part 3

Trachoma

1 Introduction

Australia is one of 46 countries[62] still to have hyper-endemic blinding trachoma. Trachoma ceased to be a problem in the mainstream Australian community about 100 years ago but it still affects many remote Indigenous communities.

These Guidelines for the treatment of trachoma in Aboriginal and Torres Strait Islander communities draw upon the *Eye Health Report* recommendations[63], the World Health Organization guidelines, Vision 2020 (a global initiative for the elimination of avoidable blindness by the year 2020)[64], and the available evidence relating to Indigenous Australians. The Guidelines identify key factors specific to the treatment and management of trachoma in Aboriginal and Torres Strait Islander communities and provide clinical information for eye health specialists and other health professionals responsible for managing the eye health of Aboriginal and Torres Strait Islander people.

The Guidelines cover the epidemiology of trachoma; screening, management and control; health promotion; and the role of Aboriginal Health Workers in trachoma prevention and management.

2 Background

2.1 Definition

Trachoma is a chronic conjunctivitis caused by repeated episodes of infection with the obligatory intracellular organism *Chlamydia trachomatis*.[64] First evident in childhood, it is an acute inflammatory condition characterised by recurrent infection and scarring of the tissues of the eyelid, which eventually causes trichiasis—an in-turning of the lid margin and the eyelashes. Rubbing of the in-turned eyelashes on the cornea leads to corneal damage, opacification and blindness.

2.2 The patient population

Aboriginal and Torres Strait Islander people, especially those living in rural and remote parts of Australia, form the patient population.

Blindness from trachoma is predominantly found in older people. Active trachoma is more likely with recurrent infection and is usually seen in children.

2.3 The purpose of control and treatment programs

Trachoma and the resulting blindness impose a significant burden, both economic and social, on the communities in which the disease is prevalent. It results in impaired quality of life[64], the risk of infecting others, the personal discomfort and pain of repeated eye infections, and high economic costs.

In terms of cost-effectiveness, non-surgical and surgical interventions for trachoma control share with cataract surgery the distinction of being among the most successful of all medical prevention activities.[65,66]

The primary purpose, therefore, of implementing strategies for controlling and managing trachoma is to prevent recurring infections that can lead in the long term to blindness, to treat blinding conditions and so limit and avoid visual impairment, and ultimately to eliminate trachoma in communities where it is currently endemic.

2.4 The affected community

The World Health Organization identified the need for and type of treatment programs based on prevalence rates of active trachoma in children aged up to 10 years in a community.[67]

- Where the prevalence rate in a community is 20 per cent or higher, trachoma is said to be hyper-endemic.

- Where the prevalence rate in a community is 5 per cent and up to 20 per cent, trachoma is said to be endemic.
- Where the prevalence rate in a community is less than 5 per cent, trachoma is said to be non-endemic.

Using this classification, trachoma is, as noted, hyper-endemic in some parts of Australia.

The WHO prevalence rates were, however, set for treatment regimes based on the application of topical tetracycline ointments. The ability to treat trachoma with a single oral dose of azithromycin antibiotic now means that this breakdown may need reconsideration and is most probably not appropriate in Australia.

2.5 The goals

The aim of these Guidelines is to provide 'best practice' standards for eye care specialists, hospital and community workers, Aboriginal Health Workers, and other health professionals, so that they can respond effectively to the presence of trachoma in Aboriginal and Torres Strait Islander communities. There are thus three goals:

- to identify the communities in which trachoma is present;
- to enable the adoption of a consistent approach to the assessment and treatment of trachoma in those communities;
- to provide a framework for the implementation of 'best practice' in the management and treatment of trachoma.

3 Epidemiology

3.1 Trachoma

Recent data on the prevalence of trachoma have often been based only on the examination of older children. Pre-school age children are more susceptible to trachoma, however, and are the most important age group to examine. Further, studies tend to report only on the presence of follicular or inflammatory trachoma (the first of the WHO grading signs—see Section 4.2) and not to assess the presence of the sequelae of trachoma: scarring and trichiasis. This makes it difficult to accurately determine the current prevalence of trachoma.

Nevertheless, there is evidence that trachoma remains a significant cause of blindness in Aboriginal people—blindness due to corneal opacity as a consequence of trichiasis. Anecdotal evidence and small surveys show that trichiasis still affects a significant proportion of the elderly Aboriginal population.[64] No data are available for Torres Strait Islander people specifically.

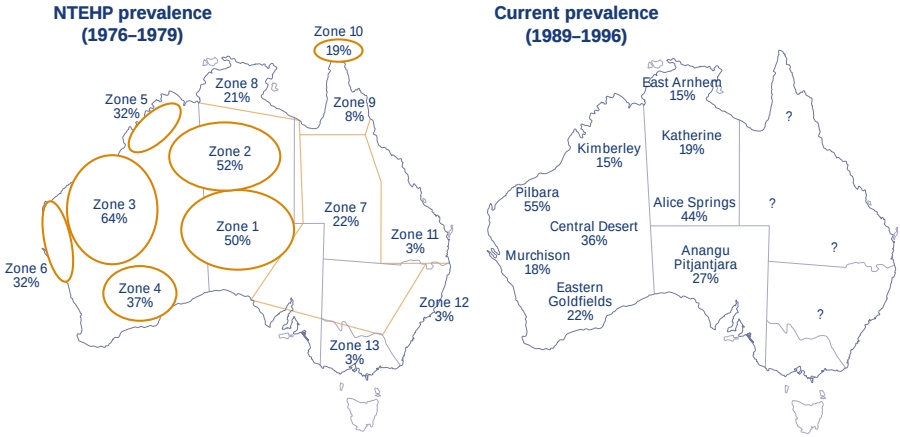
Trachoma is known to be prevalent in rural and remote areas in Western Australia, South Australia and the Northern Territory. Its incidence in Queensland and New South Wales is currently unknown, although it was endemic in Aboriginal populations in both these States in the 1970s and the 1980s.[68]

