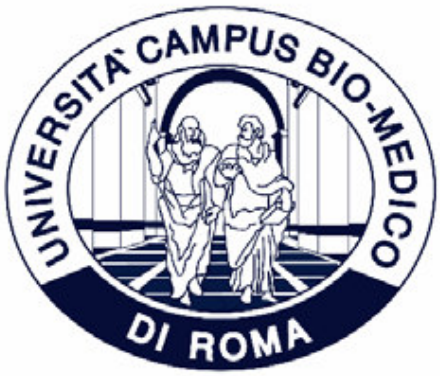

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Avoidable Blindness: Development and Implementation of Surveillance System for Trachoma in Post-Endemic Countries

How the World Health Organization supports its Member States

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1. INTRODUCTION

Blindness is one of the most tragic disabilities in the developing world.[1] The impact of visual loss on the personal, economic, and social life of an individual is profound, and when the prevalence of blindness in communities is high, the consequences become a significant public issue.

The most recent (2002 and 2004) projected estimate for world blindness points to some 45 million blind with best corrected visual acuity in the better eye of 3/60 or worse, and an additional 269 million visually disabled ('low vision' is defined as best corrected visual acuity between 6/18 and 3/60 in the better eye).[1,2] About 80% of blindness is avoidable (preventable or curable), and nine out of 10 of the world's blind live in a developing country.

The last 30 years have brought an upsurge of interest in bringing public health approaches to understanding the distribution and causes of the major blinding eye diseases in the world. Knowledge of the epidemiology is guiding both research and programs targeted toward blindness prevention. Concerted efforts on both fronts are necessary, as the present century holds special significance for the eye care community: the year 2020, beyond the obvious characterization of excellent vision, is the target of the World Health Organization Global Initiative for the Elimination of Avoidable Blindness.[3] The initiative, in partnership with governments, nongovernmental organizations, universities, and others, is a commitment to reduce blindness considered avoidable from diseases such as cataract, trachoma, onchocerciasis, and vitamin A deficiency.[3]

Projected demographic shifts globally suggest that visual loss will continue to be a public health problem into the future. As a consequence of the proportion increase of people aged 65 years and older around the world, the leading causes of blindness and visual loss will shift from infectious causes to age-related morbidities seen predominantly now in industrialized countries.[1]

In particular, the problem of blindness due to cataract will continue to be an issue in the future, as the population ages and risk factors for cataract, such as diabetes, become even more prevalent.[1]

In the meanwhile, trachoma is still the second common cause of preventable blindness in the world, with some 8.2 million severely impaired or blind, and around 41 million cases of active disease in need of treatment.[4]

In 1997, the World Health Organization (WHO) established the WHO Alliance for the Global Elimination of Trachoma, as a public health problem, to facilitate collaboration with all interested parties, including 57 endemic countries with blinding trachoma.[5]

The main goal of the Alliance is to globally eliminate blindness due to trachoma by the year 2020.

A suitable strategy, referred to as 'SAFE' (**S**urgery, **A**ntibiotics, **F**acial Cleanliness and **E**nvironmental Hygiene), has been defined and endorsed by the World Health Assembly 51.11 resolution in 1998, and is being increasingly applied in endemic countries.[6]

The impressive progress in attaining elimination of blinding trachoma made by several endemic countries showed the need to set up the surveillance system in order to monitor and control coverage achievements avoiding dispersal of skills, competences, and support.

1.1- Trachoma

Trachoma is still the leading infectious cause of blindness worldwide.[1] It is an infectious eye disease which causes persistent or repeated inflammation thus leading to scarring of the conjunctiva and later to inturned eyelashes that rub on the cornea.[7] Subsequent corneal opacification is responsible for vision loss and blindness. Although once widespread in most continents, it has largely disappeared from industrialized countries.[8]

Currently, the highest rates of trachoma are found in communities with the poorest resources, affecting their most vulnerable members: women and children.[9,10] It is prevalent in Africa, the Eastern Mediterranean, Western Pacific and some parts of South-East Asia, and the Americas (Table 1).[11]

Trachoma is caused by the obligate intracellular bacterium *Chlamydia trachomatis* that has 19 different serological variants (serovars). These are sub-divided into two biological variants (biovars); the trachoma biovar (serovars A–K) and the lymphogranuloma venereum biovar (serovars L1, L2, L2a and L3). Endemic trachoma is caused by serovars A, B, Ba and C.[12] Genital chlamydial infection, which causes pelvic inflammatory disease and infertility, is associated with serovars D–K.

During the course of its developmental cycle, *Chlamydia trachomatis* exists in two principle forms: reticulate bodies (RB) and elementary bodies (EB). [13]

The reticulate body is the larger, metabolically active, intracellular stage. Elementary bodies are the: small (200-300 nm); hardy, with a dense DNA core surrounded by a trilaminar cytoplasmic membrane, external to which is a trilaminar outer envelope; and metabolically inactive extracellular form of the organism in which it transfers between host cells and organisms.

The chlamydial developmental cycle commences with the attachment of the EB to the surface of epithelial cells which triggers endocytosis of the bacteria. Within 6-9 hours after infection, the EB becomes metabolically active and enlarges (1 μm) to form an initial RB. Inside the host cell, the RB multiples by binary fission to form a microcolony of pleomorphic chlamydial forms which lies within a cytoplasmic vacuole. By 20 hours after infection some of the RB undergo reorganization within the expanding intracytoplasmic inclusion body of Halberstaedter-Prowazek into smaller intermediate forms and then into EB. The newly formed EB are released either by lysis of the host cell or by the

fusion of the inclusion body with the plasma membrane. In vitro, the chlamydial development cycle takes between 36 and 70 hours to complete.

The organism has a single chromosome coding 875 genes and a variable numbers of small plasmids.[14] Although originally believed to lack the ability to generate energy-rich compounds, the chlamydial genome was found to contain a surprising number of genes related to energy metabolism and may be able to perform some limited ATP synthesis for at least part of its life cycle.[14]

The rigid outer membrane is composed of a number of structural proteins, the most important being the major outer membrane protein (MOMP) that accounts for 60% of the surface protein. Variations in MOMP epitopes define serovar specificity and may be an important target for the immune response to *Chlamydia trachomatis*.

Other prominent components of the outer membrane include a 60 KD cysteine-rich protein and a specific Chlamydial lipopolysaccharide (LPS). *Chlamydiae* also release two heat-shock proteins, of 57 KD and 75 KD. The 57 KD heatshock protein appears to be the major pathogenic antigen in trachoma. It stimulates the persistent deleterious cell-mediated immune response which, if chronically maintained, leads to cytokine release, causing ongoing inflammation, fibrosis and conjunctival scarring.[15-17]

In the early (active) stage, which is seen principally among children in endemic areas, trachoma is characterized by a chronic follicular conjunctivitis, which affects principally the upper tarsal conjunctiva, with hyperplastic conjunctival epithelium and a widespread inflammatory infiltrate of T and B lymphocytes, macrophages, plasma cells and neutrophils.[18] In places this is organized into B-cell follicles. Staining for collagen sub-types reveals a generalized increase in the amounts of types I, III and IV (normally found in the stroma) and deposition of new type V.[19]

Country	Country population in 2004 (millions)	Population living in endemic areas (millions)	Cases of Trachomatous Inflammation—Follicular/Trachomatous Inflammation in endemic areas (thousands)	Cases of Trachomatous Trichiasis in endemic areas (thousands)
Afghanistan	28.57	9.8	190.8	83.1
Algeria	32.36	2.83	146.7	86.7
Australia	19.94	0.12	7.3	1.1
Benin	8.18	1.27	111.2	7.6
Botswana	1.77	0.2	17.6	32.9
Brazil	183.91	58	574.5	58
Burkina Faso	12.82	12.82	553.1	32.8
Central African Republic	3.99	0.2	26.5	1
Cambodia	13.8	4.43	503.3	29.2
Cameroon	16.04	4.55	366.2	47.2
Chad	9.45	4.78	607.7	34.3
China	1315.41	364.38	1267	2330.6
Côte d'Ivoire	17.87	6.1	510.8	59.9
Djibouti	0.78	0.78	4.7	3.9
Egypt	72.64	3.61	393.1	35.4
Eritrea	4.23	4.23	130.1	42
Ethiopia	75.6	75.6	9935.2	1272.6
Fiji	0.84	0.84	18.9	0.8
Gambia	1.48	1.2	27.1	10.5
Ghana	21.67	2.72	133.1	3
Guatemala	12.29	0.25	0.2	0.03
Guinea	9.2	3	323.3	25.1
Guinea-Bissau	1.54	1.54	118.7	16.4
India	1087.12	328.18	4450.2	443
Iran (Islamic Republic of)	68.8	8.81	0	49.3
Iraq	28.06	22.03	719.4	43.9
Kenya	33.47	15.95	1535	306.8
Kiribati	0.1	0.1	8.6	0.1
Lao People's Democratic Republic	5.79	0.5	24.1	0.9
Libyan Arab Jamahiriya	5.74	0.42	20.9	13.2
Malawi	12.61	9.53	608.7	33.4
Mali	12.12	9.12	676.7	67.6
Mauritania	2.98	1.64	43.8	2.5
Mexico	105.7	0.13	0.1	0.02
Morocco	31.02	1.18	3.9	6.4
Mozambique	19.42	7.85	879.2	60.5
Myanmar	50	17.4	68.9	65.8
Namibia	2.01	0.8	30.5	6.1
Nauru	0.013	0.013	0.7	0
Nepal	26.59	16.53	513.5	138.8
Niger	13.5	13.5	1799	59.6
Nigeria	128.71	50.82	3252.5	627.3
Oman	2.53	0.07	0.2	0.6
Pakistan	154.79	51	800.6	71.7
Papua New Guinea	5.77	5.77	16.8	5.8
Senegal	11.39	11.4	260.5	129.8
Solomon Islands	0.47	0.47	32.5	0.5
Somalia	7.96	5.16	18.1	10.3
Sudan	35.52	21	1773.4	528.1
Tanzania (United Republic of)	37.63	12.56	1220.8	214.8
Togo	5.99	1.83	22.5	2.9
Uganda	27.82	11.65	2436.1	610.6
Vanuatu	0.21	0.21	14.1	0.2
Vietnam	83.12	23.29	919.3	210
Yemen	20.33	20.33	468	270.8
Zambia	11.48	1.98	388.3	8.5
Zimbabwe	12.94	9.7	1669.5	44.1
All endemic countries	1244.17	40	643.5	8248.2

Table 1. Estimated active trachoma and trachomatous trichiasis in endemic countries in 2007 for available data (courtesy WHO/CHP/PBD)

At this stage, corneal changes include punctate keratitis, indolent ulcers and vascular and cellular infiltration (pannus), which is occasionally so extensive as to impair vision.

In adults with trachomatous scarring, the conjunctival epithelium is atrophic and goblet cells are lost.[20] The loose sub-epithelial stroma is replaced with a thick scar of type V collagen. These new vertically orientated fibres are firmly attached to the tarsal plate, causing distortion.[20]

Conjunctival inflammation in the presence of scarring and trichiasis is often observed and is associated with a T-cell infiltrate.

Conjunctival scarring leads to dry eye syndrome, entropion and trichiasis. Corneal scarring and blindness might result from constant corneal abrasion due to entropion and trichiasis.

The pathologic mechanisms by which trachoma causes corneal and conjunctival scarring that lead to blindness are poorly understood.

Although the growth of *Chlamidya trachomatis* is restricted to a minority of epithelial cells,[21] the devastating complications of infection, namely conjunctival and subconjunctival scarring and blindness, may result from chronic stimulation of the immune response with inflammatory cell infiltrate extended deep into the substantia propria. Monnickendam et al, using a guinea pig model of Chlamydial eye disease, demonstrated that persistent or repeated infection led to chronic inflammatory reactions and conjunctivitis with pannus and conjunctival scarring.[22]

Ocular infection with the agent of *Chlamydia trachomatis* induces both humoral immunity[23,24] and cell-mediated immunity.[16,25,26] The immune response seems to confer partial protection against subsequent infection, yet appears also to play a major role in the pathogenesis of trachomatous scarring.

The initial response to *Chlamydia trachomatis* infection at the epithelial surface is probably made by the innate immune system, with the release of

pro-inflammatory cytokines, as interleukine-1 and tumor necrosis factor-α (IL-1, TNF-α), by epithelial cells. This promotes rapid influx of neutrophils and macrophages, which may help to limit the initial infection through phagocytosis.[18] The above mentioned initial innate immune response to Chlamydia trachomatis infection is followed by the development of adaptive immune responses with both antibody-meditated (humoral) and cell-mediated components.

