

Table 4.1 Summary of results for eye diseases

Risk factor	Condition	Finding	Group ^a	Summary sheet number ^b
Smoking	Cataract	Smoking is strongly associated with development of nuclear cataract, possibly associated with posterior subcapsular cataract and apparently not associated with cortical cataract. Risk increases with number of cigarettes smoked. Ex-smokers have a lower risk than current smokers, particularly after prolonged quitting.	1	1
Smoking	Amblyopia	No relevant studies found	7	NA
Smoking	Diabetic retinopathy	No relevant studies found	7	NA
Smoking	Glaucoma	A systematic review of cross-sectional and case-control studies showed a positive association between current smokers (but not past smokers) and glaucoma. However, a very large prospective cohort study, as well as two studies that were excluded from the systematic review, did not show this association and those with more than 10 pack-years of smoking experience had a reduced risk of glaucoma. (1 pack-year = 1 pack of cigarettes per day for 1 year)	5	4
Smoking	Age-related macular degeneration (AMD)	In two studies, current smoking was associated with an increased risk of developing AMD compared to past smokers and never smokers. Smoking is also associated with a progression to late AMD among those with early or intermediate AMD. For one study which did not show these effects, deaths from other causes may have masked the effect.	1	5
Smoking	Retinitis pigmentosa	No relevant studies found	7	NA
Smoking	Trachoma	No relevant studies found	7	NA
Age/ageing	Cataract	Prevalence of cataract increased with ageing, particularly post-60 years old when the prevalence increased from 1% to 12% at 65-69 years.	1	8
Age/ageing	Amblyopia	In a case-series of children with anisometropia, depth of amblyopia increased with ageing; prevalence also increased up to three years of age.	2	9
Age/ageing	Diabetic retinopathy	There are conflicting results as to whether or not age or ageing is associated with development of diabetic retinopathy. The best quality study in this group (Blue Mountains Eye Study) showed no statistically significant association with ageing. Further research is needed on the relationship between the incidence of DR with the time since onset of diabetes and an ongoing increase in DR with ageing in diabetic patients.	5	10
Age/ageing	Glaucoma	Cross sectional studies (level IV) show that prevalence of glaucoma (primary open-angle glaucoma, POAG) increases with ageing.	2	11
Age/ageing	AMD	Link already established	NA	NA
Age/ageing	Retinitis pigmentosa	No relevant studies found	7	NA
Age/ageing	Trachoma	No relevant studies found	7	NA
Alcohol	Cataract	Drinking increases the risk of nuclear, cortical and posterior subcapsular cataracts. Both the Blue Mountains Eye Study and the Beaver Dam Study found this effect at 'heavy' drinking levels, defined as ≥ 4 drinks/day (equivalent to approximately 280 g ethanol per week). However, a further study found that drinking at lower levels (≥ 91 g pure ethanol per week) increased the risk of posterior subcapsular opacities.	1	15

Risk factor	Condition	Finding	Group ^a	Summary sheet number ^b
Alcohol	Amblyopia	No relevant studies found	7	NA
Alcohol	Diabetic retinopathy	Alcohol consumption may be associated with an increased risk of retinopathy in diabetics. More research is needed on the long-term effects of alcohol consumption on the noncardiac complications of diabetes mellitus.	2	17
Alcohol	Glaucoma	There are conflicting results on the effect that alcohol has on the development of glaucoma and its major risk factor, ocular hypertension.	5	18
Alcohol	AMD	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 week, particularly of wine or spirits is associated with development of AMD.	2	19
Alcohol	Retinitis pigmentosa	No relevant studies found	7	NA
Alcohol	Trachoma	No relevant studies found	7	NA
Eye infections	Cataract	Eye infections (conjunctivitis and toxoplasmosis) appear to be linked to cataract.	2	22
Eye infections	Amblyopia	Amblyopia appears to occur in some cases of eye infection.	2	23
Eye infections	Diabetic retinopathy	Eye infection appears to be associated with the development of retinopathy in people with diabetes.	2	24
Eye infections	Glaucoma	A range of infectious agents (eg herpes zoster, cytomegalovirus and nematodes) appear to be associated with glaucoma.	2	25
Eye infections	AMD	There may be a link between infection with <i>Chlamydia pneumoniae</i> and macular degeneration.	2	26
Eye infections	Retinitis pigmentosa	No relevant studies found	7	NA
Eye infections	Trachoma	No relevant studies found	7	NA
UV damage	Cataract	A large number of epidemiological studies support an association between medium-wave ultraviolet light (UVB) and the development of cortical cataract.	1	36
UV damage	Amblyopia	No relevant studies found	7	NA
UV damage	Diabetic retinopathy	No relevant studies found	7	NA
UV damage	Glaucoma	No relevant studies found	7	NA
UV damage	AMD	Despite experimental evidence that the retina is susceptible to UV damage there has been no evidence that UV exposure per se is a risk for AMD. However, sunlight exposure in the teenage years and 30s is associated with increased risk of AMD-related pathologies (drusen and pigmentation) and early AMD. Other outdoor exposures did not increase risks (eg working outdoors). 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 five years).	2	40
UV damage	Retinitis pigmentosa	No relevant studies found	7	NA
UV damage	Trachoma	No relevant studies found	7	NA
UV damage	Pterygia	Current and past exposure to UV light appears to increase the population prevalence of pterygia and the risk of developing pterygia. Exposure to UV light also increases re-development of pterygia after surgical removal.	1	41