The current prevalence of trachoma varies between communities in the affected areas. It has been reported as ranging from 12 to 60 per cent among children in communities from East Arnhem Land in the Northern Territory and the Pilbara in Western Australia. An ongoing study in Anangu Pitjantjatjara lands in South Australia has found a prevalence of approximately 40 per cent in children aged 0 to 10 years.[69] Similar findings were also made in a recent study undertaken in a Central Australian Aboriginal community.[70]

Trachoma is hyper-endemic (according to the WHO definition) in many Aboriginal communities. Further, information gathered during the 1997 review[63] suggests that in some communities there has been little improvement since the National Trachoma and Eye Health Program survey conducted between 1976 and 1978 (see Figure 1).

In many remote areas of Australia trichiasis and its complications are still a serious problem in elderly Aboriginal people, although data defining the extent of the problem are limited.[63] The National Trachoma and Eye Health

Figure 1: The prevalence of follicular trachoma among Aboriginal children, 1976 to 1979 and 1989 to 1996.[63]



Note: 'NTEHP' denotes National Trachoma and Eye Health Program

Program study found trichiasis in 11.8 per cent of the Aboriginal population aged over 60 years.[68] Some occurrences were also found in younger age groups, but the development of trichiasis is strongly age-related and found most often in middle to late age groups. A 1990 survey in the Anangu Pitjantjatjara lands[71] found 36 cases, and a 1993 survey of 308 people in the Fitzroy Crossing region[72] found four people with trichiasis but scarring in 154 people. Such findings are supported by anecdotal evidence. The 1997 report[64] concluded that there is no reason to suspect the fundamental biology of trachoma has changed in the last 20 years.

3.2 Risk factors

The prevalence of trachoma is influenced by the availability of infrastructure and basic services such as clean water, garbage disposal and appropriate housing.[73] Among the main risk factors are:

- the physical environment—the presence of dirt, dust and flies, overcrowded living arrangements, sharing sleeping materials and bedding, and animals in close proximity[74,75,76];
- limited water supply, restricted access to water and associated poor hygiene practices[76];
- inadequate sewage- and garbage-disposal facilities.[63,77]

There is also a need to improve facial cleanliness among children[78,79,80]: lack of cleanliness contributes to the exchange of infection.

3.3 Extraocular infection

In areas where trachoma is endemic it has been shown that children with active ocular chlamydial infection also have extraocular chlamydial infection[81], with chlamydia being isolated or identified in otitis media and in respiratory and gastrointestinal tracts as well as the genital tract. Re-infection from extraocular sources of infection might therefore play a role in transmission of the infection. However, other studies have not confirmed this. The use of a systemic antibiotic did not lower the reinfection rates at follow-up[82], nor was the incidence rate of new infections found to differ between children who had a positive nasal specimen at baseline and children who had a negative one.[83]

3.4 The natural history of trachoma

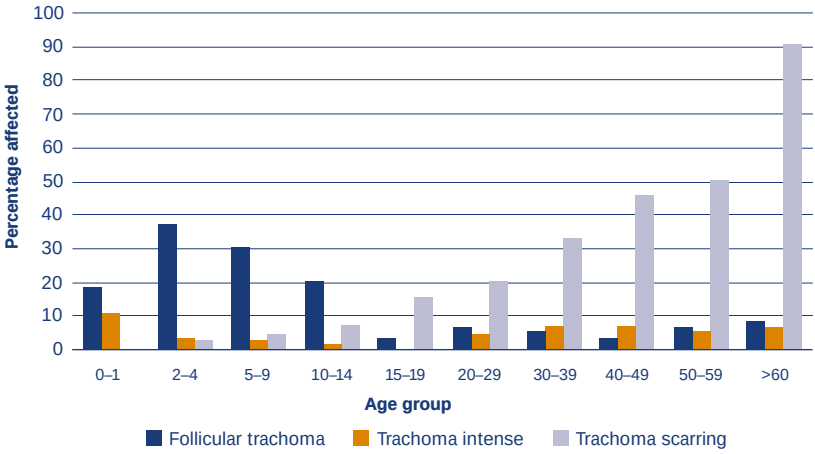
Trachoma can be regarded as having two phases:

- Inflammatory, or active, follicular trachoma is most often seen in young children, particularly those under the age of 5 years (see Figure 2). The severity of active trachoma in childhood determines the risk of developing blinding complications in later life.
- The scarring sequelae are usually found in adults, with development of trichiasis, corneal opacification and blindness.

In some countries adult women have been found to be at greater risk of developing the blinding complications of trachoma than are men.[81] This has, however, not been demonstrated in Aboriginal communities, where the blinding sequelae of trachoma occur as frequently in men as in women.[68,84]

Trachoma transmission occurs predominantly within the family or household. The risk of becoming infected is related to the likelihood of contact with an infected individual; families with infected pre-school age children, who form the reservoir of infection, are more susceptible. Children living in families where their siblings have trachoma are at increased risk, as are women acting as primary care givers.[85]

Figure 2: Follicular trachoma, trachoma intense and trachoma scarring, by age group[72]



4 Screening for trachoma

4.1 Initial surveys

Initial surveys can be conducted to assess the prevalence of trachoma in identified communities and to determine which communities require primary interventions. Epidemiological surveys are a useful way of collecting information not available from routine health information or existing surveillance systems.[86]

4.1.1 Who should be screened?

The World Health Organization recommends that children aged 0 to 10 years be screened. Current practice in Australia varies from State to State: some States screen only school-age children (5 to 15 years).[87] The main reasons for this are to do with logistics and convenience, but it can lead to a significant underestimation of prevalence.

