

## Appendix 4 Summary results tables

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### Key to tables:

– = level of evidence uncategorised (ie lower than IV)<sup>1</sup>

LPS = large population study

NA = not applicable

RCT = randomised controlled trial

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<sup>1</sup> For further information on levels of evidence, see Section 3.4

**Summary table 1 — smoking and cataract**

Paper no.	Reference	Type of study	Population/study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
460	Kelly et al 2005	Systematic review (11 cross-sectional, 9 prospective cohorts, 7 case-control)	Current smokers	Smoking	Nonsmokers or never smokers	NA	I (Adequate)	<p>19 of 27 studies found a positive association between smoking and one or more types of cataract.</p> <p>For nuclear cataract, 14 of 17 studies found a positive association with smoking (7 cross-sectional studies with OR/RR 1.09 to 4.4; 5 cohort studies with OR/RR 1.05 to 2.41; 2 case-control studies with OR/RR 1.68 to 1.99). This association fulfilled 5 of 6 criteria for attribution of causality (Bradford Hill criteria)<sup>a</sup> and the 6<sup>th</sup> criterion (biological mechanism) was also partially met as it is likely that smoking causes oxidative stress in the lens and it is known that oxidative damage is involved in cataract formation. Risk increases with number of cigarettes smoked. Ex-smokers have a lower risk than current smokers, particularly after prolonged quitting.</p> <p>For posterior subcapsular cataract, of 13 studies, 8 found no association, 3 cohort studies found an association for heavy smokers only and 2 studies found an association for men or ex-smokers only.</p> <p>For cortical cataract, of 12 studies, all found no association.</p>	Applicable to Australian population

<sup>a</sup> Hill AB (1965). The environment and disease: association or causation. *Proceedings of the Royal Society of Medicine* 58:295–300.

Summary	Group
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.	<p><b>Group 1 — Clear association/causality</b></p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 4 — smoking and glaucoma**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
695	Bonovas et al 2004	Systematic review with meta-analysis (4 cross-sectional and 3 case-control)	Current smokers in 3 countries	Smoking	Never smokers and past smokers	NA	III (Adequate)	The results of the meta-analysis suggest that current smokers are at a significantly increased risk of developing primary open-angle glaucoma (POAG). Odds ratios from a fixed-effects model were 1.37 for current smokers (95%CI 1.00 to 1.87; $P = 0.05$ ). In contrast, past smokers did not have a statistically significant elevated risk of POAG (pooled OR 1.03; 95%CI 0.77 to 1.38, $P = 0.85$ ). A Cochrane Q test has nonsignificant $P$ values indicating that the results were homogeneous, although the low number of studies limited the power of this test.	Two studies that reported an RR of 1.0 were excluded because they did not include any confidence intervals and/or used a different definition of smoking from the other studies
686	Kang et al 2003	Prospective cohort	Nurses' Health Study and Health Professionals Follow Up Study	Smoking	Analysed by current smoking status, cigarettes smoked per day and pack-years of smoking	121,701 (F) 51,529 (M)	II (LPS)	In this large study, neither current smokers nor past smokers had a higher relative risk of POAG than those who had never smoked. Heavier smoking did not increase the risk. Those with more than 10 pack-years of smoking had an approximately 20% reduced risk of POAG compared to those who had never smoked.	One pack-year = 1 pack of cigarettes per day for 1 year

Summary	Group
<p>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, and two studies 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.</p>	<p><i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <b><i>Group 5</i> — Conflicting results</b> <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies</p>

**Summary table 5 — smoking and age-related macular degeneration**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
714	Tomany et al 2004	Prospective cohort (pooling of 3 separate studies)	Adults aged 43–95 years in Australia, the Netherlands and the United States	Smoking	Past smokers or never smokers	1710 current smokers, 3732 past smokers, 3947 never smokers	I/II (LPS)	Current smoking was associated with an increased incidence of geographic atrophy and late age-related macular degeneration (AMD) (OR relative to nonsmokers 2.83 and 2.35 respectively, for past smokers 2.80 and 1.82). No significant differences were found between past smokers and those who had never smoked, suggesting that current smokers who quit can reduce their risk. A statistically significant relationship was not demonstrated separately for smoking and neovascular AMD.	Geographic atrophy is a form of dry (early) macular degeneration
720	Arnarsson et al 2006	Prospective cohort	Adults over 50 years in Reykjavik Eye Study	Smoking	Past or never smokers	846	II (LPS)	No statistically significant association was found between smoking and risk of developing late AMD — either by current/former/never smokers or by pack-years smoked, which was unexpected as the calculated baseline risk suggested that current smokers were more likely than nonsmokers to develop late AMD. However, the authors found that those who had smoked more than 20 pack-years had an increased mortality rate during the 5-year follow-up period, which may have masked the effect of smoking on both early AMD and late AMD.	One pack-year = 1 pack of cigarettes per day for 1 year
725	Clemons et al 2005	Prospective cohort	Clinic-based study in the US	Smoking > 10 pack-years	Smoking ≤ 10 pack-years	3394	II	Results suggest a relationship between smoking at baseline and the development of advanced AMD among individuals with early or intermediate AMD. Individuals with more pack-years of smoking (> 10 pack-years of smoking compared with ≤ 0 pack-years) had an increased risk of incident neovascular AMD (OR 1.55; 95%CI 1.15 to 2.09) and central geographic atrophy (OR 1.82; 95%CI 1.25 to 2.65).	

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
3410	Khan et al 2006	Case-control	4 United Kingdom counties from 2001 to 2003	Current and past smoking	Nonsmoking	435 cases and 280 controls	III-3	<p>The results were consistent with smoking being a risk factor for AMD but were not statistically significant. There was a strong association between AMD and pack years of cigarette smoking (<math>P = 0.002</math>), the odds ratio increasing with the amount smoked; for subjects with more than 40 pack-years of smoking the OR was 2.75 (95%CI 1.22 to 6.20) compared with nonsmokers. Both types of AMD showed a similar relation; smoking more than 40 pack-years of cigarettes was associated with an OR of 3.43 (95%CI 1.28 to 9.20) for geographic atrophy and 2.49 (95%CI 1.06 to 5.82) for choroidal neovascularisation. Stopping smoking was associated with reduced odds of AMD and the risk in those who had not smoked for more than 20 years was comparable to nonsmokers. The risk profile was similar for males and females. Passive smoking exposure was associated with an increased risk of AMD (OR 1.87; 95%CI 1.03 to 3.40) in nonsmokers.</p> <p>Conclusions: The results provide strong support for a causal relation between smoking and AMD. They also show an increased risk for AMD in nonsmokers exposed to passive smoking. Stopping smoking appears to reduce the risk of developing AMD.</p>	Choroidal neovascularisation is a major component of the exudative (late) form of AMD

Summary	Group
In two studies, current smoking was associated with an increased risk of developing AMD compared with 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 that did not show these effects, deaths from other causes may have masked the effect.	<p><b>Group 1 — Clear association/causality</b></p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 8 —age or ageing and cataract**

Paper no.	Reference	Type of study	Population/ study information	Risk factor/ indicator	Comparator	N	Level (quality)	Results	Other notes
1494	Cedrone et al 1999	Prospective cohort	Random population sample of people aged 45–69 years (already enrolled in a study for cardiovascular risk factors) in 1987, 7-year follow-up	Age	Reference to baseline sample without age-related cataracts Reference to follow-up sample without AR cataracts at baseline adjusted for nonresponse to follow-up	860 people at baseline; 828 of the same group at follow-up, 7 years later	II	Ageing is a ‘very important risk factor’ for cataract. Sex is not a risk factor. Prevalence of AR cataracts increased after the age of 60 (from 1% before 60 up to 12% in the 65–69-year-old group). Cataract prevalence in baseline sample: 3.7% (95%CI 2.7 to 5.2%). Cumulative incidence referring to baseline sample: 6.5% (95%CI 4.8 to 8.2%). Cumulative incidence referring to follow-up sample: 9% (95%CI 6.7 to 11.3%). Adjusted cumulative incidence of AR cataract: 7.6% (95%CI 5.6 to 9.5%). Although the severity of the AR cataracts among the subjects who developed AR cataracts during the 7 years of the study ( $N = 54$ ) was related to the baseline age, it was not <i>significantly</i> related: 25 bilateral cataracts ( $63.5 \pm 3.9$ years) and 29 unilateral cataracts ( $61.8 \pm 4.9$ years).	Frequency/rate study

