5.1 Eye disease

5.1.1 Smoking and eye disease

As was expected based on previous reviews, papers published from 1997 to 2006 and included in this review confirmed that smoking is associated with the development of cataract and AMD (Group 1). There is not enough data to define a threshold smoking level for this effect. See also Chapter 6 for information on family history and myopia in relation to AMD.

Results for an association with development of glaucoma are inconsistent (Group 5).

No relevant studies were found for this time period for retinitis pigmentosa (Group 7).

5.1.2 Age or ageing and eye disease

The link between ageing and macular degeneration is well established.

Papers published from 1997 to 2006 and included in this review showed that:

- the prevalence of cataract increases sharply with ageing, particularly from about 60 years onwards (in one study, prevalence increased from 1% to 12% at 65–69 years) (Group 1)
- the prevalence of primary open-angle glaucoma (POAG) appears to increase with ageing, based on cross-sectional studies; we did not find any higher level studies (eg cohort studies) of this association (Group 2)
- prevalence of amblyopia increases up to three years of age and the depth also increases with age (Group 2); it is therefore important to identify young children with anisometropia so that the condition can be treated before the development of amblyopia.
- results for whether a specific age or ageing is associated with development of diabetic retinopathy are conflicting; the best quality study found for this issue (Blue Mountains Eye Study) showed no statistically significant association with ageing (Group 5); however, further research is needed on the relationship between incidence of DR with time since onset of diabetes and ongoing increase in DR with ageing in diabetic patients (see Chapter 6).

No relevant studies were found in the search period for the effect of ageing on retinitis pigmentosa or trachoma (Group 7).

As noted in Section 3.1, there is a distinction to be made between the age of onset or detection of eye disease (such as early childhood and amblyopia) and disease that occurs progressively with ageing (such as cataract and AMD). Care is needed in public health messages to distinguish these two issues (eg for diabetic retinopathy).

5.1.3 Alcohol consumption and eye disease

Papers published from 1997 to 2006 and included in this review showed that drinking increases the risk of nuclear, cortical and posterior subcapsular cataracts (Group 1).

However, it is difficult to define a threshold drinking level for this effect. The lowest level that showed an effect in the included studies was 91 g pure ethanol per week (equivalent to nine Australian standard drinks).

The relationship between alcohol and AMD is difficult to evaluate due to the number of variables, including the different types and symptoms of AMD, definitions of alcohol intake and types of alcohol. However, the majority of the included literature suggests that drinking more than 6 beers per week increases the risk of developing drusen and drinking more than about 3 drinks per day, particularly of wine or spirits, is associated with development of AMD (Group 2).

Although there may be an association between alcohol consumption and diabetic retinopathy, more research is needed to clarify this effect (Group 2).

There are conflicting results on the effect that alcohol has on the development of glaucoma and its major risk factor, intraocular pressure (Group 5).

No relevant studies were found in the search period for the effect of alcohol consumption on amblyopia, retinitis pigmentosa or trachoma (Group 7).

5.1.4 Eye infections and eye disease

Papers published from 1997 to 2006 and included in this review showed the following possible associations (all Group 2):

- eye infections (conjunctivitis and toxoplasmosis) appear to be linked to cataract
- amblyopia appears to occur in some cases of eye infection (very small study)
- eye infection appears to be associated with the development of retinopathy in people with diabetes
- a range of infectious agents (eg herpes zoster, cytomegalovirus and nematodes) appear to be associated with glaucoma
- there may be a link between infection with *Chlamydia pneumoniae* and macular degeneration.

No relevant studies were found in the search period for the effect of eye infections on retinitis pigmentosa (Group 7). No studies were found for an association between trachoma and other eye infections (Group 7).

5.1.5 UV exposure/sunlight and eye disease

Papers published from 1997 to 2006 and included in this review indicate that exposure to medium-wave ultraviolet light (UVB) is associated with the development of cortical cataract (Group 1).

Exposure to UV in the teenage years and 30s is associated with increased risk of AMD-related pathologies (drusen and pigmentation) and early AMD, although outdoor exposures (eg working outdoors) did not increase risks (Group 2). Wearing sunglasses and hats for at least half the time was protective for people with the highest levels of exposure when measured at 10 years (but not at 5 years).

No relevant studies were found in the search period for an association between exposure to UV or sunlight and amblyopia, diabetic retinopathy, glaucoma, retinitis pigmentosa or trachoma (Group 7). Papers published from 1997 to 2006 and included in this review indicate that exposure to medium-wave ultraviolet light (UVB) is associated with development of cortical cataract (Group 1).

Papers published from 1997 to November 2008 and included in this review indicate that exposure to medium-wave ultraviolet light (UVB) is associated with development of pterygium and ocular surface neoplasia (both Group 1).

See Chapter 6 for further information about sunlight exposure and myopia.

5.1.6 Injuries and accidents and eye disease

Papers published from 1997 to 2006 and included in this review indicate that injuries and accidents are clearly associated with an increased risk of cataract, amblyopia and glaucoma (Group 1).