These Guidelines recommend that children aged 2 to 7 years be screened, to give an accurate indication of prevalence in a particular community.

Rapid-assessment screening can be done by a doctor, a nurse or other health worker.[68] A reporting form can be specially devised or the form recommended by the World Health Organization can be adapted and used (see Appendix A).

4.1.2 The WHO guidelines on rapid assessment

The World Health Organization has prepared draft guidelines[88] for conducting a rapid assessment. The following steps—which have been modified slightly for use in Aboriginal and Torres Strait Islander communities—are recommended:

1. Review existing community-based data on trachoma, other eye diseases and eye surgery.
2. Interview health care workers, community workers and other health professionals to identify communities likely to have trachoma.
3. In selected communities—that is, those where trachoma is likely to be present—carry out direct observations to
   - identify and contact as many as possible, if not all, people with trichiasis living in the community,
   - assess whether active trachoma is present in the community.

4. Meet with community leaders to brief them on the assessment process. A larger public meeting, to explain the purpose of the assessment and to collect observational data, should follow this initial meeting.
   - The public meeting should be used to identify as many people with trichiasis as possible through showing a picture and asking a series of questions designed to uncover who the community thinks is likely to have trichiasis.
   - Each of the cases identified through this meeting should be contacted and examined. Trichiasis should be confirmed using the WHO grading system (see Section 4.2).[68]
   - A list of patients for surgery should be prepared and arrangements made for the procedure to be performed at the nearest hospital or clinic. If a regional model for the delivery of eye care is in operation, arrangements for trichiasis surgery should be integrated within that model.[64]
   - The number of people with trichiasis gives an indication of the priority for providing surgical services for lid correction.

Two further steps should then be taken:

5. Fifty children (2 to 7 years old) from a minimum of 15 families or households should be selected for examination.
6. The active trachoma pattern should be assessed by a standardised examination of the everted eyelid using a x2 or x2.5 binocular loupe, in accordance with the WHO simplified grading system (see Section 4.2.1).

4.2 Clinical features

Trachomatous inflammation of the inside lining of the eyelids—the conjunctiva—starts with the appearance of follicles, which are yellow or white 'spots' in the tarsal conjunctiva and are lymphoid germinal centres (see Plate 1). The conjunctiva is red and swollen, and small red dots (papillae) may be visible. Severe inflammatory trachoma presents as thickening of the conjunctiva, with inflammation obscuring the deep tarsal vessels (see Plate 2).

Although corneal changes may occur during active inflammation, they are not a sensitive indicator of trachoma. Limbal follicles may appear, and new vessels develop, producing corneal pannus. Once the limbal follicles resolve, depressions remain in the periphery of the cornea, resulting in a pathognomonic sign of trachoma—'Herbert's Pits'.

Multiple infections, or prolonged and severe infection, are followed by evidence of scarring of the conjunctiva (see Plate 3). Severe scarring results in trichiasis, or in-turned eyelashes (see Plate 4).

Trichiasis causes damage to the cornea, resulting in scarring, seen as a corneal opacity. Trichiasis and entropion (where the eyelid is rolled inward against the eyeball) eventually require lid surgery to stop the eyelashes rubbing on the globe and to prevent visual loss from corneal opacification. If trichiasis is not corrected, the cornea will develop irreversible opacities (see Plate 5).[89]

4.2.1 The WHO simplified trachoma-grading system

The World Health Organization has developed a simplified classification scheme for assessing community endemicity: it should be used in determining the presence and severity of trachoma.[90] The scheme is based on five clinical signs of trachoma—see Table 1.

The WHO simplified trachoma-grading system[68] is now universally recommended for use in field surveys of trachoma. It is designed for using a binocular loupe with x2 or x2.5 magnification. A good torch is essential if the examination is done indoors; otherwise, the examination can be done in direct sunlight. Each eye should be examined separately, starting with the right eye.

The eye is examined first for trichiasis—either one or more in-turned eyelashes actually rubbing on the eye or previously removed eyelashes. To check for the former, it is important to expose the lid margins. The cornea is examined for opacities, and finally the inside of the upper lid, the tarsal conjunctiva, is examined for follicles, intense inflammation and scarring.

4.3 Chlamydial infection and clinically active trachoma: laboratory testing

Although chlamydia infection is the cause of trachoma, it cannot always be detected in the presence of the clinical disease. These Guidelines therefore recommend that intervention strategies be based on the clinical findings of the presence of active trachoma in the community or family, as determined using the WHO simplified grading system, and not on the basis of laboratory confirmation.

Laboratory diagnosis of chlamydia infection is made through detection of the organisms in ocular specimens where the infection is suspected on clinical grounds or for research interests. Diagnosis can be made using various methods, including cytological examination of stained slides of conjunctival swabs, by growing the organism in tissue-culture cells, and by detection of

antigen or nucleic acids. (Note that the National Health and Medical Research Council's *Guidelines on Ethical Matters in Aboriginal and Torres Strait Islander Health Research* are available to guide researchers; among other things, they deal with consultation, community involvement, and ownership and publication of data.)