Paper no.	Reference	Type of study	Population/ study information	Risk factor/ indicator	Comparator	N	Level (quality)	Results	Other notes
2306	Klein et al 1998	Prospective cohort	Beaver Dam Eye Study (population aged 43–84 years at baseline)	Age	NA	3684 people	II	<p>Age at baseline was the most significant characteristic associated with the incidence of all types of cataracts studied (nuclear, cortical, posterior subcapsular) in people without diabetes.</p> <p>The age effect was significant for all groups (males/females with or without diabetes) (<math>P \leq 0.03</math>), apart from the left eyes of diabetic men (<math>P = 0.2</math>).</p> <p>Incident cortical cataract increased significantly with age in all groups (<math>P \leq 0.04</math>) and progression was common in all groups and increased significantly with age.</p> <p>Incident posterior cataract (the least frequent type) was also significantly affected by age in people without diabetes (<math>P &lt; 0.001</math>), and progression was associated with age in all groups (<math>P \leq 0.01</math>).</p>	Age was only one (minor) focus of the study; other risk factors; results were given for people with and without diabetes; only the latter are included in this results table

Summary	Group
Prevalence of cataract increased with ageing, particularly post-60 years when the prevalence increased from 1% to 12% at 65–69 years.	<p><b>Group 1 — Clear association/causality</b></p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 9 — age or ageing and amblyopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1023	Donahue 2006	Retrospective case study (Based on large preschool screening data)	Preschool children (0–7 years) from mass photoscreening program, with anisometropia of > 0.1 diopter	Age	Children of same age with strabismus (N = 562)	792	NA	Prevalence and depth of amblyopia increased with age, although prevalence did not rise significantly after 3 years of age (depth continues to rise). Younger children with anisometropia had a lower prevalence and depth of amblyopia than older children. Prevalence of amblyopia: 2 years: 40% 3 years: 65% 5 years: 76% Moderate depth: 0–1 years: 2% (had amblyopia of moderate depth) 2 years: 17% 6–7 years: 45% Severe depth: 0–3 years: rare 4 years: 9% 5 years: 14% (compared with children with strabismus: stable prevalence and depth with age).	Frequency/rate study. Baseline is children who have anisometropia so may be predisposed to amblyopia. Diagnosis depends on the type of health professional diagnosing. Some issues with sensitivity to tests and standardisation.

Summary	Group
In a case series of children with anisometropia, prevalence increased up to three years of age, and depth of amblyopia also increased with age;.	<p><i>Group 1</i> — Clear association/causality</p> <p><b><i>Group 2</i> — Possible association/causality (more research needed)</b></p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><i>Group 5</i> — Conflicting results</p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

**Summary table 10 — age or ageing and diabetic retinopathy**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	<i>N</i>	Level (quality)	Results	Other notes
1577	Cohen et al 1998	Retrospective cohort	People > 50 years with type 2 diabetes, and without diabetic retinopathy at baseline; ≥ 4-year follow-up	Ageing	NA	833	III-2	<p>Age was a significant and independent predictor of development of diabetic retinopathy (DR) in the elderly.</p> <p>Both age of onset of diabetes and age were significantly associated (<math>P = 0.01</math> and <math>&lt;0.02</math>, respectively).</p> <p>10% of people (who had not developed DR after more than 13 years since onset of diabetes) developed DR during the 4-year follow-up. People who developed DR were younger at the age of diabetes onset (<math>48.7 \pm 9</math> years; compared with <math>53.4 \pm 9.9</math> years for those who did not develop DR); <math>P = 0.001</math>.</p> <p>Authors conclude that long complication-free period does not define elderly patients at lower risk of DR.</p>	Frequency/rate study
1579	Cugati 2006	Prospective cohort study	The Blue Mountains Eye Study (participants aged > 49 years, 6-year follow-up)	Ageing	NA	3509	II (LPS)	<p>No significant ageing-related trend for prevalence of DR seen in either survey. Prevalence of DR was 29.4% (1992–94) and 33.4% (1997–2000).</p> <p>A slightly higher prevalence of mild levels of DR (<math>P = 0.018</math>) but lower prevalence of moderate–severe levels of DR (<math>P = 0.049</math>) was evident after the 5-year interval.</p> <p>Study cites similar figures, as well as contradictory figures, from other studies.</p>	Frequency/rate study

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1580	Dandona et al 1999	Cross-sectional	Representative sample of an urban population in southern India of people with diabetes $\geq 30$ years (all had had diabetes for at least 10 years)	Ageing	NA	1399	IV	Used multiple logistic regression to show that the odds of having DR were significantly higher in those $\geq 50$ years than in those 30–49 years (OR 7.78; 95%CI 2.92 to 20.73)	

Summary	Group
There are conflicting results as to whether or not age and/or ageing is associated with development of diabetic retinopathy. The best quality study in this group (Blue Mountains Eye Study) showed no statistically significant age-related association. Further research is needed on the relationship between the incidence of diabetic retinopathy with time since the onset of diabetes and an ongoing increase in the disease with ageing in diabetic patients.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <b><i>Group 5</i> — Conflicting results</b> <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 11 — age or ageing and glaucoma**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1019	Wensor et al 1998	Cross-sectional	Residential (> 40 years randomly selected across city) and nursing home participants (aged 46–101 years) in Melbourne	Age	NA	Residential: 3271 Nursing: 403	IV	Rate of glaucoma in Melbourne rises significantly with age. Residential participants: overall prevalence rate of primary open-angle glaucoma (POAG) = 1.7% (95%CI 1.21 to 2.21). Overall, prevalence of POAG increased significantly with age, from 0.1% (40–49 year-olds) to 11.9% (90+ years). Lists other studies that support this finding (that glaucoma prevalence increases with age).	Frequency/rate study
983	Buch et al 2001	Cross-sectional	Copenhagen City Eye Study (Elderly urban Danish population 1986–99)	Age	NA	946 (60–80 years)	IV	Glaucoma accounted for 10% of all bilaterally blind people in the study. Bilateral blindness rose significantly with age ( $P = 0.02$ ) for all causes (age-related macular degeneration was the main cause at 60%); glaucoma was equal second with several other causes (all at 10%). Glaucoma wasn't observed as a cause of blindness in participants younger than 70 years. Despite differences in methods and locations of studies, all population-based studies conducted during the 1990s found that the prevalence of blindness increases with age, with glaucoma the primary cause of blindness in 6–12% of cases.	Frequency/rate study Glaucoma studied as one of many factors leading to blindness

Summary	Group
Cross-sectional studies (level IV) show that prevalence of glaucoma (POAG) increases with ageing.	<p><i>Group 1</i> — Clear association/causality</p> <p><b><i>Group 2</i> — Possible association/causality (more research needed)</b></p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><i>Group 5</i> — Conflicting results</p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

**Summary table 15 — alcohol and cataract**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
638	Hiratsuka and Li 2001	Review of epidemiological studies (including the prospective cohort studies — the Beaver Dam Eye Study and the Blue Mountains Eye Study)	Residents of Australia and the S	Alcohol	Less alcohol	NA	II (LPS)	The Beaver Dam Eye Study found that a history of heavy drinking was related to more severe nuclear sclerotic, cortical and posterior subcapsular opacities (OR 1.34, 1.38 and 1.57, respectively) (Ritter et al 1993). Munoz et al (1993) confirmed that heavy drinkers are at higher risk of posterior subcapsular opacities compared to nondrinkers (OR 4.6; 95%CI 1.4 to 15.1), and the Blue Mountains Eye Study confirmed the association of heavy drinking with increased risk of nuclear cataract (Cumming and Mitchell 1997).	Heavy drinking defined as an average of $\geq 4$ drinks/day (Beaver Dam; Blue Mountains) or $\geq 91$ g pure ethanol/week (Munoz et al )

Summary	Group
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 $\geq 4$ drinks/day (equivalent to approximately 280 g ethanol per week). However, a further study found that drinking at lower levels ( $\geq 91$ g pure ethanol per week) increased the risk of posterior subcapsular opacities.	<p><b>Group 1 — Clear association/causality</b></p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 17 — alcohol and diabetic retinopathy**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
745	Howard et al 2004	Systematic literature review (2 prospective cohort studies)	Results from 2 prospective cohort studies	Alcohol consumption	Less alcohol	NA	I (Good)	The 2 prospective cohort studies assessed the association between alcohol consumption at baseline and diabetic retinopathy. Moss et al (1994) found no association between alcohol consumption and the incidence or progression of diabetic retinopathy, calculated as odds per ounce (28 g) of alcohol. Young et al (1984) found an increased risk of diabetic retinopathy for those who drank $\geq 10$ pints of beer/week or equivalent.	Review of the effect of alcohol use on incidence, management and complications of diabetes
743	Kohner et al 1998	Cross-sectional	The United Kingdom Prospective Diabetes Study	Alcohol consumption	NA	2694	IV	For men, increased alcohol consumption was related to more severe retinopathy ( $P = 0.005$ ). The same effect was not seen for women although this may have been because few women involved in the study were regular or heavy drinkers.	Alcohol consumption classified into none, social, regular and heavy

