DOSSIER DOCUMENTING ELIMINATION OF TRACHOMA AS A PUBLIC HEALTH PROBLEM

Ghana

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ACKNOWLEDGEMENTS

The elimination of trachoma from Ghana has been a priority of the Ghana Health Service, Ministry of Health and the Government of Ghana culminating in the setting up of the Trachoma Elimination Programme in 2000. Delivery of interventions aimed at trachoma elimination started in the year 2000 until elimination as a public health problem was achieved in 2015 and confirmed through validation surveys in 2017. The preparation of the elimination dossier was started and completed in 2017. It has taken the efforts and hard work of various people to reach this point of accomplishment.

The drafting and finalization of this dossier has been achieved through the untiring hard work of the Trachoma Elimination Committee (TEC) set up by the Director General of the Ghana Health Service. The members of the TEC who committed themselves to this work included Dr. Agatha Aboe (Global Trachoma Programme Advisor, Sightsavers), Dr. James Addy (Head of the Eye Care Unit and Trachoma Programme Manager), Mr. David Agyemang (Programme Manager, Sightsavers), Ms. Phoebe Balagumyetime (District Director of Health Services, Jirapa District), Dr. Nana-Kwadwo Biritwum (Programme Manager, NTDs), Ms. Gifty Boafo (Eye Care Unit), Dr. Oscar Debrah (Former Head, Eye Care Unit), Dr. Dziedzom K. de Souza (Senior Research Fellow, Noguchi Memorial Institute for Medical Research), Dr. Maria Hagan (Former Head, Eye Care Unit), Mr. Edward Tei Hervie (Biomedical Scientist, NTD Programme), Dr. Joseph Koroma (Associate Director, FHI360), Dr. Benjamin Marfo (Deputy Programme Manager, NTDs), Dr. Ernest Mensah (Technical Advisor, FHI 360), Dr. Winfred Ofosu (Regional Director of Health Services, Upper West Region) and Dr. Seth Wanye (Ophthalmologist, Northern Region). These persons ensured completeness of surveys, gathering of information, write-up and review this document. The tremendous contribution of each of the members of the Trachoma Elimination Committee is highly appreciated.

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SUMMARY

Surveys in the early 1950s in Northern Ghana identified trachoma as the most prevalent cause of blindness nationally. Later reports, in the 1990s, highlighted trachoma as a problem in the Northern and Upper West Regions of the country. In December 1998, the Ministry of Health of Ghana, World Health Organization (WHO) and Non-Governmental Development Organisations collaborated in an effort to assess the trachoma situation in the two-suspected trachoma-endemic regions. They ranked affected villages to prioritize trachoma control interventions, using a modified version of the WHO Trachoma Rapid Assessment methodology in all 13 districts in the Northern Region and five districts in the Upper West Region. The results showed that approximately 70% of the 122 villages assessed in those regions would need interventions using the WHO-endorsed "SAFE" strategy for the elimination of trachoma.

In 1999-2000, baseline epidemiological trachoma prevalence surveys were conducted, starting with five districts. All five districts (Tolon-Kumbungu, Savelugu-Nanton and Tamale in the Northern Region, and Wa and Sissala in the Upper West Region) had trachoma of public health significance needing SAFE interventions.

In total, taking into consideration the results of all surveys conducted over the lifespan of the Ghana Trachoma Control Programme, about 2.8 million people were estimated to be at risk of trachomatous blindness in Ghana, with an estimated 13,000 people suffering from trichiasis.

The International Trachoma Initiative selected Ghana, alongside five other countries, as a first-round recipient of Pfizer-donated azithromycin (Zithromax®) for trachoma elimination purposes. The Ghana National Trachoma Control Programme was initiated in June 2000 by the Ghana Health Service / Ministry of Health, together with various international partners. The SAFE strategy using azithromycin was started in all known endemic communities of the five surveyed districts by 2001. By 2003, the programme had conducted baseline surveys in the remaining 13 districts in Northern and Upper West regions; data indicate that trachoma is not a public health problem in the remaining regions of Ghana. All endemic communities (communities with a prevalence of the active trachoma sign trachomatous inflammation—follicular (TF) ≥5% in children aged 1-9 years) in the 18 endemic districts had started receiving interventions with the various components of the SAFE strategy by 2004.

The programme also developed national strategic plans to guide implementation, starting with the first 2-year plan for implementation of the SAFE strategy in 2000, followed by a second strategic plan (covering 2003-2007) in 2003. In 2005, following publication of guidelines from WHO to conduct district-wide mass drug administration (MDA) in districts with TF prevalence ≥10% in children aged 1-9 years, a Five Year (2005 -2009) Strategic Plan for Trachoma Control in Ghana was developed and launched, with the goal of eliminating trachoma as a public health problem in Ghana by the year 2010.

Impact surveys were carried out in 2007-2008, revealing that the prevalence of TF had fallen to less than 5% in all districts in Northern and Upper West Regions. However, there were still TT cases to be managed to bring the TT prevalence below the elimination threshold. In 2009-2010, with support from WHO and other partners, a surveillance protocol was developed. This plan was implemented over a

four-year period in all districts of the two endemic regions. Following the 2015 release of WHO guidelines for pre-validation surveillance, in 2015-2016, the programme conducted a series of population-based pre-validation surveillance surveys in districts of the two endemic regions. The results confirmed that the WHO criteria for elimination of trachoma as a public health problem had been achieved in all districts except for Yendi, which had reached the TF elimination threshold but had not yet attained the threshold for TT. In late 2016 and early 2017, an intensive TT case search and provision of surgery campaign was conducted in Yendi district. House-to-house TT case searches were undertaken in all communities of Yendi. Currently, therefore, there are no TT cases unknown to the health system in Yendi District.

From the information in this dossier, we conclude that Ghana has met the criteria for elimination of trachoma as a public health problem and thereby submit this dossier to WHO for validation.

Lessons learned by the global trachoma community from the trachoma programme in Ghana have included use of height-based dosing of azithromycin; provision of three rounds of antibiotics for meso-endemic districts; the use of systematic active case search for TT cases, involving house-to-house, community-by-community TT searches; and intensive counselling of patients found to have TT, with an offer of immediate surgery. The latter produced considerable local improvement in surgical uptake. It is also important to note that TT surgery was and is free in Ghana, a critical Ghana Health Service decision reflecting the socio-economic disadvantage of TT patients and the impact of the condition on future earning potential of the patient and their family.

The success of the Ghana programme was a result of the strong leadership at all levels, implementation of the full SAFE strategy right from the outset, strong collaboration between Ghana Health Service and its many programme partners, and integration at lower levels of programme delivery, including community ownership.

Timeline

Year	*Activity*
1999	Trachoma rapid assessment in 18 districts.
1999–2000	Epidemiological baseline surveys carried out in 5 districts in Northern and Upper West Regions considered to be most heavily endemic (Tolon-Kumbungu, Savelugu-Nanton and Tamale in the Northern Region; Wa and Sissala in the Upper West Region).
2001	Full SAFE strategy implementation commenced in the first 5 surveyed districts. Implementation was carried out at community level, based on survey results. Later, more communities were surveyed and those that needed treatment were added to the programme. This continued until WHO provided direction for district-wide treatment based on TF prevalence.
2002	Baseline prevalence survey conducted in one additional district (West Gonja, Northern Region).
2003	Baseline prevalence surveys conducted in the remaining 12 districts in the Northern and Upper West Regions.
2005–2007	District-wide antibiotic distribution started in the 5 districts (Tolon-Kumbungu, Savelugu-Nanton, West Gonja Wa and Sissala) that had baseline TF prevalence in children aged 1-9 years ≥10%.
2005–2007	SAFE implementation in districts with TF prevalence less than 10%, with focal community-based treatment for communities with TF prevalence >5%. (At that time, WHO guidelines indicated elimination thresholds at community level.)
2007–2008	Impact surveys showed the prevalence of TF to be <5% in all 18 districts. (By this time, WHO had provided updated guidelines for elimination thresholds at district level.)
2009–2010	In collaboration with partners and guided by WHO, the Ghana programme developed guidance on surveillance activities.
2011–2014	Implementation of surveillance in all 18 districts. Based on the results, MDA was carried out in communities that had TF prevalence >5%.
2015–2016	Population-based pre-validation surveillance surveys conducted in all 18 districts. Results confirmed that WHO criteria for elimination had been reached in all districts except Yendi, which had reached the TF prevalence threshold but had not reached the threshold for TT.
2016–2017	TT case search and provision of surgery in Yendi District. A thorough house-to-house, community-by-community active case search with management for TT was undertaken throughout the district. This showed that Yendi had also met the TT elimination threshold.
2017	Development and finalisation of the dossier.
2018	Submission of dossier to WHO.

1. BACKGROUND

1.1 DEMOGRAPHIC, ECONOMIC AND DEVELOPMENT CONTEXT

Administrative structures

The Republic of Ghana is situated in West Africa, bounded by the Atlantic Ocean to the south, Burkina Faso to the north, Cote d'Ivoire to the west and Togo to the east. It has a total land area of 238,533 km^2. It is divided into 10 administrative regions, each with a regional capital. Each region is further divided into districts and sub-districts to ensure equitable resource allocation and efficient and effective administration at local level. The Ashanti, Eastern, and Greater Accra regions are home to about 50% of the country's population. Upper West is the least populated region, accounting for 2% of the total population. Overall, there are currently 216 districts in the country. Each district has a district capital, surrounded by local communities and villages. Accra is the capital of Ghana and is located in the Greater Accra Region.

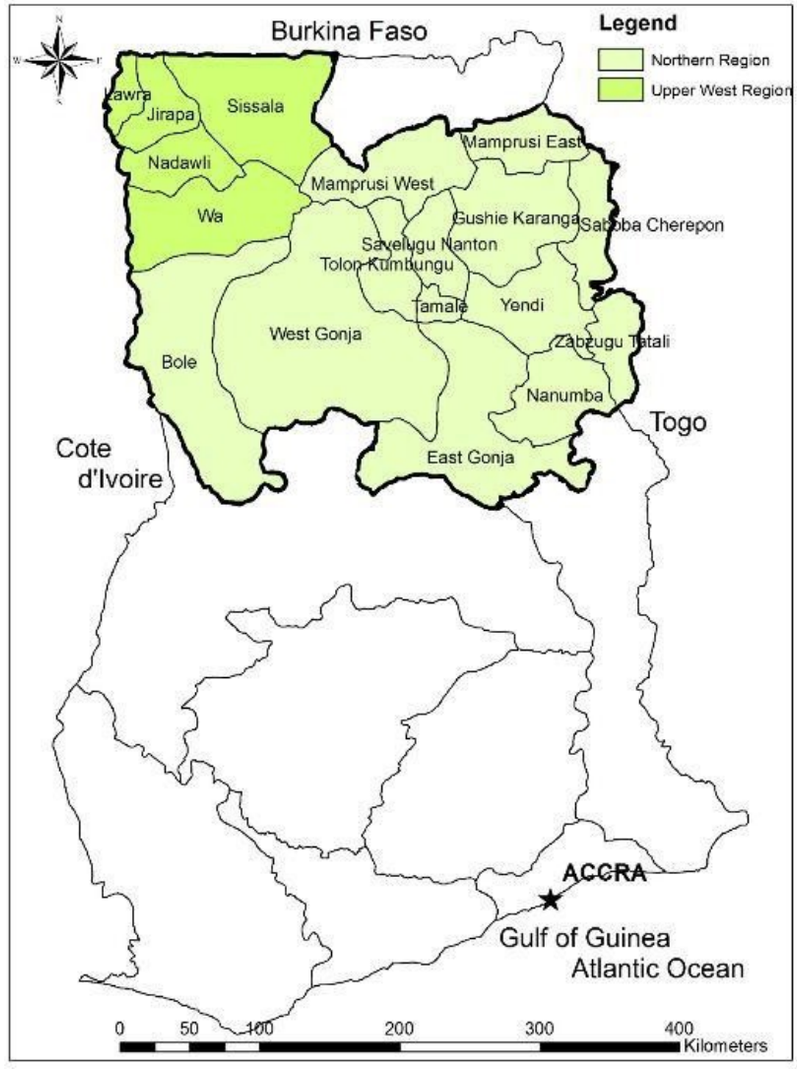

Figure 1: Map of Ghana, indicating the Northern and Upper West regions, the principal settings for the work described in this dossier

Population structure

In Ghana, communities represent the smallest units of human settlement. Some rural communities are in remote and hard to reach areas, where subsistence farming is the most common occupation. Some of these farmers have seasonal farmsteads. In these parts of the country, basic amenities can be limited or non-existent. Rural communities have traditional rulers aided by teams of elders. At the political level, Assemblymen represent the communities at the District Assembly. Social groupings in communities may be formed along gender, religious and economic activity lines, with leaders representing the groups as opinion leaders in their communities. These social groupings are very useful for community sensitization and dissemination of information for health programmes.

Demography

According to the 2010 population and housing census, the population of Ghana was 24.7 million (projected to 28,308,301 for 2016), with a growth rate of 2.5% and a population density of 103 persons / km^2. Fifty-one percent (51%) of the population lives in urban areas. The gender ratio is 95.2 males for every 100 females. Thirty-eight percent (38%) of the population is aged under 15 years, while the proportion of the population aged 65 years and older is 5%. Life expectancy at birth is 60 and 63 years for males and females respectively.

Geographic characteristics

The geographical landscape in Ghana consists mostly of low plains, with a plateau in the south-central area. The hydrological system consists of a large number of streams and rivers, together with coastal lagoons, the huge man-made Lake Volta, and Lake Bosomtwe. Ghana experiences a tropical climate with two main seasons: the wet and the dry. The North of Ghana experiences its rainy season from March to November while southern Ghana experiences its rainy season from April to mid-November. There are three clear vegetation zones, consisting of dry savannah in the northern part, humid forest in the central part, and coastal savannah and mangroves on the coasts.

Economic activities

Ghana is the second-largest cocoa producer in the world, and the second largest producer of gold in Africa. There are many other export products including oil, timber, diamond, bauxite, and manganese. Non-traditional commodities, such as pineapples, bananas, yams, and cashew nuts, also provide sources of foreign exchange. Tourism also contributes to the economy, and is currently the third-largest foreign exchange earner. An oilfield, which is reported to contain up to 3 billion barrels (480,000,000 m^3) of light crude oil, was discovered in 2007. Oil exploration is ongoing, though drilling and oil export commenced in 2011.

GDP estimates for 2016 showed an annual growth rate of 3.5%. The services sector recorded the

highest growth rate of 5.7%, followed by the agriculture sector (3.0%). The services sector remains the largest sector of the economy. Its share of GDP increased from 54.6% in 2015 to 56.5% in 2016, despite a decrease in growth rate from 6.3% in 2015 to 5.7% in 2016. The Information and Communication (21.7%) and the Health and Social Works (16.8%) components of the services sector recorded the highest growth rates. The industry and agriculture sectors accounted for 24.3% and 19.1% of 2016 GDP. In 2016, Ghana recorded a per-capita GDP of US$ 1,507, up from US$ 1,311 in 2015. The Human Development Index (HDI) rose by 0.8% annually from 1980 to 2010. About 45% of Ghana's labour force is engaged in agriculture, and 41% provide services.

Education and literacy

There are many programmes aimed at improving education and literacy in Ghana, including the school feeding programme. According to the 2014 Demographic and Health Survey, about 26% of the female population has never been to school. Among females aged 6 years and older, 27% have some primary education, 5% have completed primary school only, 39% have some secondary education or have completed secondary school, and 4% have more than a secondary school education. The proportion of females with no education is higher in older age groups, suggesting some improvement in education coverage over the years. This may be partly due to the impact of the Free Compulsory Universal Basic Education programme, introduced in 1996. The introduction of the school feeding programme, aimed at improving the nutritional status of school pupils, also resulted in an increase in school enrolment. Some 35% of the rural female population has had no education, as compared to 18% of the urban female population.

In the male population, 18% have never been to school, 31% have had some primary education or have completed primary education, 44% have had some secondary or have completed secondary education, and 8% have more than a secondary education. Twenty-five percent of males in rural areas have no education, compared with 10% in urban areas.

Recent improvements in education and literacy levels have had an impact on various NTD programmes, such as the school deworming programme targeting school-age children.

Transportation network

Transportation in Ghana is via road, rail, air and water. Ghana's road transport infrastructure is still under development, particularly for reaching rural communities. There is a good principal road network, linking most regional and district capitals. Road transportation in Ghana carries about 97% of passenger and freight traffic. All district centres are connected to their regional capitals by a network of roads, most of which are tarred. Beyond district centres, many rural communities are connected through feeder roads that are mostly untarred. Some communities remain relatively isolated. In the three northern regions of Ghana, transportation is heavily dependent on motorcycles and bicycles.

Communication

Communication in Ghana is achieved through print media, mobile phones, radio and television. Ghana is home to at least five mobile telephone companies. There are over 20 million mobile phone subscribers in the country. Between 2008 and 2014, the country witnessed a sharp increase in mobile phone ownership from 57% to 85%. In rural households, mobile phone ownership more than doubled from 37% to 76% (GDHS, 2014). In urban areas, mobile phone ownership is estimated at 92%. Thus, telephone services are available and accessible in almost all parts of the country, and this enhances communication within the health system. Internet accessibility is also widespread, with all mobile networks and other service providers providing reliable internet access. However, there are occasional challenges linked to fluctuations in network coverage and accessibility in remote rural areas.

The state-owned Ghana Broadcasting Corporation has nationwide coverage. There are also many private radio and TV stations in the country. Many district capitals have radio stations through which information is disseminated in local languages. Nationwide, 69% and 62% of households own radios and colour televisions respectively.

At community level, most communities have their own internal systems for public announcements. These include community public address systems and public announcement vans.