Direct fluorescent antibody cytology is an effective technique for detecting chronic chlamydial conjunctivitis. It offers an alternative to the tissue-culture isolation method. Data suggest that direct fluorescent antibody tests may be capable of detecting lower levels of chlamydial infection in the eye than chlamydial culture.[91]

A newer test for *C. trachomatis* is the polymerase chain reaction (PCR) assay and a variant called ligase chain reaction (LCR). These DNA-amplification tests can be performed on material obtained from swabs from patients with suspected trachoma. Studies show mixed results in relation to the benefits of PCR testing. When compared with the WHO grading system, PCR testing has been found to have good sensitivity and to be very specific[92], but it has a low negative predictive value and can be costly. Many cases with clear clinical disease are negative to PCR testing. The lag time between clearance of infection and resolution of clinical signs would account for some of these discrepancies. Although PCR testing is more sensitive than other laboratory tests[93], it should not be used routinely as the basis for classifying communities: trachoma is a clinical diagnosis.

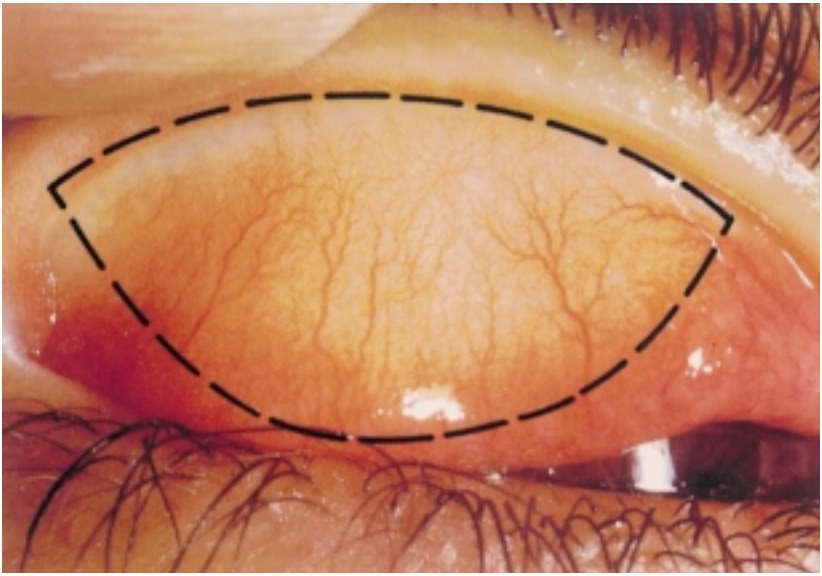
A recent study conducted in Nepal—in an area that previously had blinding endemic trachoma and still has a 6 per cent prevalence of clinically active conjunctival disease—failed to isolate any chlamydia agent, even using LCR testing.[94]

Trachoma Grading

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.

Plate 1: Trachomatous inflammation— follicular (TF).

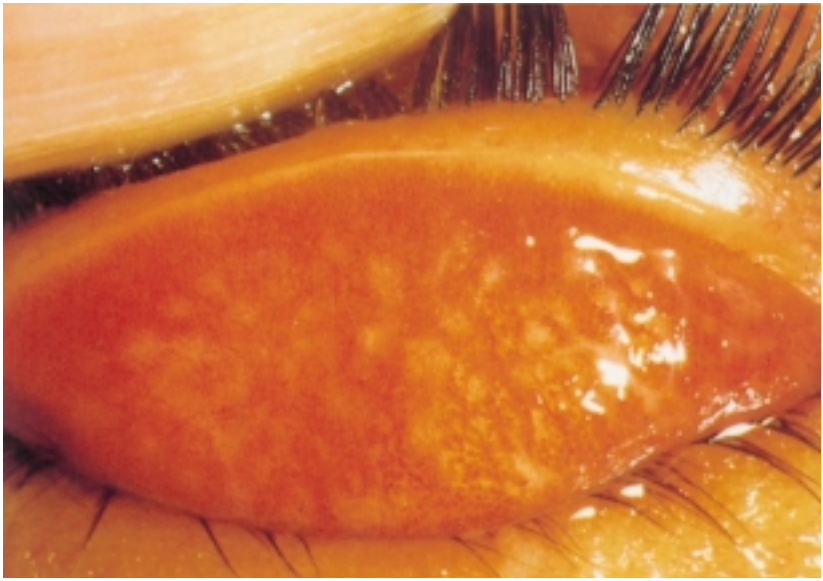


Plate 2: Trachomatous inflammation— follicular and intense (TF + TI).

Plate 3: Trachomatous scarring (TS).

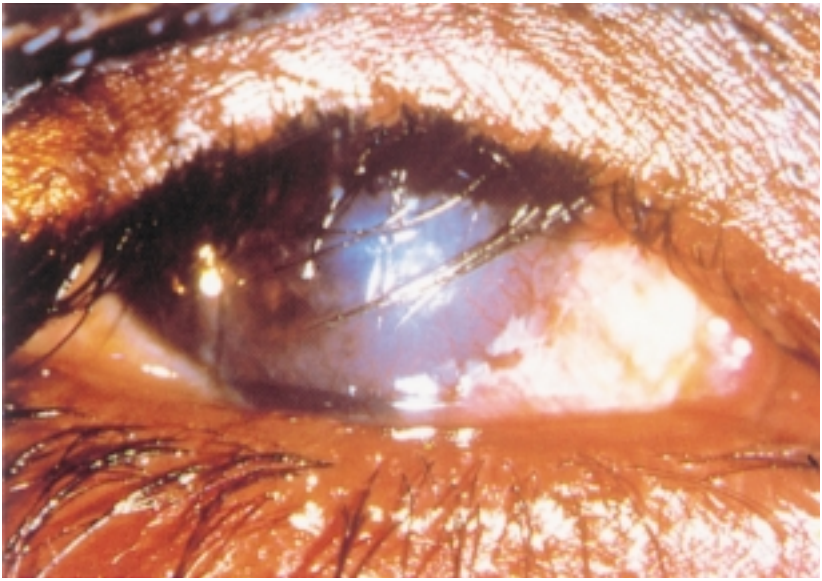


Plate 4: Trachomatous trichiasis (TT).