In particular, *Chlamydia trachomatis* replication in the conjunctival and corneal epithelial cells releases a number of pathogenic antigenic proteins including MOMP, a 60KD cysteine-rich protein, 57 KD and 75 KD heat-shock proteins, and Chlamydial LPS.[15-17,27-29]

All these antigens stimulate B-lymphocyte proliferation and differentiation into plasma cells secreting large quantities of immunoglobulins (Ig). This response is enhanced by T-lymphocytes.[30]

In effect, the role of the humoral immune response appears to be limited in trachoma. Anti-chlamydial antibodies have been found in the tears and serum of patients with clinically active trachoma. Longitudinal studies of tear anti-chlamydial IgG suggest that this is associated with increased risk of active disease, possibly through facilitating the entry of *Chlamydia trachomatis* into host cells and may reflect a T helper lymphocytes type 2 (Th2) weighted response.[31] An opposite trend was found with anti-chlamydial IgA, which may interfere with attachment to host cells.[29,32]

Animal models of chlamydial infections suggest that effective cell-mediated immune responses are necessary for the resolution of the infection.[28,33,34] Individuals who resolve clinically active trachoma have greater lymphoproliferative responses to chlamydial antigens compared with those who had persistent clinical disease.[35] In contrast, individuals with trachomatous conjunctival scarring had weaker peripheral blood lymphocyte proliferation responses compared with normal controls.[36]

Specifically, stimulation with *Chlamydia trachomatis* EB elicits IL-6 formation by B-lymphocytes[37] which induces the final differentiation of B cells to antibody-producing cells.[38] Antigen-presenting cells process and present Chlamydial antigens to CD4+ T-lymphocytes in an major histocompatibility complex (MHC) class II molecule-restricted manner, resulting in Th-lymphocyte proliferation and activation, and in secretion of several cytokines.[28,34]

The majority of CD4+ T-lymphocytes are belonging to Th1 cells producing IL-2, IL-12, and interferon-γ (IFN- γ).[39,40]

In particular, IFN-γ appears to be the pivotal cytokine in the resolution of infection through a variety of anti-chlamydial actions, as inhibition of the intracellular growth, and differentiation and clonal expansion of several different subsets of *Chlamydia*-committed effector CD8+ cytotoxic T-lymphocytes.[41] Individuals with chlamydial infection have increased expression of IFN-γ, IL-2, and IL-12 within the conjunctiva, consistent with this hypothesis.[42]

TNF-α exhibits a synergistic effect with IFN-γ to restrict intracellular growth of *Chlamydia trachomatis*.[43]

CD8+ cytotoxic T-lymphocytes contribute to antichlamydial T-cell immunity. CD8 + T cells lyse *Chlamydia*-infected cells and recognize a peptide epitope on infected cells in the context of MHC class I molecules. Their ability to resolve Chlamydial infection is correlated with the capacity to elaborate IFN-γ and TNF-α.[44,45]

On the other hand, clinically active trachoma often persists long after chlamydial infection becomes undetectable. Chronic severe conjunctival inflammation is associated with progression to scarring complications probably through the activation of fibrogenic pathways.[46] Clinically active trachoma, irrespective of the presence of infection, is associated with increased expression of pro-inflammatory cytokines.[18,42]

In fact, stimulation by IFN-γ induces aberrant MHC class II antigens expression by the infected conjunctival and corneal epithelial cells that lead to perpetuation of the inflammatory immune response, induction of an autoimmune reaction and progression of conjunctival and corneal scarring.

Apart from that, T-lymphocytes produced mediators including IL-2 and IFN-γ trigger macrophages to produce fibrogenic cytokines. Furthermore, T-lymphocytes produce transforming growth factor-β (TGF-β) that stimulates collagen synthesis.[47]

Colony-stimulating factors (CSFs),produced by CD4+ cells in response to *Chlamydia trachomatis* infection,[48] are cytokines involved in the production, differentiation and activation of phagocytic cells. Ongoing activation of these cells, even after infection has resolved, probably plays an important part in the development of scarring. Although macrophages are effector cells in cell-mediated immunity to *Chlamydia trachomatis* and inhibit intracellular replication of *Chlamydia trachomatis*,[49] they also play a central role in normal wound healing and pathologic fibrosis by virtue of their ability to release a variety of fibrogenic cytokines.[47]

Conjunctival macrophage activation in trachoma is suggested by findings of cytoplasmic expression of IL-1α, IL-1β, TNF-α and PDGF that may be important in the pathogenesis of scarring.[18] In confirmation of this, TNF-α has been found more frequently in the tears of individuals with trachomatous scarring.[50] A single nucleotide polymorphism (SNP) in the TNF-α promoter region, TNFA-308A, which leads to increased levels of TNF-α has been associated with increased risk of trachomatous scarring and trichiasis.[51]

The role of IL-1 shoul be elucidate, but it appears to stimulate fibroblast proliferation and induce exaggerated production and accumulation of subconjunctival fibrous tissue in patients with trachoma.

In addition, macrophages actively synthesise gelatinase B probably involved in matrix degradation and promotion of conjunctival scarring in trachoma.[52]

Cell-mediated immunity to ocular infection with *C. trachomatis* may thus be a two-edged sword.

Furthermore, the anti-inflammatory cytokine IL-10 also appears to influence the outcome of trachoma. It is produced by various cells including Regulatory T-cells and Th2. It counteracts pro-inflammatory responses.

However, IL-10 also opposes the action of the Th1 response mediated through IFN-γ, so may impede the resolution of infection. IL-10 is expressed at increased levels in the conjunctiva of individuals with active trachoma and certain genetic polymorphisms have been associated with increased scarring, although their functional significance is uncertain.[42,53]

Finally, matrix metalloproteinases (MMP) are a family of proteolytic enzymes which are central to the regulation of the extracellular matrix and have been implicated in many scarring disorders. They degrade the ECM and facilitate scar contraction. The expression of MMP-9 is elevated in the conjunctiva with active trachoma, becoming more marked with increasing severity of inflammatory disease.[42] A SNP in the catalytic domain of MMP-9, possibly resulting in reduced function, is associated with a reduced risk of scarring complications in trachoma.[54]

The detection of *Chlamydia trachomatis* infection is problematic. Operationally, trachoma control programmes rely on the clinical signs of disease for diagnosis. However, for research studies, it is often important to know the individual infection status. Various diagnostic tests have been used to detect *Chlamydia trachomatis*, but there is no 'Gold Standard' test.[55,56] The earliest method was Giemsa staining of smears of conjunctival cells to demonstrate the chlamydial inclusion body. This allows assessment of the adequacy of the specimen, it is specific but lacks sensitivity.[55,56] The sensitivity of microscopy can be increased by direct immunofluorescence with monoclonal antibodies to Chlamydia trachomatis antigens. [55,56] Chlamydia trachomatis can be grown in cell culture from clinical specimens and then

detected by microscopy. This approach confirms the viability of the organism; however, it requires stringent conditions and also lacks sensitivity.[55,56] Enzyme-linked immunoassays are commercially produced which detect chlamydial antigens; however, these have moderate sensitivity and cross-reaction with other bacteria is reported, reducing specificity. [56]

Nucleic acid amplification tests, such as polymerase chain reaction (PCR), are the current favoured modality for *Chlamydia trachomatis* detection.[56]

These latest tests are both highly specific and sensitive, identifying significantly more individuals harbouring *Chlamydia trachomatis* in endemic populations than previously recognized. However, they are not appropriate for non-research use due to expense and complexity. Considerable care needs to be taken in the collection and processing of conjunctival swab specimens to avoid contamination leading to false positive results. Recently quantitative real-time PCR has been used to measure the load of *Chlamydia trachomatis* infection in members of trachoma endemic communities to better define the major reservoirs of infection and monitor response to treatment.[57-60]

To better understand the difficulties in treating and eliminating trachoma, it is crucial to consider the complex relationship existing between disease and infection, with a mismatch between clinical signs and detection of *Chlamydia trachomatis*: active trachoma without detectable *Chlamydia trachomatis* and conversely *Chlamydia trachomatis* detected in clinically normal individuals.[61]

There are several contributory reasons for this mismatch. First, there may be an 'incubation period' during which infection is present but disease has not yet developed.

Secondly, the resolution of signs of disease lags behind the resolution of infection, often by many weeks.[62] The duration of both disease and infection episodes are modified by age, lasting longer in children. Thirdly, it is possible that a sub-clinical persistent form of infection may develop under certain

conditions in which the organism is not replicating but lies dormant and may not provoke the disease.

Fourthly, the signs of conjunctival inflammation are not exclusive to trachoma and could be initiated by other pathogens.

Finally, the presence of detectable chlamydial antigen or DNA does not necessarily equate to an established, replicating infection. Tests may be positive as a result of a transient inoculation of the conjunctiva with *Chlamydia trachomatis* following close contact with a heavily infected individual or the activities of eye-seeking flies.

Quantitative PCR for omp1 (a single copy gene on the *Chlamydia trachomatis* chromosome) has been used to determine the relative load of infection in members of trachoma endemic communities.[57-60] The distribution of infection load is skewed; the majority of infected individuals have relatively low infection loads, whereas a smaller number have high loads. The highest infection loads are generally found in children, especially those with intense conjunctival inflammation.

The absence of a "Gold Standard" diagnostic procedure and the existence of difficulties in the detection of the infection represent a significant problem for trachoma control programmes, which rely on signs to guide antibiotic treatment and to follow the host response in the disease process.

The clinical picture of trachoma may vary from a very mild eye disease, with minimal symptoms and signs, to severe, chronic inflammation leading to blinding cicatricial eyelid deformities and corneal scarring. The patient can be a child with mildly irritable and red eyes, although often the condition is apparently asymptomatic. There may be associated discharge which usually indicates secondary bacterial infection. More severe, active disease will present with obviously red eyes, eyelid and conjunctival oedema, irritation, sometimes pain and photophobia. Blurring of vision may be associated with a

muco-purulent discharge present on the cornea or involvement of the corneal epithelium in the disease process.

Long-standing trachoma with eyelid scarring causes trichiasis, where eyelashes are turned inwards and rub on the cornea and bulbar conjunctiva. Entropion and trichiasis, together with corneal scarring, are usually found in adults and more commonly in women. However, older children may also show features of the later scarring complications.

Trichiasis is often associated with entropion, where the eyelid margin, distorted due to scarring, is turned inwards against the eyeball. In trachoma this typically affects the upper eyelid.

In 1987, the World Health Organization published a simplified system for the assessment of trachoma and its complications.[63] This simple grading system describes the progression of eye disease, and its severity (Fig. 1). It is useful for diagnosing trachoma in a particular individual as well as assessing the magnitude and severity of the problem in communities. The system can also be used to monitor the results of medical treatment and of other control strategies.

The WHO system for assessment of trachoma is as follows:

– **TF** = **T**rachomatous Inflammation – **F**ollicular

This stage is characterized by the presence of five or more follicles, at least 0.5mm in size, on the 'flat' surface of the upper tarsal conjunctiva. Follicles are tiny accumulations of lymphoid cells. They are rounded, slightly raised and usually paler than the surrounding conjunctiva surface, appearing white, grey or yellow. To confirm this grade of the pathology they should be on the flat surface of the tarsal conjunctiva which overlies the tarsal plate. The corners of the everted eyelid and the lower edge of the everted conjunctiva should not be considered in confirming this grade of trachoma.

– **TI** = **T**rachomatous Inflammation – **I**ntense

At this stage, a pronounced inflammatory thickening of the upper tarsal conjunctiva obscures more than half of the normal deep conjunctival vessels. Clinically, the tarsal conjunctiva appears red, rough and thickened with oedema and enlarged vascular papillae. Trachomatous follicles are usually present and numerous although partially or totally covered by the diffuse inflammatory infiltration. There is not yet any evidence of conjunctival scarring.