Risk factor	Condition	Finding	Group ^a	Summary sheet number ^b
UV damage	Ocular surface neoplasia	Some epidemiology studies indicate that ocular surface neoplasms may be associated with exposure to UVB/sunlight. A causal effect of UV is further substantiated by molecular evidence of UV-induced mutations. Other risk factors include fair skin, light coloured iris, HIV infection, HPV infection and smoking.	1	42
Injuries and accidents	Cataract	Cataract can be caused by ocular trauma.	1	43
Injuries and accidents	Amblyopia	Ocular injuries and accidents can cause young children to develop amblyopia, either from visual deprivation or anisometropia. These injuries can have a wide range of causes, including dangerous toys and shaken baby syndrome.	1	44
Injuries and accidents	Diabetic retinopathy	No relevant studies found	7	NA
Injuries and accidents	Glaucoma	Glaucoma can occur as a complication of ocular trauma by a number of mechanisms. The risk of developing post-traumatic glaucoma after contusion is associated with increased age, poor visual acuity, iris injury, lens injury, hyphema and angle recession. The original trauma may be the result of any type of injury, including sporting injuries and automobile injuries.	1	46
Injuries and accidents	AMD	Macular degeneration does not appear to be linked to ocular injury.	4	47
Injuries and accidents	Retinitis pigmentosa	No relevant studies found	7	NA
Injuries and accidents	Trachoma	No relevant studies found	7	NA
Corticosteroids	Cataract	Inhaled corticosteroids may be associated with cataracts	2	50
Corticosteroids	Amblyopia	No relevant studies found	7	NA
Corticosteroids	Diabetic retinopathy	No relevant studies found	7	NA
Oral corticosteroids	Glaucoma	The use of oral glucocorticoids increases the risk of ocular hypertension or open-angle glaucoma in older people.	1	53
Topical corticosteroids	Glaucoma	The long-term use of potent formulations of topical corticosteroids near the eyes may increase the risk of glaucoma.	2	53
Inhaled corticosteroids	Glaucoma	Inhaled corticosteroid use may present an increased risk of glaucoma and ocular hypertension for people who are on high doses for long periods of time, or for those with a family history of glaucoma.	1	53
Corticosteroids	AMD	No association was found between the use of systemic anti-inflammatory medications and the cross-sectional incidence or prevalence of age-related macular degeneration.	4	54
Corticosteroids	Retinitis pigmentosa	No relevant studies found	7	NA
Corticosteroids	Trachoma	No relevant studies found	7	NA
High myopia	Cataract	Myopia, particularly high myopia, is associated with cortical, nuclear and posterior subcapsular cataract, although the causal mechanism remains unknown.	1	57
High myopia	Amblyopia	It is not clear whether children with high myopia are at increased risk of amblyopia.	5	58
High myopia	Diabetic retinopathy	The relationship between high myopia and diabetic retinopathy remains unclear.	5	59