Water sanitation and hygiene

Ghana is making efforts to ensure universal access to safe drinking water and improved sanitation facilities by the year 2025 (MWRWH, 2009). At national level, the percentage of the population using an improved water source in 2014 was 64.2%: 57.0% and 71.4% in urban and rural areas respectively. Access to improved sanitation at national level was 15% in 2014: 20.5% and 9.6% in urban and rural areas respectively (GDHS, 2014). Hand washing is actively promoted by the government as one of the most efficient ways to stop the spread of diseases. There are on-going campaigns on TV and radio, as well as in schools and health facilities, aimed at boosting awareness of the importance and practice of hand-washing with running water and soap. According to the 2014 GDHS, 46% households in urban areas had soap and water at toilet facilities for hand-washing, compared with 29% of rural households. Inadequate potable water supply and poor sanitation increase the risk of soil-transmitted helminths, trachoma and yaws, among other diseases. Through support from USAID and other funding agencies such as Relief International, the Adventist Development Relief Agency, and Winrock International, the Ghana Water Sanitation and Hygiene (WASH) project aims to improve the water and sanitation facilities, and increase hygiene education among rural and peri-urban communities to prevent the spread of diseases.

1.2 HEALTHCARE SYSTEM CONTEXT

Healthcare system structure

Health care in Ghana is provided by the Ministry of Health (MoH) and its agencies including the Ghana Health Service (GHS), National Health Insurance Scheme, and Health Training Institutions. Health care delivery is also undertaken by faith-based and other private healthcare facilities. The healthcare system has five levels of providers: health posts and Community-based Health Planning and Services (CHPS) compounds, health centres and clinics, district hospitals, regional hospitals and tertiary hospitals. The overall health system in Ghana includes systems for promotion, prevention, curative, and rehabilitative care.

From 1996 to date (and therefore throughout the life of the trachoma elimination programme), there have been seven directorates in the Ministry of Health, led by the Minister of Health, including: Policy, Planning Monitoring and Evaluations, Human Resource for Health Development, Research Statistics and Information Management, Traditional and Alternative Medicines, Procurement and Supplies, General Administration and Finance. The MoH is responsible for policy formulation, coordination, monitoring and resource mobilization, with a mandate to improve the health status of all people living in Ghana, thereby contributing to the government's vision of universal health coverage and a healthy population. Together with its agencies and partners, the MoH aims to "create wealth through health" through development and implementation of proactive policies that will ensure improved health and vitality.

The GHS is a Public Service body established under Act 525 of 1996, as required by the 1992 constitution. It is an autonomous executive agency responsible for implementation of national healthcare policies under the control of the Minister for Health, through its governing Council - the Ghana Health Service Council. The GHS is headed by a Director General. The mandate of the GHS is to provide and prudently manage comprehensive and accessible health services with special emphasis on primary health care at regional, district and sub-district levels, in accordance with approved national policies. The GHS has five functional levels (National, Regional, District, Sub-District and community). Figure 2 is a schematic representation of the health system structure in Ghana.

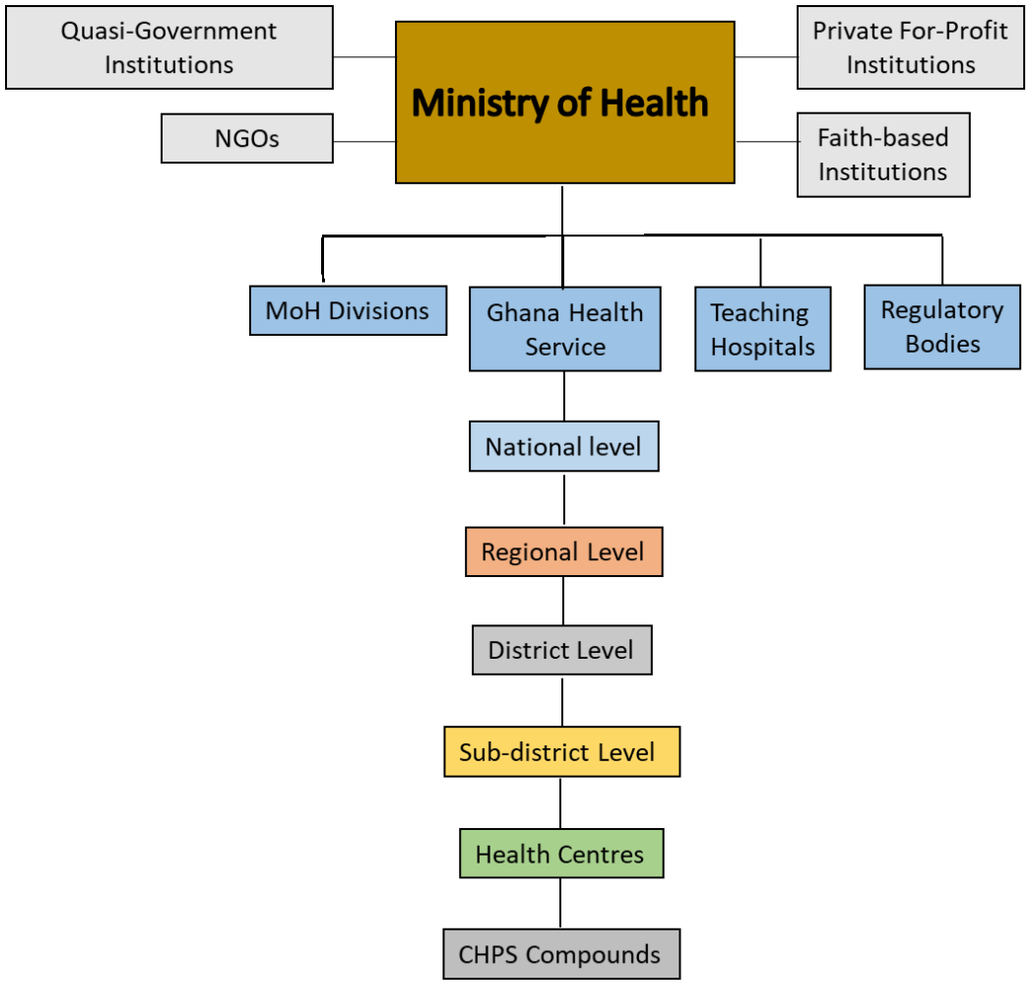

Figure 2: Health System Structure

Health system goals & priorities

The vision of the GHS is to have a healthy population for national development, and its mission is to contribute to socio-economic development and the development of a local health industry by promoting health and vitality through access to quality health for all people living in Ghana, using motivated personnel. The objective of the trachoma programme is well aligned to the vision and mission of the GHS.

In the 2014-2017 Health Sector Medium Term Development Plan, the GHS declared four main priority areas for the medium term. These were:

1. Meeting the Millennium Development Goals
2. Disease prevention and control, which includes controlling
    a. Increasing morbidity and mortality due to non-communicable diseases;
    b. High prevalence communicable diseases, including epidemic-prone diseases and climate-related diseases; and
    c. High morbidity and disability from Neglected Tropical Diseases (NTDs)
3. Access to health services

4. Quality of care and mental health services

The top 10 causes of hospital admission nationally are malaria, anaemia, gastroenteritis, hypertension, sepsis, pneumonia, urinary tract infections, respiratory tract infection, abortion and septicaemia. The top 10 causes of death are: cerebrovascular accidents, pneumonia, septic shock, HIV, anaemia, congestive cardiac failure, hypertension, liver diseases, diabetes and birth asphyxia (GHS Annual Report 2016).

The GHS framework was developed in line with the National Health Sector Policy, the objectives of Ghana Poverty Reduction Strategy 2, Millennium Development Goals (MDGs), Sustainable Development Goals (SDGs) and the New Partnership for African Development health strategy. In particular, the GHS draws on SDG 3 Target 3.3, which aims to end the epidemics of AIDS, tuberculosis, malaria, and NTDs and combat hepatitis, water-borne diseases, and other communicable diseases by 2030.

Health service delivery and implementation programmes

The Ghana government is committed to improving access and equity of access to essential health care services. Programmes to achieve equity are supported by the United Nations Population Fund (UNFPA), USAID, the World Bank, and other development partners. There is also emphasis on preventive as well as community-based health care services, necessitating the introduction of the CHPS programme in which trained nurses are stationed in selected communities to provide health care services to members of the communities. Another essential health intervention instituted as part of the government's efforts to make health care accessible and affordable to all includes the 2004 introduction of the National Health Insurance Scheme (NHIS), and a free maternal care programme. The Ghana NTDs Master Plan (2013-2017), presents a multiyear plan that addresses the various components of the NTD programme. It focuses on preventive chemotherapy treatment and case management of NTDs and is based on national strategic priorities.

Health management in Ghana is decentralized. The GHS situates management of the primary level at the district, and of secondary-level care at the region, while teaching hospitals operate at the tertiary referral level. At the GHS National Headquarters and tertiary level, the Director General of GHS and Chief Executives of teaching hospitals report to the Minister of Health. Complementing this arrangement are institutional/health facility management teams. At each of these management levels is a budget and management centre.

Primary-level care (primary health care, PHC) is delivered by the District Health System. It comprises all institutions (CHPS, clinics, health centres and hospitals) in the district. The health centre is responsible for providing clinical, public health and maternity services to the catchment population, which is usually at sub-district level. It uses a combination of facility-based services, regular outreaches and mass campaigns in close collaboration with communities, community institutions, leaders and community-based health workers. The district hospital serves as the first referral point in the PHC system. It provides out-patient and in-patient, surgical, laboratory and maternity services. At

the secondary level, the regional hospital is the secondary referral point and offers specialized services. Teaching hospitals form the apex of specialized care in the country. In addition to the above, there are also faith-based health institutions and private health providers who deliver care.

Health financing

The Government allocation to the health sector is still below the Abuja recommendation of 15% (OAU, 2001). In 2015, the health sector allocation in Ghana was 9.47%. The bulk of the government allocation is spent mainly on health workers' salaries, with some investment in infrastructure development and biomedical services. Other sources of funding for the health sector are from development partners, international non-governmental organizations (development partners, international NGOs), and a few private-sector organisations.

The introduction of the National Health Insurance Scheme (NHIS; www.nhis.gov.gh) has led to a considerable improvement in access to health care. In 2014, NHIS coverage stood at 62% of women and 48.4% of men (DHS-2014).

Human resource capacity

Development of human resources for health care in Ghana has not matched need; the number of health workers nationally is inadequate. The doctor to population ratio was 1: 9,043 in 2014 (GHS 2014) and the nurse to population ratio was 1: 1,084 in 2013 (MoH 2014). The midwife to women in fertile age (WIFA) ratio was 1: 1,374 in 2014 (GHS 2014). There are currently 91 ophthalmologists in the country; the two trachoma-endemic regions (Northern and Upper West: see below) have three ophthalmologists in total, with the remaining residing in larger urban areas (GHS 2016). Regional ophthalmologists undertake outreach surgical services to District Hospitals. In Northern and Upper West regions, in 2014, there were 20 and 11 medical officers respectively. Within the same period, there were 350 ophthalmic nurses in the country, 33 of whom were in the two trachoma-endemic regions. There are also community-based volunteers who assist in surveillance and drug distribution.

Health information management

The Centre for Health Information Management is in charge of health information for the GHS and the MoH. It receives data routinely from all health facilities (both public and private). Integrated Disease Surveillance and Response (IDSR) is a strategy to record and report on major diseases in the country. IDSR captures data from the community through the sub-district, to the district, to the regional level and finally to the national level. The District Health Management Information System (DHMIS 2) provides the GHS with a platform to standardise collection and collation of essential health data.

Inter-sectoral collaboration

The GHS works with the Ministry of Local Government & Rural Development, Ministry of Education, Ministry of Food & Agriculture, Ministry of Works & Housing, Ministry of Water and Sanitation, Ministry of Finance & Economic Planning among others, to implement activities and thereby ensure higher coverages of services to the population. Some of these services include MDA, control of schistosomiasis and soil-transmitted helminthiasis through de-worming of school-age children, National Immunization Days (NIDs), and provision of potable water and sanitation facilities. NGOs, Civil Society Organisation and multilateral and bilateral agencies play roles in planning and evaluating health services.

Other endemic diseases relevant to the actions of the Trachoma Programme in Ghana

There is a high burden of NTDs in Ghana, with 13 of the NTDs identified by WHO being endemic in the country. The government, with support of donors and partners, established in 2006 an integrated programme to control and eliminate NTDs. A national master plan was put in place to address the situation in an integrated manner and ensure NTD plans include the associated costing and financing requirements. A strategic plan for the NTD programme was launched in 2013, with the vision "**Ghana free from ancient diseases and afflictions that have burdened humanity for centuries**" (NTDP 2013). The goal is to improve the capacity of GHS to establish an integrated NTD programme capable of delivering interventions to prevent, control, eliminate or eradicate neglected tropical diseases by the year 2020. In line with the resolve to eliminate or eradicate NTDs, the Ghana NTDs Master Plan was developed, as a comprehensive multi-year plan (2013-2017), addressing all necessary components of the NTD programme. Several NTDs overlap geographically. Figure 3 presents the historical regional distribution of NTDs amenable to preventive chemotherapy. However, programmes targeted at the control of individual diseases are independent, despite the use of the same strategies and human resources at sub-national level in implementation of their activities.

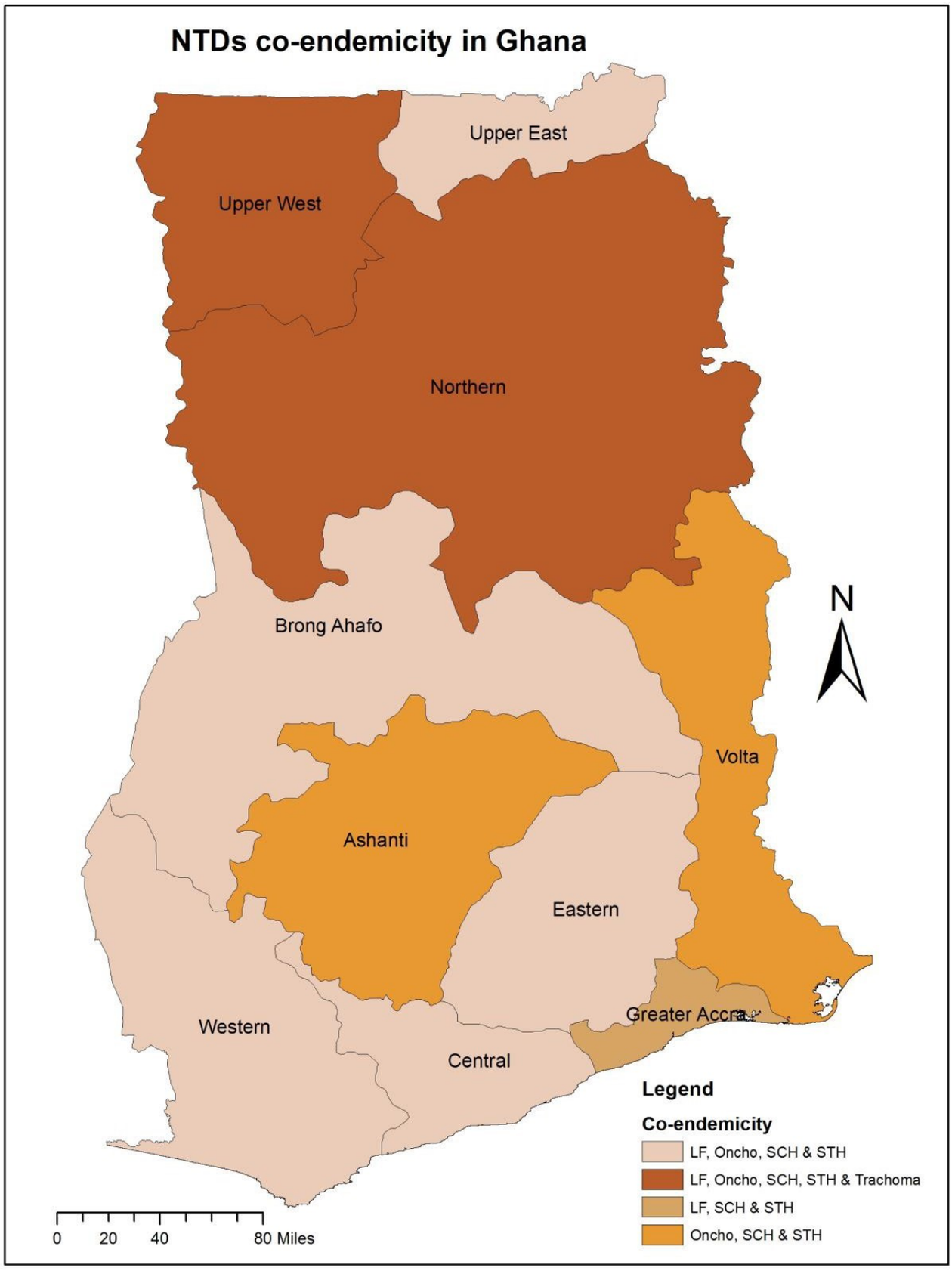

Figure 3: Region-level co-endemicity map for lymphatic filariasis, onchocerciasis, soil-transmitted helminthiasis, schistosomiasis and trachoma.

There is integration of work against trachoma and some other NTDs in Ghana.

Environmental improvement in trachoma-endemic districts included provision of safe water and sanitation. This is relevant for diseases whose prevalence is linked to lack of safe water and latrines. Schistosomiasis is acquired when a person wades, swims or bathes in water bodies that contain infected intermediate snail hosts. Provision of safe water in trachoma endemic districts means fewer people will need to use contaminated water, leading to a reduction in the transmission of schistosomiasis. As latrines and urinary facilities are provided, open defecation will be reduced leading to reduction in the contamination of water bodies. Yaws also spreads in communities where there is a high rate of unhygienic practices and lack of safe water. As safe water is provided, coupled with education in the communities, hygienic practices will be intensified and hence the incidence and prevalence of yaws will fall. The incidence of diarrheal diseases also reduces as safe water and latrines are provided in communities. Environmental improvement also leads to a reduction in the number of stagnant pools of water that serve as breeding sources for mosquitoes, which are the vectors of lymphatic filariasis and malaria.