– **TS** = **T**rachomatous **S**carring

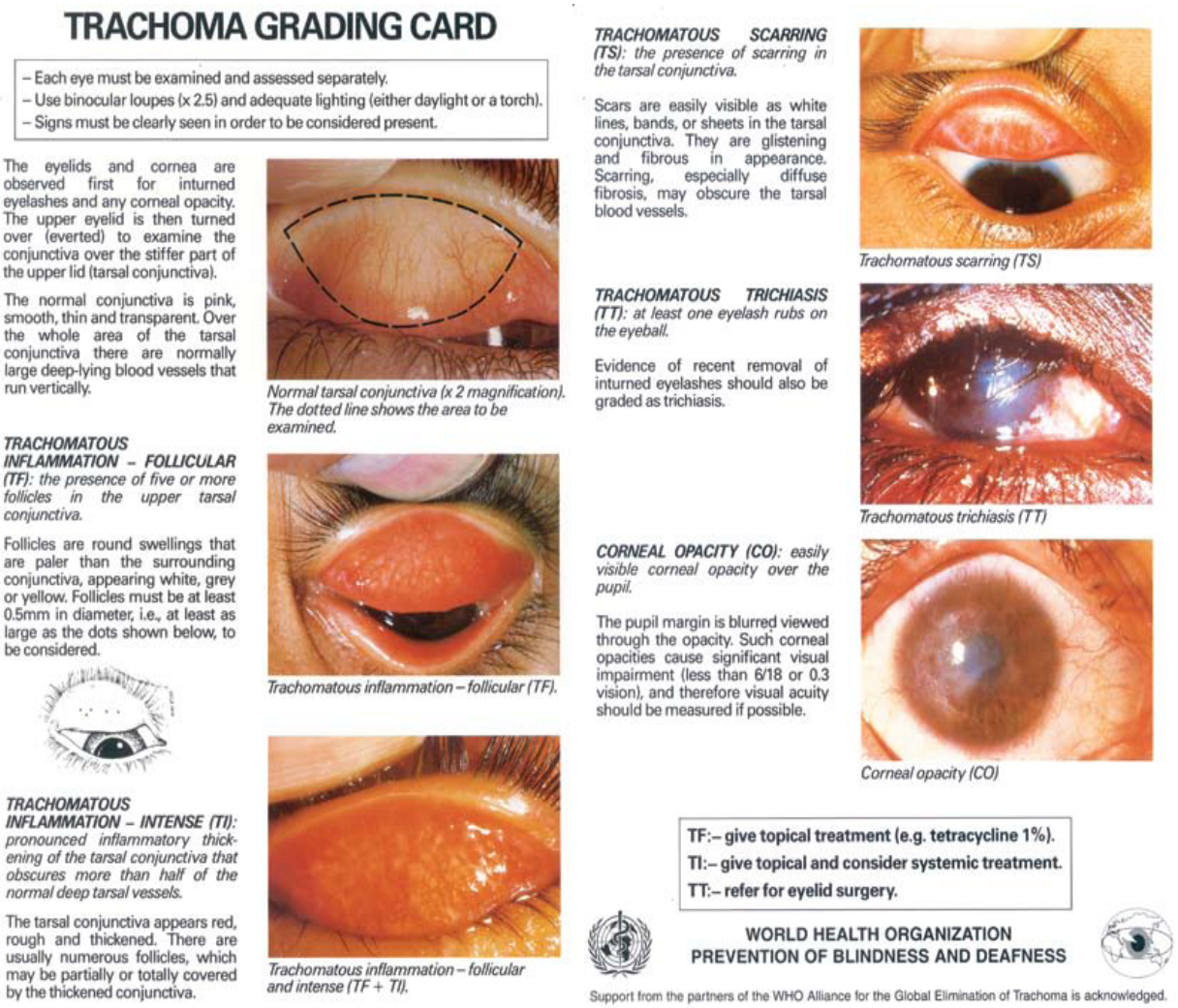
The main sign of this grade is the presence of scarring in the tarsal conjunctiva. Scars are visible white lines, bands, or sheets (fibrosis) which may take a variety of shapes and angles. They are glistening and fibrous, and may obscure the tarsal blood vessels.

– **TT** = **T**rachomatous **T**richiasis

At least one eyelash must rub on the eyeball to diagnosize this grade of trachoma. Trichiasis is the result of the lid margin rotating inward (entropion), as scarring consequence, with one or more lashes abrading the cornea.
Evidence of recent removal of inturned eyelashes should also be graded as TT. In fact, many patients use to remove inturned eyelashes causing ocular irritation, rubbing on the conjunctiva and cornea, by epilation. An epilated eyelash grows again causing incremented eye irritation in about 4 to 6 weeks. This is one of the very irritating and painful stages of trachoma with constant scratching on the sensitive cornea.

– **CO** = **C**orneal **O**pacity

This sign refers to the presence of central corneal scarring so dense to blur or obscure at least part of the pupil margin causing significant visual impairment (less that 3/18 or 3/10). It is normally seen in people aged 20 years or more.



TRACHOMA GRADING CARD

– Each eye must be examined and assessed separately.
– Use binocular loupes (x 2.5) and adequate lighting (either daylight or a torch).
– Signs must be clearly seen in order to be considered present.

The eyelids and cornea are observed first for inturned eyelashes and any corneal opacity. The upper eyelid is then turned over (everted) to examine the conjunctiva over the stiffer part of the upper lid (tarsal conjunctiva).

The normal conjunctiva is pink, smooth, thin and transparent. Over the whole area of the tarsal conjunctiva there are normally large deep-lying blood vessels that run vertically.

Normal tarsal conjunctiva (x 2 magnification). The dotted line shows the area to be examined.

TRACHOMATOUS INFLAMMATION – FOLLICULAR (TF): the presence of five or more follicles in the upper tarsal conjunctiva.

Follicles are round swellings that are paler than the surrounding conjunctiva, appearing white, grey or yellow. Follicles must be at least 0.5mm in diameter, i.e., at least as large as the dots shown below, to be considered.

Trachomatous inflammation – follicular (TF).

TRACHOMATOUS INFLAMMATION – INTENSE (TI): pronounced inflammatory thickening of the tarsal conjunctiva that obscures more than half of the normal deep tarsal vessels.

The tarsal conjunctiva appears red, rough and thickened. There are usually numerous follicles, which may be partially or totally covered by the thickened conjunctiva.

Trachomatous inflammation – follicular and intense (TF + TI).

TRACHOMATOUS SCARRING (TS): the presence of scarring in the tarsal conjunctiva.

Scars are easily visible as white lines, bands, or sheets in the tarsal conjunctiva. They are glistening and fibrous in appearance. Scarring, especially diffuse fibrosis, may obscure the tarsal blood vessels.

Trachomatous scarring (TS)

TRACHOMATOUS TRICHIASIS (TT): at least one eyelash rubs on the eyeball.

Evidence of recent removal of inturned eyelashes should also be graded as trichiasis.

Trachomatous trichiasis (TT)

CORNEAL OPACITY (CO): easily visible corneal opacity over the pupil.

The pupil margin is blurred viewed through the opacity. Such corneal opacities cause significant visual impairment (less than 6/18 or 0.3 vision), and therefore visual acuity should be measured if possible.

Corneal opacity (CO)

TF:– give topical treatment (e.g. tetracycline 1%).
TI:– give topical and consider systemic treatment.
TT:– refer for eyelid surgery.

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Support from the partners of the WHO Alliance for the Global Elimination of Trachoma is acknowledged.

Figure 1. Trachoma grading card (http://who.int/blindness/publications/ trachoma_english1)

The TF and TI grade represent the active form of the disease with ongoing trachomatous inflammation.

TS, with or without TT, shows that the patient has, or has had, trachoma. Therefore, these grades are signs of cicatricial trachoma. Presence of trichiasis indicates the potential risk to develop a disabling lesion, as corneal opacity, wich may rapidly lead to blindness.

In public heath the grading of trachoma is also used to assess the importance and diffusion of trachoma in an examined community. In fact the proportion of TF, with or without TI, among children less than 10 years old demonstrates the infection spreading in the community. On the other hand, the proportion of TI in the same range of age indicates the severity of the disease in the community.

The proportion of TS is the measure of the trachoma diffusion in the past, while the number of people with TT indicates the immediate need to provide surgical services for lid correction to avoid disabling lesions. Indeed, the proportion of people with CO shows the impact of trachoma in the community in terms of visual loss.

1.1.1- The SAFE strategy

Medical and surgical treatments of trachoma are decided on the basis of above mentioned grading and are standardized by WHO in the SAFE strategy (**S**urgery for trichiasis, **A**ntibiotics to treat *Chlamydia trachomatis* infection, and **F**acial cleanliness and **E**nvironmental improvement to reduce transmission of *Chlamydia trachomatis* from one person to another) recommended to control trachoma in districts and communities with endemic disease.

The prevalence of TF in children aged 1–9 years is the key index for determining whether an area needs intervention with the A, F and E components of SAFE. The prevalence of TT determines the probable need for surgical services. The prevalence of CO is a rough measure of the burden of blindness and visual impairment due to trachoma.

To better understand the application of the SAFE strategy it is necessary to explain some important principles of trachoma epidemiology and assessment.

A person's risk of trichiasis, potentially cause of blindness, probably increases in relation to the total number, duration and intensity of *Chlamydia trachomatis* infections during his or her lifetime. As a result, trichiasis tends to occur more commonly in women, because they tend to spend more time than men do with children, who are most frequently infected. It also becomes more and more common with increasing age. Implementation of trachoma control activities is prioritized in communities where the prevalence of active trachoma in children aged 1–9 years is 10% or higher or where the prevalence of trichiasis in people aged 15 years and over is 1% or higher.

Places in which trachoma is known to be endemic are shown in Figure 2.

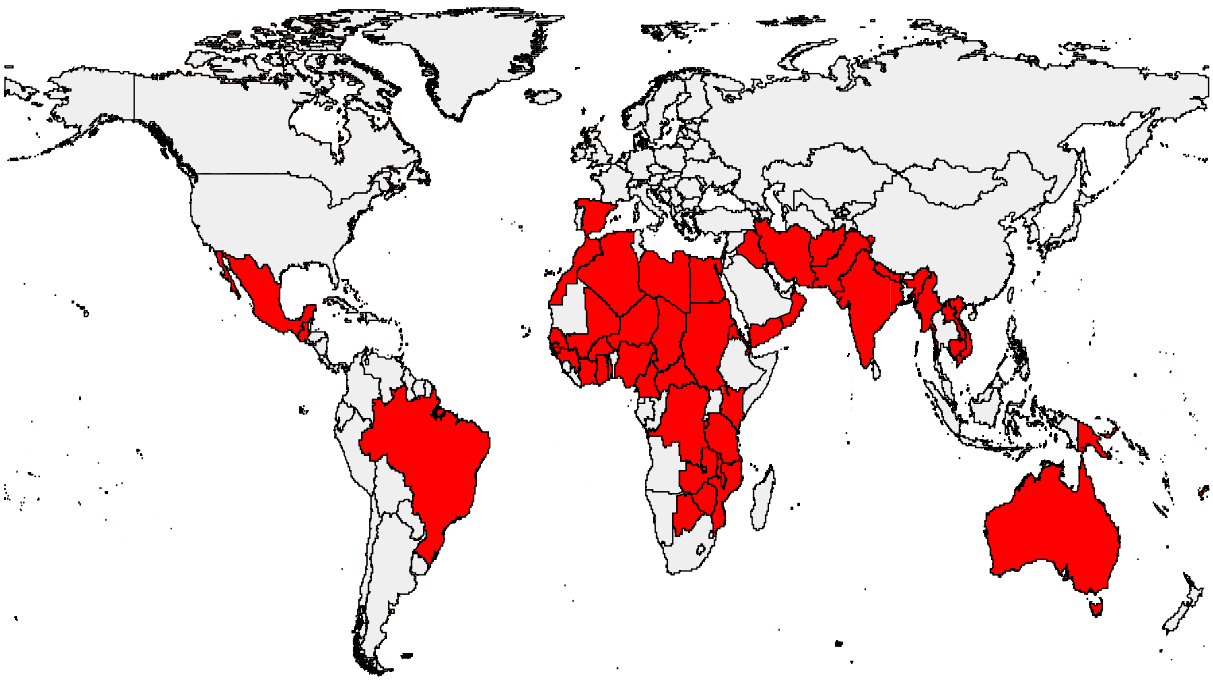

Figure 2. Global distribution of trachoma as a public health problem.

Within many of these areas, however, the distribution of trachoma is focal, affecting certain communities, and within these communities only some households. In some areas, trachoma is a problem in nearly all rural communities.

For both logistical and epidemiological reasons, WHO recommends that the unit of implementation for trachoma control activities be the district. A district generally corresponds to an average population size of about 100,000. To facilitate planning, the burden of disease should therefore be estimated (in the first instance) at the district level.

In districts classified as likely to be endemic for trachoma, the burden of disease is determined. It is not practical to examine each person in the district, as this would take too long and be too expensive. Instead, a survey is conducted, it means that a sample is selected and the trachoma status of each person in the sample determined. The prevalence in the sample approximates the prevalence in the population if the sample is sufficiently large and has been selected appropriately to be representative of the population as a whole.

The size of the sample is usually chosen to allow determination of the prevalence of TF in 1–9-year-old children with an acceptable degree of certainty. Children aged 1–9 years are used as the standard because the prevalence of TF is highest in this age group. The prevalence of TT is also measured, but, because the prevalence of this sign is generally less than 5% in most endemic areas, the certainty of the estimate will be much lower.

Once the required sample size is evaluated on the basis of epidemiological rules, and, from that, the number of clusters to be examined is calculated, the clusters are selected following a method of probability proportionate to size.[64]

In each cluster, households are randomly selected from the list requested to the community opinion leaders, and include in the survey all 1–9-year-old children and people aged 15 years or more who are resident in the household

are included in the survey. Continue random sampling until the required cluster size of 1–9-year-old children is obtained. If a list of households cannot be obtained, and the random sampling is not feasible, households are selected by a random walk.

All children aged 1–9 should be examined for TF and all peopple aged 15 years or more for TT and CO.

For the SAFE strategy, it is also important to determine whether there is a latrine and ask how long it takes in the dry season to walk from the house to the place where water is collected in each household sampled.

As comprehensive assessment of trachoma takes a long time and is expensive, the Trachoma Rapid Assessment (TRA) is sometimes used. It is a method endorsed by WHO.[65] It is a simple, fast, cheap way for setting priorities for trachoma control. Districts and communities in which trachoma is likely to be endemic are selected as described above, and the communities are visited.

During the visit, persons who may have TT are identified by consultation with village informants. The total number of persons who have or who are suspected to have TT is divided by the total population of the village to obtain a crude estimate of the prevalence of TT in the community. In addition, the eyes of 50 1–9-year-old children are examined. These children are chosen from 20 households that appear to have the lowest socioeconomic status in the community. The percentage of the 50 children who have active tracoma is then calculated.