Injuries and accidents appear not to increase the risk of AMD (Group 4).

No relevant studies were found in the search period for an association between injuries and accidents and diabetic retinopathy, retinitis pigmentosa or trachoma (Group 7).

5.1.7 Corticosteroids and eye disease

Papers published from 1997 to 2006 and included in this review show that:

- oral corticosteroids can increase the risk of ocular hypertension or OAG in older people (Group 1)
- inhaled corticosteroids can increase the risk of glaucoma and intraocular hypertension in people who take high doses of this medication for long periods of time, or for those with a family history of glaucoma (Group 1) and may also be associated with cataracts (Group 2)
- topical corticosteroids used near the eyes may increase the risk of glaucoma (Group 2).

No relevant studies were found in the search period for an association between corticosteroids and amblyopia, diabetic retinopathy, retinitis pigmentosa or trachoma (Group 7).

5.1.8 High myopia and eye disease

Papers published from 1997 to 2006 and included in this review show that high myopia is associated with cortical, nuclear and posterior subcapsular cataract although the direction of causality is not clear (Group 1).

Myopia may also increase the risk of POAG, and of developing glaucoma early in life (Group 2).

High myopia does not appear to increase the risk of AMD (Group 4).

Due to conflicting results, it is unclear whether high myopia is associated with an increased risk of amblyopia in children, or with an increased risk of diabetic retinopathy (Group 5). However, this is a complex area of research and more detailed analysis was beyond the scope of this review.

No relevant studies were found in the search period for an association between high myopia and retinitis pigmentosa or trachoma (Group 7).

See also further information in Chapter 6 on the relationship between high myopia and retinal detachment and chorio-retinal degeneration.

5.1.9 Ocular hypertension and eye disease

Papers published from 1997 to 2006 and included in this review show that ocular hypertension (OHT) may lead to glaucoma, with even mild and moderate pressure increasing the risk (Group 2). However, in many cases of glaucoma, OHT may be normal. See Chapter 6 for further information on the relationship between OHT and glaucoma.

Due to conflicting results, it is unclear whether OHT is associated with an increased risk of cataract development (Group 5).

No relevant studies were found in the search period for an association between OHT and amblyopia, diabetic retinopathy, retinitis pigmentosa, AMD or trachoma (Group 7).

5.1.10 Poor living conditions and eye disease

It is difficult to determine the effects of poor living conditions on eye health because of the lack of a standard classification system for socioeconomic status. Studies use a range of different socioeconomic factors (eg income, education, occupation, etc) to identify poor living conditions. However, papers published from 1997 to 2006 and included in this review show that poor living conditions may be linked to a higher risk of diabetic retinopathy and glaucoma (Group 2).

Due to conflicting results, it is not clear whether poor living conditions are associated with cataract and AMD (Group 5).

No relevant studies were found in the search period for an association between poor living conditions and amblyopia or retinitis pigmentosa (Group 7). There is a well-established association between poor living conditions and trachoma but no relevant studies were found in this review (indicating that this was already well established by 1996).

In retrospect, ‘poor living conditions’ may not have been the best search term for this topic and a further research of the literature about socioeconomic status and eye disease may yield further relevant information (see Chapter 6).

5.1.11 Diabetes and eye disease

Papers published from 1997 to 2006 and included in this review show that type 1 and type 2 diabetes are significantly linked with all types of cataract but, in the early stages diabetic cataract can be reversed with a change in diet and medication (Group 1).

There is a high rate of diabetes in people with trachoma, but causality is not clear because both diseases are poverty related. Diabetic retinopathy may make people more susceptible to poor visual acuity after trachoma (Group 2).

Diabetes appears not to be a risk factor for AMD (Group 4).

Due to conflicting results, it is not clear whether diabetes is associated with AMD (Group 5).

No relevant studies were found in the search period for an association between diabetes and amblyopia or retinitis pigmentosa (Group 7).

5.1.12 Heredity and eye disease

Papers published from 1997 to 2006 and included in this review show that heredity is the major factor determining cataract development (Group 1).

Development of POAG is strongly linked to heredity factors; secondary OAG less so (Group 1). However, unlike cataracts, where a simple genetic mechanism is involved, glaucoma has different phenotypes (sometimes due to cornea thickness, sometimes due to increased intraocular pressure, etc). This makes it more difficult to associate heredity with particular cases.

Also, heredity strabismus may be linked with amblyopia (Group 2).

No relevant studies were found in the search period for an association between heredity and diabetic retinopathy, AMD, or trachoma (Group 7). However, see Chapter 6 for further information on the contribution of genetic mutations to AMD.

Retinitis pigmentosa is known to be inherited.

This is a very complex area that requires further, more focused literature research to identify the contribution of genetics to eye disease (see Chapter 6).

5.1.13 Hypertension and eye disease

Papers published from 1997 to 2006 and included in this review show that hypertension is a risk factor for retinopathy in people with and without diabetes, and for glaucoma (Group 1).