Summary	Group
More research is needed on the long-term effects of alcohol consumption on the noncardiac complications of diabetes mellitus.	<i>Group 1</i> — Clear association/causality <b><i>Group 2</i> — Possible association/causality (more research needed)</b> <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 18 — alcohol and glaucoma**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
692	Fan et al 2004	Case-control	Adults admitted for early onset primary open-angle glaucoma (POAG) in a hospital in China	Alcohol	Less alcohol	32 (early onset POAG) 96 (controls)	IV	This study found that alcohol consumption had a protective effect against early onset POAG (OR 0.028; 95%CI 0.001 to 0.548). The authors suggest that moderate intake of alcohol dilates blood vessels and promotes outflow, thus reducing intraocular pressure (ocular hypertension is the major cause of progressive damage in glaucoma). The study defined alcohol consumption as consuming an average of at least 100 mL of liquor (equivalent to 38 g of alcohol) daily for not less than 1 year.	This study may not be generalisable to the Australian population
676	Yoshida et al 2003	Cross-sectional	People attending an annual health check-up without previous history of glaucoma	Alcohol	NA	569	IV	Alcohol consumption score was found to have a significant positive correlation with intraocular pressure in men ( $P < 0.001$ ). Alcohol consumption was measured as 'never or seldom', 'several times per month', 'several times per week' and 'every day'.	

Summary	Group
There are conflicting results on the effect that alcohol has on the development of glaucoma and its major risk factor, ocular hypertension.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <b><i>Group 5</i> — Conflicting results</b> <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 19 — alcohol and age-related macular degeneration**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
720	Arnarsson et al 2006	Prospective cohort	Random sample from Reykjavik Population Census for individuals 50 years or older (Reykjavik Eye Study)	Alcohol	Less alcohol	846	II (LPS)	Current alcohol consumption was found to have a moderately protective effect against the development of drusen compared with people who had never drunk alcohol (OR 0.48, 95%CI 0.28 to 0.82 for < 1 drink per month; 0.34, 95%CI 0.16 to 0.72 for > 1 drink per month). It may also increase the risk of pigmentary abnormalities, although this was not found to be statistically significant (OR 1.37, 95%CI 0.77 to 2.43 for < 1 drink per month; 1.42, 95%CI 0.69 to 2.91 for > 1 drink per month). The combined result suggested an increased incidence of age-related macular degeneration (AMD) (OR 1.65, 95%CI 1.06 to 2.56 for < 1 drink per month; 1.98, 95%CI 1.13 to 3.49 for > 1 drink per month; $P < 0.05$ ).	
650	Buch et al 2005	Prospective cohort	Volunteers between 60 and 80 years of age in Copenhagen (Copenhagen City Eye Study)	Alcohol	Less alcohol	301	II	Alcohol consumption of more than 250 g/week (25 standard drinks) was among the risk factors for early AMD (OR 2.9; 95%CI 1.0 to 9.2; $P < 0.01$ ); there was a similar trend for late AMD (OR 2.8; 95%CI 0.8 to 9.9) but this was not statistically significant.	In Australia, 1 standard drink = 10 g alcohol
736	Klein et al 2002	Prospective cohort	Beaver Dam Eye Study	Alcohol	Less alcohol	2764	II (LPS)	Total alcohol consumption at baseline was not associated with the incidence of early or late AMD or progression of AMD. Those who drank 78 g or more of alcohol as beer per week at baseline had an increased risk of developing large (greater than 250 $\mu$ m in diameter) drusen compared with those who did not drink any beer (RR 1.84; 95%CI 1.07 to 3.14). In contrast, consumption of beer in the past year was not associated with the incidence of pigmentary abnormalities or exudative macular degeneration. Men who drank 56 g or more of	

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
								<p>alcohol from liquor per week had an increased risk of developing exudative macular degeneration compared to men who did not drink liquor (RR 6.09; 95%CI 1.50 to 21.80). The same relationship was not found for women.</p> <p>Heavy drinking (defined as 4 or more drinks per day) was associated with a statistically significant increase in incidence of exudative AMD abnormalities, for both former heavy drinkers (RR 2.55 95%CI 1.03 to 6.34) and in current heavy drinkers at baseline (RR 6.51, 95%CI 1.41 to 30.21). This effect was maintained for both men and women in a logistic regression model in relation to smoking.</p> <p>There was a trend towards a reduction in the incidence of early AMD with wine consumption (&lt; 23 g/week and ≥ 23 g/week) but the result was not statistically significant.</p>	
761	Moss et al 1998	Prospective cohort	Beaver Dam Eye Study	Alcohol	Less alcohol	3684	II (LPS)	Men drinking 78 g/week or more of alcohol from beer had a higher incidence of early AMD than those who did not drink beer, although this trend was not statistically significant ( $P = 0.08$ ). The incidence of soft indistinct drusen, increased drusen area and confluent drusen were associated with beer drinking in men.	
755	Cho et al 2000	Prospective cohort	Nurses' Health Study and Health Professionals Follow Up Study	Alcohol	Less alcohol	62252	II (LPS)	Compared with nondrinkers, women who drank 30 g/day or more of alcohol had an increased risk of AMD (RR 1.54; 95%CI 0.99 to 2.39, after adjustment for smoking). The same trend, although weaker, was found for men. When the two types of AMD were considered separately, the association was found for both early and dry AMD but not wet AMD. When alcohol types were considered separately beer consumption was not found to be associated with AMD. Drinking more than 2 wines per day was associated with AMD in women (RR	

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
								2.07; 95%CI 1.20 to 3.58) but not in men (RR 1.7; 95%CI 0.42 to 4.46).	
762	Obisesan et al 1998	Prospective cohort	National Health Nutrition and Examination Survey (NHANES-1)	Alcohol	Less alcohol	3072	II	A statistically significant and negative association was found between drinking wine and AMD after adjusting for the effect of age, gender, income, history of congestive heart failure and hypertension (OR 0.81; 95%CI 0.67 to 0.99).	

Summary	Group
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 that drinking more than about 3 drinks per day, particularly of wine or spirits is associated with development of AMD.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 22 — eye infections and cataract**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1437	Madhaven 1999	Cross-sectional	People with conjunctivitis in Chennai, India between 1990 and 1998 had eye swabs taken and analysed	Eye infections	NA	1061	IV	Rubella virus was found in 86 lens aspirates from eyes with congenital cataract (8.1%).	
1441	Vutova et al 2002	Prospective cohort	Infants and children with eye manifestations of congenital toxoplasmosis	Eye infections	NA	38	II (small study)	Cataract was found in 16% of children with congenital toxoplasmosis.	

Summary	Group
Eye infections (conjunctivitis and toxoplasmosis) appear to be linked to cataract.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 23 — eye infections and amblyopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1466	Kunimoto et al 1998	Case series	Children up to 16 years being treated for microbial keratitis in Hyderabad India between 1991 and 1995	Eye infections	NA	107	NA	70.3% of the children aged under 10 years (37/107) had poor visual acuity outcomes, linked to amblyopia.	Amblyopia is barely mentioned as a measured outcome
1465	Chong et al 2004	Case series	Children under 16 years diagnosed with herpes simplex virus (HSV) keratitis in 1 institution in Texas, USA	Eye infections	NA	23	NA	Amblyopia occurred in 3 children (13%).	Reviewed clinical records of patients presenting with HSV keratitis and followed the results of their treatments

Summary	Group
Amblyopia appears to occur in some cases of eye infection.	<p><i>Group 1</i> — Clear association/causality</p> <p><b><i>Group 2</i> — Possible association/causality (more research needed)</b></p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><i>Group 5</i> — Conflicting results</p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

**Summary table 24 — eye infections and diabetic retinopathy**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1469	Dev 1999	Case series	Diabetics with endophthalmitis treated between 1992 and 1997 in Wisconsin	Eye infections	NA	11 people (12 eyes)	–	The 6 cases with no retinopathy before endophthalmitis did not go on to develop retinopathy. Of the 6 eyes, cases with pre-existing nonproliferative retinopathy, 4 showed evidence of progression within 6 months of the infection.	