It is important to underline that the TRA protocol does not provide a good estimate of the prevalence of TT in a community, because persons suspected of having this condition (but not examined) are assumed to have it. The protocol is also specifically designed to overestimate the percentage of children with active trachoma. TRA indicates only whether trachoma is likely

to be a problem in a given community and therefore whether further comprehensive assessment and intervention are needed.

On the basis of the SAFE strategy, if the baseline district prevalence of TF in 1–9-year-old children is 10% or greater, antibiotic treatment of all residents should be undertaken annually for 3 years. After these three treatments, a repeat district survey should be carried out.

If the district prevalence of TF in 1–9-year-old children is still 10% or greater, annual mass treatment should be continued.

If the prevalence is less than 10%, surveys should be conducted to determine the prevalence at community level. Then, in communities in which the prevalence is less than 5%, treatment can be stopped; and in communities in which the prevalence is 5% or greater, annual treatment should continue until such time as it falls below 5%.

If the baseline district prevalence of TF in 1–9-year-old children is less than 10%, the prevalence should be determined at community level.

- In communities in which the baseline prevalence is 10% or greater, mass treatment should be undertaken annually for 3 years. A repeat survey should be carried out after 3 years.

  Then, in communities in which the prevalence has fallen below 5%, treatment can be stopped. In communities in which the prevalence is 5% or above, annual treatment should continue until such time as it falls below 5%.
- In communities in which the baseline prevalence is 5% or greater but less than 10%, F and E interventions should be implemented (without antibiotic treatment) for 3 years. A repeat survey should be carried out after 3 years. If the community-level prevalence has fallen below 5%, active trachoma control interventions can be discontinued.

If the community-level prevalence is 5–10%, F and E interventions should be continued for another 3 years.

In communities in which the baseline prevalence is less than 5%, implementation of the A, F and E components of SAFE is not a priority.

After antibiotic treatment is stopped, the prevalence of TF in children should be measured twice, at two 3-yearly intervals.

WHO currently recommends two antibiotics for the control of trachoma: 1% tetracycline eye ointment and azithromycin.

Tetracycline eye ointment can clear ocular *Chlamydia trachomatis* infection if administered to both eyes twice daily for 6 weeks, and is almost universally available. It is, however, difficult and unpleasant to apply, so compliance is often poor.

Azithromycin clears ocular *Chlamydia trachomatis* infection with one oral dose (20 mg/kg body weight) and is well tolerated by both children and adults, but is relatively expensive. If azithromycin is available, trachoma control programmes are encouraged to choose it as their first-line antibiotic, with small quantities of tetracycline eye ointment for children under 6 months of age. If azithromycin is not available to the programme, tetracycline eye ointment should be offered to all persons who need antibiotics.

Achieving high antibiotic coverage, at least 80%, is critical to the effectiveness of the 'A' component of SAFE.

The health promotion is required to ensure that transmission of trachoma remains low. In particular, it plays a crucial role in: educating people about trachoma and how it is spread; encouraging acceptance of surgery; increasing acceptance of antibiotics; encouraging facial cleanliness; promoting a clean environment; and creating demand for household latrines.

Infection transmission occurs through direct contact, either between contaminated fingers of infected children and healthy ones or through cloths

or towels used to wipe away eye or nose secretions from children and adult faces, or by eye-seeking flies. In fact, flies pick up the disease-causing organism from eye and nose discharges of infected people and transmit the germs moving to non-infected eyes. Flies implicated in trachoma transmission are also attracted by human and animal excreta, domestic waste, and some types of foods.

A further environmental factor associated with transmission is overcrowding in homes where the same bed, bed sheets and pillows are shared.

Personal and environmental hygiene have been identified as crucial determinants in reducing the spread of trachoma. In countries and communities where significant improvements in personal hygiene, water supply and disposal of human and animal excreta and domestic solid waste have occurred, trachoma has ceased to be a public health problem. They all need to be included in interventions aiming at the sustainable and long-lasting reduction or elimination of blinding trachoma.

A variety of materials can be used in health promotion, as posters, radio messages, flipcharts, booklets.

The "F" component is evaluated as number of communities that have received health promotion in the examined year.

The 'E' component of SAFE aims to reduce transmission of *Chlamydia trachomatis* by promoting better personal and environmental hygiene. To do this, the access of large populations to latrines (or other methods of safe disposal of faeces) and water must be improved.

Latrines will improve environmental cleanliness only if they are used consistently by a large proportion of the community. As a priority, water and latrines must be readily available to primary schools throughout the area. If they are available and appropriately maintained in schools, schoolchildren can be taught face washing habits and latrine use that they will both transmit to their families and retain themselves for the rest of their lives.

Adequate coverage for household latrines should be 80% of households either having a functional latrine or using other methods of safe disposal of faeces.

Adequate coverage for water should be 80% of households in the district that are within 1 km (a 15- min walk one way) of the nearest point from which water is available during the dry season. As the water used for face-washing does not need to be drinkable, surface water points should be considered.

For treatment of TT, WHO recommends the bilamellar tarsal rotation procedure. There should be at least 1 experienced TT surgeon providing TT surgery in each district in which TT is a public health problem. In nearly all trachoma-endemic countries, there are too few ophthalmologists and a large backlog of TT patients. As a result, most programmes train non-ophthalmologists as TT surgeons, as nurses or medical assistants who have good surgical skills.

Effective case finding is essential to the success of the 'S' component of SAFE. At least one trusted resident of each trachoma-endemic community should be trained to identify people aged 15 years or more with TT .

For each case, the surgeon must record the patient's general information sufficiently detailed to allow the surgeon tofind the patient again for the follow-up. He or she must record the number of lashes touching the globe, the presence (and area) or absence of corneal opacity for each eye, and visual acuity in each eye separately before and after surgery.

At 1 year, the patient should be seen again. Visual acuity should be measured and both eyes examined for recurrent or incident (in an unoperated eye) TT.

To ensure good TT surgery with a low incidence of recurrence, surgeons' technique and results should be checked regularly.

To mantain adequate proficiency, WHO recommends that each surgeon performs at least 10 operations per month. If they fail to do so for 6

successive months, their technique should be supervised by an experienced TT surgeon before they begin again.
Obviously, the presence of CO and its consequences on the visual acuity should be clearly explained to patients in order to avoid the false expectation of a *restitutio ad integrum* after TT surgery. For this reason, it is important to record also TT surgery refusal cases.

1.1.2- Surveillance System

As the main objective of the SAFE strategy is to eliminate blinding trachoma and not to eradicate the *Chlamydia trachomatis* infection, it means that the ultimate intervention goals of this strategy are aimed at controlling the spread of the disease and avoiding its negative consequences.
WHO defines elimination of trachoma as a cause of blindness and a public health problem when there are both a reduction in the prevalence of TT to less than one case per 1000 total population, either a reduction in the prevalence of TF in 1–9-year-old children to less than 5% in each endemic district of an endemic country.
While a number of trachoma-endemic countries have implemented the SAFE intervention strategy to prevent blinding trachoma, often only the "S" and/or "A" components have been adopted. Consequently, success rates result to be low, and infection and disease often re-emerge within a year or two following cessation of mass or targeted antibiotic treatment programs.[59,66-70]
It demonstrates that the provision of antibiotics alone will not control this disease, although use of azithromycin has greatly improved the ease of treatment for trachoma, when compared to use of topical antibiotics.
Postoperative rates of trichiasis recurrence are high even with treatment for *Chlamydia trachomatis* at the time of surgery.[71-74]

Once the elimination targets have been achieved in endemic districts and countries, it is crucial to set up a specific suveillance system to assure that they are mantained under established limits avoiding dispersal of skills, competences and support.

Public health surveillance is the ongoing, systematic collection, analysis, interpretation, and dissemination of data regarding a health-related event for use in public health action to reduce morbidity and mortality and to improve health.[75-77]

The main goal of a surveillance system is to monitor and control trends in endemic diseases in order to evaluate interventions, needs, progress in achieving elimination objectives, and programme performances.

All public health intervention programmes require constant evaluation and feedback on performances to enable programme managers to check the quality and efficacy of activities, to immediately respond to environmental changes, to prioritize the allocation of health resources.

The surveillance system attributes include: simplicity, flexibility, data quality, acceptability, sensitivity, predictive value positive, representativeness, timeliness, and stability.

Because public health surveillance systems vary in methods, scope, purpose, and objectives, attributes that are important to one system might be less important to another. A public health surveillance system should emphasize those attributes that are highest priority for a the system itself and for its objectives.

The public health importance of a health-related event and the need to have that event under surveillance can be described in several ways, and it is influenced by the level of preventability of the disease.[78] Other parameters for measuring the importance of a health-related event and, therefore, the public health surveillance system with which it is monitored, can include: indices of frequency and summary measures of population health status (e.g., quality-

adjusted life years (QALYs), years of healthy life (YHLs), and disability-adjusted life years (DALYs)); indices of severity (e.g., bed-disability days, case-fatality ratio, and hospitalization rates and/or disability rates); disparities or inequities associated with the health-related event; costs associated with the health-related event; potential clinical course in the absence of an intervention; and public interest.[79-80]

A functional surveillance system has to be integrated with other surveillance and health information systems. Streamlining related systems into an integrated public health surveillance network enables individual systems to meet specific data collection needs while avoiding the duplication of effort and lack of standardization that can arise from independent systems.[81]

The public health surveillance system should operate in a manner that allows effective to dissemination of health data so that decision makers at all levels can readily understand the implications of the information.[77]

A formal certification process validating that a country has achieved elimination is a critical part of any large-scale elimination program.

Once a country has met criteria for elimination, the country may begin the Pre-notification process. This phase marks the beginning of the certification process.

Surveillance is an essential part of assurance that trachoma is under control and Certification for elimination is valid (Table 2).

Thus, elimination documentation must include evidence of public health surveillance for trachoma and trichiasis cases, and systems for management of outbreaks and surgical cases. Such systems must be in place in all previously endemic districts, with demonstrated efficacy. Elimination documentation may include evidence that the district routine surveillance reports are received by a national committee in a timely fashion, that investigations of outbreaks have occurred shortly after discovery, and follow up procedures instituted.

Whatever the approach to surveillance that is adopted, there must be validation of the surveillance system. Validation must include the following: evidence that the system would detect an increase in active trachoma, where it to occur, or a problem with underserved trichiasis cases; that this information would trigger a response by the health care system to rectify the problem; and there is adequate follow up to assure that the problem has been solved.

After the Notification Report has been accepted and the interim period has passed, a country may submit a formal request for Certification in the form of a Certification Report. An update of the country trachoma control program and how it has been incorporated into the existing health care system since the original materials were submitted will also be important. The final materials are submitted in support of the request for Certification, and supplement the original materials.

After the certification requirements have been submitted, the WHO will arrange an ICT of international experts who will work with the Ministry of Health officials to review documents, interview public health professionals, perform hotspot checks, identify any new issues such as mass immigrations, and then make recommendations.

1. **National Team submits Certification Report requesting formal certification.**

   Report includes:

   - Certification Survey
   - Update on Surgery capacity
   - **Data from on-going surveillance**
   - Evidence regarding sustainability, including progress towards Millennium Development Goals (MDG's).

2. **Report and results reviewed by International Certification Team, which sends final report to International Commission for Certification of Trachoma Elimination at WHO.**

3. **If results adequate, Certification granted.**

Table 2. Certification process

1.2- The World Health Organization

The World Health Organization is a specialized agency of the United Nations established in 1945. It is a goal-oriented organization working to meet clearly defined objectives. At the moment, 193 countries and two associate members are WHO's membership.

The main objective of the World Health Organization is the attainment by all peoples of the highest possible level of health.

In order to achieve its objective, the WHO: establishes and maintains effective collaboration with the United Nations, specialized agencies, governmental health administrations, professional groups and such other organizations as may be deemed appropriate; assists Governments, upon request, in establishing or strengthening health services furnishing appropriate technical assistance and, in emergencies, necessary aid; stimulates work to eradicate epidemic, endemic and other diseases; promotes the improvement of nutrition, housing, sanitation, recreation, economic or working conditions and other aspects of environmental hygiene; develops, establishes and promotes international standards with respect to diagnostic procedures, and to food, biological, pharmaceutical and similar products. All these functions include : advocacy of measures to improve health; stimulating and mobilizing specific health action and disseminating information; developing norms and standard, plans, and policies; training; research promotion; direct technical consultation; and resource mobilization.

Finally, WHO experts produce health guidelines and standards, and help countries to address public health issues. WHO also supports and promotes health research. Through WHO, governments can jointly tackle global health problems and improve people's well-being.

The relevant plans of action are determined by general programs of work outlining for each six-year period a global health policy framework as well as a framework for WHO' s action.

The main objective of the Prevention of Blindness Department (PBL) in WHO is to promote health policies to prevent avoidable blindness as endorsed by the 56.26 Resolution of the World Health Assembly (WHA) in May 2003 (Annex 1). The WHO/PBL team works with Member States through WHO regional offices to develop strategies for prevention and control of blindness and visual impairment. Team members, together with many partners in the field, including NGOs and WHO collaborating centres, work with country-based teams to support the implementation of relevant strategies. In addition, to facilitate ongoing strategic planning, the PBL team co-ordinates the collection and dissemination at national, regional, and global levels of data that reflect the burden of visual impairment and the implementation of program strategies.