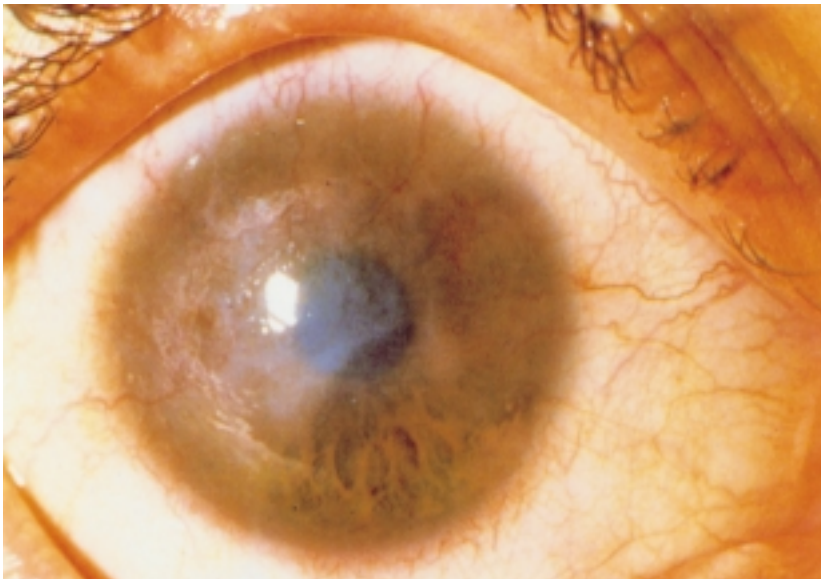


Plate 5: Corneal opacity (CO).

TF: give topical treatment (eg.tetracycline 1%).
TI: give topical and consider systematic 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

Table 1: The WHO simplified trachoma-grading system[68]

Sign	Description	Significance
Trachomatous inflammation —follicular (TF)	The presence of five or more follicles of at least 0.5 mm in diameter in the upper tarsal conjunctiva. (Follicles are whitish, round spots paler than the surrounding conjunctiva.)	Current active infection requiring antibiotic treatment.
Trachomatous inflammation —intense (TI)	Pronounced inflammatory thickening of the tarsal conjunctiva that obscures 50% or more of the normal deep tarsal vessels. The tarsal conjunctiva often appears red, roughened and thickened. Inflammatory thickening of the conjunctiva should not be confused with that caused by scarring.	Severe current infection with an increased risk of scarring and also requiring antibiotic treatment.
Trachomatous scarring (TS)	The presence of scarring in the tarsal conjunctiva. This should be easily visible as white lines or bands on the tarsal conjunctiva—glistening and fibrous in appearance. Scarring may also obscure the tarsal blood vessels, and it should not be confused with diffuse inflammatory thickening.	The patient has or has had trachoma and will require regular review to identify and deal with possible progression to trichiasis.
Trachomatous trichiasis (TT)	At least one eyelash rubs on the eyeball. Evidence of recent removal of in-turned eyelashes should also be graded as trichiasis.	The patient might develop corneal opacity and visual loss and require surgery to correct the condition as soon as possible.
Corneal opacity (CO)	Easily visible corneal opacity over the pupil. This means central corneal scarring so dense that at least part of the pupil margin is blurred when viewed through the opacity.	This is a disabling lesion. The patient will require rehabilitation and support and should be referred to an ophthalmologist for consideration of possible surgical correction.

5 Management and control of trachoma

5.1 An integrated primary health approach

A comprehensive community-based primary health care system is a prerequisite for sustainable implementation of trachoma programs. The aim of programs designed to manage and control trachoma is not only to treat active trachoma where it is found but also to reduce and ultimately eliminate the risk factors associated with the condition.[95]

An integrated primary health approach to the management and control of trachoma involves a combination of screening activity, antibiotic and surgical treatment, and environmental improvements to promote personal and community hygiene.

Only with environmental and hygiene changes will the long-term control and sustained elimination of trachoma be achieved.[96] Where trachoma is endemic, antibiotic treatment will be necessary to provide short-term relief and to reduce the reservoir of *C. trachomatis* in the community; at the same time, hygiene and environmental initiatives should be introduced.[74]

5.1.1 The World Health Organization's SAFE Strategy

The World Health Organization recommends an integrated and comprehensive approach to the prevention and treatment of trachoma—the SAFE Strategy—which should be implemented in the context of a planned national primary health care system.[97] The SAFE Strategy has four components designed to produce a combined medical, behavioural and environmental approach. It requires the active participation and involvement of communities. The four components are:

- Surgery to correct trachomatous trichiasis;
- Antibiotics to reduce the reservoir of chlamydial infection within the community;
- Facial cleanliness, especially in children;
- Environmental changes to reduce the transmission of trachoma.

Although these components are listed in this way for the sake of an easy acronym, they are actually listed in ascending order of priority: environmental changes are the most important component.

5.2 Surgery for trichiasis

In rural and remote areas where there is or has been trachoma, all people aged 40 years or more should have an eye examination for trichiasis as part of their routine health check. Lid surgery can correct the trichiasis that leads to corneal scarring.[98]

5.2.1 Epilation

Epilation is not recommended as a treatment for trichiasis because of the potential for damage to the eye from regrowth of in-turned lashes and because broken lashes can be more harmful than unbroken lashes. Epilation can, however, give temporary relief before surgery. It should be done carefully, under supervision and using loupes.

