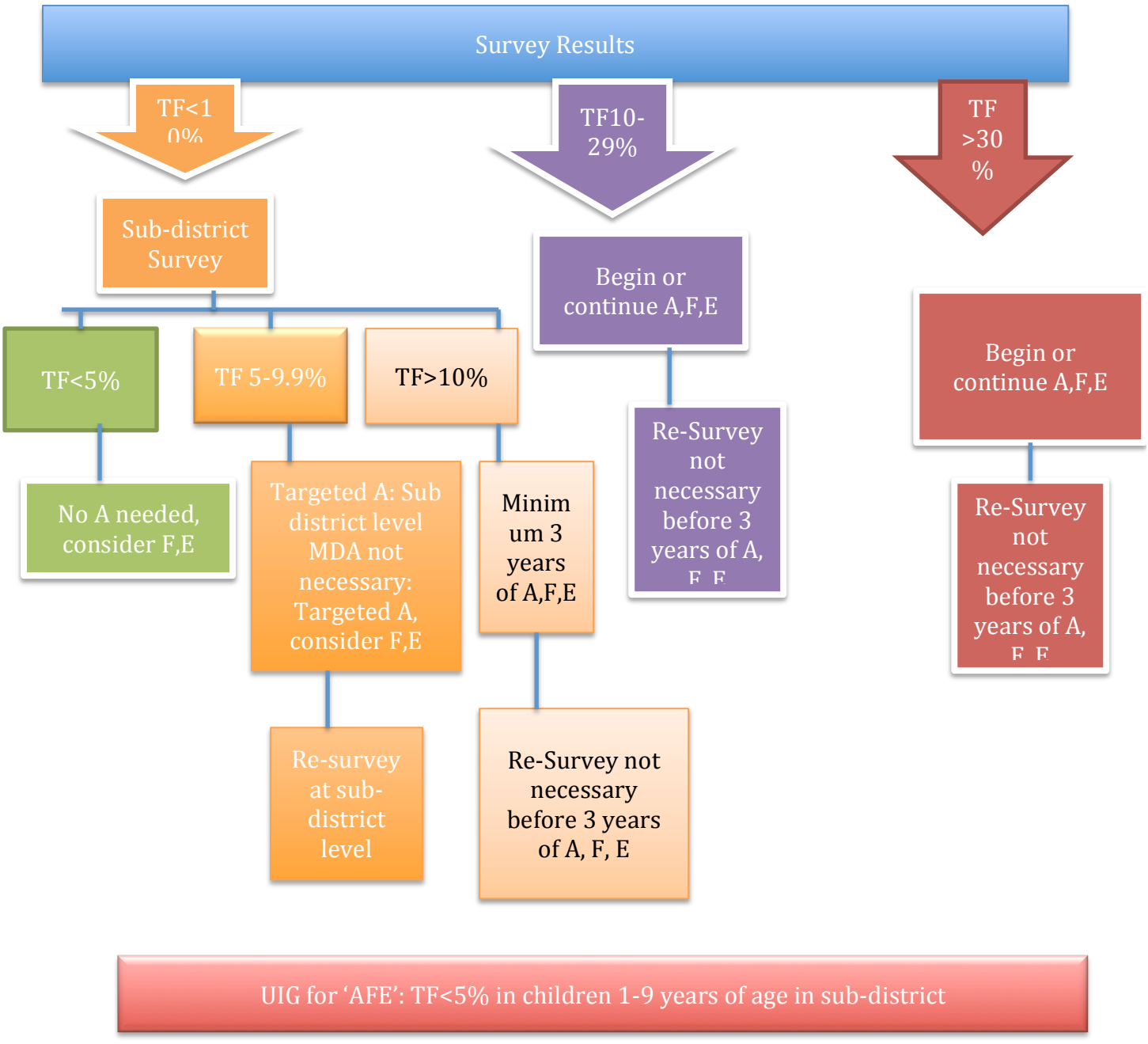
World Health Organization (2013), REPORT OF THE 17th MEETING OF THE WHO ALLIANCE FOR THE GLOBAL ELIMINATION OF BLINDING TRACHOMA, GENEVA, Switzerland. Accessed on May 20, 2014. http://www.who.int/blindness/GET12-REPORT-ENG_final.pdf

Yorston, D, Mabey, D, Hatt, SR, Burton, M, 2006, Intervention for trachoma trichiasis. Cochrane Database of systematic Reviews. Issue 3. Art No:CD004008.DOI:1002/14651858.CD004008.pub2

Appendices

Annex 1 Guidelines for mass antibiotic treatment of trachoma

Guidelines for Antibiotic Treatment of Trachoma



Adopted from world Health Organization Report of 3rd Global Scientific Meeting on Trachoma and WHO manual: "Trachoma Control: A Guide for programme Managers"