1.3 TRACHOMA HISTORY

Historical information and epidemiology of trachoma in Ghana

A number of surveys that were conducted between 1952 and 1953 in West Africa to understand the burden of various eye conditions revealed that trachoma was the most prevalent cause of blindness. Northern Ghana (then called Northern Gold Coast) was described in that period as “the country of the blind” (Wilson, 1960, pp.123 and 126). The earliest published reports of trachoma in Ghana, which identified trachoma as a major cause of blindness, were by Sarkies (1952) and Rodger (1959) who were both based in the country’s north. The 1993 Annual Report of the Bawku Presbyterian Rural Eye Programme, which was based in the Upper East Region of Ghana but extended its services to the Northern and Upper West regions, highlighted trachoma as a problem in the latter regions.

A review of data from eye clinics in the country, undertaken in 1996 at the then Eye Care Secretariat (now the Eye Health Unit), showed conjunctivitis to be a frequent cause of presentation in the Northern and Upper West regions. This informed a decision to conduct more detailed investigations in the two regions. A rapid assessment of trachoma was done in 1997 in the Daboya sub-district of the Northern Region. The results showed the presence of trachoma in the sub-district.

In December 1998, the Ministry of Health, WHO and NGDOs collaborated in an effort to assess the trachoma situation in the two-suspected trachoma endemic regions, and ranked affected villages in order to prioritize trachoma control interventions. A modified version of the WHO Trachoma Rapid Assessment (TRA3) methodology was used to investigate the endemicity of trachoma in all of the then 18 districts in the Northern (13 districts) and Upper West (5 districts) regions. The results showed that approximately 70% of 122 (Aboe A et al. 2002) villages assessed in both regions would need interventions using the various components of the WHO endorsed “SAFE” strategy for the elimination

of trachoma.

Interventions carried out before launch of the National Trachoma Programme

In 1999, studies on treatment of trachoma using azithromycin (Zithromax®) donated by Pfizer were conducted in the Daboya sub-district of West Gonja district. The study was the first to pilot the use of community volunteers to distribute azithromycin for trachoma control (Solomon et al., 2001).

In 1999-2000, based on the results of the TRA done in all 18 districts of Northern and Upper West regions, the programme conducted population-based baseline trachoma prevalence surveys in areas suspected to be most endemic for the disease. Five districts were surveyed in 2000; all five (Tolon-Kumbungu, Savelugu-Nanton and Tamale in the Northern region and Wa and Sissala in the Upper West region), had trachoma of public health significance needing interventions with the various components of the SAFE strategy. (Aboe et all. 2002) Later, as funds became available, other districts within these regions had baseline surveys done. Ultimately, baseline surveys were completed in the remaining 13 (of 18) districts in these two regions.

The International Trachoma Initiative (ITI) selected Ghana, alongside five other countries, as one of the first recipients of Pfizer-donated azithromycin for trachoma elimination purposes. The Ghana National Trachoma Control Programme was launched in the year 2000.

1.4 TRACHOMA PROGRAMME OVERVIEW

The Trachoma Programme undertook a process of learning by doing, with development of best practices to support programme implementation and impact surveys. The programme has been shaped by WHO recommendations and guidelines as well as recommendations from GET2020 meetings. This has determined strategies for mass drug administration (MDA), social mobilization, impact surveys and determination of endpoints of MDA. In several important instances, as will be detailed in this document, it also helped to shape refinement of WHO recommendations.

Establishment of the National Trachoma Control Programme

The Ghana National Trachoma Control Programme was initiated in June 2000 by GHS/MoH together with its partners (ITI, The Carter Center, CBM, Sightsavers, Swiss Red Cross and WHO) to eliminate trachoma as a public health problem in the Northern and Upper West Regions. The WHO-endorsed SAFE strategy using azithromycin was started by 2001 in all known endemic communities identified in the first tranche of five surveyed districts.

Structure and functions of the National Trachoma Control Programme

The National Trachoma Control Programme was located within the Public Health Directorate of the GHS but the secretariat was with the Eye Care Unit, which is under the Institutional Care Division of

the GHS. Programme activities were also led by the Eye Care Unit. Figure 4 below shows the organogram of the Trachoma Control Programme at National Level. The programme ran as a vertical programme until 2006, when GHS decided to have an integrated NTD programme with support from USAID and other partners. A national strategy for the integrated programme was developed in 2006 and used to guide the implementation of the programme. Integrated training manuals, integrated behaviour change communication (BCC) materials and integrated dosing poles were also made for the programme. After integration, trachoma-specific elements of the programme continued to be led by the National Eye Care Unit. The NTD department worked very closely with the National Eye Care Unit to lead in the implementation of trachoma elimination activities.

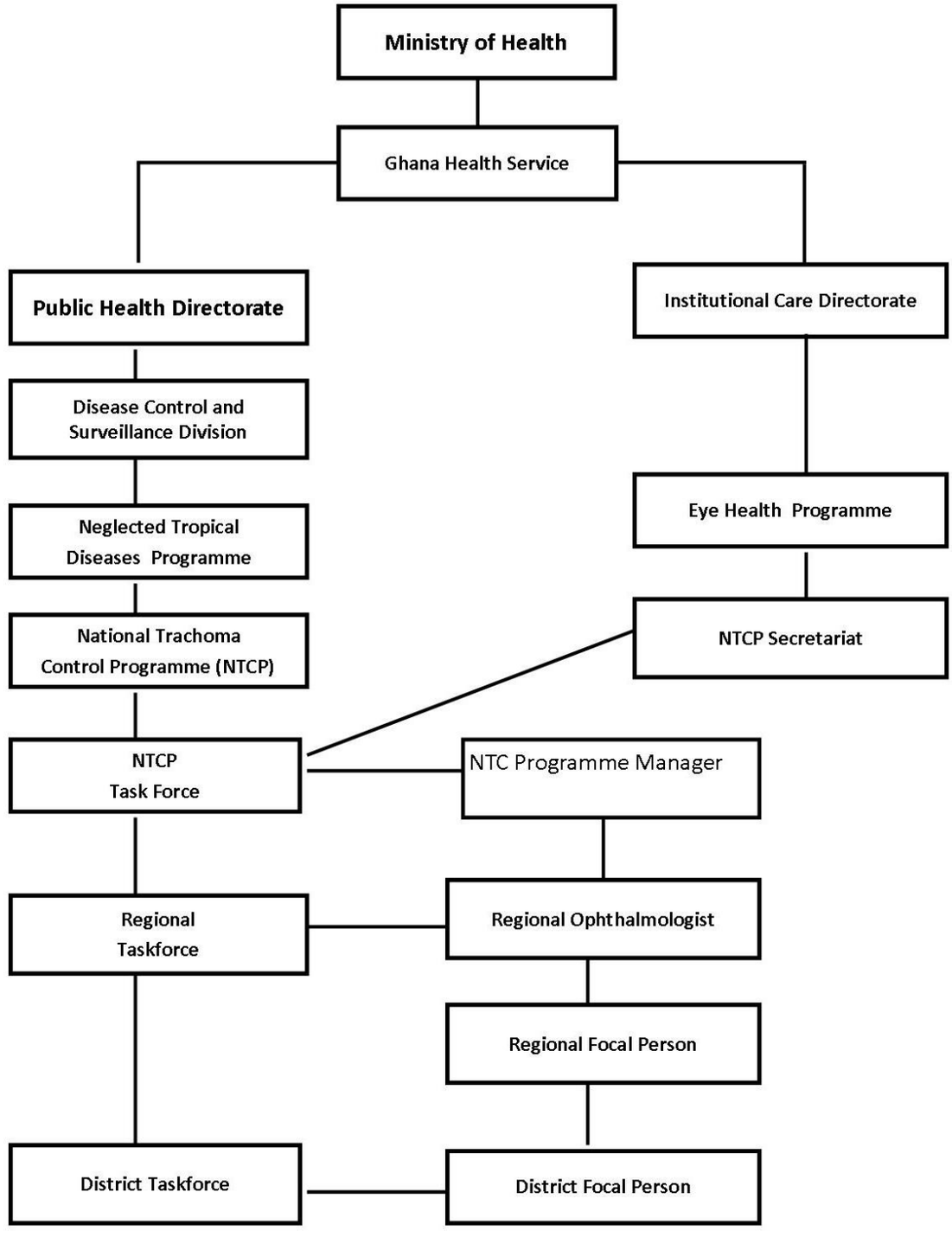

Figure 4: Structure of the Trachoma Control Programme

The National Trachoma Task Force, which was formed in the year 2000, was composed of representatives from the MoH, GHS (Public Health Directorate and Eye Care Unit), Ministries of Local Government and Rural Development, Water and Housing, Ministry of Women and Children's Affairs, international NGDOs, local NGOs, WHO and UNICEF. Regional and District Tasks Forces were formed in the two trachoma-endemic regions to oversee the implementation of programme activities in the districts.

The National Trachoma Task Force was responsible for the implementation of the full SAFE strategy. Various components of the strategy were led in collaboration with different agencies. The GHS led the implementation of the S and A components of SAFE. The F component was led by the GHS and the Ghana Education Service. The Ministry of Water and Housing, and Ministry of Local Government led in the implementation of the E component. The Ministry of Women and Children's Affairs provided support in social mobilization for all aspects of the programme. International NGDOs and local NGOs provided technical and financial support, where appropriate. For the antibiotic component, Pfizer, through ITI, donated Zithromax®, which was the drug of choice for MDA. Tetracycline eye ointment was provided for those who were ineligible to take azithromycin.

Affected communities actively participated in the implementation of all components of the SAFE strategy. The chiefs, elders, opinion leaders and other community leaders gave their full support for the programme. They assisted in community mobilisation and helped in the choice of community volunteers. Community volunteers mobilized the people for antibiotic MDA, assisted in measuring height to determine dose, and provided water to help people swallow tablets. The communities were involved in the construction of Kumasi Ventilated Improved Pit latrines by providing sand, water, and digging the pit. The community members also took part in the development of BCC materials such as short piece dramas, jingles and songs in local languages. School-teachers and pupils also participated in the programme. Both teachers and pupils quickly embraced face-washing activities. Trachoma was added to the basic school curriculum in 2007 and taught in schools.

Integration of the trachoma programme with other public health programmes

Thirteen of the NTDs identified by WHO are known to be endemic in Ghana. The government together with partners initiated various programmes to control, eliminate or eradicate these diseases. Many of these programmes, including the trachoma programme, were initially run as vertical programmes. Many diseases were co-endemic and some employed similar strategies in their elimination efforts. In 2006, the government, with support of donors and partners, established an integrated programme to control and eliminate the NTDs that use preventive chemotherapy. Thus, the onchocerciasis, lymphatic filariasis, schistosomiasis, soil-transmitted helminths and trachoma programmes were integrated into one NTD elimination programme. However, programmes targeted at the control of individual diseases remained independent, despite the use of the same strategies and human resources at the sub-national level in implementation of their activities.

The Ghana trachoma programme undertook some co-implementation with the Guinea Worm Eradication Programme at programmatic level in 2009-2010. An active case search for TT and Guinea worm was jointlycarried out in some districts that were co-endemic for the two diseases. There was

also a joint WASH programme for trachoma, Guinea worm and diarrhoeal diseases. UNICEF and other partners funded this project, which saw the drilling of many boreholes, wells and provision of improved latrines.

In 2009, the reporting of trachoma was integrated into the integrated disease surveillance and response system. Data inputs of TF and TT are included in the DHIMS.

Data Collection

Cross sectional surveys

Data collection through cross-sectional surveys followed WHO guidelines and methodologies for baseline, impact and pre-validation surveillance surveys. These methodologies have been described in detail in the appropriate sections below. These activities were led at national level, and as such, the data collected were stored at national level. Analysis was done at the national level. After analysis and interpretation of the results, the national programme decided on what actions to take based on the results, and information was sent back to the districts through the relevant Regional Health Directorate. Based on data, for example, decisions were made to undertake house-to-house case searches in areas that had high TT prevalence, and to treat communities and districts that had TF prevalence estimates in children aged 1-9 years that were above the WHO threshold for elimination.

Routine data collection

During the lifespan of the trachoma elimination programme, the integrated disease surveillance and response (IDSR) data system did not include collection of data on TF and TT. The programme therefore designed and developed tools and special data collection forms to collect routine data for programmatic use. The information was collected from the community level, health centres or other facilities and during outreach services. Ophthalmic nurses used the data collected to visit areas to confirm suspected cases of active trachoma and TT and provide appropriate treatment, as needed. The ophthalmic nurses then reported on the number of confirmed cases and treatment given, with numbers progressively collated at the district, regional and national levels. There were also times when national-level staff led teams to conduct TT case searches and provision of surgery. Data from these national-level-led activities were collated by the national team and stored at national level.

MDA with antibiotics was conducted at district level and led by district-level teams. National- and regional-level teams conducted monitoring and supervision. Data on MDA including events was sent by the district through regional offices to the national level.

Data on facial cleanliness in children aged 1-9 years and on environmental improvement (such as the provision of safe water and improved sanitation) were collected at the regional and national levels through surveys. All prevalence surveys including pre-validation surveillance surveys included data on facial cleanliness.

Districts also collected data on provision of new water points and household latrines and presented this information during yearly annual review meetings, alongside other data.

There was solid collaboration of the programme with the partners in the WASH sector. These partners (including District Assemblies, the Community Water and Sanitation Agency, UNICEF, World Vision, WaterAid and local WASH NGOs such as New Energy and ProNet) provided data on WASH indicators. Data on facial cleanliness were, however, generally not captured by these partners.

The Trachoma Programme used Guinea Worm volunteers to routinely collect and report data on WASH and trachoma in endemic communities. In addition, periodic joint Guinea worm and trachoma case-searches were organised, using community based volunteers who moved from house to house to collect data. In the Northern region, an interagency coordinating committee comprising the Guinea Worm, trachoma, cholera and other WASH programmes played a coordinating role that helped to identify and address WASH data gaps.

Surveillance data

On reaching the WHO threshold for elimination of trachoma, the Ghana trachoma programme and its partners, with guidance from WHO, developed a three-year post treatment surveillance plan which employed both passive monitoring and periodic active monitoring systems. This document was used actively from 2011-2014.

The passive surveillance system had both facility-based and community-based components. In the facility-based component, trained ophthalmic nurses in district eye care clinics detected, treated and reported trachoma cases that had presented to the clinics. Other health staff were also trained to detect and report suspected trachoma cases to eye clinics for confirmation and management. The community-based surveillance system involved mainly community-based volunteers who were trained to detect suspected TT and TF cases in their communities and report them to health workers in the sub-districts. Data (which included number of suspected cases of active trachoma and number of suspected cases of TT) were compiled and submitted to the district level and these cases were followed-up and investigated by ophthalmic nurses for confirmation and management.

Suspected trachoma cases identified in a district were reported monthly to the regional level using the IDSR. The region aggregated reports from all districts and submitted them to the Disease Surveillance Department. These data allowed the programme to be alerted and respond to high numbers of suspected cases in a district or region. The same data were also used to confirm the status of areas of the country which were originally delineated as non-endemic.

The data collected during the surveillance period also included periodic active monitoring: data on TF and TT from population-based surveys conducted in two communities per district per year. Results of these surveys provided the basis for further studies in adjacent communities as needed. Treatment with azithromycin was provided to areas that were identified as hot spots. Each such community had the required number of rounds of treatment with antibiotics from 2011-2014. Individuals found to have TT in these active monitoring exercises were registered and surgery was arranged for them.

2. DELINEATION OF AREAS REQUIRING INTERVENTION

2.1 DEFINITION OF EVALUATION UNITS

Administrative units

Ghana is divided into ten regions. At the beginning of the programme, there were 110 districts in the country. The two trachoma endemic regions had 18 districts; 13 in the Northern Region and 5 in the Upper West Region. Some of the districts have since been split, making (in 2017) 37 districts in the two regions (26 in the Northern Region and 11 in the Upper West Region). (By the time of this dossier's submission, there were 216 districts in total nationwide.)

Definition of evaluation units

The district is the evaluation unit (EU) of the Ghana Trachoma Programme. It is a geographic area with a population of about 75,000 to 95,000. Larger districts, with populations of over 95,000 (or 250,000), are classified as municipal (or metropolitan), respectively. At the start of the programme, therefore, there were 18 EUs. As noted in the previous paragraph, the number of districts in the two regions changed over time to become 37 districts in 2017. However, the programme continued to use the same EUs (as defined at baseline) for both impact and pre- validation surveillance surveys; thus, "new" districts were effectively combined with their parent districts during surveys to maintain the initial 18 EUs. Figure 4 below shows the 18 districts in the two endemic regions.

The next section describes the data used to classify EUs as endemic or non-endemic.