5.2.2 Bilamellar tarsal rotation surgery

There are two indicators for bilamellar tarsal rotation surgery:

- if one or more eyelashes are in-turned and touching the cornea when the patient is looking straight ahead; or
- if there is evidence of recent removal of in-turned lashes or corneal damage from trichiasis.

A prospective randomised controlled clinical trial performed in Oman showed that bilamellar tarsal rotation surgery was more effective than other forms of surgery for upper lid trichiasis due to trachoma.[99,100] Such simple surgery is, however, not recommended if there is defective lid closure.

Trichiasis surgery is quick, requires minimal equipment and can be performed under local anaesthetic. In other countries, trained paramedical eye health workers have successfully performed the procedure in the community setting.[101] This is the only procedure that has been fully evaluated in randomised clinical trials[102] and has proven efficacy.[103] In Australia, trichiasis surgery can be performed in the community if there are appropriate clinic facilities such as a treatment room suitable for suturing; otherwise it can be done in a regional hospital.

Surgical management of the condition involves rotating the marginal part of the eyelid outwards away from the globe, so that the lashes are no longer in contact with the eye. A horizontal split is made approximately 3 millimetres from the lid margin (through the tarsal conjunctiva and tarsal plate and as well through the orbicularis oculi muscle and skin). This is followed by the outward rotation of the distal fragment, which is effected by everting mattress sutures.[104]

As noted, tarsal rotation surgery is not recommended where there is defective lid closure as a result of lid shortening. These cases require more extensive lid reconstruction, which may necessitate expertise in ocular plastic surgery.

Appendix B provides a full description of the bilamellar tarsal rotation technique recommended by the World Health Organization.

5.2.3 Long-term follow up

As the disease process continues, trichiasis may recur a year or more later, even in an eye that has undergone successful surgery. Further surgery may be needed. For this reason, patients who have had trichiasis surgery should be followed up annually.

5.3 Antibiotics

The antibiotic component of the World Health Organization's SAFE Strategy is designed to reduce the transmission of ocular chlamydia infection and reduce the prevalence and severity of active trachoma.

In general, the family should be regarded as the transmission unit for trachoma, and treatment should be directed at that unit.[64] At high levels of endemicity, however, where many families in a community have trachoma, the community should be regarded as the transmission unit.

5.3.1 Tetracycline ointment

Until recently, the treatment recommended by the World Health Organization was an application of tetracycline ointment 1% twice a day for six weeks. Intermittent treatment schemes of ointment application—twice a day for five consecutive days a month for at least six consecutive months or once a day for 10 consecutive days a month for six months—were also acceptable.[105]

There are, however, difficulties associated with topical tetracycline treatment that lead to poor patient compliance:

- Ointment is difficult to apply, particularly to young children and infants.
- Discomfort and blurring are associated with the use of ointment.
- The infection can be symptomless and as a consequence there can be a lack of motivation to continue with a course of treatment.
- The presence of extraocular chlamydial infection can lead to re-infection.

5.3.2 Azithromycin

An alternative to the use of topical tetracycline ointment is azithromycin, which overcomes most of the difficulties associated with the ointment. Azithromycin is an erythromycin-like macrolide antibiotic and requires only a single oral dose to maintain adequate tissue levels for up to eight days. Where this drug is available, the World Health Organization recommends its use in both individual and community programs for the treatment of trachoma.[96]

In Australia, use of azithromycin is the preferred mode of treating trachoma.[64] Through special arrangements under the Pharmaceutical Benefits Scheme, azithromycin is now available free of charge to patients obtaining health care in rural and remote areas. As a result, cost considerations—which in other countries act as a barrier to the widespread adoption of azithromycin as the drug of choice—do not apply.[106]

A single dose of azithromycin is as effective as a six-week course of topical tetracycline in clearing ocular chlamydial infection and resolving signs of active trachoma. Studies undertaken in the Gambia[85] and randomised clinical trials in Saudi Arabia[107] and northern Egypt[108] have demonstrated this.

A community-based randomised trial conducted in Egypt, the Gambia and Tanzania assessed the long-term effect of mass treatment with azithromycin compared with tetracycline.[109] One year after treatment, both clinical disease and laboratory evidence of infection in the community were reduced in each treatment group. There was, however, a significant and more sustained reduction in chlamydial infection with azithromycin treatment compared with topical tetracycline.

If only active cases are treated with azithromycin, and the other components of the SAFE Strategy are not used, active trachoma will recur. This confirms the need for an integrated approach: antibiotic treatment alone is insufficient to entirely eliminate active trachoma.[102]

Just what is the optimal interval for the re-treatment of trachoma in endemic communities and what are the appropriate target groups are somewhat uncertain.[103] Lietman et al.[110] used newly available data to model mathematically the effect of azithromycin treatment and the optimal frequency of re-treatment for reducing or eliminating trachoma. The model shows that when only children are treated and no other interventions are implemented, annual treatment is adequate in areas with a prevalence of 35 per cent in children. In hyper-endemic areas, where the prevalence was

50 per cent or higher in children, in the absence of other interventions, six-monthly treatment would be preferable.

In spite of this, these Guidelines recommend that all family members be treated and that the SAFE Strategy be implemented in its entirety.[94]

5.3.3 The benefits of azithromycin

Azithromycin offers several important benefits:

- Given as a single oral dose, it removes the possibility of incomplete treatment.
- It is absorbed within a few hours.
- It is very safe and has few side-effects. The most common side-effects are gastrointestinal symptoms, which are usually mild to moderate and disappear relatively quickly.[96] The Australian Drug Evaluation Committee has reported that azithromycin can be used by pregnant and lactating women.[111]
- It assists with the control of most respiratory, skin and genital infections.