Summary	Group
Eye infection appears to be associated with the development of retinopathy in people with diabetes.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 25 — eye infections and glaucoma**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1457	Thean et al 2001	Case series	People with herpes zoster ophthalmicus (HZO) and secondary uveitis seen in Victoria over a 10-year period	Eye infections	NA	34	–	56% of patients developed secondary glaucoma. 15% of all patients required surgical intervention to treat glaucoma.	
1444	De Schryver et al 2006	Case series	People from a clinic in Paris, France, referred between 2001 and 2003 for chronic uveitis associated with glaucoma; all testing negative for human immunodeficiency virus (HIV)	Eye infections	NA	5	–	All patients responded to treatment for cytomegalovirus (CMV) infection, with ocular inflammation and glaucoma being controlled. Two patients required surgery as well. After therapy was stopped, 3 cases relapsed and required further CMV therapy. Polymerase chain reaction (PCR) tests of eye tissue were positive for CMV and negative for other viruses. PCR testing was positive in the patients who relapsed once therapy stopped.	
1448	Egbert et al 2005	Case series	People at a clinic in Ghana, Africa undergoing surgery for glaucoma or cataracts had skin snip biopsies to test for nematode infection	Eye infections in glaucoma patients	Eye infections in cataract patients	286	–	Nematode infection was present in 10.6% of glaucoma patients, compared to 2.6% in cataract patients. Once adjusted for age, region and sex, subjects with glaucoma were over 3 times more likely to test positive for nematode infection than people with cataract (OR 3.50; 95%CI 1.10 to 11.18).	
1441	Vutova et al 2002	Prospective cohort	Infants and children with eye manifestations of congenital toxoplasmosis	Eye infections	NA	38	II (small study)	Glaucoma was found in 16% of children with congenital toxoplasmosis.	

Summary	Group
A range of infectious agents (eg herpes zoster, cytomegalovirus and nematodes) appear to be associated with glaucoma.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 26 — eye infections and macular degeneration**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1130	Kalayoglu et al 2003	Case-control	People with age-related macular degeneration (AMD) who had choroidal neovascular (CNV) membrane removed	Eye infections in AMD eyes	Non-AMD eyes	9 AMD, 9 non-AMD	III-3 (very small study)	<p><i>Chlamydia pneumoniae</i> was isolated in 4 out of the 9 AMD samples. None of the non-AMD samples had <i>C. pneumoniae</i> present.</p> <p>This paper refers to 2 other studies that have shown some association between <i>C. pneumoniae</i> infection and AMD:</p> <p>Ishida O et al (2003). Is <i>Chlamydia pneumoniae</i> infection a risk factor for age related macular degeneration? <i>British Journal of Ophthalmology</i> 87:523–524.</p> <p>Kalayoglu MV et al (2003). Serological association between <i>Chlamydia pneumoniae</i> infection and age related macular degeneration. <i>Archives of Ophthalmology</i> 121:478–482.</p>	Performed PCR and immunohistology on samples from AMD and non-AMD eyes

Summary	Group
There may be a link between infection with <i>Chlamydia pneumoniae</i> and macular degeneration.	<p>Group 1 — Clear association/causality</p> <p><b>Group 2 — Possible association/causality (more research needed)</b></p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 36 — UV and cataract**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
932	McCarty and Taylor 2002	General review of 22 epidemiological studies (mostly cross-sectional but also including prospective cohort and case-control)	Included studies from Australia and the US	UV	NA	NA	II	Most of the 22 epidemiological studies reviewed met most of the criteria for causality, supporting an association between exposure to medium-wave ultraviolet light (UVB) and the development of cortical cataract. There was also limited evidence to suggest a link between UVB and posterior subcapsular cataract.	

Summary	Group
A large number of epidemiological studies support an association between UVB and the development of cortical cataract.	<p><b>Group 1 — Clear association/causality</b></p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 40 — UV and age-related macular degeneration**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
901	Cruickshank et al 2001	Prospective cohort study	Beaver Dam Eye Study (5-year follow-up)	Sun exposure	Various variables	3684	II (LPS)	<p>Leisure time spent outdoors between the ages of 13 and 19, and between 30 and 39, was significantly associated with the risk of early age-related macular degeneration (AMD) (OR 2.09; 95%CI 1.19 to 3.65). Job time spent outdoors and leisure time spent outdoors in winter did not increase the risk of AMD.</p> <p>There was a slight but nonsignificant protective effect associated with the use of hats and sunglasses (OR 0.72; 95%CI 0.5 to 1.03). There were no associations between estimated ambient UVB exposure and the incidence of early AMD.</p> <p>There was no association between skin sensitivity (never burns, or tans, versus burns) and incidence of AMD. This is apparently contradictory to an earlier report from the Blue Mountain Eye Study in Australia (Mitchell et al 1998) that showed an association between skin sensitivity and early AMD.</p> <p>People with blonde or red hair had an increased risk of early AMD (RR 1.31, 95%CI 0.96 to 1.78)</p>	
908	Tomany et al 2004	Prospective cohort study	Beaver Dam Eye Study (10-year follow-up)	Sun exposure	Various variables	2764	II (LPS)	<p>Participants exposed to summer sun for more than 5 hours per day during their teens, in their 30s, and at baseline examination were at a higher risk of developing increased pigmentation (RR 3.17; 95%CI 1.24 to 8.11; <math>P = 0.01</math>) early AMD (RR 2.14; 95%CI 0.99 to 4.61; <math>P = 0.05</math>). No relationships were found between UVB exposure or winter leisure time spent outdoor and the 10-year incidence and progression of AMD. For those who reported a high amount of sun exposure (teens and 30s), hat and sunglass use for at least half the time had a protective effect against the 10-year incidence of soft indistinct drusen (RR 0.55; 95%CI 0.33 to 0.90; <math>P = 0.05</math>) and retinal pigment epithelial depigmentation (RR 0.51 95%CI 0.29 to 0.91; <math>P = 0.02</math>). Those who had experienced more than 10</p>	

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
								incidents of severe sunburn during their youth were more likely to develop $\geq 250 \mu\text{m}$ drusen by the 10-year examination (RR 2.52; 95%CI 1.29 to 1.71; $P = 0.01$ ).	
3397	Mitchell et al 1998	Cross-sectional	Blue Mountains Eye Study	NA		3654	IV (LPS)	Blue iris colour was significantly associated with an increased risk of both late AMD (OR 1.69) and early AMD (1.45). Abnormal skin sensitivity, either high (OR 2.54) or low (OR 2.18), was associated with increased risk of AMD.	

Summary	Group
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 5 years).	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) (sunlight generally — not UV) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 41 — UV and pterygium**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
08-01	Vojnikovic et al 2007	Case-control	Mean age 65-80 years	Exposure to UV light (chronic)	Urban population compared to rural agriculturalists and fisherman. (Croatia)	480 rural, 61 urban	III-3	Prevalence of pterygium: Villagers 23% (16% in males, 7% in females), urban people 0%.	Applicable to specific population
08-02	Lu et al 2007	Prospective cohort study	Tibetan people $\geq 40$ years	UV exposure and other factors	None	2632	II (LPS)	<p>Prevalence of pterygium: 14.49% (95% CI 13.03 to 15.95).</p> <p>Risk factors:</p> <p>Increasing age for persons aged 70-79 years, compared with those aged 40-49 years (OR 2.0; 95% CI 1.4 to 2.8);</p> <p>Female gender (OR 1.6; 95% CI 1.2 to 2.0);</p> <p>Dry eye symptoms (OR 1.3; 95% CI 1.0 to 1.7)</p> <p>Seldom use of sunglasses/ crystal spectacles (OR 4.6; 95% CI 1.9 to 11.3)</p> <p>Seldom use of hats (OR 3.6; 95% CI 2.4 to 5.4)</p> <p>Lower education level (&lt;3 years) (OR 1.6; 95% CI 1.1 to 2.4)</p> <p>Low socioeconomic status (OR 1.9; 95% CI 1.5 to 2.4).</p>	Applicable to specific population