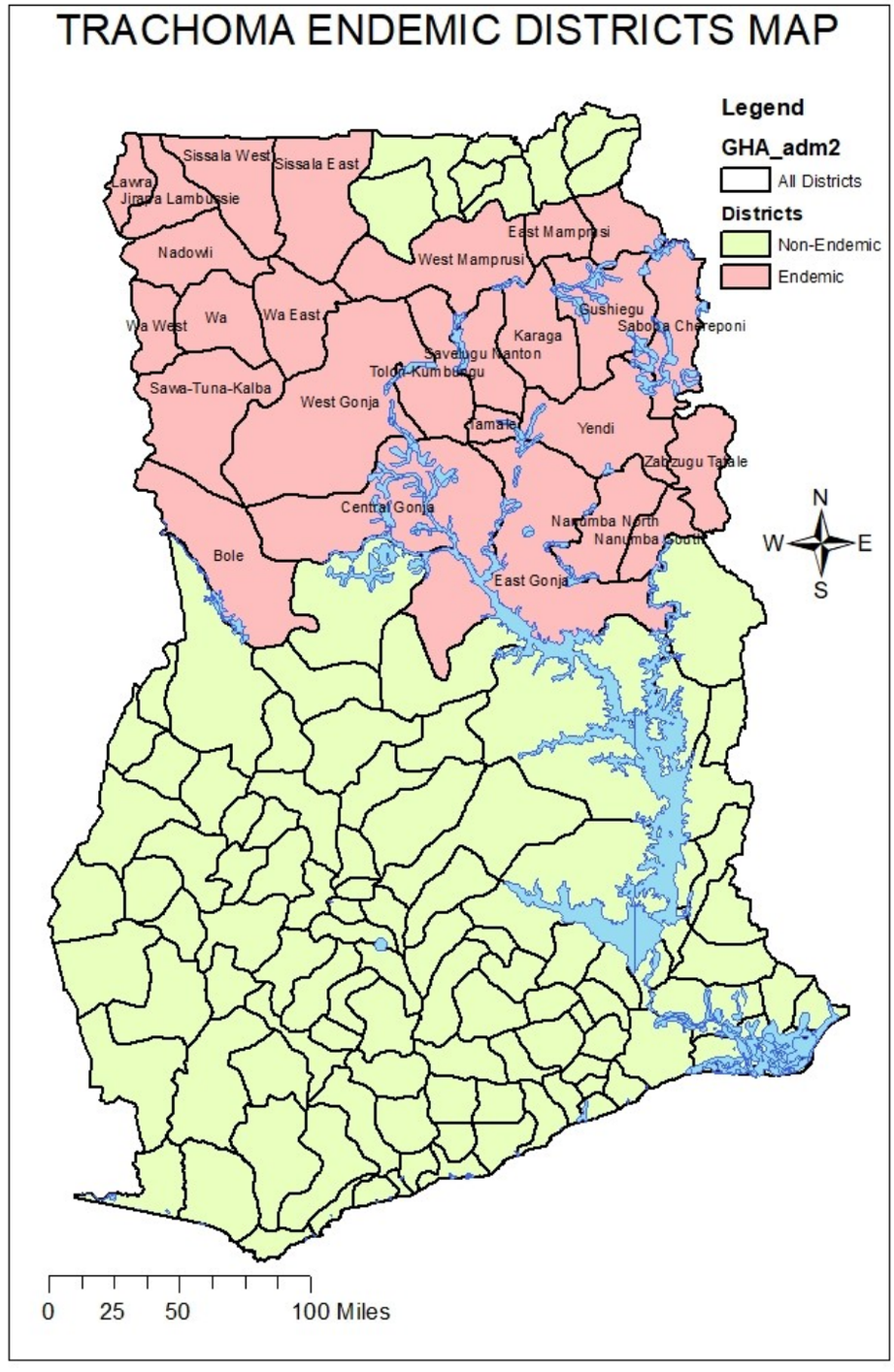

Figure 5: Map of the 18 trachoma-endemic districts in Ghana

2.2 DATA USED TO CLASSIFY EVALUATION UNITS

As indicated above, in 1999-2000, the programme conducted population-based baseline trachoma prevalence surveys in five districts suspected (on the basis of TRA data) to be endemic for the disease.

A further population-based baseline trachoma prevalence survey was conducted in a sixth district (West Gonja in the Northern Region) in 2002. In 2003, the programme conducted baseline surveys in the remaining 12 districts (of the then-18 districts) in the two endemic regions.

Below is a brief description of the methodology and outcomes of these surveys.

Methodology

A multi-stage sampling technique, as recommended by WHO (http://www.who.int/trachoma/resources/9241546905/en/) for conducting trachoma prevalence surveys, was used to select subjects for examination in each district. A list of all communities with respective populations and the sub-districts in which they were located was compiled. Communities with populations greater than 5000 or less than 200 were excluded. The remaining communities were then arranged in a table, with those having strong evidence of trachoma (from routine service delivery data) first, those with some evidence of trachoma second, and those with no evidence of trachoma last. A column was created with the cumulative population, adding each successive village's population to the previous total. The total population of each district was divided by 50 (50 communities were to be selected in each district) to calculate the sample interval. In order to select the first community in each district, a random number table was used to choose a number between 1 and the sampling interval. The first community selected was the one where the cumulative population was just above the value of the random number. The next community was selected by adding the value of the random number to the sampling interval. The community whose population just made the cumulative population above this figure was selected. This procedure was repeated until all communities were selected in each district population. About 20% of the total number of communities per district were selected.

In each selected community, a list of all compounds was made and simple random sampling technique was used to select compounds. In compounds with more than one household, a random sampling technique was used to select one. The average household size was 5-6 people.

Children under 1 year of age were excluded from examination due to the low prevalence of disease amongst this age group and the difficulty of examining their eyes.

Sample sizes used for this survey were based on an expected active trachoma prevalence of 10% among children aged 1-5 years and TT of 4% among women aged 40 years and above. The confidence level was 95% and the power was 80%. The sample size obtained for each district was multiplied by a factor of 1.5 to account for the cluster-sampled design. Sample size calculations were done with EPInfo v6.02a software.

Data collection

Examination of the faces and eyes of children as well as eyes of women aged 40 years and above, was done by trained and standardized ophthalmic nurses under the supervision of an ophthalmologist and public health physicians.

Ophthalmic nurses specifically trained for this purpose did data collection. One-day training was conducted for the ophthalmic nurses on how to use the WHO grading of trachoma. This training, which also included how to record findings on data collection forms, was immediately followed by a standardization study. The standardization study provided an opportunity for the nurses to practice filling the data collection forms.

Standardization

As part of the standardization test, the supervising ophthalmologist identified 50 people, 25 of whom had either TF or TI. The rest included people with other signs of trachoma, other eye conditions and normal eyes. Each ophthalmic nurse examined all 50 individuals using a binocular loupe and torchlight and recorded their findings. The findings of each nurse were compared with those of the ophthalmologist. The assumption in this test was that the findings of the ophthalmologist were correct. All ophthalmic nurses used in the data collection obtained an agreement score (kappa) of 80% and above.

Results

The surveys indicated that all 18 districts in the Northern and Upper West Regions were endemic for trachoma. (Prior to the introduction of district-wide antibiotic distribution, WHO criteria for elimination were framed at community level, so the Ghana Trachoma Control Programme selected communities with TF ≥5% for implementation of antibiotic MDA. After new WHO guidelines were issued, this approach changed to adhere to global recommendations.) Table 1 presents summary data.

In total, taking into consideration the results of all surveys conducted over the lifespan of the Ghana Trachoma Control Programme, about 2.8 million people were estimated to be at risk of trachomatous blindness in Ghana, with an estimated 13,000 people suffering from trichiasis.

Table 1: Trachoma prevalence in districts of Northern and Upper West regions at baseline

Region	District	%TF in children aged 1-5 years	%TF/TI in children aged 1-5 years	%TT in women aged 40 years and above	Survey year
Northern	Tolon- Kumbungu	-	12.4	8.4	2000
Northern	Tamale		4.7	4.9	2000
Northern	Savelugu- Nanton		9.7	4.5	2000
Northern	West Gonja	-	11.7	3.7	2002
Northern	Yendi	3.5	-	1	2003
Northern	Saboba-Chereponi	3.2	-	0.5	2003
Northern	Bole	8.2	-	1.8	2003
Northern	East Mamprusi	2.8	-	0.6	2003
Northern	West Mamprusi	6.8	-	0.8	2003
Northern	Zabzugu-Tatale	6.7	-	0.4	2003
Northern	Gushiegu-Karaga	4.4	-	0.8	2003
Northern	Nanumba	3.8	-	0.5	2003
Northern	East Gonja	3.7	-	0.9	2003
Upper West	Sissala	-	11.5	1.6	2000
Upper West	Wa	-	16.1	2.6	2000
Upper West	Nadowli	3.6	-	1.3	2003
Upper West	Jirapa-Lambussie	5.0	-	0.8	2003
Upper West	Lawra	2.8	-	0.7	2003

Delineation and confirmation of non-endemic areas

1. Upper East Region

A trachoma prevalence survey was undertaken in Upper East Region in 2007 because it is located in the same geographical zone and shares borders with the Northern and Upper West Regions. The survey used multi-stage cluster sampling techniques and covered children aged 1-9 years and adults aged 15 years and above (Gyasi et al., 2010). The TF prevalence in 1-9-year-olds was 0.01% (CI: 0.0-0.1); the TI prevalence in 1-9-year-olds was 0.03% (CI: 0.0-0.1). The TT prevalence in adults was 0.05% (CI: 0.0-0.1). Thus, trachoma was of no public health importance in the Upper East Region. The reasons for the low prevalences of TF and TT are not necessarily clear, but might be attributed to (1) the presence in Upper East of a specialized Eye Hospital with resident ophthalmologists, which had provided comprehensive eye care including trachoma services over several years; (2) the fact that>90% of the population had access to potable water; or (3) other factors.

2. Volta and Brong Ahafo regions

Routine outpatient and surgical data—specifically, data on presentations of trichiasis— from the seven remaining regions of Ghana indicated that trachoma was unlikely to be a public health problem elsewhere in the country. Volta and Brong Ahafo regions are immediately south of the Northern Region, however, and therefore merited slightly greater scrutiny. Within the Northern Region, except for the endemic districts of Bole and West Gonja (which had baseline TF prevalence estimates higher than 5%), all other endemic districts along the borders with Brong Ahafo and Volta Regions had TF prevalence estimates below 5%. To put greater certainty on the impression that Brong Ahafo and Volta districts were not trachoma-endemic, a desk review was carried out in September 2017. The primary objective of the review was to ascertain whether the numbers of TT, TF, epilation and conjunctivitis cases reported between 2015 and 2017 were sufficiently high to indicate a need for conducting population-based surveys. All eye health reports and surveillance reports relating to trachoma submitted between 2015 and 2017 were reviewed.

In Volta Region, Nkwanta North, Krachi West and Krachi Nchumuru districts share borders with the Northern Region. A review of data from these districts for 2015–2017 showed that no confirmed TT cases occurred there during this period. Conjunctivitis cases seen clinically were not trachomatous conjunctivitis. Volta Region has one ophthalmologist, nine optometrists, 27 ophthalmic nurses and nine dispensing opticians. In terms of water and sanitation facilities, the 2010 population and housing census revealed that 72.3% of the population in the region had access to toilet facilities, while 73.7% had access to clean water supplies.

In Brong Ahafo Region, Pru, Kintampo North, Sene West and Banda districts share borders with the Northern region. No TT cases were reported in these districts from 2015–2017. Brong Ahafo Region has three ophthalmologists, 25 ophthalmic nurses, 18 optometrists and 15 opticians in the region. In terms of water and sanitation facilities, the 2010 population and housing census revealed that 82.2% of the population in the region had access to toilet facilities, whiles 83.3% has access to clean water supplies.

Although high numbers of conjunctivitis cases were reported in Banda, Kintampo and Pru districts from 2015-2017, the number of conjunctivitis cases reported in other districts during the same period were comparable (Table 2). These conjunctivitis cases were not believed to be related to trachoma, and the data are not supportive of trachoma being transmitted outside the established previously-trachoma-endemic area.

The data collected on number of cases of conjunctivitis in the districts are coarse but could have been a way for an active trachoma signal to be detected if it was a problem.

The review also confirmed that the districts had adequate numbers of trained eye care nurses: more than the WHO-recommended minimum of 1 per 100,000 people and also had disease control officers. Similarly, the districts had good coverage for water and sanitation facilities compared to the Northern and Upper West regions, where the corresponding coverage proportions were 27.4% and 27.1% for toilet facilities, and 70.4% and 81% for clean water supplies. Based on the desk review, it was

concluded that trachoma is not of public health importance in Brong Ahafo and Volta Regions of Ghana.

Table 2: Number of conjunctivitis cases presenting to eye care personnel in adjacent districts of Northern, Brong Ahafo and Volta regions, 2015–2017

Endemic Districts in Northern Region	Year	Acute Eye Infections	Shares border with	Non-endemic Districts in Brong Ahafo and Volta	Year	Acute Eye Infections
Bole	2015	2 163		Banda	2015	1 587
	2016	2 119			2016	1 296
	2017	761			2017	446
				Kintampo North	2015	4 041
					2016	4 253
					2017	2 350
Central Gonja	2015	514		Pru	2015	3 026
	2016	662			2016	3 420
	2017	467			2017	1 728
East Gonja	2015	346		Krachi Nchumuru	2015	75
	2016	440			2016	68
	2017	55			2017	26
Kpandai	2015	530		Sene West	2015	813
	2016	737			2016	695
	2017	540			2017	298
Nanumba South	2015	797		Nkwanta North	2015	867
	2016	581			2016	525
	2017	478			2017	258

3. Ashanti, Western, Eastern, Central and Greater Accra regions

To confirm the non-endemicity of trachoma in other regions delineated as being non-endemic, the programme reviewed data on suspected TT cases captured on the IDSR system over the period 2011–2017. These data are shown in Table 3 below. The data show that the number of suspected TT cases reported per district was mostly between 0 and 4, except in 2011, when the Eastern Region showed a district average of 17. Numbers of suspected TT cases dropped in this same region over the subsequent years to 0–2. These data provide strong supporting evidence that there is no trachoma of public health significance in the other regions of the country.

Table 3: Number of suspected TT cases reported through the Integrated Disease Surveillance and Response (IDSR) System and District Health Information Management System (DHIMS)

Region		Number of suspected cases of TT reported through IDSR &DHIM- Regional Total & Average per District per Year													
		2011		2012		2013		2014		2015		2016		2017	
	Number of Districts	Regional Total	Av per district	Regional Total	Av per district	Regional Total	Av per district	Regional Total	Av per district	Regional Total	Av per district	Regional Total	Av per district	Regional Total	Av per district
Ashanti	30	84	3	10	0	0	0	9	0	3	0	20	1	22	1
Brong Ahafo	27	11	0	63	2	0	0	4	0	58	2	23	1	11	0
Central	20	32	2	4	0	0	0	8	0	72	4	1	0	5	0
Eastern	26	451	17	18	1	0	0	2	0	0	0	0	0	2	0
Greater Accra	16	0	0	1	0	0	0	35	2	56	4	57	4	2	0
Northern	26	25	1	7	0	0	0	2	0	0	0	0	0	1	0
Upper East	13	22	2	123	9	0	0	0	0	0	0	0	0	0	0
Upper West	11	49	4	10	1	0	0	13	1	3	0	1	0	1	0
Volta	25	32	1	9	0	0	0	0	0	2	0	0	0	0	0
Western	22	7	0	25	1	0	0	5	0	28	1	3	0	1	0

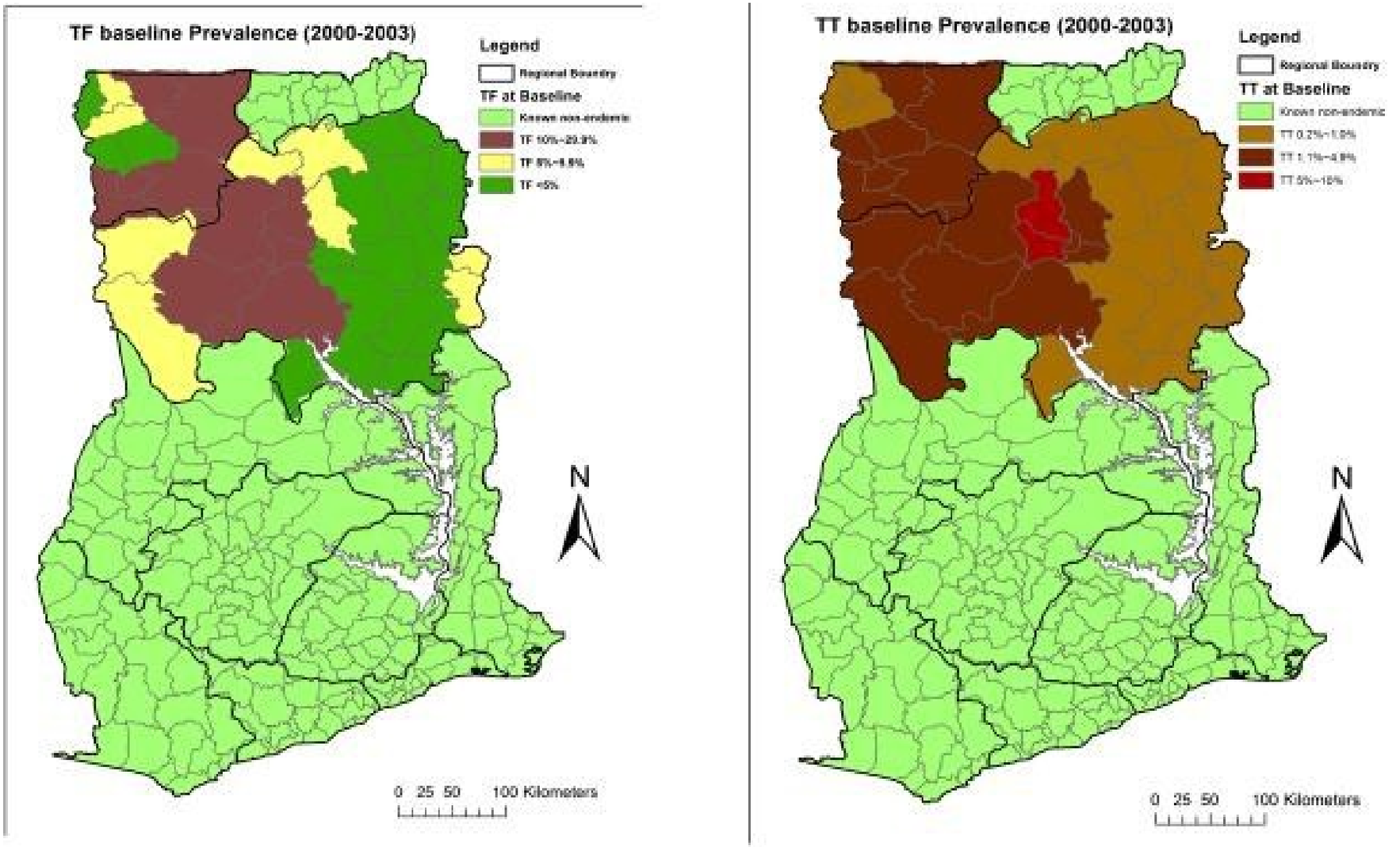

Figure 6: Map of Ghana showing prevalence of TF (in children aged 1-5yrs) and TT (in women aged 40yrs and above) at baseline

3. IMPLEMENTATION OF SAFE INTERVENTIONS

The programme developed national plans to guide implementation of SAFE interventions in the country. In 2000, the first two-year plan for implementation of the SAFE strategy was developed. In 2003, a second strategic plan (Programme Information and Planning Document, 2003-2007) was developed and launched to guide trachoma control in Ghana.