5.3.4 The Australian experience

In Australia, azithromycin has been shown to be effective in reducing the rate of active trachoma in a number of Aboriginal communities. In the Katherine region of the Northern Territory, a trachoma treatment program was implemented using azithromycin in conjunction with health promotion initiatives.[87] The treatment protocol was based on the WHO guidelines, but only children were treated, not adults. The results demonstrated a fall in prevalence from 49 per cent in 1995 to 19 per cent in 1996 post-treatment. Azithromycin programs have been introduced in other communities with positive results[112]: in the Pilbara region of Western Australia, a 95 per cent resolution of active trachoma was found in children examined six to eight weeks after azithromycin treatment.[63]

5.3.5 Bacterial resistance

The possibility of bacterial resistance developing with widespread use of azithromycin is considered slight, given the drug's unusual pharmokinetics.[113] But this question is not settled. An Australian study of the effect of azithromycin treatment on trachoma also monitored the drug's effect on the carriage and antimicrobial resistance profiles of pneumococci[114]: it showed that azithromycin allowed the growth and transmission of pre-existing azithromycin-resistant strains. However, other data lead to the conclusion

that the prevalence of azithromycin-resistant pneumococci remains low.[115] Continuing surveillance is important.

5.3.6 Family-based treatment

The family or living unit has been recommended as the target for treatment in Australia.[64] Family-based treatment of trachoma means that all families or households with one child or more with trachoma need to be identified and all members of the household treated.

Compared with community-based treatment, family-based treatment reduces the number of people to be treated and thus minimises the risk of bacterial resistance. Even in hyper-endemic areas, there will be some families without trachoma. Family-based treatment is more cost- and resource-effective.[63]

In communities that are known to have a high prevalence of infection—that is, areas of hyper-endemicity, or where the prevalence rate is 20 per cent or greater—it may be simpler to treat the entire community and obviate the need to examine members of all families. However, in areas where prevalence is lower or where prevalence rates have fallen, it will be necessary to specifically identify those households that have children with active trachoma. This means that all children in a family need to be examined to ensure that no child in that family has trachoma.[105]

Action for family-based treatment

- Treatment should be given to all family members or all members of households in which there are children with active trachoma. In hyper-endemic areas this effectively means that most families in a community will be treated. For the purposes of treatment, ‘the family’ consists of those people (related or not) who live together or share a sleeping area.
- The treatment course involves a single oral dose of azithromycin taken under supervision:
  - Children: 20 milligrams per kilogram, up to a maximum of 1000 milligrams;
  - Adults: 1 gram.
- Families that still have children with active trachoma should be re-treated annually, until active trachoma disappears.

5.4 Facial cleanliness

Facial cleanliness protects against trachoma.[75] As a result, interventions that encourage facial cleanliness—and not just facial washing—especially among pre-school and school children, are very important.

5.4.1 Interventions for facial cleanliness

Various studies support the WHO emphasis on facial cleanliness and the need to implement combined trachoma-control interventions that include behavioural change strategies and take into account the availability of water.

In Tanzania, children from villages using the face cleaning and tetracycline intervention had reduced levels of trachoma when compared with children from villages who received only antibiotic treatment.[116] Children with a sustainably clean face also had a lower risk of constant severe trachoma.[117]

An improvement in personal and community hygiene requires improved access to water and health and public education efforts in conjunction with environmental improvements.[101]

5.4.2 Promoting facial cleanliness

- Support Aboriginal Health Workers in their efforts to promote personal hygiene (including face washing) through as many channels as possible—directly with mothers and carers and through women's groups, families, school health workers, community groups, and so on.
- Take the opportunity to promote hand washing before eating and after using the toilet and nose blowing. This may help to reduce the transmission of trachoma and will help to prevent ear and diarrhoeal diseases and upper respiratory tract infections.[118]
- Follow neighbourhood meetings with school plays, posters, colouring books for children, workshops, or meetings with tribal leaders and traditional healers and arrange for individual health workers to meet with families and household groups to explain, promote and gather support for changed behaviour.[112]
- Use the health promotion aids that are available to assist with education and promotion. Appendix C provides a list of currently available health promotion materials and where they can be obtained.
- Develop health promotion aids that suit the circumstances of the particular community in which the intervention is occurring and that are sensitive to the local situation. This could include local television or radio programs or

obtaining the cooperation of a sporting or local 'hero' to spread health promotion messages.

- School-based health interventions—such as the Healthy Kids Program in the Northern Territory with the BBC program *Breathing, Blowing, Coughing in the Northern Territory*—may be useful for promoting facial cleanliness in some communities.

5.5 Environmental improvements

Improvements in living conditions will lower trachoma prevalence rates. Trachoma will be eliminated successfully in the long term only if appropriately targeted, community-based interventions are implemented.[119]

A recent review of the evidence for associations between environmental sanitation and transmission of trachoma identified the presence of flies, the availability and use of water, the presence of latrines, garbage collection and disposal, and animal hygiene as important factors associated with trachoma.[63]

The type of water supply, the distance to the water source, crowding, and trachoma endemicity in the community also influence the distribution of trachoma.[76]

A 1987 environmental health review[120] in Australia, *Uwankara Palyanyku Kanyintjaku*, described and quantified a physical environment that prevented the adoption of healthy living choices among the Aboriginal people on the Anangu Pitjantjatjara freehold lands of South Australia. The review developed a list of nine healthy living practices—ranging from the provision of water to dust control—that were needed to improve the health status of the people concerned. It also emphasised the importance of providing functional and suitable housing.