Effective eye health promotion specifically involves a combination of the three area of health promotion action: health education, directed at behaviour change to increase adoption of prevention behaviours and uptake of services; improvements in health services such as the strengthening of patient education and increased accessibility and acceptability; and advocacy to improve political support for blindness prevention policies.[82]

The role of human behaviour and the scope for prevention depends on the specific disease: for conditions such as trachoma, eye injuries, vitamin A deficiency, and sexually transmitted diseases there is considerable scope for primary prevention.

Secondary prevention involving recognition of symptoms and early presentation for treatment is appropriate for other conditions as cataract, trichiasis, eye infections, and leprosy.

Even when the intervention is mass treatment (for example, for the control of onchocerciasis and trachoma), willingness by communities to take up these services is key in determining the success of the program.

Many influences on behaviour including culture, economics, power, and tradition operate at the community level. A community based program is one which works within a geographically defined area, takes into account influences that operate at community level, and seeks to involve community members in the decision making process and in implementation.[83]

Health education should take place alongside improvement in services. Improvements should address locally identified barriers, which might include quality of clinical care as well as all the other non-clinical aspects of care as: timing of clinics and operating sessions; separate waiting areas for men and women; provision of culturally acceptable food and prayer areas; cleanliness of environment.

The quality of information provided to patients is crucial to promote adherence to treatment regimes and follow up, to increase awareness of possible side effects and action needed to prevent recurrence.

Successful patient education may involve a range of approaches including teaching in groups, using videos in waiting areas, training lay people as counsellor/peer educators, involving other family members, training clinic staff to give clear and relevant advice supported with leaflets or charts.[84-86]

Advocacy includes all activities designed to raise awareness of the importance of blindness prevention among policy makers and planners, to increase resources for blindness prevention, and for the integration of blindness prevention into other programs. Advocacy can also lead to enactment and enforcement of laws ensuring ‘‘the right to sight’’.

Advocacy can take place at every level. One of the most notably success for advocacy at the international level has been the adoption by Member States of the resolution WHA56.26.

The WHA56.26 refers, among the others, to a previous resolution , the WHA 51.11, adopted in 1998 to eliminate blinding trachoma by the year 2020 (Annex 2). To this end the WHO Alliance for the Global Elimination of Blinding Trachoma by the year 2020 (WHO-GET 2020 Alliance) was formed with the participation of representatives from WHO, National blindness control programmes from endemic Member States, nongovernmental organisations (NGOs) working in the field, and academic institutions. The WHO-GET 2020 supports and collaborates with WHO in carrying out essential activities such as epidemiological assessment, including rapid assessment and mapping, project implementation, coordination, and monitoring, disease surveillance, project evaluation and resource mobilization.

2. PROJECT OBJECTIVES

The cooperative effort made at the international level to reach the objective of global elimination of blinding trachoma by the year 2020, has resulted in effective activities at national and community level. WHO/PBL has been able to scale up the internal political support to national trachoma programs and to expand the implementation of the WHA51.11 Resolution.

As some endemic countries are approaching the ultimate intervention goals of the elimination, WHO/PBL was requested to support the development of a methodology for post-endemic trachoma surveillance to reveal a possible trachoma re-emergence but also to have in place one of the solicited element to apply for the certification process.

The main objectives of this project were:

1. to organize and hold an expert meeting in order to set up an efficient national post-endemic surveillance system with minimum requirements;
2. to identify at least two countries that are approaching the ultimate intervention goals for the elimination;
3. to develop, with the support of WHO/PBL, a national plan for post-endemic trachoma surveillance in the selected countries.

3. MATERIALS AND METHODS

3.1- Expert Meeting

A meeting of experts in trachoma and public health was held at the headquarters of the WHO in Geneva, Switzerland, from 4 to 5 November 2008. The meeting was attended by 18 participants (Annex 3) and was focused on development of a methodology for the establishment and implementation of post-endemic surveillance system for blinding trachoma. In particular, the purpose of the meeting was to advise and recommend to WHO-GET2020 a set of actions to be suggested to Member States in order to set up an efficient national post-endemic surveillance system with minimum requirements to monitor the situation in terms of trachoma re-emergence and provide evidence to move forward to the attainment of the WHO certification of achieved elimination of blinding trachoma, as defined in WHA 51.11.
To attain the meeting objective, participants were requested to: review the principles of surveillance; consider the experiences of countries that are into surveillance, as Morocco and Oman; challenge the feasibility of surveillance systems in least developed health systems; and frame the surveillance system in the neglected tropical diseases interventions.

3.2- Country Selection

Each year the WHO-GET2020 Alliance organizes a four-days meeting with the participation of all partners, relevant NGOs, and Member States Representatives in order to discuss and monitor the trachoma elimination around the world. All Member States Representatives are invited to report the trachoma elimination status in their own country. For this reason, they are

requested to fully compile the Trachoma Data Form (TDF, Annex 4) presenting the trachoma distribution and the activities in place.

During the yearly meeting all participants can consult the above mentioned TDFs, a selected list of Member States describe the current own country situation, with particular attention to succes stories or specific problems and relevant causes, all data are discussed, and implementation strategies are planified.

The official TDF information is used by WHO/PBL for trend analysis, program and political support, and advocacy. These data have also been used to select countries in which develop trachoma post-endemic surveillance system.

Since the institution of WHO-GET2020 Alliance two countries, Oman and Morocco, have attained the ultimate intervention goals for the blinding trachoma elimination with evident reported data. Both countries have set up impressive trachoma surveillance system to monitor and control coverage achievements.

Some countries, as Mexico, have only few endemic areas in limited and well-known regions. Among the others with completed and updated information, Ghana is reaching all the objectives for the elimination in the endemic districts; while Mali is approaching in five endemic districts the requested prevalence for TF and TT.

3.3- National Plan Development

The Prevention of Blindness and Trachoma Program managers of Ghana and Mali informed the respective Ministry of Health concerning the attainment of trachoma interventions, as mentioned above, and WHO/PBL was requested to technically assist the country in developing a national plan for post-endemic trachoma surveillance.

Two missions were planned in Mali to technically support the program coordinator in establishing indicators and methodology to develop the surveillance system national plan and to present the finalized official document to the Representatives of the interested regions.

A single mission was organized in Ghana to contribute to a national meeting with participation of: coordinator of the Eye Care Unit of Ghana Health Service, other persons in charge for the prevention of blindness activities in the country, the deputies of the endemic districts, the Deputy Director of Disease Surveillance and Disease Control.

4. RESULTS

4.1- Expert Meeting Report and Recommendation to WHO

Two working days were used to present and discuss the different approaches and possibilities in developing minimum requirements methodology in multiform cultural, political and economic behaviours.

A perfect example of well functional surveillance system in place is Oman.

Oman is on the verge of applying for certification of the elimination of blinding trachoma and has appointed a team to conduct the certification process. Oman began surveillance for trachoma in 1983.

Oman is a Member State of the WHO Eastern Mediterranean Region with 11 health regions divided into 61 districts (*wilayats*), and the 175 Ministry of Health institutions have well-demarcated catchment areas. The eye health care program is conducted under the guidance of a national eye health care through numerous optical and cataract clinics. The Ministry of Health has one tertiary hospital and nine regional hospitals, 21 eye clinics with ophthalmologists for outpatient care, and 163 primary health care centers where the physicians are trained in primary eye care. There are also private health and eye care facilities, and a nongovernmental organization, Al Noor Association for the Blind, supports many activities to combat blindness.

Education is free and school enrolment is 100% at the primary and 80% at the secondary level. Each year, all primary schoolchildren (around 45 000) undergo a comprehensive eye screening, and prevalence rates for TF and TI in children aged 6–7 years are generated. The households of all the children with active trachoma are visited and family members are screened for TF, TS and TT (1200 persons in 2007). All cases of active trachoma are treated with azithromycine.

Information related to the 0-5 year olds are collected during the campaign for vaccinations. Otherwise, the entire population is screened and followed through primary health care centres (that are compulsory the same for all life); that means that they are screened for trachoma (TF, TS, and TT) during the first visit independently by the reason of the visit.

Health care facilities implement a surveillance system that comprises notification on a monthly basis of all cases of TF and TT presenting for care.

Regular surveys have also been undertaken.

There is a clear and regular flow of computerized trachoma surveillance information from the periphery to the centre and to the international level.

Trachoma control, including the importance of face-washing, is incorporated in the school curriculum, and health education campaigns are conducted weekly in schools and also for adults. Activities related to the "E" component are integrated in those aimed at the attainment of the Millennium Development Goals. In schools, quality of water, ventilation, illumination and sanitation are checked twice a year. Such efforts may be sufficient to monitor the "F" and "E" components, without specific activities related to trachoma control.

Surveillance has helped Oman to monitor the reduction of trachoma and progress towards the elimination of blinding trachoma. It also helps in identifying trouble spots, in generating internationally acceptable indicators and timely action in pockets of high endemicity, and in appealing for additional funding from higher government authorities. It has also highlighted areas where resurgence was occurring. The Oman program shows that surveillance for active trachoma can be incorporated in health, eye-care and school-based programs, and in communicable disease surveillance.

In the final discussion was important to consider that Oman is a country in transition from developing to developed, and noncommunicable diseases are becoming a burden. Its primary health care and eye care systems are well

developed and provide a good model for others. Several surveillance and monitoring functions – detection, analysis, data management, and reporting – are common to all health programs.

Experts were requested to consider the feasibility and applicability of the methodology also in countries in economic and social conditions totally dissimilar.

Niger has 7 regions and a population of around 13 million, with an under-5 mortality rate (2007) of 176 and a life expectancy of 47 years. Only 52% of the population has access to safe water, and in 1987 the prevalence of blindness was 2.2%.

Ophthalmic human resources are inadequate in number and distribution, in particular 7 of the 10 existing ophthalmologists (1/1,388,256 vs. 1/500,00 recommended) work in Niamey and 25 of the 40 nurses (1/347,064 vs. 1/100,000 recommended) practise in the capital. The active cataract surgeons are 2 in all the country.

Estimation for active trachoma undertaken between 1999 and 2001 indicated a prevalence: from 5% to 8% in the region of Agadez and in Niamey; from 20% to 50% in three regions; and >50% in the remaining three regions (Diffa, Maradi, Zinder).

A trachoma control strategy was developed in 2001 and an impact survey conducted after 3 years of SAFE strategy implementation in Zinder region showed that TF/TI prevalence was reduced from a range between 26.4% and 63.8% at baseline to a range between 4.9% and 31% after SAFE strategy implementation; while prevalence of TT was reduced from a range between 1.2% and 7.7% at baseline to a range between 0.04% and 2.3% after implementation.

Since 2001, an integrated diseases surveillance sentinel system was developed in Niger with coordination at national level. Unfortunately, the Prevention of Blindness Program is not informed on the results of surveillance

activities and is affect by a lack of financial resources to assure the needed impact in eliminating blinding trachoma.

And yet, Ethiopia has a population of around 83 million with a life expectancy of 53 years. Forty-two percent of the total population has access to drinking-water, and only 11% has improved sanitation facilities.

A national survey on the visual impairment undertaken in 2006, showed a prevalence of blindness of 1.6% and a prevalence of low vision of 3.7%. People affected by avoidable blindness were 1,049,198.

Trachoma is the second cause of blindness and it is endemic in 529 of the 611 districts with a population at risk estimated at 65 million. Prevalence of active trachoma was higher in Amhara (63%), Oromia (41%) and SNNPR (33%). TF prevalence in children aged 1–9 years was of 40%, while 1.3 million of TT cases were detected in aged>15 years.

Federal Ministry of Health coordinates the National Committee for the Prevention of Blindness. Primary eye care units are 47, ophthalmologists are 103 (60% in the capital) and ophthalmic nurses are 96. Personnel are trained every year to improve their number in the country.

Although national and regional review meetings involving all stakeholders are organized every year, data collection and flow of standardized trachoma information are irregular and incomplete.

Last country profile analysed was Zimbabwe. It has an area of just under 400,000 km^2 with 10 administrative provinces and a population of around 11 million, 65% living in rural areas.

Since 2000, the country's infrastructure of one of the most stable economies in Africa has been decimated by socioeconomic crisis. Gross domestic product growth in 2007 was < 5.7%. Poverty affects 80% of the population with an unemployment rate around 85%.

The economic crisis restricted medical activities due to: inadequate government budget allocation; lower personnel interest due to poor

remuneration and working condition; community economic difficulty in accessing to health care services.

Trachoma seems to be confined to north-east and south areas with 50% of population at risk. Reliable data are insufficient due to lack of ophthalmologist and eye-care trained personnel in rural areas.

The current status of disease surveillance system is mainly passive with hospital admission and outpatient record evaluation.

Taking into account all the multiple information obtained by Member State Representatives, at the end of the meeting the participants adopted a list of conclusions and proposed the following recommendations to WHO-GET 2020:

1. Countries should start planning as early as possible for trachoma post-intervention surveillance as part of their blinding trachoma elimination plan, taking into account existing national surveillance systems.

   WHO is requested to issue guidelines for the establishment and management of such surveillance in different settings.

2. Experience from ongoing programs shows that surveillance is not necessary in countries where the trachoma rate is >45-50%. Surveillance should start in countries or part of the endemic districts where ultimate intervention objectives of SAFE strategy are reaching or approaching.