In 2005, it became necessary to develop a new national strategic document as more districts were brought on board and new guidelines from WHO recommended district-wide antibiotic MDA in districts in which the TF prevalence was ≥10%. A Five Year (2005 -2009) Strategic Plan for Trachoma Control in Ghana was developed and launched to eliminate trachoma as a public health problem by the year 2010. District-wide antibiotic distribution was started in five districts (Tolon-Kumbungu, Savelugu-Nanton, West Gonja, Wa and Sissala), which had TF prevalence estimates in children aged 1-5 years of 10% or above. (Savelugu-Nanton District actually had a TF prevalence of 9.7% in children aged 1-5 years, but the programme decided to conduct district-wide antibiotic MDA in this district, too.)

3.1 SURGERY

Planning for the surgery component of the SAFE strategy was initiated by estimating the number of people with trichiasis in all 18 districts of Northern and Upper West regions, based on district-level prevalence data. The backlog of TT at the inception of the programme was estimated to be 13,234 people. All districts in the two trachoma-endemic regions needed to have the surgical component implemented. Partners supported the programme to procure trichiasis sets and some consumables for TT surgery. Most people in Ghana with TT were elderly and were uncomfortable spending time outside due to photophobia. Most trachoma endemic communities were remote and access to transport was an issue. It was therefore decided that the programme would conduct outreach services in addition to provision of static services, to ensure that TT surgery was made as accessible as possible to all TT sufferers. Through the support of partners, the programme procured several vehicles and some motorcycles to ensure that outreach services could be provided to endemic communities. The national or regional level management led most TT surgery campaigns. This accounts for the lack of district level data for TT surgeries carried out. (The regional or national level data have been included in the accompanying Excel sheet.) At the impact surveys in 2007-2008, the TT backlog had dropped to less than 5,000 people. The results also showed that each district had reached the TF threshold for elimination of trachoma; however, some districts had still not reached the threshold for TT elimination. Provision was made to ensure that anyone with TT would be able to access TT surgery both at health facilities and through eye health outreach services.

Selection, training and certification of trichiasis surgeons

Due to the nature of the surgery that needed to be performed, the large numbers of people that needed to have surgical intervention, and inadequate numbers of ophthalmologists in the endemic regions, it was decided by the programme to train local ophthalmic nurses to provide treatment for persons with TT. The programme knew the importance of ensuring provision of high quality surgery in order to save the sight of those with TT as well as to encourage others with the disease to accept surgery. To ensure high quality surgery, there was a need to ensure that the right people were selected both to do the training as well as the persons to be trained.

A trainer of trainers from Tanzania was supported by ITI to provide training for the first group of trainers. Four ophthalmic nurses from each of the two endemic regions were trained and certified as trainers. These trainers in turn trained a number of other ophthalmic nurses. Later on, when each of the two regions had an ophthalmologist, a decision was taken that ophthalmologists, especially the two ophthalmologists in the two endemic regions, should be the trainers and supervisors of TT surgeons.

The programme also drew up criteria to be used to select people to be trained. These initially included

i. Ophthalmic nurse training
ii. Dexterity - this was tested by observing the candidate suturing orange peel
iii. Good binocular vision

In 2000, 10 ophthalmic nurses were trained as TT surgeons. In 2003, an additional six were trained.

Later on, during programme implementation, it was realised that to meet the 2010 elimination target for Ghana, more TT surgeons needed to be trained. Experienced theatre nurses and experienced health centre general nurses who had keen interest in eyelid surgery, had experience in eye examinations, and had seen and assisted in eye surgeries were duly selected and trained. It was, however, noted after their training that in some cases, their interest quickly waned; in other cases, they could not perform TT surgeries in addition to their other duties as general nurses. The programme subsequently decided to focus on training more ophthalmic nurses as TT surgeons.

Indications, contraindications and techniques used for trichiasis surgery

The bilamellar tarsal rotation (BLTR), as recommended by WHO, was the technique of choice for the Ghana programme. Training followed the WHO Yellow Manual for training in TT surgery.

The training programme covered, among other things, the anatomy of the eye and eyelid, diagnosis and registration of TT patients for surgery, preoperative assessment of the patient, assessment of health facilities, surgical materials and sterilization/high level disinfection methods, preoperative preparation, intra-operative procedure/possible difficulties, post- operative care and post- operative complications.

All those trained went through the certification process before being released to conduct TT

surgeries. For a trainee TT surgeon to be certified, he/she had to successfully undertake at least five trichiasis surgeries under supervision and then ten trichiasis surgeries independently, using the BLTR method. Refresher training for TT surgeons was conducted once a year and anytime TT case search and surgeries were undertaken. All TT surgeons had at least one refresher training during the life of the programme; some had two or three. The programme budgeted and conducted refresher training each year for a number of TT surgeons.

Indications, contraindications and methods used for non-surgical management of trichiasis

Epilation of in-turned eyelashes was considered an appropriate alternative if the patient refused surgery. All trainees were also trained in how to carry out epilation correctly and to teach TT patients or their caregivers how to carry out epilation correctly. They were also advised not to use any sharp instrument to cut the eyelashes. The programme did not supply patients with forceps for epilation.

Methods used for case finding of individuals with trichiasis and modes of delivery of trichiasis surgery (fixed site, surgical camps, mobile teams)

Learning from various strategies and methodologies for social mobilisation, the systematic house-to-house case search in all communities and districts was agreed to represent best practice for finding TT cases in Ghana. A team of three, comprising an ophthalmic nurse, a health worker and a community based volunteer, was used for case finding. Before any case-finding exercise, one-day refresher training was done for all team members, using pictures, flip charts and slides for the training. TT cases identified during the exercises were advised and counselled on surgery and if they consented, surgery was done for them on the same day or a day after in their communities. Those who did not accept surgery immediately were noted and visited on three occasions and offered surgery. If, after the third offer, they still refused to consent to have surgery or epilation, their names were moved from the list of unmanaged TT patients to the list of patients known to the health system. Apart from the active case search, patients who visited hospitals or eye units and were diagnosed to have TT, had surgeries performed in hospital, if, after counselling, they agreed to have surgery. TT patients who were identified on cataract surgical outreach campaigns had surgery at the outreach camps if, after counselling, they accepted surgery.

Tetracycline eye ointment was used as post-op treatment after TT surgery. Following a research publication suggesting that providing a dose of azithromycin provided benefit, each post-operative TT patient was given a dose of azithromycin. To facilitate this adjunctive treatment, ITI supplied additional doses of azithromycin.

In-service supervision of trichiasis surgeons

Regional ophthalmologists visited and supervised TT surgeons in their districts at least once a year. They also provided supportive supervision during TT case search and surgery campaigns. The ophthalmologists also supervised and provided additional refresher training for surgeons as needed.

Routine follow-up of operated patients

Follow-up of patients who had undergone TT surgery was routinely done on the day following surgery (first post-operative day) and again between 7 and 10 days after surgery. The TT surgeon or an experienced ophthalmic nurse conducted the follow-up visit at the patient's home. Patients who were operated on in hospitals were requested to visit hospital the day after surgery and a week after surgery. On each visit, complications like bleeding, infection, granulomata and recurrence of trichiasis were documented if present, and managed as needed. A three- and six- month follow-up was also scheduled and budgeted for; however, this only eventuated for a minority of patients.

No formal surgical audits were carried out during the lifetime of the programme.

3.2 ANTIBIOTICS

Use of antibiotics and dosage

Pfizer-donated azithromycin (Zithromax®) was used for community-level interventions and the dose (20 mg/kg) used was as outlined in ITI guidelines. In determining the dose for an individual, height was used as a proxy for weight, following pioneering work led by the GHS in West Gonja. Adults and children aged more than 5 years were given the correct dose for their height in tablet form, and children aged 1-5 years were given paediatric oral suspension. 1% tetracycline eye ointment (applied twice daily for 6 weeks) was used to treat all those ineligible for azithromycin, including pregnant women, the seriously ill and children aged less than 1 year old. In 2005, it became accepted internationally to give azithromycin to children aged between 6 months and one year, and this change was adopted in Ghana.

Indications and contraindications

All members of trachoma endemic communities were eligible for treatment with antibiotics. Azithromycin was indicated for all except pregnant women, seriously ill individuals, and children below the age of one year. The lower age limit for azithromycin was reduced from 12 to 6 months in 2005. Tetracycline eye ointment was offered to all those not eligible for azithromycin.

Community sensitization and drug distribution

Prior to any mass drug administration, communities were sensitized about the impending event using all available communication channels. Radio announcements, community information centres, community durbars, mobile vans with PA systems, town criers and "gong-gong beatings" were mostly used. Thereafter, a one-day training of volunteers and health workers was organized. Consequently, community drug distributors (CDDs) were used to register all members of the community; health workers supervised this registration process. Lymphatic filariasis and onchocerciasis community

registers were used in some districts to estimate and track the population. Volunteers assisted health workers during mass drug administration by measuring the height of recipients. The house-to-house strategy was used for drug distribution and the directly-observed treatment approach was strictly adhered to.

At the start of the programme, districts for MDAs were selected based on their TF prevalence. Initially, the implementation unit for MDAs was the community because at that time, the WHO criteria for elimination were framed at community level. Using survey data, communities were added to the programme based on TF prevalence estimates of ≥5%, regardless of the district-level TF prevalence estimate. More communities were therefore surveyed and added to the programme until the strategy following the introduction of new guidance from WHO. Districts with TF prevalence estimates ≥10% started district-wide antibiotics in 2005, whilst other districts (which had TF prevalence estimates of <10%) continued community-level treatment, aiming for community-level TF prevalences of <5%. Each district or community slated for treatment received at least three rounds of antibiotics.

Mop-up exercises were undertaken within 2 weeks in communities or districts where reported treatment coverage was below 80%; as shown in Figure 7, however, coverage was sometimes lower than 80% even after mop-up.

Adverse events

No serious adverse events were encountered during MDA exercises. There were, however, a few refusals initially because of reported adverse reactions to drugs used for treating lymphatic filariasis and onchocerciasis. Fortunately, this was detected early and standard operating procedures were changed so that azithromycin was given before drugs used for the other diseases. Members of recipient communities became more assured and confident to take azithromycin when they noticed that health workers monitored for adverse events following MDA.

Overview of treatment 2001 - 2008

Antibiotics treatment was conducted from 2001 to 2008. Overall reported treatment coverage was about 81%. Cumulative treatment numbers rose steadily from 2001 through to 2005 when the 5-year strategic plan was launched. With more surveyed districts being covered by azithromycin MDA, treatment peaked in 2007. The last district-wide treatment was conducted in 2008. Figure 7 presents the populations treated and the reported coverage achieved over the eight-year period in which MDA was used.

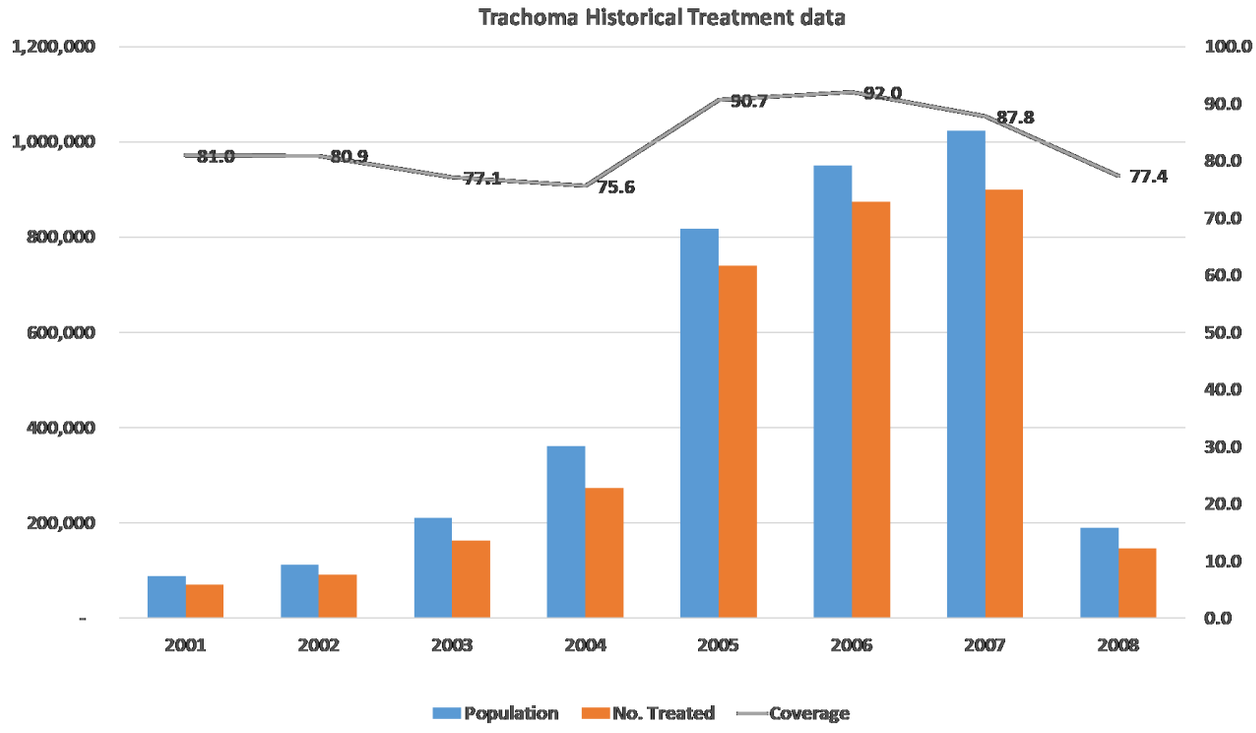

Figure 7: Data on antibiotic treatments for trachoma

3.3 FACIAL CLEANLINESS

Like the other three components of the SAFE strategy, a great deal of effort was devoted to the F component. The selection of a broad mix of channels for communicating, choice of messages and the use of appropriate personnel for health education yielded desirable results. At the beginning of the programme, based on the results of the 2001-2003 baseline surveys, less than 70% of children aged 1-9 years in the programme area had clean faces. These surveys (which examined children for signs of trachoma) also looked for clean faces in all the children examined. A clean face was the absence of ocular or nasal discharge on the face of the child. By the time of the 2008 impact surveys, over 90% of children in the programme area had clean faces (Figure 8).

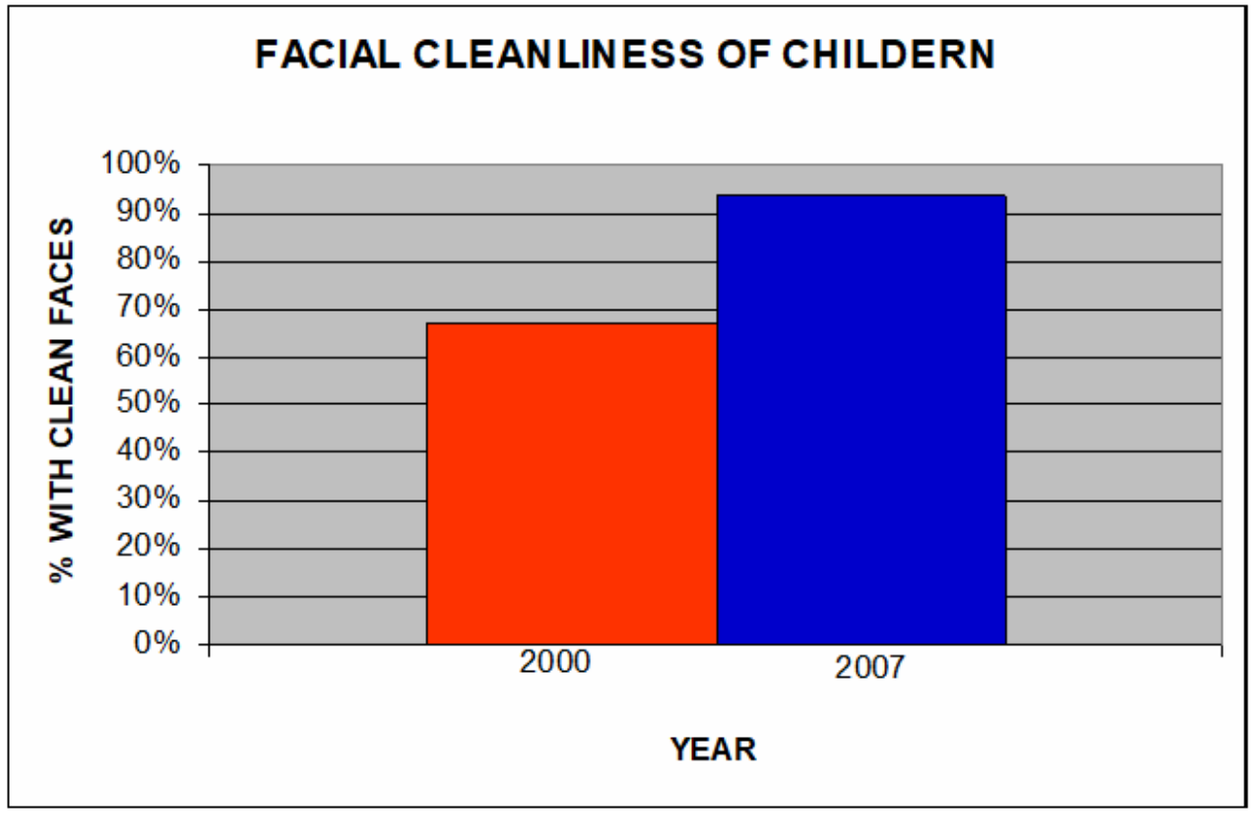

Figure 8: Prevalence of facial cleanliness of children at baseline and at the time of impact surveys

Channels

To produce desired behavioural changes as far as facial cleanliness was concerned, various communication channels and methods were carefully selected and employed. Channels used for disseminating messages included radio, community durbars, dramas, school health education and radio listening and learning clubs. Most communities in trachoma-endemic areas had FM radio coverage and community radio stations with a very good listenership. These channels were therefore used extensively to provide information about trachoma and to promote personal hygiene, especially for face washing, facial cleanliness and hand washing. Local languages were used in the production of such health education and behavioural change programming. Community members therefore identified with the programme, which in turn facilitated information and knowledge sharing on good personal hygiene practices.