Projects implemented following the review demonstrated that improvements in essential health hardware provided in remote communities encourage the adoption of positive health practices and lead to specific improvements in health status.[121]

5.5.1 Water

There is a close association between access to water and the prevalence of trachoma. A reduction in the risk of trachoma is consistently associated with better access to water.[79] However, the patterns of water consumption and water use are also of great importance.[122]

The frequency of trachoma increases with a household's increasing distance from water. The effect of the household's distance from the water source is independent of the amount of water brought into the family on a daily basis.[123] Households situated more than 30 minutes from the source of their water are at increased risk of trachoma. There is a plateauing effect with respect to consumption when water is within 30 minutes' distance from the home[116], unless the pump or tap is in the home or yard.[124]

The relationship between water supplies and trachoma is complex, however, and the availability of water or easier access to it does not automatically lead to hygiene improvements or change the way the water is used.[125] It is important not only to provide access to water but also to implement education strategies to explain how the water can be used.

In Australia, running water is available in most communities. A census of each house—to see if pipes, taps, toilet and shower facilities are in working order—would help ensure that household members can use the available water.

The presence of a properly maintained swimming pool in the community has been shown to help reduce scabies, upper respiratory tract infection and trachoma.[126]

5.5.2 Flies

Flies are an important vector in trachoma transmission, although hyper-endemic trachoma can still occur in communities with low fly densities or no flies.[83]

In trachoma-endemic areas, flies are frequently seen around children's faces and eyes, where they feed on mucus and discharge. A recent study in the Gambia[127] showed a strong relationship between flies and the transmission of trachoma. It also demonstrated the impact of fly-control programs: insecticide spraying reduced the prevalence of active trachoma and the number of new cases of the disease in the intervention villages when compared with the control villages.

Various studies have shown that 'unclean environments'—those in which there is uncollected garbage or excreta—attract and foster the proliferation of flies.[63]

An increased number of flies around a house is a predictor of the presence of infection[68,128], although the usefulness of this as a predictor may vary with different environmental conditions.[129] Flies on children's faces were consistently associated with increased risk of trachoma in a study of six

villages in Tanzania. This may be an easier measure than assessing the number of household flies; it is also less intrusive.

Several types of flies are implicated in the transmission of trachoma: *Musca domestica* and *M. sorbens* have both been shown to transfer infectious nasal and ocular discharges from person to person.[130,131]

A recent study examined whether there was a consistent relationship between fly populations and the presence of trachoma in three Aboriginal communities in north-western Australia.[124] In Australia, *M. domestica* and *M. vetustussima* (the bush fly) are most prevalent and are closely associated with human communities. The bush fly, like *M. sorbens*, has eye-seeking behaviour. It is also a passive vector of *C. trachomatis*.[132] The study[124] confirmed the presence of bush flies in the surveyed communities. Fly numbers were consistent across the communities and were greatest in the wet season, which is the peak season for trachoma.

Fly levels have also been associated with cattle dung. Limiting dung volumes by introducing dung beetles can reduce fly levels.

It is probable that fly control through environmental improvement would have a significant impact on the occurrence of trachoma in particular communities and would assist with the reduction in other diseases such as diarrhoea.

The World Health Organization has reviewed the role of environmental interventions[63]—such as proper construction and use of pit latrines and keeping cattle away from human dwellings[117]—that can reduce the prevalence of trachoma through controlling fly populations. Other studies have also demonstrated the protective effect of these interventions.[133,134]

5.5.3 Recommended interventions for reducing the fly population

The following interventions are recommended for reducing the fly population:

- multiple insecticide spraying, although this may be difficult to sustain in the longer term and may not be necessary in most Australian communities;
- well-maintained, functioning toilets;
- covered latrines to limit fly-breeding sites, which can substantially remove the population of eye-seeking flies;
- proper disposal of household and village or community rubbish;
- animal care.

5.5.4 Community-level environmental interventions: water supply, sanitation and housing

To bring about environmental change it is necessary first to identify in a given community the problems that need to be resolved. This can only be done in consultation with the community and by helping the community to identify its needs and priorities.

The water source and supply for a community needs to be assessed, as do attitudes about water use for personal hygiene, general cleanliness and sanitary practices. It may be necessary to promote improved water use and sanitation. Building water-storage tanks might be helpful in some communities. Similarly, ensuring that showers, washing machines and hot water services all work is important.

In addition, cleaning up housing areas and yards and maintaining or enabling houses to be maintained so that equipment and services function are important. The planting of vegetation and shade trees could provide expanded sleeping areas and so reduce crowding. A further benefit from planting vegetation around houses, in public places and along roads is that it assists with dust control: dust aggravates the symptoms of eye disease.

5.5.5 Household-level environmental interventions: latrines, rubbish and animals

The presence of pit latrines in houses—even when the latrines are full and unscreened—has been shown in Egypt to result in a reduction in trachoma prevalence.[80] In the Australian Housing for Health project, the presence of functioning toilets was shown to be important, particularly when house populations are high.[131] In the Australian study pit toilets were not always well accepted, so care needs to be taken to ensure their acceptance if they are proposed for installation in communities. Pit latrines can, however, be valuable if there is no guaranteed water supply. It may be necessary to show community members how to use their own resources and expertise to construct a pit latrine.

Householder members should be shown how to deal with waste and garbage in a way that discourages fly breeding. Garbage dumps might need to be constructed away from living areas.

Communities should be educated about the role of animals—both domestic and farm—in the transmission of germs and about dung and excreta providing a breeding ground for flies.