   As trachoma programs develop, prevalence data at the district and then community level should be collected.

   When the district-level prevalence of TF in children aged 1–9 years is <10%, a community-by-community approach to assessment and intervention is recommended. If school enrolment is very high (>90%)

and district-level prevalence of TF in children 1–9 years of age is between 5% and 10%, trachoma surveys in schools may be useful to identify "hotspots" that need trachoma intervention, in addition to but not replacing population-based surveys.

- In communities in which the baseline prevalence is 10% or greater, mass treatment should be undertaken annually for 3 years and F and E components should be put in place or implemented. A repeat survey should be carried out after 3 years.
- In communities in which the baseline prevalence is 5% or greater but less than 10%, F and E interventions should be implemented (without antibiotic treatment) for 3 years. A repeat survey should be carried out after 3 years.

If the district-level population-based survey or the district prevalence of TT in persons aged 15 years or more is <0.1% TT surgery should be performed within routine eye care.
If the TT prevalence is > 0.1% TT cases should be detected and managed in an active manner.

3. Once a country has met criteria for elimination, it may apply to the WHO for certification, entering in the pre-certification phase. During this interim period of 3 years, surveillance must be in place.
Rationale for surveillance would be:

- to justify stopping treatment and to evaluate re-emergence of TF in place where it was under control at the end of the SAFE strategy implementation;

- to demonstrate that routine eye care services are managing incident and recurrent TT cases and monitoring incidence to detect any increase in blinding disease.

4. Trachoma surveillance for TF prevalence should be conducted in 2 selected communities (with 1,000-2,000 habitants each) per endemic district per year biased to the least developed and suspected most endemic. The selected sites should rotate annually. If the selected districts have more than 200,000 habitants, the sentinel sites to evaluate in those districts shall be 4.
The evaluation must involve all school entrance-aged children where attendance is >90% and there is no gender bias. In the other cases the investigation should be conducted on a minimum of 50 children in the community (5-6±2 years of age), but if it is feasible all children in the community should be examined.

- If the response to the examination is a TF<5% no actions are required.

- If the response to the examination is a TF >5%, all children aged 1-9 year olds should be examined and all the positive cases should be treated and their families and neighbours should be investigated and treated.
  In these cases the examination should be also extended to nearby villages. Facial cleanliness and environmental change must be verified and implemented.
  If TF >5% in all the community 1-9 year olds, AFE coverage should be assessed and the entire community should be treated.

All school entrance aged children in all the surrounding sub-district communities should be examined and in TF results to be >5%, AFE strategy should be re-implemented for 3 years in the sub-district area and the situation evaluated at the end of this period.

5. Trachoma surveillance for TT prevalence should be conducted as a TT screening in all people aged >40 years in the same 2 selected sentinel communities per endemic district per year (see recommendation 4, mentioned above) .

On the other hand, National Health System should be able to collect, analyses and furnishes every year number of TT cases evaluated and/or operated in the country. In other words, also refused and recurrence cases must be reported per year. For this reason, all people referring to a hospital must be screened for trichiasis and in any case volunteers in villages should be trained to detect trichiasis, also after the achievement of the certification.

The ideal way to detect all cases should be organizing house-to house evaluation, but where this is not possible it must be useful to take advantage of other ophthalmic campaigns.

Refused cases should be investigated as a further follow-up on surgical quality, that in any case must be scheduled in the criteria for certification. In fact, each country must demonstrate the ability to discriminate detected/undetected cases and to manage the incident cases.

6. During the three year surveillance period a National Committee should quarterly receive district data reports with TF and TT data coming from district where the collection and analysis should be monthly.

7. Surveillance should be continue at least 10 years after the achievement of certification.

Facial cleanliness and environmental change must remain in place also after the elimination of trachoma to ensure the conditions of elimination.

Where possible the surveillance system should be integrated into other surveillance programs in order to be under the direct responsibility of Member States involved. However partners must be engaged and should continue their role in the control of the disease.

Drafting report so as the creation of relevant guidelines and recommendations contained within the scope of the WHO/PBL representatives. WHO Officers have also the role to share, coordinate and technically support expert decisions following United Nations rules.

4.2- Selected Country Profiles

WHO/PBL analysed data reported by Member States in the TDFs referred to the year 2009. Two countries were selected to develop a National Plan for post-endemic trachoma surveillance, on the basis of the above mentioned recommendations, as they are approaching the requested ultimate intervention goals for elimination.

Ghana plans to eliminate blinding trachoma by 2010 and has implemented the SAFE strategy since 2001.

Trachoma was first documented as a cause of blindness in the Northern Region of Ghana in 1959.[87] A small pilot project to control trachoma was first implemented in Upper West Region by the Ghana Health Service in 1995.[88]

District	TF/TI %	TT %	Year of baseline survey	Intervention strategy
Savelugu/Nanton	9.7	4.3	2000	◦ TT surgeries provided at clinics and through active TT case search and community surgery ◦ Annual MDA on a community-by-community basis with azithromycine, 2001—2003; district-wide MDA 2004—2007 ◦ School-based trachoma health education, ongoing radio programming, training of health educators, environmental health officers, school teachers and volunteers; community and household education session ◦ Promotion of latrine use, training masons to build latrines, provision of latrines in some communities and advocating for new water points
Tolon/Kumbungu	12.4	8.4	2000	
West Gonja	11.7	3.7	2002	
Sissala	11.5	5.9	2000	
Wa	16.1	1.3	2000	
Bole/Salwa-Tuna-Kalba	8.2	1.8	2003	◦ Decentralized trichiasis surgery referral program and clinic-based surgery ◦ Annual MDA with azithromycine in endemic communities, 2004—2007 ◦ School-based trachoma health education, ongoing radio programming, training of health educators, environmental health officers, school teachers and volunteers; community and household education session ◦ Promotion of latrine use and advocating for new water points
Tamale Municipalc	6.1	2.3	2000	
West Mamprusi	6.8	0.8	2003	
Zabzugu/Tatale	6.7	0.4	2003	
Jirapa/Lambussie	5.0	0.8	2003	
East Gonja	3.7	0.9	2003	◦ Trichiasis surgery referral program and clinic-based surgery ◦ Community-by-community assessment and annual MDA in trachoma-endemic communities, no distribution in non-endemic communities ◦ School-based trachoma health education, ongoing radio programming, training of health educators, environmental health officers, school teachers and volunteers; community and household education session ◦ Promotion of latrine use and advocating for new water points
East Mamprusi	2.8	0.6	2003	
Gushiegu/Karaga	4.4	0.8	2003	
Nanumba	3.8	0.5	2003	
Saboba/Chereponi	3.2	0.5	2003	
Yendi	3.5	1.0	2003	
Lawra	2.8	0.7	2003	
Nadowli	3.6	1.3	2003	

Legend. TF: trachomatous inflammation-follicular (1-9 years); TI: trachomatous inflammation intense (1-9 years); TT: trachomatous trichiasis (in women aged ≥40 years); MDA: mass drug administration.

Table 3. Baseline trachoma prevalence in Northern and Upper West Regions of Ghana and subsequent program interventions by district as reported by the Ghana Health Service.

After baseline trachoma prevalence surveys were completed in areas suspected to be endemic for the disease, the Ghana Health Service, with support from partners, established and implemented SAFE activities in the five most endemic districts of Northern and Upper West Regions, and by

2004 all endemic communities in the 18 endemic districts had been identified and have received interventions.

In 2006,according to a report from the Ghana Health Service, a prevalence survey in the Upper East Region confirmed that trachoma was not a public health problem there (personal communication).

Table 3 provides the baseline estimates of trachoma prevalence in the Northern and Upper West Regions and a summary of the subsequent interventions implemented. The districts in which active trachoma prevalence was ≥10% received SAFE on a community basis between 2001 and 2003 and on a district-wide scale from 2004 to 2007. All communities considered endemic at baseline received SAFE interventions for at least 5 years.

In the districts with estimates of active trachoma in children between 5 and 9% initially interventions were implemented on a community-by-community basis until 2004 when SAFE was implemented district-wide. In the districts in which the baseline estimate of active trachoma in children was <10% community surveys were conducted and a range of active trachoma of 0-53.3% was found. Interventions to control trachoma were implemented only in communities with >5% active trachoma (314 of 551) and were never extended to the whole district.

As of the first quarter 2008, all trachoma-endemic communities in the Northern and Upper West Regions had received at least 3 years of SAFE interventions in accordance with WHO guidelines.[64]

A population-based survey has been conducted in the two regions that were endemic at baseline. The overall estimate of TF in children aged 1-9 years was 0.84% with a range of point estimates by district of 0.14-2.87%. The majority of children examined had clean faces with an overall estimate of 84.9%, and a range by district of 74.0-98.3%.

The overall estimate of household latrine ownership was 11.6% with a range by district of 1.5-31.0%. An estimated 79.2% of households reported a safe

source of water with a range by district of 49.7-99.3%, with 72.6% reporting a round trip for water collection of ≤30 min.

Among adults aged ≥15 years, the overall prevalence of TT was 0.31% with a range by district of 0.0-1.07%, and a estimated backlog of not operated TT cases of 4950 between undetected and recurrent cases.

WHO/PBL on the basis of data analysis suggested to the Ghana Health Service to survey the "hotspot" communities in order to confirm the achievement of the target for TF (<5% at community level), to actively address the TT backlog, and to improve sanitation in both the regions. In the same time WHO/PBL suggested to the Member State to start the procedure to develop a National Plan for post-endemic Surveillance for Trachoma as all data confirm that the country is approaching the requested ultimate intervention goals.

Mali has 8 administrative regions, divided in 59 districts, and a population of around 13 million, 70% living in rural areas.

The last and considered as baseline national prevalence survey was conducted in 1996 and 1997, showing a TF prevalence in 1-9 year-old of 34.9% and a prevalence of TT of 2.51% in women aged ≥15 years. The endemic districts were 51.

In 2001, Mali established and implemented SAFE activities in 4 endemic health districts of 3 Regions (Koulikoro, Kayes, and Mopti) with support from partners, and extended to other districts over the years.

A five-year National Plan was launched in 2005 throughout the whole country to eliminate blinding trachoma by 2015.

Région	District	TF/TI %	TT %	Year of survey
KAYES	Kayes	42.5	3.3	1996
	Kita	5.87	2.97	2006
	Bafoulabé	1.24	2.14	2006
	Kéniéba	42.5	3.3	1996
	Diéma	3.12	3.1	2007
	Yélimané	42.5	3.3	1996
	Nioro	7.18	2.4	2007
KOULIKORO	Koulikoro	0.2	1.06	2005
	Kati	2.7	2.49	2005
	Kangaba	4,87	1.25	2005
	Banamba	5,28	1.27	2005
	Ouéléssébougou	1,34	1.09	2005
	Kolokani	6,25	2.05	2007
	Nara	4	1.76	2007
	Fana	2,37	1.33	2005
	Dioila	0,81	1.48	2005
SIKASSO	Sikasso	6,83	0,65	2008
	Bougouni	5,76	0,64	2008
	Kolondiéba	7,45	1,47	2008
	Yanfolila	12,45	1,74	2008
	Kadiolo	2,95	0,79	2008
	Koutiala	0,49	0,5	2008
	Yorosso	3,73	1,19	2008
	Sélingué	13,51	1,52	2008
SEGOU	Ségou	23,1	1,8	1996
	Barouéli	23,1	1,8	1996
	Markala	23,1	1,8	1996
	Macina	23,1	1,8	1996
	Niono	23,1	1,8	1996
	Bla	9,2	2,7	2005
	San	23,1	2,2	2005
	Tominian	12,4	3,4	2005
MOPTI	Mopti	44,1	1,7	1996
	Douentza	13,2	0,6	2005
	Bandiagara	44,1	1,7	1996
	Djenné	46,2	2,1	2005
	Tenenkou	66,6	0,2	2005
	Youwarou	15,8	1,1	2005
	Bankass	44,1	1,7	1996
	Koro	25,1	2,6	2005
TOMBOUCTOU	Tombouctou	31,7	1,2	1997
	Niafunké	31,7	1,2	1997
	Goundam	31,7	1,2	1997
	Diré	31,7	1,2	1997
	Gourma-Rharous	31,7	1,2	1997
GAO	Gao	4,99	0,18	2008
	Ménaka	22,95	0,13	2008
	Ansongo	6,69	0,13	2008
	Bourem	8,8	0,04	2008
KIDAL	Kidal	16.99	0.37	2009
	Abeibara	16.99	0.37	2009
	Tin-Essako	16.99	0.37	2009
	Tessalit	16.99	0.37	2009

Legend. TF: trachomatous inflammation-follicular (0-9 years); TI: trachomatous inflammation intense (0-9 years); TT: trachomatous trichiasis (in women aged ≥15 years).

Table 4. Trachoma prevalence in the 8 administrative Regions of Mali

When the first treated endemic districts had received at least 3 years of SAFE interventions in accordance with WHO guidelines, impact surveys were planned and conducted between 2005 and 2007 in order to confirm the TF and TT prevalence reduction. Survey data showed (see Table 4) that among 9 districts of Koulikoro region 9 revealed an estimate of TF <10% in children aged 0-9 years with a range by region of 0.2-6.25% , while in Kayes region only 4 out of 7districts had TF <10% with a range by region of 1.24-42.5%.