Risk factor	Condition	Finding	Group ^a	Summary sheet number ^b
High myopia	Glaucoma	There is an increased risk of POAG in myopic eyes. In studies of patients with ocular hypertension, myopic patients appear more susceptible to developing POAG than nonmyopic patients. Myopic patients may also be more likely to develop glaucoma early in life.	2	60
High myopia	AMD	Myopia does not appear to be a risk factor for age-related macular degeneration.	4	61
High myopia	Retinitis pigmentosa	No relevant studies found	7	NA
High myopia	Trachoma	No relevant studies found	7	NA
Ocular hypertension	Cataract	There are conflicting results from studies of possible links between ocular hypertension and development of cataract.	5	64
Ocular hypertension	Amblyopia	No relevant studies found	7	NA
Ocular hypertension	Diabetic retinopathy	No relevant studies found	7	NA
Ocular hypertension	Glaucoma	Increased ocular hypertension (OHT) can lead to glaucoma; treatment of even mild and moderate OHT may help to prevent the onset of glaucoma.	2	67
Ocular hypertension	AMD	No relevant studies found	7	NA
Ocular hypertension	Retinitis pigmentosa	No relevant studies found	7	NA
Ocular hypertension	Trachoma	No relevant studies found	7	NA
Poor living conditions	Cataract	It is not clear whether or not poor living conditions are linked to cataracts. Two studies found an association between low socioeconomic status and cataract (confined to nuclear cataract in one study and type not specified in the other) and a third study did not. Possible reasons for the discrepancy are the lack of a standard classification system for socioeconomic status, and the use of cataract surgery as a surrogate for cataract.	5	71
Poor living conditions	Amblyopia	No relevant studies found	7	72
Poor living conditions	Diabetic retinopathy	Lower socioeconomic status may be linked to a higher incidence of diabetic retinopathy.	2	73
Poor living conditions	Glaucoma	Low income may be associated with glaucoma.	2	74
Poor living conditions	AMD	It is not clear whether or not poor living conditions are associated with AMD. Two studies found an association between socioeconomic factors (income, education and occupation) and AMD; two did not. Possible reasons for the discrepancy are the lack of a standard classification system for socioeconomic status and the different factors measured in the different studies.	5	75
Poor living conditions	Retinitis pigmentosa	No relevant studies found	7	NA
Poor living conditions	Trachoma	No relevant studies found	7	NA
Diabetes	Cataract	Type 1 and type 2 diabetes are both significantly associated with cataract formation (all three types). If diagnosed early, diabetic cataract can be reversed with a change in diet and medication.	1	78
Diabetes	Amblyopia	No relevant studies found	7	NA
Diabetes	Diabetic retinopathy	Link already established	NA	NA

Risk factor	Condition	Finding	Group ^a	Summary sheet number ^b
Diabetes	Glaucoma	A systematic review with meta-analysis indicates that diabetes is a risk factor for open-angle glaucoma; however, some prospective cohort studies suggest the opposite.	5	81
Diabetes	AMD	Diabetes appears not to be a risk factor for macular degeneration.	4	82
Diabetes	Retinitis pigmentosa	No relevant studies found	7	NA
Diabetes	Trachoma	There are high rates of diabetes in patients with trachoma, but causality is not clear. Both diseases are poverty-related and this single study looked at a very poor population. Diabetic retinopathy appears to make people more susceptible to poor visual acuity after trachoma.	2	84
Heredity	Cataract	Heredity is the major factor in determining cataract development.	1	85
Heredity	Amblyopia	Heredity strabismus appears to be linked with amblyopia.	2	86
Heredity	Diabetic retinopathy	No relevant studies found	7	NA
Heredity	Glaucoma	Development of primary open-angle glaucoma appears to be strongly linked to heredity factors in some cases. Secondary open-angle glaucoma may not be as strongly linked to heredity factors. Ethnic variations in physiology also account for differences in rates of glaucoma across different ethnic groups.	1	88
Heredity	AMD	No relevant studies found	7	NA
Heredity	Retinitis pigmentosa	No relevant studies found	7	NA
Heredity	Trachoma	No relevant studies found	7	NA
Hypertension	Cataract	There are conflicting results on the relationship between hypertension and cataract. Further studies are required, and should distinguish between different types of cataract in their analysis.	5	92
Hypertension	Amblyopia	No relevant studies found	7	NA
Hypertension	Diabetic retinopathy	Hypertension is a risk factor for retinopathy in both people with diabetes and people without diabetes.	1	94
Hypertension	Glaucoma	Ocular hypertension is a risk factor for glaucoma in the general population.	1	95
Hypertension	AMD	There may be an association between hypertension/blood pressure and age-related macular degeneration (AMD). One study showed no association between hypertension and ARM; others showed that hypertension/high blood pressure were risk factors for ARM/AMD. Beaver Dam Eye study had a smaller number of incident cases of ARM than Klein et al 2003 (see results column). Van Leeuwen study had a much larger study sample than other two studies (other 2 were of comparable size).	5	96
Hypertension	Retinitis pigmentosa	No relevant studies found	7	NA
Hypertension	Trachoma	No relevant studies found	7	NA
Squint	Cataract	No relevant studies found	7	NA
Squint	Amblyopia	Although there is debate about different intervention and screening programs, strabismus is clearly a cause of amblyopia.	1	100
Squint	Diabetic retinopathy	No relevant studies found	7	NA
Squint	Glaucoma	No relevant studies found	7	NA
Squint	AMD	No relevant studies found	7	NA