Due to conflicting results, it is not clear whether hypertension is a risk factor for cataract or AMD.

No relevant studies were found in the search period for an association between hypertension and amblyopia, retinitis pigmentosa or trachoma (Group 7).

5.1.14 Squint and eye disease

Papers published from 1997 to 2006 and included in this review show that strabismus is clearly a cause of amblyopia, although there is debate about different intervention and screening programs (Group 1).

No relevant studies were found in the search period for an association between squint and cataract, diabetic retinopathy, glaucoma, AMD, retinitis pigmentosa or trachoma (Group 7).

5.1.15 Anisometropia and eye disease

Papers published from 1997 to 2006 and included in this review show that anisometropia can lead to amblyopia (Group 1). The condition is associated with the presence of cataract, although causality has not been confirmed (Group 2).

No relevant studies were found in the search period for an association between anisometropia and diabetic retinopathy, glaucoma, AMD, retinitis pigmentosa or trachoma (Group 7).

5.1.16 Cataract and eye disease

Papers published from 1997 to 2006 and included in this review show that congenital cataracts cause abnormal or reduced visual stimulation during the sensitive period of visual development, which can result in amblyopia (Group 1).

Due to conflicting results, it is not clear whether incidence of cataracts or cataract surgery is linked to AMD (Group 5).

No relevant studies were found in the search period for an association between cataract and diabetic retinopathy, glaucoma, retinitis pigmentosa or trachoma (Group 7).

5.1.17 Physical activity and eye disease

Papers published from 1997 to 2006 and included in this review show that physical activity may protect against cataract and exudative AMD (Group 6).

No relevant studies were found in the search period for an association between physical activity and amblyopia, diabetic retinopathy, glaucoma, retinitis pigmentosa or trachoma (Group 7).

Physical activity is also related to UV/sunlight exposure (see Section 5.1.5).

5.1.18 Diet and eye disease

Papers published from 1997 to 2006 and included in this review show that (all Group 6):

- a diet high in fruit and vegetables, especially spinach and kale, has a modest protective effect against cataract
- nutrients such as riboflavin, thiamin, vitamin C and vitamin E may protect against cataract, although further studies are needed
- a low-fat, low-glycaemic diet high in fruit, fish and nuts may protect against the onset of AMD, although again, further studies are needed.

Prospective studies suggested that diet (specifically fatty acids and antioxidants) had neither a beneficial nor a harmful effect on the development of POAG (Group 3).

Glycaemic load does not appear to be related to cataract (Group 4).

No relevant studies were found in the search period for an association between diet and amblyopia or retinitis pigmentosa (Group 7).

More research is needed on the role of diet in eye health.

5.1.19 Nutritional supplements and eye disease

Papers published from 1997 to 2006 and included in this review show that supplements (in the form of antioxidants) do not significantly reduce the risk of glaucoma (Group 3).

Due to conflicting studies, it is not clear whether supplements (in the form of vitamins, antioxidants, lutein, zeaxanthin and zinc) have any beneficial or harmful effect on AMD (Group 5). Similarly, it is not clear whether lutein supplements have any effects on retinitis pigmentosa, although docosa-haxaenoic acid (long chain omega-3 fatty acid; DHA) supplements appear not to be beneficial for this condition (Group 5).

No relevant studies were found in the search period for an association between nutritional supplements and amblyopia, diabetic retinopathy or trachoma (Group 7).

5.1.20 Fatty acids and eye disease

Papers published from 1997 to 2006 and included in this review show that particular fatty acids can increase the risk of age-related nuclear opacities, although it is not clear whether a similar association exists for dietary fats and cataracts (Group 2). Fatty acids may lead to improvements in retinitis pigmentosa, but more studies are needed before this could be recommended as therapy (Group 2).

Due to conflicting results, it is not clear whether omega-3 fatty acids protect against glaucoma or AMD (Group 5).

No relevant studies were found in the search period for an association between fatty acids and amblyopia, diabetic retinopathy or trachoma (Group 7).

5.1.21 Obesity and eye disease

Papers published from 1997 to 2006 and included in this review suggest that:

- a body mass index (BMI) and waist-to-hip ratio within the normal range offers the lowest risk of ARM (Group 1);
  higher or lower than average BMI is a risk factor for visually significant AMD (indicating a J-shaped relationship)
- obesity is associated with an increased risk of cataract (especially posterior subcapsular cataract) (Group 2)

- abdominal obesity is a risk factor for retinopathy in people with or without diabetes, although body mass index (BMI) is not a risk factor for this condition (Group 2)

BMI may not affect the risk of glaucoma, but more research is needed to confirm this finding (Group 4).

No relevant studies were found in the search period for an association between obesity and amblyopia, retinitis pigmentosa or trachoma (Group 7).

5.1.22 Combined diet, supplements and weight, and eye disease

See Chapter 6 for further discussion diet and eye disease.

Overall, the effect of diet on eye health is an extremely complex area of research. Within the scope of this review, it has not been possible to analyse all the dietary factors in detail or fully appraise the quality of individual studies