The same regions were evaluated again in 2009 after 2 years without implementation of SAFE strategy. The results, presented in Table 5 and 6, indicate a re-emergence of active trachoma cases with only 6 out of 9 districts with TF <10% in Koulikoro region, and only 1 district in Kayes region with a prevalence of 2.5% (6 out of 7 districts had TF<10%).

The overall reported estimate of household latrine ownership in the whole country is 77.0%. An estimated 67.3% of households reported a source of drinking water within 1h of walking.

Among adults aged ≥15 years, the overall prevalence of TT was 1.13% in Koulikoro region with a range of 0.34-1.78%, while in Kayes region the regional estimate was 1.37% with a range of 1.0-1.87%.

District	TF%	TT%
Banamba	17.2 (13.7-20.7)	1.78 (1.0-2.5)
Dioila	7.8 (6.0-9.7)	1.24 (0.59-1.9)
Fana	3.9 (2.2-5.7)	0.34 (0.01-0.67)
Kangaba	2.1 (0.6-3.7)	0.68 (0.11-1.3)
Kati	8.4 (4.7-12.2)	1.07 (0.39-1.8)
Kolokani	14.1 (9.2-18.9)	1.55 (0.69-2.4)
Koulikoro	11.4 (9.0-13.8)	1.61 (0.70-2.5)
Nara	2.9 (1.5-4.2)	0.53 (0.0-1.2)
Ouelessebougou	1.7 (0.8-2.6)	0.55 (0.0-1.1)

Legend. TF: trachomatous inflammation-follicular (0-9 years);
TT: trachomatous trichiasis (in women aged ≥15 years)

Table 5. Prevalence of clinical signs of trachoma by District, Koulikoro region

District	TF%	TT%
Bafoulabe	15.4 (11.7-19.0)	1.37 (0.6-2.1)
Diema	4.7 (2.0-7.4)	1.87 (0.2-3.5)
Kayes	5.3 (3.4-7.2)	1.69 (0.9-2.5)
Kenieba	7.1 (3.5-10.8)	1.65 (0.8-2.5)
Kita	2.5 (0.9-4.1)	1.51 (0.6-2.4)
Nioro du Sahel	8.7 (6.0-11.3)	1.26 (0.2-2.3)
Yelimane	6.5 (4.8-8.1)	0.37 (0.0-0.8)

Legend. TF: trachomatous inflammation-follicular (0-9 years);
TT: trachomatous trichiasis (in women aged ≥15 years)

Table 6. Prevalence of clinical signs of trachoma by District, Kaynes region

WHO/PBL exhorted the Prevention of Blindness Program and the Ministry of Health to immediately set up a surveillance system for trachoma in order to avoid new re-emergence cases and to control active infection in the districts and communities currently below the recommended threshold. It was also recommended to implement the SAFE strategy in all the districts avoiding interruption of mass drug administration and increasing education and sanitation efforts.

4.3- National Plan developed in Ghana and Mali

The Ministry of Health of Ghana and Mali requested WHO/PBL to technically support the Prevention of Blindness and Trachoma Program Managers of their countries in developing the National Plan for the surveillance system for trachoma in post-endemic area.

A first seven-day mission was organized in Mali in May 2009 to discuss the indicators and methodology to be used in the relevant surveillance system

with the National Prevention of Blindness (PNLC) Coordinator and his collaborators.

An initial draft was proposed to the Director of Ministry of Health obtaining his political support and the recommendation to share the document with the National Responsible of the Health Surveillance System (SIS) and of the Epidemiological Surveillance Department of the Disease Prevention Division, respectively.

The final document was drawn with the technical assistance of the above mentioned persons and was submitted to the Ministry of Health for the approbation.

The endorsed National Plan expects the creation of a surveillance system that meets the minor requirements recommended by WHO. As school enrolment is <90%, trachoma surveillance will be yearly conducted in 2 communities per district (4 communities in districts with more than 200,000 inhabitants) randomly selected between the least developed and suspected to be the most endemic, and annually rotated. All children aged 1-9 years in the selected communities will be screened for TF detection, and needed actions will be planned consequently and in accordance with WHO suggestions. In the same sentinel communities all people aged >15 years will be screened for TT reporting operated, refusal and recurrent cases. In case of high refusal and recurrent rates, a quality evaluation of TT surgery will be organized.

The National Health System will provide all health centres and hospitals in the interested districts with specific forms for TT comprehensive screening, and all health campaigns will be used for trichiasis detection.

All data monthly collected at district level will be sent a central level each three months and an annual report will be transmitted to WHO/PBL.

The second mission was held in December 2009 in order to present the National Plan on Surveillance for Trachoma to Deputies of relevant Regions and districts, and to inform them of the activities to be undertaken.

In December 2009, WHO/PBL representative was invited to participate to a meeting organized by Ghana Health Service and National Eye Care with the support of Ministry of Health.

WHO/PBL was requested to present WHO recommendations and existing post-endemic surveillance systems for trachoma, and technical assistance to design a specific National Plan.

After a four-day consultation, the participants to the meeting unanimously developed and approved a draft to be submitted to the Minister of Health in order to rapidly establish a relevant surveillance system for trachoma in post-endemic districts and to integrate it in the run National Neglected Tropical Diseases Surveillance System.

The system will screen all children aged 1-9 years in 2 or 4, on the basis of WHO advices, randomly and rotationally selected communities per district per year for TF detection. Positive cases will be treated in accordance with WHO proposals.

In the same selected communities all people >15 years of age will be actively screened for TT and surgically managed. All operated, refusal, and recurrent cases will be recorded.

The collected data will follow the current monthly health information flow from villages to districts and to central level in order to allow an immediate feedback in case of worsening of the active infection diffusion or of increasing of the TT backlog. The system will be reinforced after natural disasters or social and economic crisis.

The "F" and "E" components will be implemented and will be maintained in place during and after the surveillance period.

The drawn document is following the normal process of approval by the Minister of Health.

5. CONCLUSIONS

The goal of any certification process should be not only to ensure the validity of the statistics presented by a country in its application for certification, but also to encourage that elimination efforts are carried forward such that progress is most likely to be sustained. For trachoma, this requires looking beyond the most visible indicators of trachoma burden to consider indicators of behaviour change, surveillance system functioning, and progress made in improving environmental sanitation.

A mechanism for the certification of blinding trachoma elimination should include objective consideration of achievements made in each of the four components of the SAFE strategy as well as an assessment of the capacity of the surveillance system to detect both active disease and trachomatous trichiasis. Strengthening of surveillance system is one means by which trachoma elimination programs benefit health system as a whole, and the development and use of simple indicators of surveillance system capacity would help to measure and document positive impacts. The surveillance approach to disease control has significant potential for integration and expansion to other priority diseases.[89-90]

Indicators must be internationally consistent to enable comparison across country programs, facilitate evaluation of cost-effectiveness of interventions in different settings, and help to establish best practices. A functional system empowers managers to allocate resources more efficiently, motivates staff with clear indicators of progress, and enhances communication between country managers and local and international partners.

In conclusion, the achievement of certification and the establishment of a functional surveillance system means that country could be able to allocate human and economic resources for other priority diseases, to progress from a developing to a developed phase, to strengthen its health system.

The mandate of WHO is the attainment by all peoples of the highest possible level of health, and for all the reasons listed above, the technical participation to the development and establishment of relevant surveillance system for trachoma fits into the objective.

The WHO/PBL seeks to achieve, among others, aims to assist Member States in defining the roadmap for the final trachoma elimination and in constantly assessing the progress towards the accomplishment of the goal. The project described here represents a part of a unique program to assure not only the quick trachoma detection in the event that it resumes after elimination, but also the development of self-sustainable health systems. The choice to elaborate a methodology, more than a method, is a clear evidence of the WHO approach to Member States needs. This gives countries the opportunity to exploit the pre-existing structures and activities and to apply the indicators in the form they find the most appropriate to their cultural, geographic, economic, and social context.

The efforts made by Member States with the support of international partners and WHO are giving the first evident results. Some countries, as Oman and Morocco, have achieved the trachoma elimination and have started all the needed procedures to apply for the certification process.

Ghana is reaching the objective and is putting in place all the necessary activities to create a self-sustainable condition to control the disease. In fact, in 2009 the country has accepted the WHO/PBL proposal to insert trachoma prevention health messages in the national curriculum for all the primary schools. This means that all children aged 5-9 years in Ghana are receiving and will receive as part of the basic education health messages referred to trachoma prevention through environmental changes. The expected impact of this action is a reaction cascade; schooled children are held in high regard by the family and the village of origin and are the best carriers of information.

Their behaviour and recommendations are followed by the majority of the community. This is a good demonstration of self-sustainable process.

Mali had a different starting condition given that almost the entire country was endemic and the economic resources are dissimilar. Nevertheless, the local and international efforts are advancing the country towards achieving the target goal. Three additional Regions (Ségou, Sikasso, and Mopti) are completing, by 2010, the third year of mass drug distribution at district level. They will be surveyed and required actions will be planned and implemented.

Mali has also agreed to include general messages of hygiene for trachoma prevention in the national primary school curriculum. Despite the school attainment rate is far below the 90%, the decision will have an obvious impact on the population and on adults of tomorrow.

Many other countries are reaching the elimination targets. WHO/PBL is ready to continue to support them in this crucial matter and in all the next steps, working at the same time as the activities of elimination are increased in all endemic countries, and the surveillance activities in post-endemic area are able to ensure that the active infection remains under the threshold values and all TT cases are adequately managed by the national health system.

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世界衛生大會 決議 قرار جمعية الصحة العالمية
RESOLUTION OF THE WORLD HEALTH ASSEMBLY
RÉSOLUTION DE L'ASSEMBLÉE MONDIALE DE LA SANTÉ
РЕЗОЛЮЦИЯ ВСЕМИРНОЙ АССАМБЛЕИ ЗДРАВООХРАНЕНИЯ
RESOLUCION DE LA ASAMBLEA MUNDIAL DE LA SALUD

FIFTY-SIXTH WORLD HEALTH ASSEMBLY **WHA56.26**

Agenda item 14.17 **28 May 2003**

Elimination of avoidable blindness

The Fifty-sixth World Health Assembly,

Having considered the report on elimination of avoidable blindness;[1]

Recalling resolutions WHA22.29, WHA25.55 and WHA28.54 on prevention of blindness, WHA45.10 on disability prevention and rehabilitation, and WHA51.11 on the global elimination of blinding trachoma;

Recognizing that 45 million people in the world today are blind and that a further 135 million people are visually impaired;

Acknowledging that 90% of the world's blind and visually impaired people live in the poorest countries of the world;

Noting the significant economic impact of this situation on both communities and countries;

Aware that most of the causes of blindness are avoidable and that the treatments available are among the most successful and cost-effective of all health interventions;

Recalling that, in order to tackle avoidable blindness and avoid further increase in numbers of blind and visually impaired people, the Global Initiative for the Elimination of Avoidable Blindness, known as Vision 2020 – the Right to Sight, was launched in 1999 to eliminate avoidable blindness;

Appreciating the efforts made by Member States in recent years to prevent avoidable blindness, but mindful of the need for further action,

1. URGES Member States:

(1) to commit themselves to supporting the Global Initiative for the Elimination of Avoidable Blindness by setting up, not later than 2005, a national Vision 2020 plan, in partnership with WHO and in collaboration with nongovernmental organizations and the private sector;

[1] Document A56/26.

(2) to establish a national coordinating committee for Vision 2020, or a national blindness prevention committee, which may include representative(s) from consumer or patient groups, to help develop and implement the plan;

(3) to commence implementation of such plans by 2007 at the latest;

(4) to include in such plans effective information systems with standardized indicators and periodic monitoring and evaluation, with the aim of showing a reduction in the magnitude of avoidable blindness by 2010;

(5) to support the mobilization of resources for eliminating avoidable blindness;

2. REQUESTS the Director-General:

(1) to maintain and strengthen WHO's collaboration with Member States and the partners of the Global Initiative for the Elimination of Avoidable Blindness;

(2) to ensure coordination of the implementation of the Global Initiative, in particular by setting up a monitoring committee grouping all those involved, including representatives of Member States;

(3) to provide support for strengthening national capability, especially through development of human resources, to coordinate, assess and prevent avoidable blindness;

(4) to document, from countries with successful blindness prevention programmes, good practices and blindness prevention systems or models that could be modified or applied in other developing countries;

(5) to report to the Fifty-ninth World Health Assembly on the progress of the Global Initiative.