Risk factor	Condition	Finding	Group ^a	Summary sheet number ^b
Squint	Retinitis pigmentosa	No relevant studies found	7	NA
Squint	Trachoma	No relevant studies found	7	NA
Anisometropia	Cataract	This study shows that anisometropia is associated with the presence of cataract. Further research would be required, however, to confirm causality.	2	106
Anisometropia	Amblyopia	It is well-established that anisometropia can lead to amblyopia, although it is not the only cause of this condition. Australian studies have shown that amblyopia is a significant cause of reduced visual acuity in the adult population.	1	107
Anisometropia	Diabetic retinopathy	No relevant studies found	7	NA
Anisometropia	Glaucoma	No relevant studies found	7	NA
Anisometropia	AMD	No relevant studies found	7	NA
Anisometropia	Retinitis pigmentosa	No relevant studies found	7	NA
Anisometropia	Trachoma	No relevant studies found	7	NA
Cataract	Amblyopia	Congenital cataracts cause abnormal or reduced visual stimulation during the sensitive period of visual development, which can result in amblyopia.	1	114
Cataract	Diabetic retinopathy	No relevant studies found	7	NA
Cataract	Glaucoma	No relevant studies found	7	NA
Cataract	AMD	It is not clear whether incidence of cataracts or cataract surgery is linked to age-related macular degeneration.	5	117
Cataract	Retinitis pigmentosa	No relevant studies found	7	NA
Cataract	Trachoma	No relevant studies found	7	NA
Physical activity	Cataract	Physically active people may be less likely to develop cataract than those who are inactive, although more research is needed.	6	120
Physical activity	Amblyopia	No relevant studies found	7	NA
Physical activity	Diabetic retinopathy	No relevant studies found	7	NA
Physical activity	Glaucoma	No relevant studies found	7	NA
Physical activity	AMD	Physical activity may have a protective effect against exudative AMD, independent of body mass index and other confounders.	6	124
Physical activity	Retinitis pigmentosa	No relevant studies found	7	NA
Physical activity	Trachoma	No relevant studies found	7	NA
Diet (Fruit and vegetables)	Cataract	These studies suggest that diet high in fruit and vegetables has a modest protective effect on cataract. This is especially true for spinach and kale, which are naturally high in the antioxidant lutein, found to be protective against nuclear cataract.	1	258
Diet (Glycaemic load)	Cataract	Glycaemic load does not appear related to the incidence of cataract.	4	258
Diet (Other nutrients)	Cataract	Other nutrients such as riboflavin, thiamin, vitamin C and vitamin E may protect against cataract but further studies are required.	2	258
Diet	Amblyopia	No relevant studies found	7	NA