Short piece dramas and radio jingles were developed in partnership with the BBC World Service Trust. The jingles were regularly played on community radios and FM stations. The jingles caught on well with community members due to the frequency at which they were played on air. A noticeable result of this strategy was that many people, including children, could sing the jingles and they would do so any time they saw members of trachoma programme teams, who could be identified by their distinctive T-shirts. Additionally, information vans were used to reinforce dissemination of health

information in communities.

Community members performed dramas on sanitation and general cleanliness in local languages. These were very much liked by community members and contributed to knowledge of trachoma, attitudinal change and good personal hygiene practices.

Community durbars and household sessions provided the platform for disseminating health information. These sessions were very participatory and interactive and allowed for questions to be asked and clarifications made. Focus group discussions and one-on-one sessions were also used to get information on trachoma to community members. The programme took advantage of these sessions to screen for TF and TT as well. All communities in the endemic districts benefitted from these durbars at least once between 2001-2007.

School health education sessions on trachoma were held through the School Health Education Programme (SHEP). Each school in the endemic districts benefited from these sessions. As an additional component of the SHEP, school children also had screening of their eyes during the surveillance period. Those found to have eye problems were treated or referred to the hospital for further investigation and treatment.

Radio listening and learning clubs were also formed, where community members gathered to listen to radio and discussed issues pertaining to their well-being, including their health. Wind-up or solar radios were purchased for the clubs.

In 2006 and 2008, documentaries on SAFE were produced and regularly broadcast on the national television network for sensitization and awareness creation about trachoma.

Messages

The main reason for providing messages on trachoma was to convey to community members the importance of personal and environmental hygiene and to empower improvements in personal hygiene practices. Standardized key messages on facial cleanliness, face washing, hand washing and environmental cleanliness were developed in collaboration with the Health Promotion Unit of the Ghana Health Service and produced as pamphlets, leaflets and posters. Some of the initial messages were also developed with the BBC World Service Trust. Songs, jingles and short piece dramas produced by the BBC World Service Trust were aired on district and regional FM radio stations. Fliers and postures developed were shared with endemic communities by environmental health officers and community health nurses.

Some of these messages were: “Keep Trachoma Away”; “Keep Your Face Clean”; “Trachoma is an Eye Condition”; “Keep the Environment Clean”; “Let’s drive trachoma away”, etc.

Materials

Pre-tested materials used for health education included flip charts, posters, booklets and leaflets

developed by the programme in collaboration with the Health Promotion Unit of the Ghana Health Service. The programme also created interesting materials for children to learn whilst playing. These included “snake and ladders” board games, playing cards, etc. The short piece dramas and jingles were put on audio cassettes.

Personnel

Health workers were key in promoting behavioural change. Staff involved included nurses, field technicians and environmental health officers. These persons focused most of their work in the communities and worked tirelessly to ensure knowledge provided to the community members translated into behavioural change: mothers washing the faces of their children and older siblings washing the faces of younger siblings. Teachers were trained to provide behavioural change messages to school children through SHEP. Community-based surveillance volunteers were also trained and these persons worked within their own communities ensuring that people were mobilised for durbars, focus group discussions and environmental hygiene promotion activities.

Frontline staff all worked together and facilitated health promotion and education activities on a regular basis in all endemic districts. During community durbars and school health screening and promotion activities, posters, flip charts and role-plays were some of the channels used to demonstrate face washing and its importance.

All districts in the two endemic regions were required to report on SAFE activities undertaken during the year at annual trachoma review meetings.

Supervision

Supervision of health promotion activities was undertaken from the regional level cascading down to districts, sub-districts and communities. Supervisors included regional and district health promotion officers, regional and district public health nurses and regional and district environmental health officers. National-level staff and partners also provided supportive supervision during field activities.

3.4 ENVIRONMENTAL IMPROVEMENT

Strategies to improve water availability

An integrated disease advocacy approach was the main strategy employed by the trachoma programme to increase provision of water to trachoma-endemic communities. Since many such communities were co-endemic with Guinea worm and other WASH-related diseases, the respective programmes engaged in joint advocacy to provide safe water and other interventions for affected communities. Interventions included provision of water and latrines in schools, sanitation promotion using the Community-Led Total Sanitation approach, and hygiene promotion by community health workers, volunteers and mass media broadcasting (Hamilton and Velleman 2013). In response to this

joint approach, the Government of Ghana and other development partners made the presence of Guinea worm, diarrheal diseases and trachoma major criteria for safe water provision. By the end of 2006, more than 1000 potable water sources were constructed in trachoma-endemic communities (Figure 9). At the beginning of the trachoma control programme, in 2001, 72% of communities had at least one source of potable water. The result of the 2016 pre-validation survey showed that 72% of households had access to an improved water source.

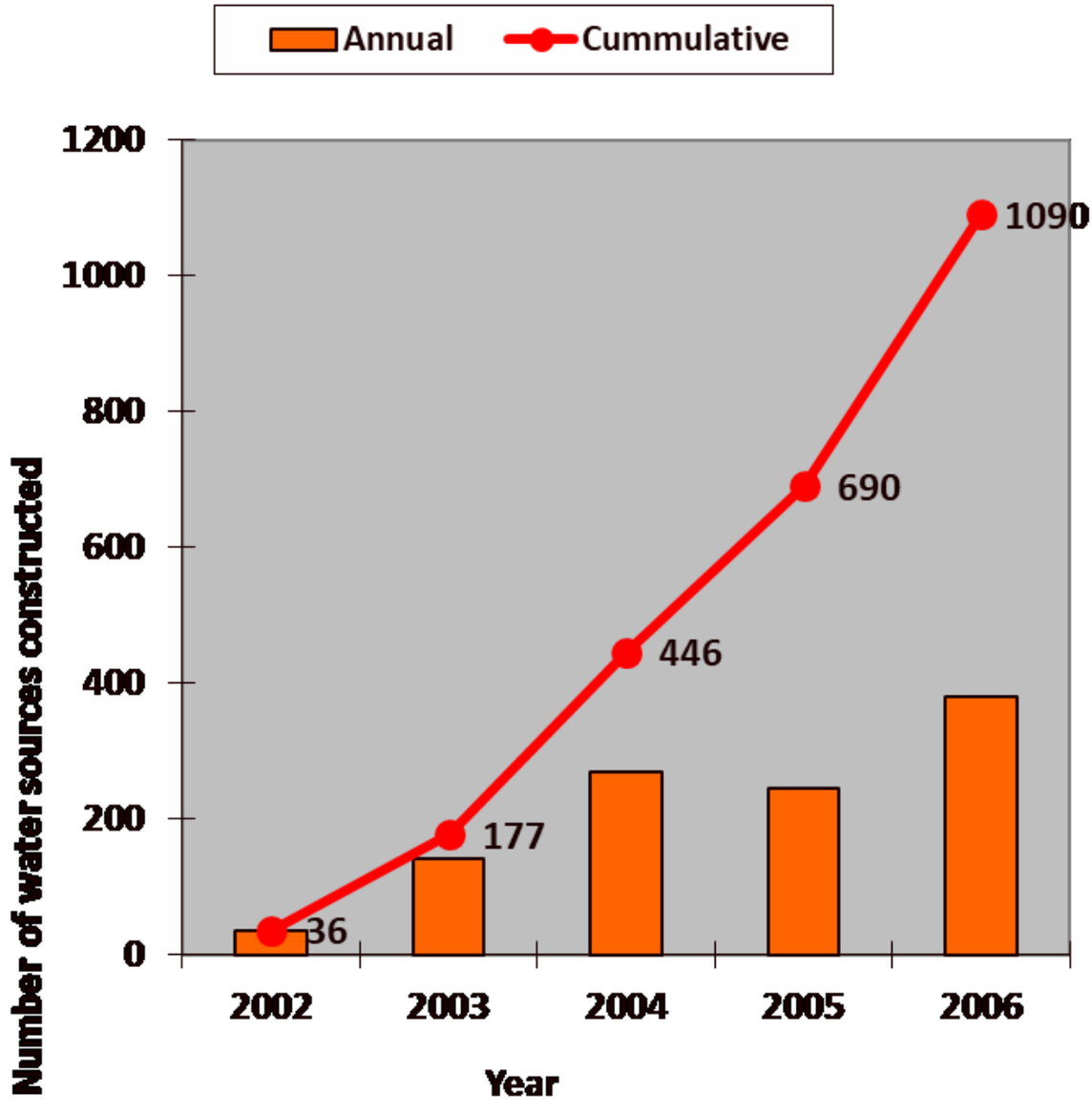

Figure 9: Potable water sources constructed between 2002 and 2006

Strategies to improve sanitation

The type of latrine promoted in Ghana was the Mozambican type. The Community Water and Sanitation Agency trained latrine slab artisans who, in turn, trained apprentices. The beneficiary

household was responsible for digging the hole, building, and roofing the superstructure. The average cost per latrine in 2007 was $43.25. More than 11,000 latrines were constructed between 2001 and 2007 (Figure 10). At the beginning of the trachoma control programme in 2001, the percentage of households with sanitation facilities was 2.1% (range at district level, 0–9%). By 2010, latrine coverage was 30.8% of households. The programme did not facilitate the construction of any other types of solid waste disposal.

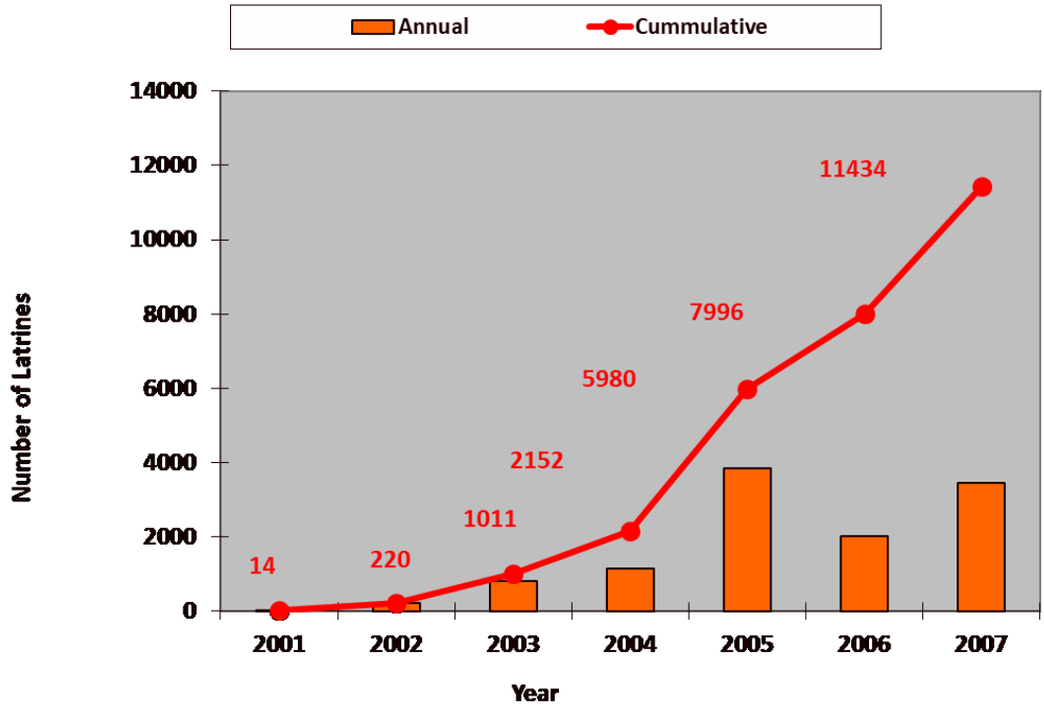

Figure 10: Number of latrines constructed between 2001 and 2007

There was very close collaboration between the programme and the WASH sector. The WASH partners of the programme, the Community Water and Sanitation Agency, UNICEF, World Vision Ghana and WaterAid Ghana, joined the programme at its inception in 2001. They were part of the group that developed the very first strategic plan and developed the session and budget for the F&E part of the programme. Local WASH partners, New Energy and ProNet, were also strong collaborators. These organisations and agencies provided safe water sources and improved sanitation for communities and households. They also participated in some health promotion activities encouraging facial cleanliness.

4. IMPACT AND PRE-VALIDATION SURVEILLANCE SURVEYS

4.1 IMPACT SURVEYS

Between 2007 and 2008, a set of impact surveys was carried out (Yayemain *et al.*, 2009). The results showed that the prevalence of TF in 1-9-year-olds had fallen to less than 5% in all districts in the Northern and Upper West Regions. There were still some TT cases to be managed, so the programme continued to provide public health-level services to people with TT.

Methodology

Even though new districts were created within the original 18 districts (EUs) of the Northern and Upper West regions, for the purposes of undertaking the surveys the original boundaries were maintained, to allow comparison with baseline prevalence estimates. Each of the 18 districts was considered a separate EU, with the surveys utilizing multistage, cluster random sampling to provide robust district-level trachoma prevalence estimates.

Sample size

Assuming that the actual prevalence of TF in 1 to 9-year-olds was 3.0% and to provide at least an 80% chance (power) of correctly determining that the upper 95% CI of TF in this age group was <5.0%, an effective sample size of 343 children was needed for each EU. The following additional assumptions were made: a mean household size of six persons; children aged 1—9 years comprise 28% of the population; approximately 15% non-response rate; and a design effect of 3.0 to allow for the cluster-sampled design. The design effect chosen was based on data from the trachoma prevalence surveys conducted previously. Due to logistical constraints, we selected 24 clusters of 30 households per EU, rather than a statistically preferred 30 clusters with fewer households. In each EU, we estimated that selection of 24 clusters of 30 households (a total of 720 households per EU) was likely to provide 1028 children aged 1—9 years, with a total sample size of 452 clusters and 12 960 households across the 18 EUs in the two regions.

Sampling

The survey adhered to WHO guidelines for assessing prevalence of trachoma (WHO. Trachoma control: a guide for program managers. Geneva: World Health Organization; 2006). Villages of <200 or >5000 people were excluded from the sampling frame. A cluster was defined as a village. Clusters were selected with a probability proportional to size methodology. In each selected cluster, the second stage involved random selection of 30 households, which were defined as either: a man, his wife or wives plus any dependents; a widow plus her dependents; or an elder brother or sister and their dependents if orphaned. Households were selected using a segmentation method (Turner et al., 1996). Selected households were not replaced if residents were absent or they declined to participate.

Trachoma grading and standardization

Eighteen ophthalmic nurses experienced in conducting trachoma surveys were retrained in examination techniques, the WHO simplified trachoma grading system (Thylefors et al., 1987), how to select households within a cluster and recording findings on standard forms. Training included a formal inter-observer reliability test of trachoma grading against a standardized set of 50 slides. It was not possible to conduct a reliability study among patients due to insufficient people with clinical signs of trachoma in the non-sampled villages selected for practical training.

Data collection

Ophthalmic nurses who scored >80% overall against the gold standard were assigned to survey areas where they had not been involved in delivering community interventions. In each selected household, only residents were enumerated. All available residents aged >6 months and for whom consent had been obtained were examined for trachoma in both eyes and the worst grade recorded. Prior to lid eversion, faces of children aged 1-9 years were observed for signs of ocular or nasal discharge. A clean face was defined as the absence of both ocular and nasal discharge. One follow-up visit was made to any household with missing residents on the day of the survey.

One adult female respondent was interviewed in each household to determine presence and use of a household latrine; primary source of water; and the approximate distance to water source estimated by round-trip time of collection. The presence of a latrine was confirmed by direct observation and “use” was defined as the presence of faeces within the pit. An improved source of water was defined as a covered borehole or well, hand pump or town supply. Participation in antibiotic distribution was assessed by showing each individual (or guardian) an azithromycin bottle and the distinctive pink tablets and asking whether the respondent had ever taken the drug for trachoma control, and if so, for how many annual rounds (years) they had taken it. During a separate interview, the respondent was shown the azithromycin bottle and tablet then asked if the household had ever received azithromycin, and if so, for how many years.

Data processing

Data were double entered and compared using Microsoft Access (Microsoft Corp., Redmond, WA, USA). Discrepancies between the two entries were identified and corrected. Based on selection methods used, within each district it was assumed that the probability of selection of each individual was equal and thus that the data were self-weighted. Therefore, the prevalence estimates calculated were unadjusted. Ninety-five percent (95%) confidence intervals for all estimates were adjusted to account for correlation due to clustering through Taylor Expansion using SAS SURVEYFREQ procedures (SAS version 9.1; SAS Institute Inc., Cary, NC, USA). Overall estimates for the programme area as a whole were adjusted for variation between districts. The number of un-operated TT patients was calculated as the sum of the district backlogs, where each district backlog was the product of the total population and the population prevalence of TT for that district.

Results

In total, 74 225 persons from 12 679 households were examined. The TF prevalence TF in 1-9-year-old children was 0.84% (95% CI 0.63—1.05, range of district-level estimates 0.14—2.81%) and the prevalence of trichiasis in adults aged ≥15 years was 0.31% (95% CI 0.24—0.38, range by district 0.00—1.07%). There were an estimated 4950 persons with trichiasis, of whom 72.6% were aged ≥60 years and 71.4% were women. Latrines were observed in 11.6% of households; 79.2% of interview respondents reported use of an improved water source. Given these results of the midterm evaluation and impact survey, active trachoma was therefore considered below the elimination prevalence threshold. Figures 11 and 12 below show the prevalence of active trachoma and trichiasis at baseline and impact survey.