Tenth plenary meeting, 28 May 2003
A56/VR/10

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FIFTY-FIRST WORLD HEALTH ASSEMBLY **WHA51.11**

Agenda item 20 16 May 1998

Global elimination of blinding trachoma

The Fifty-first World Health Assembly,

Recalling resolutions WHA22.29, WHA25.55 and WHA28.54 on the prevention of blindness, and WHA45.10 on disability prevention and rehabilitation;

Aware of previous efforts and progress made in the global fight against infectious eye diseases, in particular trachoma;

Noting that blinding trachoma still constitutes a serious public health problem amongst the poorest populations in 46 endemic countries;

Concerned that there are at present some 146 million active cases of the disease, mainly among children and women, and that in addition, almost six million people are blind or visually disabled as a result of trachoma;

Recognizing the need for sustainable community-based action - including surgery for inturned eyelids, antibiotics use, facial cleanliness and environmental improvement (the SAFE strategy) - for the elimination of blinding trachoma in the remaining endemic countries;

Encouraged by recent progress towards simplified assessment and enhanced management of the disease, including large-scale preventive measures, particularly for vulnerable groups;

Noting with satisfaction the recent establishment of the WHO alliance for the global elimination of trachoma, comprising certain collaborating nongovernmental organizations and foundations and other interested parties,

1. CALLS ON Member States:

(1) to apply the new methods for the rapid assessment and mapping of blinding trachoma in the remaining endemic areas;

(2) to implement, as required, the strategy including surgery for inturned eyelids, antibiotics use, facial cleanliness and environmental improvement (the SAFE strategy) for the elimination of blinding trachoma;

(3) to collaborate in the WHO alliance for the global elimination of trachoma and its network of interested parties for the global coordination of action and specific support;

(4) to consider all possible intersectoral approaches for community development in endemic areas, particularly for greater access to clean water and basic sanitation for the populations concerned;

2. REQUESTS the Director-General:

(1) to intensify the cooperation needed with Member States in which the disease is endemic for the elimination of blinding trachoma;

(2) further to refine the components of the SAFE strategy for trachoma elimination, particularly through operational research, and by considering potential antibiotic or other treatment schemes for safe large-scale application;

(3) to strengthen interagency collaboration, particularly with UNICEF and the World Bank, for the mobilization of the necessary global support;

(4) to facilitate the mobilization of extrabudgetary funds;

(5) to report, as appropriate, to the Executive Board and the Health Assembly on progress made.

Tenth plenary meeting, 16 May 1998
A51/VR/10

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WORLD HEALTH ORGANIZATION

Meeting on Post-Endemic Trachoma Surveillance

Geneva, SWITZERLAND, 4-5 November 2008

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GET/ALL/EN-REV6

Prevention of Blindness & Deafness

ANNUAL MEETING OF THE WHO ALLIANCE FOR THE GLOBAL ELIMINATION OF BLINDING TRACHOMA

Geneva, Switzerland

Update on trachoma control activities

TRACHOMA DATA FORM (2009)

COUNTRY .....

Total Country Population ..... Urban: _ _% Rural: _ _%

Number of provinces/regions/states* in country: _____

Number of endemic provinces/regions/states* :_____

Total population in endemic provinces/regions/states*: _____

Number of districts in the country: _____

Number of endemic districts: _____

Total population in all endemic districts: _____

**Cancel the unnecessary mentions, please*

Instruction for National Coordinator

1. Fill and send before the 15th March 2009 (the form serves as the base to finalize the GET 2020 meeting agenda)

2. Attach the survey protocol(s) and results

3. In case of ANY question, please contact:

a) trachoma@who.int

b) Fax: + 41 22 791 47 72

c) Dr. Simona Minchiotti: minchiottis@who.int Tel. + 4122.7914477

PART I: NATIONAL LEVEL

EPIDEMIOLOGY OF TRACHOMA

CORE INDICATORS AT COUNTRY LEVEL

PREVALENCE	TYPE OF DATA	YEAR
• **TF/TI IN 1- 9 YEARS OLD :** ____ % (males and females)	☐ Survey* ☐ Estimate	_ _ _ _
• **TT IN > 14 YEARS OLD:** ____% (males and females)	☐ Survey* ☐ Estimate	_ _ _ _

*** PLEASE ATTACH SURVEY RESULT (OR PUBLICATION) FOR THE ABOVE AND THE BELOW PROVIDED DATA**

OTHER INDICATORS (IF COLLECTED)

Prevalence:	Age range	Sex	Type of data:	Year
TF: ___% (0-9 years old)	_____ *Reference:*.....	___	☐ Survey* ☐ Estimate	_ _ _ _
TI: ___% (0-9 years old)	_____ *Reference:*.....	___	☐ Survey* ☐ Estimate	_ _ _ _
TS: ___% (all ages)	_____ *Reference:*.....	___	☐ Survey* ☐ Estimate	_ _ _ _
TT: ___% (males and females > 14 years old)	_____ *Reference:*.....	___	☐ Survey* ☐ Estimate	_ _ _ _
CO: ___% (males and females > 14 years old)	_____ *Reference:*.....	___	☐ Survey* ☐ Estimate	_ _ _ _

	Number	Percentage of national blindness:	Year
Number of Blind Persons due to trachoma:	_____	_____	_ _ _ _

No data available: ☐

PART II: SUMMARY TABLE

ULTIMATE INTERVENTION GOALS (UIG) & ANNUAL INTERVENTION OBJECTIVES (AIO)

"SAFE" component	U.I.G. (numbers)	A.I.O. *Year 2008*		A.I.O. *Year 2009*	A.I.O. *Year 2010*	A.I.O. *Year 2011*
S		# Surgery Planned				
		# Surgery Done				
		Coverage %				
A		# Treatments Planned				
		# Treatments Done				
		Coverage %				
F		Planned				
		Achieved				
		Coverage %				
E		Is there a plan to meet the MDG 7, Target 10 * ? YES ☐ NO ☐				
		Has the plan been publicly known (in the MoH)? YES ☐ NO ☐				
		Has the plan been implemented? YES ☐ NO ☐				

PLEASE ADD AS MANY TABLES AS NECESSARY !

***Millennium Development Goals, Number 7: ensuring environmental sustainability, target 10**

PART III: DISTRICT LEVEL

Please indicate Intervention unit concerned*:

Region	District	Population	Year	TF/TI % or priority	Age group	TT %	Age group and sex	Survey or T.R.A.

Surgery:

Region	District	Number of trichiasis surgeons	Number of trichiasis surgeons trained last year (2008)	Number of trichiasis surgeries (people)	Number of recurrences of trichiasis

Antibiotics:

Region	District	A.I.O. (# people targeted for treatment)	# People Treated	Azithromycine = A, Tetracycline = T

Facial cleanliness:

Region	**District**	**Number of clean faces**	**% clean faces**	What method was used (school education, community education, else)

Environmental improvement:

Region	**District**	% of people who have access to clean water	% of people who have access to functional latrines

***: if available space is not sufficient, please annex additional pages with tables.**

PART IV: TRACHOMA CONTROL

Which year been set as a target for the Elimination of blinding trachoma? Year ____

- **Is there political support to trachoma control?** ☐**Yes** ☐ **No**
  If yes, in which form is it shown?

  _____

- **Is blinding trachoma considered a public health problem by the Government?** ☐ **Yes** ☐ **No**
  If yes, provide reference (Annex the National Eye Care Plan, or the National NTD Plan, or the National Vision 2020 Plan where Trachoma elimination target is clearly stated and objectives defined)

  _____

- **Does a Trachoma Control Programme exist?** ☐ **Yes** ☐ **No**
  If yes, how is it organized?(how many persons are involved, how often do they meet, where is it based?)

  _____

- **Does a Trachoma National Task Force/Committee exist?** ☐**Yes** ☐**No**
  If yes, who are the members (i.e. relevant MoH departments, Ministry of Education, Environment, NGDOs, etc) and how many times did it meet in 2007?

  _____

PART V: COMMUNITY PARTICIPATION

- **Are villages/communities involved in trachoma control?** ☐ **Yes** ☐ **No**

- **In intervention areas, in which component(s) of the SAFE strategy are the village communities involved?**
  (please tick as appropriate)

S **Surgery**	**A** **Antibiotics**	**F** **Facial cleanliness**	**E** **Environmental change**
☐	☐	☐	☐

- Please provide details on how communities are mobilized and actively involved in trachoma elimination: ……..
  ……
  ……
  ……
  ……

PART VI: SURGERY (S)

♦ **Human resources**

No. of TT surgeons:_____ _ _ _ _ _ _ _ _ _ _ _ _of which ____% in rural areas

No. of Surgeons Certified for good quality surgery*: ……

No. of TT surgeons in training:____ _ _ Where are they trained? _____

♦ **Equipment**

Surgical instruments:	☐ Adequate (i.e. 2 surgical kits/surgeon)	☐ Insufficient
Consumables:	☐ Adequate	☐ Insufficient
Drugs:	☐ Adequate	☐ Insufficient

♦ **National policy**

TT surgery: ☐ Free of charge ☐ Cost recovery system (Price/operation in US$:_____)

* **Final assessment of trichiasis surgeons, WHO/PBD/GET/05.2**

Are Primary Health Care (PHC) workers trained to identify TT ? ☐Yes ☐ No

Do PHC workers refer TT for treatment? ☐ Yes ☐ No

PART VII: ANTIBIOTICS (A)

♦ **Human resources**

Is training in TF/TI identification provided to all PHC workers? ☐ Yes ☐ No

Can a PHC worker identify TF/TI? If yes, what percentage (%)? ___% ☐Yes ☐ No

Is a PHC worker trained to treat TF/TI (i.e. by providing antibiotics)? ☐ Yes ☐ No

Is trachoma treatment recorded in PHC activity registries? ☐ Yes ☐ No

Is trachoma recorded as a separate entity (i.e. not as "conjunctivitis")? ☐Yes ☐ No

♦ **Treatment**

Tetracycline eye ointment available in all PHC centres ☐ Yes ☐ No
If yes, price/tube in US$: _____

Tetracycline eye ointment available in town pharmacies ☐ Yes ☐ No
If yes, price/tube in US$: _____

Tetracycline eye ointment available in village pharmacies ☐ Yes ☐ No
If yes, price/tube in US$: _____

Azithromycin available in all PHC centres ☐ Yes ☐ No
If yes, price in US$: _____

Azithromycin available through a **donation programme** ☐ Yes ☐ No
If yes, how many people were treated last year: _____

Azithromycin available in all town pharmacies ☐ Yes ☐ No
If yes, price in US$: _____

Azithromycin available in all village pharmacies ☐ Yes ☐ No
If yes, price in US$: _____

PART VIII: FACIAL CLEANLINESS & ENVIRONMENTAL CHANGE (F&E)

In endemic areas:

- Percentage of population with access to functional water source within 1 hr travel time (or 1 kilometer) _____% ☐ **Survey*** ☐ **Estimate** **Year : …..**
- Percentage of households using latrines (or with access to a functional latrine) _____% ☐ **Survey*** ☐ **Estimate** **Year : …..**
- Are there any current activities to promote F & E in trachoma endemic regions ?
  If yes, please indicate what is being carried out by whom (MoH, NGDOs, etc):

F activities: ☐ Yes ☐ No	**E activities:** ☐ Yes ☐ No
If YES, provide brief details	*If YES, provide brief details*

- Do other MOH depts., Ministries and NGOs participate/collaborate in the planning of the National Prevention of Blindness Programme (NPBP) activities? ☐Yes ☐ No
  If yes, please provide a list:

School Health

- Is prevention of blindness education taught in primary schools? ☐Yes ☐ No
- Is trachoma prevention part of the curriculum for school teachers? ☐Yes ☐ No
- When is the next school curriculum revision planned by the Ministry of Education? Year : ……..

- Is personal and environmental hygiene part of PHC workers training? ☐ Yes ☐ No

- Please list your NPBP partners (current) for F & E components (MOH depts., MoE, NGDOs, groups, clubs, civil society, etc)

CURRENT PARTNERS	
F activities	
MoH	Yes No
MoE	Yes No
UNICEF	Yes No
WHO Country Office	Yes No
Others_____ _____	Yes No
E activities	
Ministry of Water	☐ Yes ☐ No
Ministry of Agriculture	☐ Yes ☐ No
Others_____ _____	☐ Yes ☐ No

- Can NPBP access national media (TV, radio, press) regularly? ☐ Yes ☐ No
- Can NPBP access national media (TV, radio, press) free of charge? ☐ Yes ☐ No
- Do you have regular programmes broadcasted on prevention of trachoma? ☐ Yes ☐ No
- Is any high-level politician/key player a steward for trachoma elimination? ☐ Yes ☐ No
  If yes, who is he/she? _____

COUNTRY ……

In order to establish an up-to-date data base, we should appreciate it if you could please indicate the references of the responsible person (s) for trachoma control activities in the country, and any other contact that you deem appropriate.

Ministry of Health : National Trachoma Elimination Focal Point

NAME: ……

Profession/title: ……

Affiliation: ……

Mailing address: ……

Telephone: +…… Fax: +……

E-mail: ……

Ministry of Health : National Neglected Tropical Diseases Focal Point

NAME: ……

Profession/title: ……

Affiliation: ……

Mailing address: ……

Telephone: +…… Fax: +……

E-mail: ……

Ministry of Education Focal Point for Trachoma Control:

NAME: ……

Profession/title: ……

Affiliation: ……

Mailing address: ……

Telephone: +…… Fax: +……

E-mail: ……

Ministry of Water and Sanitation (Agriculture/Rural Development) Focal Point for Trachoma Control:

NAME: .....

Profession/title: .....

Affiliation: .....

Mailing address: .....

Telephone: **+**..... Fax: **+**.....

E-mail: .....