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
08-03	Paula et al 2006	Cross-sectional study	Four Brazilian Indigenous populations	UV exposure and other factors on pterygia and cataract prevalence	Ethnic and social groups (Group 1: Fisherman, Group 2: Hunters)	624	IV	Prevalence of pterygium: Group 1 (36.6%) versus Group 2 (5.0%), significantly different ( $P < 0.0001$ ) Gender was not associated with pterygium ( $P = 0.1326$ ) and pterygium did not increase with age ( $P = 0.8079$ ) in either group.	Applicable to specific population
08-04	Mathur et al 2005	Cross-sectional study	Indian salt workers	UV exposure	Occupational groups (brine workers, dry salt workers, others)	865 salt workers, 304 controls	IV	Prevalence of pterygium: Brine workers (21.0%), dry salt workers (9.1%) ( $P < 0.000001$ ), non-salt-worker controls (9.4%) ( $P = 0.00007$ ). Risk factors: Exposure during 3rd decade of life ( $P = 0.046$ ) compared to exposure in second decade of life.	Applicable to specific population
08-05	Al-Bdour et al 2004	Case control study	Adult Jordanians presenting with pterygium	Environmental factors including sunlight exposure	Workplace location, past and current sun exposure	96 cases, 192 controls	III-3	Significant increase in risk of pterygium in outdoor workers compared to indoor workers (OR 5.47), current sun exposure (OR 3.54) and previous sun exposure (4.52).	Applicable to specific population
08-06	Saw et al 2000	Case-control study	Singaporean adult patients at the Singapore National Eye Centre	Current sunlight exposure	Past exposure to sunlight (5 years ago, 10 years ago)	61 cases, 125 controls	III-3	Risk of developing pterygia was higher for participants who had spent time in the sun five years ago (OR 1.27, 95% CI 1.06 to 1.54) and ten years ago (OR 1.31, 95% CI 1.09 to 1.57) compared to current exposure.	

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
08-07	McCarty et al 2000	Prospective cohort study	Nine randomly selected population clusters from Melbourne; 14 nursing homes within 5km radius of the 9 Melbourne clusters; 4 randomly selected rural clusters. Age range 40 to 101 years.	Lifetime exposure to sunlight	Location, past and current sun exposure	5147 (2850 female)	II	Prevalence of pterygium: Melbourne residents (1.2%) Nursing home residents (1.7%) Rural residents (6.7%) Overall weighted population prevalence (2.83%, 95% CI 2.35 to 3.31%). Risk factors: Age (OR 1.23, 95% CI 1.06 to 1.44) Male sex (OR 2.02, 95% CI 1.35 to 3.03) Rural residence (OR 5.28, 95% CI 3.56 to 7.84) Lifetime ocular sun exposure (OR 1.63, 95% CI 1.18 to 2.25). Attributable risk of sunlight and pterygium: 43.6% (95% CI 42.7 to 44.6).	Australian population
08-08	Threlfall et al 1999	Case-control study	Cases had surgical removal of pterygium, control subjects had ENT procedure	Exposure to sunlight	Presence of pterygium versus no pterygium.	150 cases, 135 controls	III-3	Risk factors for pterygium: Sun exposure (highest exposure quartile) (OR 4.0, 95% CI 1.6 to 10.9) Estimated daily ocular solar radiation dose (highest exposure quartile) (OR 6.8, 95% CI 2.6 to 19.7)	Australian population
08-9	Tang et al 1999	Cross-sectional study	Postmen in Central Taiwan	Outdoor work (exposure to sunlight)	Indoor work (low occupational sunlight exposure)	394 postal workers (248 postmen, 146 office workers)	IV	Prevalence of pterygium: Postmen (7.3%). Significantly different to office workers (P<0.05). When cumulative sun exposure increased by one unit (one year x hour/day) pterygium risk increased by 0.8%.	Applicable to specific population

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
08-10	Khoo et al 1998	Case control study	Singaporean patients at Singapore National Eye Centre with pterygium	Sunlight exposure (outdoor workers)	Indoor work (low sunlight exposure)	61 cases, 125 controls	III-3	Risk of pterygium: OR 7.0 (95% CI 3.2 to 15.3); AOR 4.2 (95% CI 1.7 to 10.1).	
08-11	Sekelj et al 2007	Prospective cohort study	Patients with primary and recurrent whose pterygia were surgically removed	Exposure to sunlight	Patients with primary and recurrent pterygium not exposed to sun after surgical removal of pterygia	19 cases (38 eyes); 10 controls (20 eyes)	II	Pterygia recurrence rate: Exposed group (27%) Unexposed group (10%)	

Summary	Group
Current and past exposure to UV light increases the population prevalence of pterygia and the risk of developing pterygia. Exposure to UV light also increases re-development of pterygia after surgical removal.	<b>Group 1 — Clear association/causality</b> <b>Group 2 — Possible association/causality (more research needed)</b> <b>Group 3 — Lack of association/causality</b> <b>Group 4 — Possible lack of association/causality (more research needed)</b> <b>Group 5 — Conflicting results</b> <b>Group 6 — Possible protection</b> <b>Group 7 — No studies</b>

**Summary table 42 — UV and ocular surface neoplasms**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
08-12	Kiire and Dhillon 2006	Systematic review (2 retrospective cohort studies; 2 case-control studies)	Patients with conjunctival tumours, Africa, US, Thailand	Sun exposure			Adequate Level III-2/III-3 studies	<p>One study showed that the incidence of squamous cell carcinoma (SCC) of the eye fell by 49% for every 10-degree increase in latitude from &gt;12 cases/million/year in Uganda to 0.2 cases/million/year in the UK.</p> <p>A retrospective cohort study showed an SCC of the conjunctiva incidence rate of 0.03/100000, with 5-fold higher rates among males and whites. Positive association between UVB exposure and SCC rates (beta = 2.25; <math>r = 0.58</math>).</p> <p>In one case-control study, conjunctival cancer was associated with HIV infection (OR 10.1, 95% CI, 5.2 to 19.4; <math>P &lt; 0.001</math>); risk increased with time spent in cultivation/direct sunlight (<math>P = 0.05</math>); risk decreased with decreasing age at leaving home (<math>P = 0.05</math>).</p> <p>1 small study did not show a link between sunlight exposure and risk of conjunctival intraepithelial neoplasia.</p>	
08-13	Gallagher and Lee 2006	General review of adverse effects of UV (brief description of 7 studies from 1988 to 2003)	Patients with conjunctival tumours,	UV/sunlight			NA	<p>Authors concluded that there is evidence for a probable relationship between with solar UVR and squamous intraepithelial neoplasm of the conjunctiva or cornea, although one or more co-factors may be necessary (eg smoking, HPV).</p> <p>This tumour more common in people with fair skin.</p>	

08-14	Basti and Mascai 2003	General review of ocular surface squamous neoplasia (OSSN) (brief description of 10 studies from 1950–1997)					NA	UVB is a major risk factor for OSSN. Other risk factors included pale skin, pale iris, time spent outdoors and distance from equator. Causal evidence comes from mutation studies that show an increased prevalence of <i>P53</i> mutations.	
08-15	Ateenyi-Agaba et al 2004	Case-control study	Patients with squamous cell carcinoma, controls with benign conjunctival lesions in Uganda, Africa	Exposure to sunlight		21 cases, 22 controls	III-3	P53 mutations were found to be associated with SCC cases, particularly CC-->TT transitions, which is the signature mutation for solar UV damage. The prevalence of CC-->TT transitions was the highest reported in any cancer type and matched that of skin cancers in subjects an inherited disease causing hypersensitivity to UV damage. These results indicate at the molecular level a causal role of solar UV rays in the aetiology of SCC of the eye.	Paper in German

Summary	Group
Some epidemiology studies indicate that ocular surface neoplasms may be associated with exposure to UVB/sunlight. A causal effect of UV is substantiated by molecular evidence of UV-induced mutations. Other risk factors include fair skin, light coloured iris, HIV infection, HPV infection and smoking.	<p><b>Group 1 — Clear association/causality</b></p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 43 — injuries/accidents and cataract**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
778	Brouzas et al 2003	Case series	People admitted to a hospital in Athens, Greece, with elastic cord-induced ocular injuries over a 67-month period from October 1996	Injuries and accidents	NA	28	–	Cataract developed in 7.1% of patients (2/28). The most common injury was hyphaema (71.4%).	Frequency/rate study
771	Ariturk 1999	Case series	Children (under 20 years) admitted with ocular trauma to a hospital in Samsun, Turkey between November 1983 and October 1996 Reviewed history of patients with ocular trauma to see what kind of trauma, treatment, follow up, etc	Injuries and accidents	NA	138	–	Blunt trauma accounted for 17.4% of injuries and perforating trauma 82.6%. Cataract was one of the most frequent complications of blunt trauma (12.5% of cases) and occurred after 24.6% of perforating trauma cases.	Frequency/rate study
824	Wong et al 2002	Case-control Appear to have used both cross-sectional and case-control analysis	People with a history of ocular trauma taken from the Beaver Dam Study	Injuries and accidents	People with no history of ocular trauma taken from the same group	4926	III-3/IV	People with a history of ocular trauma were more likely to have cortical (OR 1.5; 95%CI 1.0 to 2.2) and posterior subcapsular (OR 1.7; 95%CI 1.0 to 3.1) cataracts, compared to people without a history of trauma. These associations were stronger for people with previous trauma caused by a blunt object (OR 3.3; 95%CI 1.6 to 6.9) for cortical cataract, and (OR 4.1; 95%CI 1.5 to 10.8) for posterior subcapsular cataracts.	Frequency/rate study