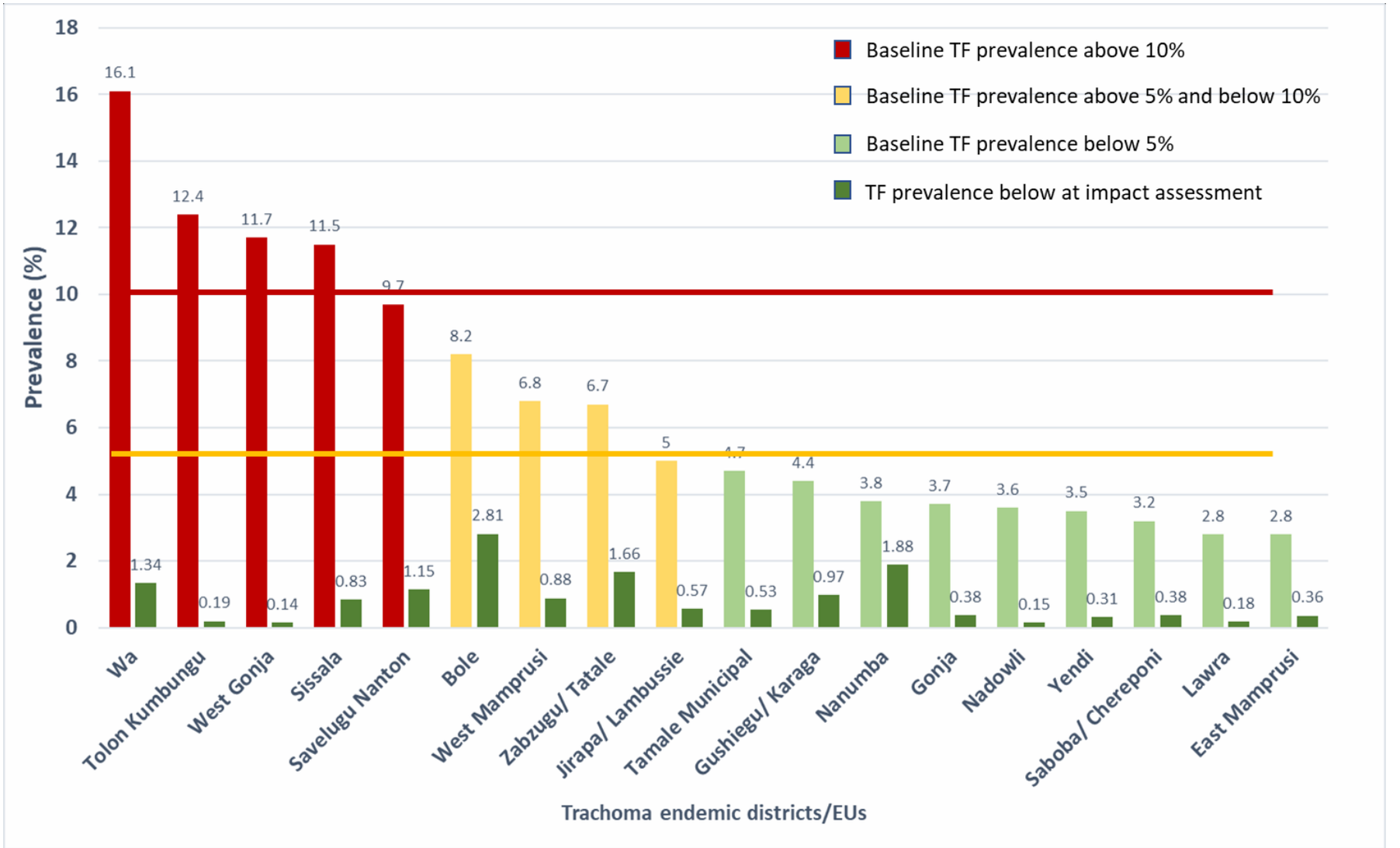

Figure 11: District-level prevalence of TF at baseline (2000-2003) and impact survey (2007-2008). For each district, the left-hand column represents the prevalence estimate at baseline, while the right-hand column represents the prevalence estimate at impact survey. Horizontal lines indicate the 5% and 10% TF prevalence thresholds. The dark green label shows TF prevalence below 5% at impact survey"

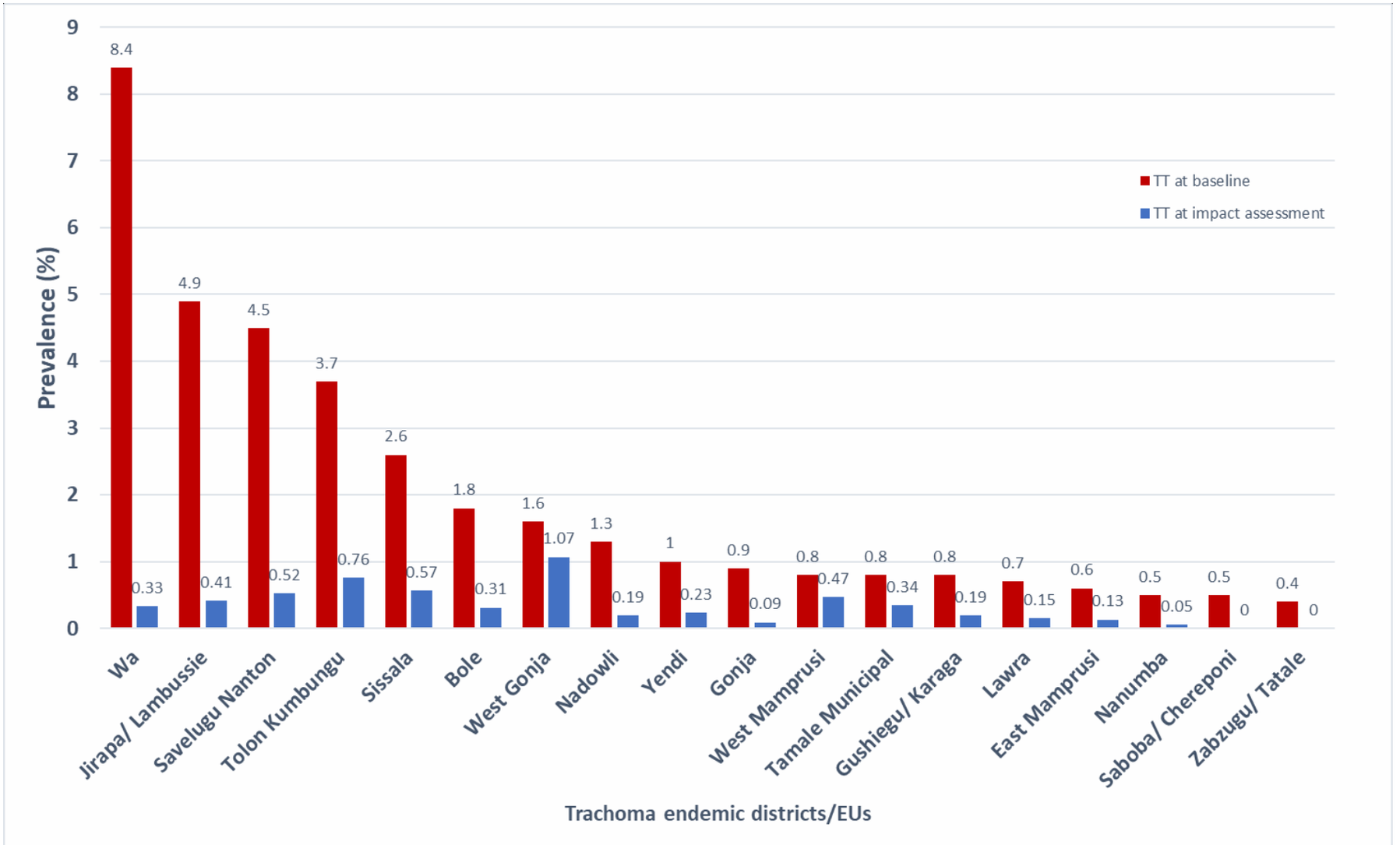

Figure 12: District-level prevalence of trichiasis at baseline (2000-2003) and impact survey (2007-2008). For each district, the left-hand column represents the prevalence estimate at baseline, while the right-hand column represents the prevalence estimate at impact survey.

4.2 PRE-VALIDATION SURVEILL ANCE SURVEYS

Having reached the TF elimination threshold for each trachoma endemic district based on the results of the 2008 impact surveys, in 2010, a surveillance plan was developed with the assistance of WHO and other programme partners, and implemented for four years between 2011 and 2014.

The general objectives of the surveillance plan were:

1. To detect and manage TT cases in trachoma endemic districts in Ghana
2. To integrate TT surveillance into the national IDSR system
3. To detect and respond to active trachoma
4. To collect information on facial cleanliness among children aged 1-9 years
5. To collect information on households using potable water
6. To collect information on households using household latrines

The specific objectives of the surveillance plan were to:

- Conduct active epidemiological surveillance: active case searches in endemic communities for TT in those aged 15 years and above and TF in children aged between 1 and 9 years old. Two communities were randomly selected in each endemic district, and house-to-house screening was done. This was undertaken for 4 years, randomly selecting communities after excluding communities selected in previous years.
- Conduct screening in preschools, in primary schools up to class three, and in junior high schools. Five communities were randomly selected in endemic districts and all children aged 1 – 9 years from preschools to primary level were examined for TF. This was done for 4 years, randomly selecting communities after excluding communities selected in previous years.
- Conduct passive surveillance in all health facilities within the framework of IDSR. At least one village health worker from each community and 30 health workers from each endemic district were trained to identify TT in the community and to have a high index of suspicion for TF in patients who visited health institutions.
- Generate information on surgery for TT and treatment of active cases, respectively. Patients identified to have TT or TF during surveillance were given appropriate treatment, with relevant data collated, reported and retained at national level.

Pre-validation surveillance surveys

In 2015-2016, Ghana conducted a set of district-level population-based surveys to demonstrate elimination of trachoma as a public health problem (Debrah et al., 2017a).

Design

In each district, a two-stage cluster sampling methodology was employed. Assessment of clinical signs of trachoma was undertaken by trained ophthalmic nurses.

Sites

The study was conducted in each of the 18 districts (EUs) of Northern and Upper West regions.

Sampling

Approaches followed those of the Global Trachoma Mapping Project (Solomon *et al.*, 2015). The primary sampling unit, the village, was selected based on probability proportional to size. In each district, 24 villages were selected. The total population of the district was divided by 24, to obtain the sampling interval. A random number between 1 and the sampling interval was generated to select the first cluster (village). The sampling interval was then successively added to select the remaining 23 villages. Secondary sampling units, households, were randomly selected using compact segment sampling (Turner *et al.*, 1996; Luman *et al.*, 2007). Forty (40) households were selected per village. Where the number of households in the village was less than 40, all households were assessed. However, where the number of households was more than 40, they were grouped into segments of 20 households and each segment numbered. Two segments were then selected at random and surveyed.

All eligible individuals (i.e., individuals above the age of 1 year) in the household were sampled. Selected households were not replaced when residents were absent or refused examination. To minimize the number of residents missed in selected households, survey teams re-visited the household before leaving the village on the day of the survey. The sample size was calculated for the required precision of TF in children aged 1-9 years old, based on the following parameters: The sample size was calculated for the required precision of TF in children aged 1-9 years old, based on the following parameters: prevalence (p) of 4%, a precision (d) of +/- 2%, a Z value (z) of 1.96 or 95% confidence level, a design effect of 3.3 estimated from previous surveys, and an expected non-response rate of 10%.

Thus, a total of 1,338 children were required to be recruited for the study in each EU. This gives a total of 24,084 across the 18 EUs. Based on 2010 census data that we used, there is assumed to be an average of 1.7 children per household. Based on a total of 24 clusters per EU, a total of 33 households were to be sampled per cluster.

Trachoma assessment

The survey team interviewed the head of each selected household for basic demographic information as well as other standard trachoma survey questions concerning access to water, sanitation and hygiene. GPS data were collected. Facial cleanliness (presence or absence of ocular and nasal discharge) was assessed. Consenting individuals were graded for signs of trachoma using the WHO simplified grading system (Thylefors et al., 1987).

Data management considerations and statistical analysis

Data collection and storage

Questionnaire data and clinical examination results were collected, using the LINKS system (Pavluck *et al.*, 2014), a smart phone application allowing data to be entered electronically and sent to a centralized cloud-based server through an encrypted connection. Training was held on the use of the system in advance of fieldwork to ensure correct, uniform usage of the tool. Password-protected access to the database was only granted to study investigators.

Data analysis

Results from clinical examination within an EU were aggregated to determine the TF prevalence in children aged 1-9 years (adjusted for age), and the TT prevalence in adults aged 15 and above (adjusted for age and gender). As clusters were selected using probability proportional to size sampling, data were assumed to be self-weighted. To prevent villages in which greater numbers were examined having greater influence on the calculated prevalence, the mean of the adjusted cluster-level estimates was taken as the EU-level prevalence. The number of TT patients unknown to the health system was calculated as the sum of the EU-level backlogs, where each EU backlog was the product of the total population and the population prevalence of TT for that EU. Analysis was undertaken using STATA 12 (College Station, TX: USA). Maps were drawn using ArcGIS 10.2.

Quality assurance

Grader Qualifying Workshop

All trachoma graders were assessed for accuracy in diagnosis of TF compared to a gold standard grader trainer, who had extensive experience of training graders and had been certified by the Global Trachoma Mapping Project. All graders achieved a kappa score for TF of at least 0.7 to qualify for inclusion in the team. Due to the low prevalence of TF cases in Ghana, training and standardisation of graders was conducted in Sokoto, Nigeria, where prevalence of trachoma was higher (Solomon *et al.*, 2015).

Training for Field Activities

Field teams were trained over a one-week period. Training included both theoretical and practical sessions, covering issues of data collection (including how to safely conduct clinical examinations, collect blood spots and take ocular swabs), recording, sampling procedures and ethical considerations and pre-testing of the study protocols). Blood spots and swabs were taken as part of multi-national research efforts to compare prevalence of clinical markers with findings from serology and PCR. Three ophthalmologists with experience in trachoma were present during the training, pre-testing and supervision of actual data collection.

Results

45,660 individuals were examined. The EU-level TF prevalence estimates in 1–9 year-old children

ranged from 0.1% to 1.2% (Figure 13). The EU-level prevalence of TT unknown to the health system ranged from 0.00 to 0.36% (Figure 14). Amongst EU-level trichiasis prevalence estimates (Figure 12), only Yendi District (0.36%; 95% CI: 0.0 – 1.01) failed to meet the elimination threshold of < 0.2% TT prevalence in adults aged 15 and above. In this district, the estimated TT backlog was 417 (Debrah et al., 2017).

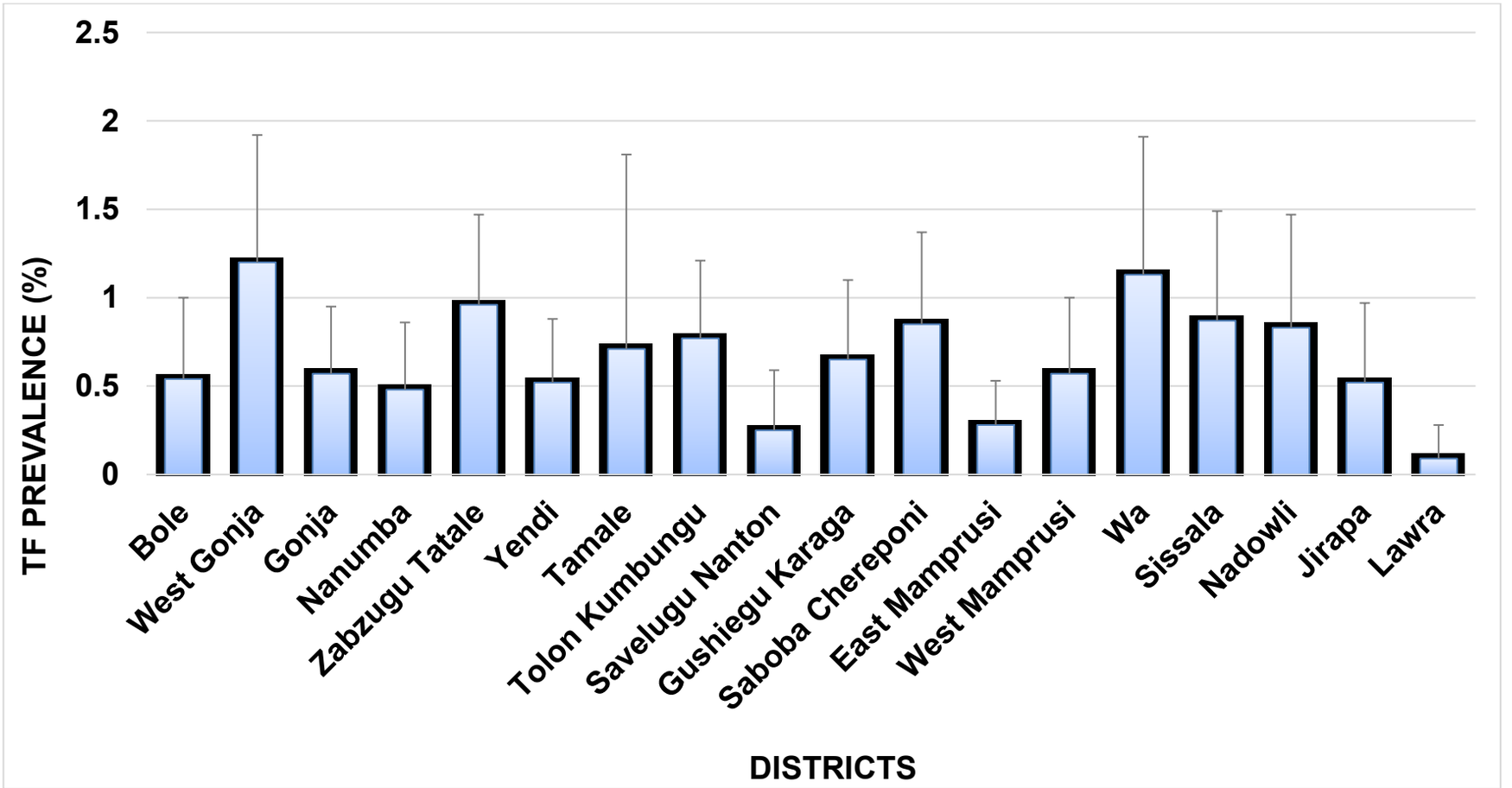

Figure 13: TF prevalence in children aged 1-9 years, by district, pre-validation surveillance surveys, 2015-2016