Risk factor	Condition	Finding	Group ^a	Summary sheet number ^b
Diet	Diabetic retinopathy	Although in vitro and animal studies have suggested that vitamins E and C may protect against the development of retinopathy, there is insufficient evidence from epidemiological studies to confirm this protective effect.	6	260
Diet	Glaucoma	These prospective studies suggest that diet, specifically fatty acids and antioxidants, is neither a causative nor a protective factor for primary open-angle glaucoma.	3	261
Diet	Macular degeneration	A low-fat, low-glycaemic diet high in fruit, fish and nuts may be protective against the onset of age-related macular degeneration. Other factors, such as zinc, coffee or carbohydrate intake, were not related to AMD. Further research is required before any supplements could be recommended.	6	262
Diet	Retinitis pigmentosa	No relevant studies found	7	NA
Diet	Trachoma	Numerous studies have shown that malnutrition predisposes an individual to infections, due to immunological deficits. Although malnutrition and trachoma share risk factors, such as poor hygiene and low socioeconomic status, this study did not find a direct causal relationship between malnutrition and trachoma.	4	264
Nutritional supplements	Cataract	Major studies show no association between vitamins E, C and β -carotene; vitamin E alone; vitamin C alone; or carotenoid supplements and the risk of any type of cataract development. One randomised controlled trial (RCT) from China and a number of observational studies have shown a reduction in all types of cataracts after multivitamin use or supplements with riboflavin and niacin. NB: Adverse effects of supplements need to be taken into account (eg β -carotene has been shown to increase risk of lung cancer in smokers; vitamin E has increased heart disease in people with vascular disease or diabetes).	6	222
Nutritional supplements	Amblyopia	No relevant studies found	7	NA
Nutritional supplements	Diabetic retinopathy	No relevant studies found	7	NA
Nutritional supplements	Glaucoma	Supplements (in the form of antioxidants) do not significantly reduce the risk of glaucoma.	3	224
Nutritional supplements	AMD	It is not clear whether supplements (vitamins, antioxidants, lutein, zeaxanthin and zinc) have a positive, negative or no effect on macular degeneration. Other adverse effects of supplements should be taken into account (eg β -carotene has been shown to increase risk of lung cancer in smokers; vitamin E has increased heart disease in people with vascular disease or diabetes).	5	226
Nutritional supplements	Retinitis pigmentosa	It is not clear whether lutein supplements are beneficial in retinitis pigmentosa. Docosa-hexaenoic acid (DHA, long chain omega-3 fatty acid) supplements do not appear to be beneficial.	5	227
Nutritional supplements	Trachoma	No relevant studies found	7	NA

Risk factor	Condition	Finding	Group ^a	Summary sheet number ^b
Fatty acids	Cataract	Most types of dietary fat do not appear associated with cataract. The Nurses' Health Study found that high intakes of the 18-carbon polyunsaturated fatty acids linoleic acid and linolenic acid were significantly associated with the prevalence of nuclear opacities. This is supported by In vitro studies, which have demonstrated a potential mechanism for epithelial lens cell damage by polyunsaturated fatty acids. However, more detailed studies are required, particularly studies that separate different types of polyunsaturated fatty acids, as there is conflicting evidence from cross-sectional studies.	5	251
Fatty acids	Amblyopia	No relevant studies found	7	NA
Fatty acids	Diabetic retinopathy	No relevant studies found	7	NA
Fatty acids	Glaucoma	The association of fatty acids and glaucoma is unclear from this literature. Further randomised control trials would be required to support recommending fatty acids as a treatment.	5	254
Fatty acids	Macular degeneration	Although some studies suggest that omega 3 fatty acid consumption has a protective effect against AMD, the studies that have been done on this issue are not of very good quality and the results have been inconsistent. Further research with well-designed RCTs or prospective cohort studies is required to resolve this issue.	5	255
Fatty acids	Retinitis pigmentosa	Although trends of improvement in some retinitis pigmentosa outcomes were found in randomised control trials, more research is required in this area before fatty acids can be recommended as a therapy for retinitis pigmentosa.	6	256
Fatty acids	Trachoma	No relevant studies found	7	NA
Obesity	Cataract	Although causality has not been established, these studies suggest that obesity is associated with an increased risk of cataract, especially posterior subcapsular cataract.	2	244
Obesity	Amblyopia	No relevant studies found	7	NA
Obesity	Diabetic retinopathy	Abdominal obesity appears to be a risk factor for retinopathy in people with and without diabetes; however, body mass index is not.	2	246
Obesity	Glaucoma	Obesity does not appear to be a risk factor for glaucoma, although more research is required in this area.	4	247
Obesity	Macular degeneration	High body mass index (BMI) is a risk factor for visually significant AMD (but possibly not neovascular) in males; however, a low BMI is also associated with increased risk of visually significant ARM. A BMI within the normal range offers the lowest risk of ARM in men.	1	248
Obesity	Retinitis pigmentosa	No relevant studies found	7	NA
Obesity	Trachoma	No relevant studies found	7	NA

a Groups are as follows:

- Group 1 — Clear association/causality
- Group 2 — Possible association/causality (more research needed)
- Group 3 — Lack of association/causality
- Group 4 — Possible lack of association/causality (more research needed)
- Group 5 — Conflicting results
- Group 6 — Possible protection
- Group 7 — No studies

b Summary sheets number refers to the results tables in Appendix 3.