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
834	Lithander 1999	Cross-sectional	Random selection of schoolchildren given visual screening from grades 1–6 in Oman	Injuries and accidents	NA	6292	IV	12 out of 6292 children had poor visual acuity due to trauma; of those 12 children, 4 developed cataract.	Frequency/rate study

Summary	Group
Cataract can be caused by ocular trauma.	<p><b>Group 1 — Clear association/causality</b></p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 44 — injuries and accidents and amblyopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
834	Lithander et al 1999	Cross-sectional	Nationwide survey of primary schools in Oman	Injury	NA	6292	IV	The study detected several children with untreated traumatic cataract from injuries incurred several years before the study, allowing amblyopia to develop.	
803	Jeng et al 2001	Case report	Cases of penetrating ocular injury due to toy ninja stars	Injury	NA	2	–	A 3-year-old boy suffered a large corneal laceration and traumatic cataract after trauma from a toy ninja star. After a penetrating keratoplasty he required ongoing treatment for amblyopia. The authors note that many toys can cause injury but sharp pointed projectiles are particularly dangerous.	
829	Capone 2003	Case series	Infants with amblyogenic vitreous and/or subinternal limiting membrane haemorrhage from shaken baby syndrome managed by lens-sparing vitrectomy	Injury	NA	11 eyes	–	Dense vitreous haemorrhage may cause amblyopia, either from visual deprivation or anisometropia. Vitreous haemorrhage may require more time to resolve spontaneously in infants, and because infants can develop amblyopia within days or weeks the authors recommend lens-sparing vitrectomy.	

Summary	Group
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.	<p><b>Group 1 — Clear association/causality</b></p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 46 — injuries and accidents and glaucoma**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
854	Girkin et al 2005	Retrospective cohort	Data from the United States Eye Injury Registry on people who had suffered ocular contusion	Injury	Various	6021	III-2	The risk of developing posttraumatic glaucoma following contusion was associated with increased age (OR 1.02; 95%CI 1.02 to 1.03), poor visual acuity (OR 1.92; 95%CI 1.19 to 3.10), iris injury (OR 1.60; 95%CI 1.05 to 2.44), lens injury (OR 1.86; 95%CI 1.11 to 3.11), hyphema (OR 2.23; 95%CI 1.40 to 3.54) and angle recession (OR 1.71; 95%CI 1.00 to 2.90).	
782	Cavallini et al 2003	Case series	People presenting to a clinic in Italy with injuries from wine bottle corks	Injury	NA	13	–	All people had closed globe injuries, with anterior chamber hyphema the most frequent injury. Post-traumatic glaucoma was one of the resulting complications.	
848	Duiguid and Leaver 2000	Case report	Person with giant retinal tears following deliberate gouging in a rugby game	Injury	NA	1	–	A person presented with giant retinal tears which he had suffered as a result of deliberate gouging during a game of rugby. After surgical treatment he developed complications including glaucoma.	
805	Kenney and Fanciullo 2005	Case report	Person with blunt ocular trauma resulting from airbag injury	Injury	NA	1	–	A person who sustained blunt ocular trauma from the deployment of an airbag during a motor vehicle accident later developed complications, including traumatic/inflammatory glaucoma.	
847	De Leon-Ortega and Girkin 2002	Background	NA	NA	NA	NA	NA	Glaucoma is a possible complication of ocular trauma. Traumatic glaucoma is a multifactorial condition and can result from a variety of mechanisms including closed globe trauma (early or late onset) and open globe trauma (with or without an intraocular foreign body).	

Summary	Group
<p>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.</p>	<p><i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies</p>

**Summary table 47 — injuries and accidents and macular degeneration**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
884	Klein et al 2005	Prospective cohort	Beaver Dam Eye Study (5-year follow-up)	X-ray exposure	Less exposure	3 684	II	No evidence to link macular degeneration to X-ray exposure	
888	Shiuey and Lucarelli, 1998	Case study with historic control group	Patients with traumatic hyphema treated in a Massachusetts hospital between 1991 and 1995 had visual acuity measured and followed up	Traumatic hyphema treated in emergency dept	Historic control group treated as inpatients for the same condition between 1986–89	154	–	Only one patient developed macular degeneration as a result of traumatic hyphema	Study not set up to study AMD

Summary	Group
Macular degeneration does not appear to be linked to ocular injury.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <b><i>Group 4</i> — Possible lack of association/causality (more research needed)</b> <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 50 — corticosteroids and cataracts**

Paper no.	Reference	Type of study	Population/study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1123	Uboweja et al 2006	Systematic review with meta-analysis (2 case-control, 1 cross-sectional and 1 cohort with nested case-control analysis)	NA	Inhaled corticosteroids	No corticosteroids	Meta-analysis of about 20,000 cases and 50,000 controls	IV (Acceptable)	Inhaled corticosteroids (ICS) may be associated with systemic side effects such as cataracts. Pooled OR was 1.48. Further evaluation required to assess impact of dosage and duration of drug use.	The risk of increased cataract needs to be weighed against the benefits of ICS

Summary	Group
Inhaled corticosteroids may be associated with cataracts.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 53 — corticosteroids and glaucoma**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2049	Lipworth 1999	Systematic review (2 case reports and 1 case-control study of glaucoma)	NA	Inhaled corticosteroids	No corticosteroids	NA	III-3	The case-control study found that there was no association between current use of inhaled glucocorticosteroids and increased risk of glaucoma and intraocular hypertension, but patients using high doses on a regular basis were at an increased risk (OR 1.44; 95%CI 1.01 to 2.06).	Systematic review of adverse effects of corticosteroids
1067	Gartlehner et al 2006	Systematic review (1 cross-sectional and 1 case-control)	NA	Inhaled corticosteroids	No corticosteroids	NA	IV	In a cross-sectional study based in Australia, a dose-related increase in the risk of open-angle glaucoma was found in patients using inhaled corticosteroids with a family history of glaucoma (OR 2.8; 95%CI 1.2 to 6.8). Authors note that the risk-benefit ratio appears to favour inhaled corticosteroid treatment in patients with moderate to severe chronic obstructive pulmonary disease.	Systematic review of efficacy of corticosteroid use
1634	Garbe et al 1997	Case-control	People with ocular hypertension or POAG	Oral glucocorticoids	No glucocorticoids	9793 cases, 38,325 controls	III-3	Current users of oral glucocorticoids were more likely to develop ocular hypertension or primary open-angle glaucoma (POAG) than nonusers (OR 1.41; 95%CI 1.22 to 1.63). There was a dose-related increase in the odds ratios for current users, increasing from 1.26 for those on less than 40 mg/day hydrocortisone to 1.88 for those on more than 80 mg/day. The odds ratios also increased with the duration of treatment over the first 11 months of exposure.	

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2058	Sahni et al 2004	Case report	29-year-old woman	Topical steroids used near the eyes	NA	1	–	Sahni et al describe a case involving a 29-year-old woman who used large quantities of topical steroids to treat severe eczema, including a potent formulation near the eyes. She developed bilateral glaucoma and irreversible visual loss. Although there have been few case reports of glaucoma from topical steroid application, the authors recommend regular glaucoma screening during prolonged periorbital topical steroid use. Long-term use of strong formulations should be avoided.	