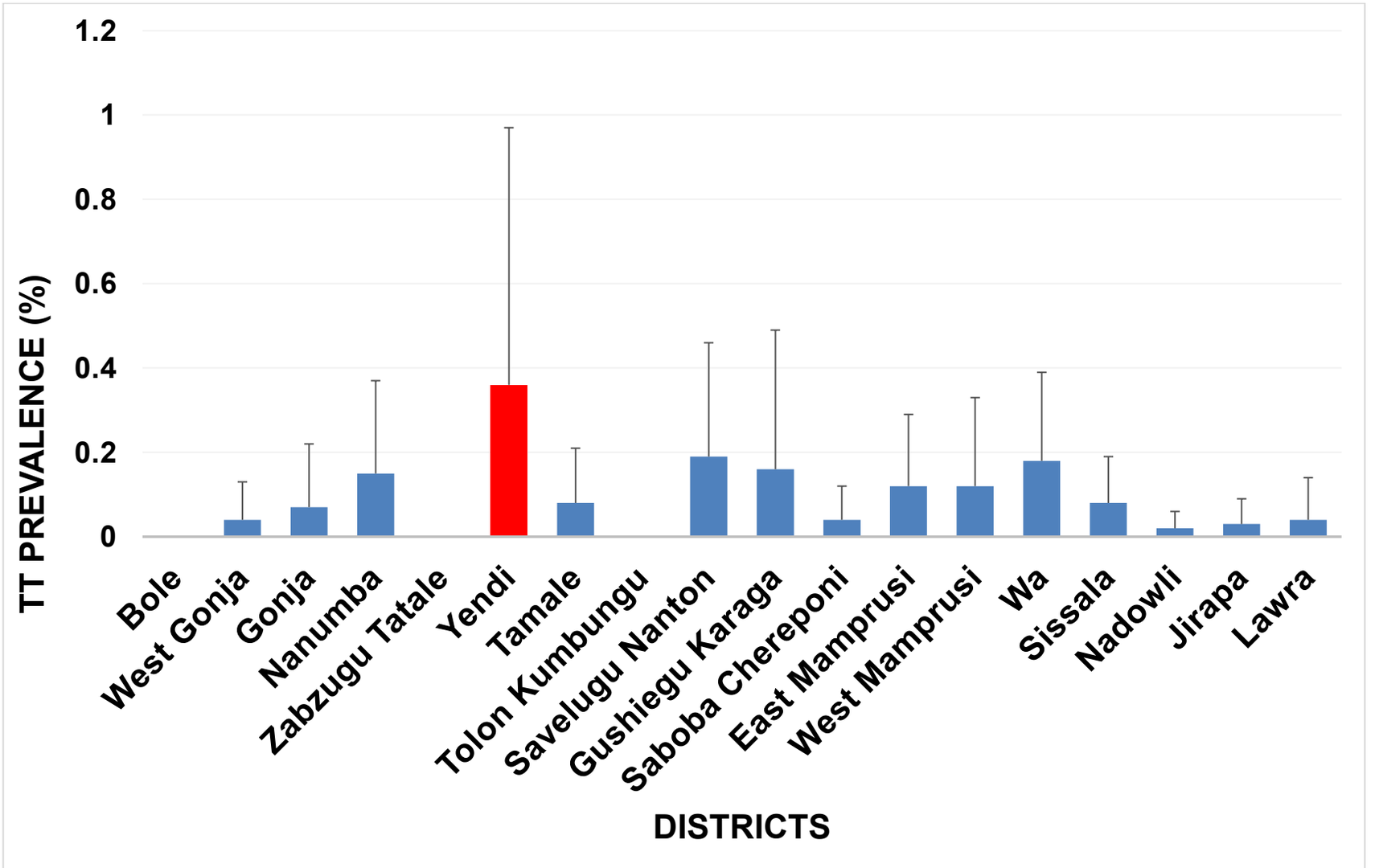

Figure 14: TT prevalence in adults aged 15 years and above, by district, pre-validation surveillance surveys, 2015-2016

TT case search, Yendi District

Following the pre-validation surveillance surveys, the Ghana programme embarked on an active TT case search and management campaign in all 487 communities of Yendi district. A thorough house-to-house, community-by-community TT case search was completed in 2017.

Teams consisting of five ophthalmic nurses were formed to undertake the case search and TT surgeries. Seven teams were deployed, each assessing four communities per day. All households in every community were visited. Records of all TT cases observed during the search were collected using a TT case detection form and a tally form to record the number of people examined.

Prior to the case search, nurses were given refresher training on topics including case detection, identification, preparation of the patient and space for the surgery, infection control, anaesthesia and the surgical procedures, based on guidelines developed for TT programmes, (ICTC 2016; WHO 2006). Postoperative management was also discussed. Field teams were supervised by a team of ophthalmologists who reviewed TT cases and surgeries in the field. There was daily communication with field teams and field findings were updated regularly. A debriefing was undertaken each morning and evening.

A total of 61,225 individuals aged 15 years and above were examined, representing 72.1% of the expected total district adult population of 84,953. This included 25,674 males (41.9%) and 35,551 females (58.1%). A total of 90 TT cases (19 males and 71 females) were observed. The age range of TT patients was from 28 to 101 years, with only a few cases found in individuals below the age of 50 years. Fifty-eight of the cases were provided with TT surgery, 21 cases were taught to epilate, and 11 cases refused management. Because of the thorough census with all cases identified in individuals making themselves available for examination, and the presumption that those not wishing to be examined would not wish to have surgery if indeed they had TT, there are currently no cases of TT in Yendi unknown to the health system. Thus, Yendi has also met the trachoma elimination threshold. The programme will continue to identify and provide surgery for TT cases in Yendi and all other endemic districts.

In view of the above results, Ghana is happy to declare that it has reached the elimination threshold for trachoma and that trachoma is no longer a public health problem in Ghana.

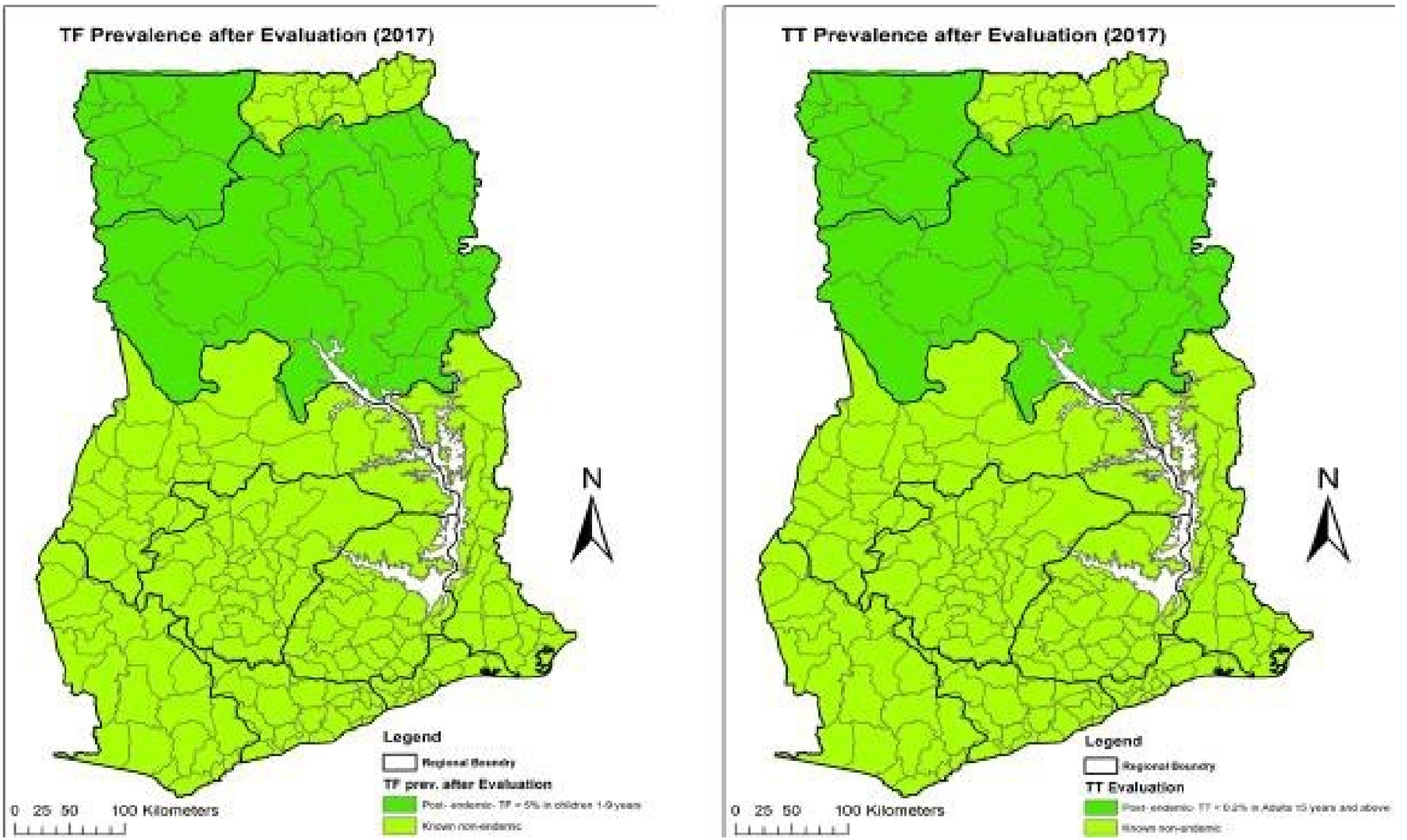

Figure 15: Map of Ghana showing the prevalence of TF and TT, incorporating the results of the pre-validation surveillance surveys and inferred TT prevalence for Yendi following the case search and provision of surgery

4.3 REGIONAL CONTEXT

Ghana shares border with Cote d'Ivoire to the West, Burkina Faso to the North and North-West, and Togo to the East. This section covers the situation of trachoma in these three neighbouring countries.

Cote d'Ivoire

There are very few historical data available on the prevalence and distribution of trachoma in Côte d'Ivoire. Up-to-date information has not been published in the peer-reviewed press (Smith et al., 2013). In 2015, a mapping exercise in 11 districts thought to be at risk revealed that nine districts were endemic for trachoma. USAID supported the NTD programme to treat four of these nine districts in 2016 using drugs (azithromycin donated through ITI, and tetracycline eye ointment procured with USAID funds). With financial support from USAID and Sightsavers, another nine districts were mapped in 2017 and four of those nine districts were determined to be trachoma endemic, bringing the total number of endemic districts to 14. One district (Bouna, which borders the Northern Region of Ghana and had a baseline TF prevalence of 8.6%) qualified to undertake a trachoma impact survey after one MDA round in 2016, and in 2017 returned a TF prevalence at that impact survey of <5%. Another district (Seguela, TF prevalence 5.4%) has had the one MDA round required in 2017 and will conduct an impact survey in 2018. Treatment for trachoma will gradually be scaled up to cover all remaining endemic districts. It should be noted that the country currently has no partner supporting morbidity management, so management of TT has not yet started.

Togo

Available data (from surveys conducted in 2006, 2009 and 2011) indicate that the prevalence of TF among children aged 1-9 years was below 5% in all studied districts of Togo. Therefore, no specific programme of A, F and E activities has ever been implemented in the country for trachoma elimination purposes. Data from the 2009 surveys suggested that TT prevalence among adults 15 years and older might be above the WHO elimination threshold of 0.2% in some districts (Dorkenoo et al., 2012); further population-based surveys were therefore conducted in September 2017. These surveys showed that prevalence estimates of both TF and TT were below the elimination threshold in all suspected-endemic districts, with TF prevalence among children aged 1-9 years below 5%, and TT prevalence among those aged ≥15 years below 0.2% in all districts.

Burkina Faso

Baseline trachoma mapping carried out between 2007 and 2010 showed that the disease was endemic in 30 health districts (TF prevalence ≥10% in children aged 1 to 9 years). This led to the implementation of interventions to eliminate trachoma. By the end of 2015, 29 of 30 endemic districts had stopped MDA after reaching previous WHO prevalence thresholds for stopping MDA.

However, a subsequent change to global practice encouraged treatment of districts with TF prevalence estimates between 5% and 9.9%, and as a consequence, 18 districts were added to the original 30 districts, taking the total number of endemic districts to 48 and increasing the number of districts still needing mass antibiotic treatment to 19. In September 2017, the national trachoma programme in Burkina Faso completed impact surveys in these 19 districts and initial reports indicate that all 19 districts now have TF prevalence estimates <5%. This means that all 48 trachoma-endemic districts have achieved the TF elimination threshold, including those that border Ghana.

Taking into consideration all of the above data, trachoma in neighbouring countries is not felt to present a risk to the achievement of the Ghana programme in having eliminated trachoma as a public health problem.

5. POST-VALIDATION SURVEILLANCE

Plans for post-validation surveillance

Until WHO introduces revised trachoma post-validation surveillance protocols, GHS will continue to depend on its existing trachoma surveillance system, which has proven sensitive enough to detect and deal with incident TT cases. As Ghana is anticipated to be one of the first countries in sub-Saharan Africa to be validated as having eliminated trachoma as a public health problem, the evidence base which might form a foundation for designing post-validation surveillance protocols is somewhat lacking. The MoH and GHS are engaging with WHO and academic partners to formulate operational research to help generate evidence for future best practice in this area. In the meantime, the MoH commits to continuing to offer trichiasis management to patients that need it, using the following principles: trachoma surveillance is fully integrated into the IDSR system of GHS and it is one of the priority diseases for which reports are required on a monthly basis from all health facilities across the country. This mandates that staff involved in IDSR are routinely trained on trachoma surveillance as part of their IDSR training. To further support this system, in 2014 and 2015, the trachoma elimination programme trained 1,627 community volunteers and 868 non-eye care workers, including clinicians and disease control officers, to be able to detect and report any suspected TT cases as they go about routine activities.

Plans for ongoing provision of TT surgeries

Efforts have also been made to train ophthalmic nurses for all district hospitals. These nurses are responsible for investigating suspected TT cases and carrying out surgeries where necessary. In addition, each of the formerly endemic districts has been provided two TT surgery kits to facilitate management of incident TT cases. TT surgery is provided free of charge to recipients under the NHIS.

Plans for ongoing WASH Activities

The trachoma programme will continue to benefit from the coordinated WASH approach that was used for the prevention and elimination of cholera, Guinea worm and trachoma. This approach ensured that communities with high trachoma, Guinea Worm and diarrhoea were targeted for delivery of WASH interventions. As the Trachoma Elimination Programme comes to an end, formerly endemic communities will continue to benefit. In other words, to avoid recrudescence of disease, a history of previous trachoma endemicity will be one of the reasons for choosing communities for safe water provision and other WASH interventions.

In addition, previously trachoma-endemic communities will benefit from the implementation of the Water Sector Strategic Development Plan (2012 - 2025), which was published in 2014. This plan provides a framework for implementing the vision of the sector, which is sustainable water and basic sanitation for all by 2025. This means ensuring that all people living in Ghana have access to adequate, safe, affordable and reliable water services, practise safe sanitation and hygiene and that water

resources are sustainably managed.

6. SPECIAL ISSUES

Even though there were some conflicts in Yendi District, Northern Region, the programme was not disrupted since most of the trachoma control activities took place when there was peace.

The programme implemented most of its activities during the dry season. This helped to ensure that all communities could be reached, since during the rainy season there were some communities that were cut off by rivers.

There are nomadic herdsmen (e.g., Fulanis) who move around various districts and neighbouring countries. These individuals are likely to have missed treatment, and therefore constitute a group of interest. Operational research studies focussing on these nomadic populations would be useful in assessing possible challenges to the trachoma surveillance programme.

7. RESOURCES AND PARTNERSHIPS

Table 4. Partners of the trachoma elimination programme, listed in alphabetical order

Partner Name	Nature of support	Geographical areas of support
CBM	Human resource, initiation of trachoma activities	In the two endemic regions
Conrad N Hilton Foundation	Financial support through The Carter Center	In the two endemic regions
Community Water and Sanitation Agency	Provision of water and toilets	In the two endemic regions
District Assemblies	Human resource, logistics for Environmental health activities	In the two endemic regions
Ghana Education Service	Human resource for School Health Programme	In the two endemic regions
Ministry of Local Government and Rural Development	Provision of water and toilet facilities	In the two endemic regions
Ministry of Gender, Child and Social Protection	Advocacy and social mobilisation	In the two endemic regions
New Energy	Provision of water and sanitation facilities, hygiene promotion	Northern Region
Operation Eyesight Universal	Logistics	In the two endemic regions
Pro Net	Provision of water and sanitation facilities, hygiene promotion	Upper West Region
Sightsavers	Financial support for surgery, surveillance and Pre-validation surveys, Human Resource, Technical support	In the two endemic regions
Swiss Red Cross	Human resource, Logistics for surgery, vehicular support	In the two endemic regions
Task Force for Global Health /ITI/Pfizer	Financial support, Zithromax® donation, Technical support for SAFE activities	In the two endemic regions
The Carter Center	Financial Support for surgery, F and E activities, advocacy, mid-term prevalence survey, Technical support	In the two endemic regions
UNICEF	Technical support	In the two endemic regions
USAID END in Africa/FHI360	Financial, Technical support	In the two endemic regions
Water Aid Ghana	Provision of water and sanitation	In the two endemic regions
WHO	Technical, Financial support for development of Surveillance Protocol	In the two endemic regions
World Vision Ghana	Provision of water, environmental improvement	In the two endemic regions

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9. ABBREVIATIONS

CHPS – Community-Based Health Planning and Services
DHMIS – District Health Management Information System
GHS – Ghana Health Service
GTMP – Global Trachoma Mapping Project
IDSR – Integrated Disease Surveillance and Response
ITI – International Trachoma Initiative
MDG – Millennium Development Goals
MoH – Ministry of Health
NGO – Non-Governmental Organization
NHIS – National Health Insurance Scheme
PHC – Primary Health Care
SDG – Sustainable Development Goal
SHEP – School Health Education Programme
TF – Trachomatous inflammation—follicular
TI – Trachomatous inflammation—intense
TS – Trachomatous scarring
TT – Trachomatous trichiasis
UNICEF – United Nations Children's Fund
USAID – United States Agency for International Development
WASH – Water, sanitation and hygiene
WHO – World Health Organization

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