Summary	Group
<p><b>Inhaled</b> 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.</p> <p><b>Oral</b> The use of oral glucocorticoids increases the risk of ocular hypertension or open-angle glaucoma in older people.</p> <p><b>Topical</b> The long-term use of potent formulations of topical corticosteroids near the eyes may increase the risk of glaucoma.</p> <p><b>General</b> Monitoring of intraocular pressure may be advisable in patients who require long-term treatment with high doses of corticosteroids.</p>	<p><b>Group 1</b> — Clear association/causality (<b>inhaled/oral</b>)</p> <p><b>Group 2</b> — Possible association/causality (<b>more research needed</b>) (<b>topical</b>)</p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><i>Group 5</i> — Conflicting results</p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

**Summary table 54 — corticosteroids and age-related macular degeneration**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
3059	Wang et al 2003	Prospective cohort	Blue Mountains Eye Study	Anti-inflammatory medications (both steroids and nonsteroids)	No anti-inflammatory medications	3654	II (LPS)	It has been postulated that inflammatory processes may play a role in the pathogenesis of AMD. This study explored whether systemic use of anti-inflammatory medication, including steroidal and nonsteroidal types, influenced the development of AMD. However, no protective effect was found.	

Summary	Group
No association was found between the use of systemic anti-inflammatory medications and the cross-sectional incidence or prevalence of age-related macular degeneration.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <b><i>Group 4</i> — Possible lack of association/causality (more research needed)</b> <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 57 — high myopia and cataract**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1786	Saw et al 2005	General review (includes population-based cohort studies, cross sectional studies and case-control studies)	Beaver Dam Eye Study (USA), Blue Mountains Eye Study (Australia) and Barbados Eye Study	High myopia	NA	NA	II (LPS)	There is a large body of evidence from population and clinic-based studies to suggest that cataract (including posterior subcapsular, nuclear and cortical cataract) is associated with myopia. Care should be taken when assessing cross-sectional studies, however, as the possibility that myopic shifts occurred as a consequence of cataract cannot be excluded.	
507	McCarty 2002	General review of Australian data	Melbourne Visual Impairment Project and Blue Mountains Eye Study	High myopia	NA	NA	II (LPS)	Both studies identify myopia as a significant risk factor for cortical, nuclear and posterior subcapsular cataracts (PSC). The Melbourne Visual Impairment Project found that myopia increased the risk of cortical (OR 1.76), nuclear (OR 2.73) and PSC (OR 3.59). The Blue Mountain Eye study also showed that myopia was a risk for cortical (OR 2.9) nuclear (OR 2.3) and PSC (OR 4.9). The author predicts that the absolute and relative amount of cataract in the Australian population will increase dramatically due to population ageing.	
580	Mukesh et al 2006	Prospective cohort study	Melbourne Visual Impairment Project	Myopia	NA	3721	II (LPS)	This recent study further demonstrated that myopia is an independent risk factor for development of cortical cataract.	

Summary	Group
Myopia, particularly high myopia, is a risk factor for cortical, nuclear and posterior subcapsular cataract, although the causal mechanism remains unknown.	<p><b>Group 1 — Clear association/causality</b></p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 58 — high myopia and amblyopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1814	Robaei et al 2006	Cross-sectional	The Sydney Myopia Study (6-year-old Australian children)	High myopia	NA	1741	IV	This study reports an association between amblyopia and both high hyperopia and anisometropia but not myopia.	
1801	Fitzgerald et al 2005	Cross-sectional	Children less than 10 years of age with high myopia	High myopia	NA	178	IV	In a study of 178 children with high myopia, 75.8% had amblyopia or reduced corrected visual acuity. The study concluded that children under 10 years with high myopia were at high risk of developing amblyopia.	
1810	Marr et al 2001	Cross-sectional	Children between 3 and 10 years of age with high myopia	High myopia	NA	112	IV	The study found that children with high myopia rarely had 'simple' high myopia, 54% had an underlying systemic condition (such as Marfan syndrome), while 38% had associated ocular problems such as amblyopia. This suggests that children with high myopia should be referred for further examination.	

Summary	Group
It is not clear whether children with high myopia are at increased risk of amblyopia.	<p><i>Group 1</i> — Clear association/causality</p> <p><i>Group 2</i> — Possible association/causality (more research needed)</p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><b><i>Group 5</i> — Conflicting results</b></p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

**Summary table 59 — high myopia and diabetic retinopathy**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1820	McKay et al 2000	Cross-sectional	Victorian residents aged 40 years and over	Myopia	NA	4744	IV	Retinopathy was not significantly associated with myopia ( $P < 0.05$ ).	
1818	Dogru et al 1998	Case series	Patients from the Kobe University Department of Ophthalmology, Diabetes Outpatient Clinic with asymmetric proliferative diabetic retinopathy	High myopia	NA	19	–	The authors state that high myopia has previously been suggested to induce asymmetric diabetic retinopathy. This study found that there were trends towards high myopia being a protective influence, although statistical significance was not achieved, due to the small study size.	

Summary	Group
The relationship between high myopia and diabetic retinopathy remains unclear.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <b><i>Group 5</i> — Conflicting results</b> <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 60 — high myopia and glaucoma**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1825	Coleman and Wilson 2000	General review (including relevant prospective cohort study)	Blue Mountains Eye Study	High myopia	NA	NA	II (LPS)	The Blue Mountains Eye Study found a strong association between low myopia and primary open-angle glaucoma (POAG) and a stronger association between moderate-to-high myopia and POAG (OR 3.3). A survey in Japan, however, found increasing POAG prevalence and decreasing myopia prevalence with age, a relationship possibly specific to that population. There are numerous reports of a relationship between myopia and ocular hypertension, the most important risk factor for POAG, although the Blue Mountains Eye Study found that the relationship between POAG and myopia is independent of intraocular pressure. Myopia was not a risk factor for POAG.	Myopia as risk factor for glaucoma
1638	Georgopoulos et al 1997	Prospective cohort	Untreated glaucoma suspects	High myopia	Nonmyopic patients	345	II	Axial myopia was more common in patients who progressed from ocular hypertension (OHT) to glaucoma ( $\chi^2$ 0.45; $P < 0.01$ ).	Myopia as a risk factor for progression from OHT to glaucoma

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1832	Ko et al 2002	Case series (retrospective review of patients who presented for juvenile open-angle glaucoma [JOAG] and chronic open-angle glaucoma [COAG])	Clinical data from patients with JOAG and COAG	Myopia	Patients with JOAG compared to those with COAG	JOAG – 27 COAG – 30	NA	The JOAG patients were more likely to have a myopic refractive state than COAG patients ( $P < 0.001$ ).	Risk of early-onset glaucoma
1833	Landers et al 2002	Case-control (random selection of patients attending clinic for POAG and ocular hypertension (OHT) — data collected on family history, myopia, migraine, etc)	A sample of patients with POAG and OHT selected from a glaucoma practice	Myopia	Patients with POAG compared with patients with OHT	POAG – 438 OHT – 301	III-2	Myopia is more prevalent among patients with POAG than with OHT (OR 1.5; 95%CI 1.0 to 2.2), suggesting that myopic patients with OHT may be more susceptible to POAG.	Myopia as a risk factor for progression from OHT to glaucoma
1838	Nomura et al 2004	Cross-sectional	Randomly selected subjects aged 40–82 years from Japan	Myopia	Development of ocular hypertension	1855	IV	Intraocular pressure increased with advancing degrees of myopia, even after adjustment for related factors such as age and central corneal thickness ( $P = 0.011$ ). This finding supports the hypothesis that the relationship between glaucoma and myopia might be pressure mediated.	

Summary	Group
<p>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.</p>	<p><i>Group 1</i> — Clear association/causality <b><i>Group 2</i> — Possible association/causality (more research needed)</b> <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies</p>

**Summary table 61 — high myopia and age-related macular degeneration**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1861	Wang et al 1998	Cross-sectional	Blue Mountains Eye Study	Myopia	NA	3654	IV	No significant associations were found between myopia and any AMD stage. The authors warn that this result should be interpreted cautiously due to the potential for symptoms of myopic retinopathy to cause misclassification.	

Summary	Group
Myopia does not appear to be a risk factor for age-related macular degeneration.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 64 — intraocular pressure and cataract**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1604	Mori et al 1997	Cross-sectional	Patients who had developed cataracts before the age of 2.5 years and had been monitored until they were age 5 without operative correction	Ocular hypertension (OHT)	NA	41 patients (58 eyes)	IV	Open-angle glaucoma and OHT did not develop in any patients. Closed-angle glaucoma developed in 2 eyes. Intraocular pressure was not linked to cataract.	
1602	Leske et al 2002	Prospective cohort	Participants in the Barbados Eye Study with no nuclear opacities at baseline were followed over 4 years and underwent regular ophthalmic examinations	OHT	Less pressure	2609	II (LPS)	Risk factors for developing cataracts included age, myopia, diabetes and being on treatment for ocular hypertension (RR 2.7). Treated patients had a threefold increased risk of cataracts (RR 3.2; 95%CI 1.6 to 6.5). Participants with IOP $\geq$ 21 mmHg and receiving treatment had a fivefold increased risk (RR 5.0; 95%CI 1.7 to 15.1) versus those who were untreated.	

Summary	Group
There are conflicting results from studies of possible links between ocular hypertension and development of cataract.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <b><i>Group 5</i> — Conflicting results</b> <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 67 — intraocular pressure and glaucoma**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1613	Ontoso et al 1997	Systematic review (18 randomised controlled trials)	People receiving treatment with timolol for ocular hypertension (OHT)	Ocular hypertension (OHT)	Less pressure	NA	I (Adequate)	People who did not receive treatment for mild or moderate OHT may be more likely to develop glaucoma. Meta-analysis (using weighted and adding zetas) suggested that treatment of even mild and moderate OHT may help to prevent the onset of glaucoma.	
2593	Friedman et al 2004	Systematic review (6 randomised controlled trials, 3 prospective cohorts)	People receiving treatment with timolol for OHT and participants in cohort trials	OHT	Less pressure	NA	I (Good)	Some people with OHT will develop glaucoma. Risk factor for OHT was: (OR 1.11; 95%CI 1.04 to 1.18).	
1633	Flammer et al 2002	General review (experimental and clinical intervention studies)	NA	OHT	Less pressure	NA	III-2	Several studies have shown that reducing intraocular pressure (IOP) can relieve glaucoma, but not for all patients. Pressure reduction does not avoid damage in all patients. Women are more likely to develop glaucoma, despite having similar IOPs to men. Other risk factors also contribute to glaucoma: myopia, genetics, sex and race.	
1636	Gasser 1999	General review (clinical and experimental evidence)	NA	OHT	Less pressure	NA	III-2	Systemic hypotension is a more significant risk factor for glaucoma than systemic hypertension.	

Summary	Group
Ocular hypertension (OHT) can lead to glaucoma; treatment of even mild and moderate OHT may help to prevent the onset of glaucoma.	<p><i>Group 1</i> — Clear association/causality</p> <p><b><i>Group 2</i> — Possible association/causality (more research needed)</b></p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><i>Group 5</i> — Conflicting results</p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

**Summary table 71 — poor living conditions (lower socioeconomic status) and cataract**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
592	Klein et al 2003	Prospective cohort	Beaver Dam Eye Study (persons aged 43–86 years)	Level of income	Income	4926	II (LPS)	A direct association was found between low income and nuclear cataract (but not for cortical or posterior subcapsular cataract). For nuclear cataract, cumulative incidence rates were 23.6% for income < \$10,000, falling to 19.5% at income > \$44,000 ( $P < 0.001$ ).	Cataract surgery
2542	Younan et al 2002	Prospective cohort	Blue Mountains Eye Study	Occupation	Occupation	3654 in 1992–94; 2334 in 1997–99	II (LPS)	Information on participants' principle occupation was analysed using Australian Bureau of Statistics categories (stratified into 4 groups) and the Daniel Occupational Prestige Scale. There were no statistically significant associations for any of the occupational categories with the 5-year incidence of cataract surgery. The authors suggest that this study supports the view that cataract surgery is largely patient driven, according to patient benefit.	Cataract surgery
3395	Meddings et al 1998	Case–control	Residents of British Columbia aged 50–65 years	Socioeconomic decile and cataract surgery	Controls	2323 cases and 243,045 controls	III-3	Residents aged 50–65 living in the 4 lowest socioeconomic deciles were significantly more likely than those living in the highest socioeconomic areas to undergo cataract surgery (RR for males of 2.3–1.4 and for females of 2.7–1.4 over the age range 50–65 years). Results were similar in presence or absence of diabetes.	

Summary	Group
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.	<p><i>Group 1</i> — Clear association/causality</p> <p><i>Group 2</i> — Possible association/causality (more research needed)</p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><b><i>Group 5</i> — Conflicting results</b></p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

**Summary table 73 — poor living conditions (lower socioeconomic status) and diabetic retinopathy**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2511	Bachmann et al 2003	Cross-sectional	People with diabetes among general practices in Avon and Somerset, UK	Level of income and education	NA	567 of 770	IV	Low income and level of education are associated with diabetic retinopathy (DR). The lowest earning and least educated patients were about 4 times more likely than the highest earning and most educated to have DR (adjusted OR 4.1; 95%CI 1.0 to 16.0).	
2512	Bihan et al 2005	Cross-sectional	Consecutive diabetic patients admitted to the hospitalisation unit of a French endocrine department	Deprivation status	NA	123 of 135	IV	Deprivation was assessed using 42 socioeconomic questions on education, income, occupation, family structure, housing conditions, employment, social benefits, financial difficulties, leisure activities, social support, life events, self-perceived health and use of health care. The more deprived patients were more likely to have DR than those less deprived (OR 3.66; 95%CI 1.39 to 9.64; $P = 0.009$ ).	

Summary	Group
Lower socioeconomic status may be linked to a higher incidence of diabetic retinopathy.	<p><i>Group 1</i> — Clear association/causality</p> <p><b><i>Group 2</i> — Possible association/causality (more research needed)</b></p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><i>Group 5</i> — Conflicting results</p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

**Summary table 74— poor living conditions (lower socioeconomic status) and glaucoma**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2518	Ho et al 1997	Cross-sectional	Poor individuals receiving vision-screening examinations in Los Angeles	Low income	NA	925	IV	Higher rates of glaucoma were observed in both homeless and poor nonhomeless populations than in the general population. For all ethnic groups combined, the 52–64-year-old individuals in this study had crude glaucoma rates of 5.4% (homeless) and 9.8% (nonhomeless); this compares to a rate of 1.4% prevalence among the same age groups in the Framingham Eye Study.	

Summary	Group
Low income may be associated with glaucoma.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 75 — poor living conditions (lower socioeconomic status) and age-related macular degeneration**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	<i>N</i>	Level (quality)	Results	Other notes
2503	Chew et al 2005	Comparative study (not randomised)	Patients undergoing therapy for condition secondary to AMD, in Canada in 2000–01	Unable or unwilling to fund surgery for AMD	Willing to self-fund surgery for AMD	115	NA	Patients divided according to whether or not willing to self-fund therapy for complication of AMD, or preferred a government-funded alternative. Those not willing to pay had significantly worse macular disease ( $P = < 0.001$ to 0.032, depending on feature measured) before treatment and a significantly lower mean income ( $P = 0.05$ ) than those willing to pay. However, there was no significant difference in percentage with postsecondary education between the 2 groups.	
2508	Reidy et al 1998	Cross-sectional study	Random sample of people aged 65 years or older from general practices in north London	Socioeconomic status	Higher levels of socio-economic status	1547 of 1840	IV	Possible association between low socioeconomic status and AMD, but not statistically significant.	
756	DeAngelis et al 2004	Case-control	Sibling pairs in which 1 of pair had AMD and other did not	Low level of education	Higher levels of education	73 of 81 pairs	III-3	No link found between AMD and education for high school graduation (OR 0.44; 95%CI 0.13 to 1.45) or < high school graduation (OR 0.32; 95%CI 0.06 to 1.79).	
2506	Klein et al 2001	Prospective cohort	Individuals aged 43–86 years participating in Beaver Dam Eye Study, USA	Low level of education and service-related occupation	Higher levels of education	3681	II (LPS)	Less education and being in a service-related occupation (rather than a white-collar one) was associated ( $P < 0.5$ ) with the incidence of early AMD. The link with occupation may reflect higher level of passive smoking. No significant association was found between income and AMD.	

Summary	Group
<p>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.</p>	<p><i>Group 1</i> — Clear association/causality  <i>Group 2</i> — Possible association/causality (more research needed)  <i>Group 3</i> — Lack of association/causality  <i>Group 4</i> — Possible lack of association/causality (more research needed)  <i>Group 5</i> — <b>Conflicting results</b>  <i>Group 6</i> — Possible protection  <i>Group 7</i> — No studies</p>

**Summary table 78 — diabetes and cataract**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
507	McCarty 2002	Systematic review (2 prospective cohorts)	Melbourne Visual Impairment Project, Blue Mountains Eye Study	Diabetes	NA	NA	I (Adequate)	Melbourne study: diabetes duration > 5 years significantly associated with cortical (OR = 2.57) and nuclear (OR = 2.04) cataract. Blue Mountains Study: posterior subcapsular cataract was significantly associated with diabetes (OR = 1.8).	
449	Abraham et al 2006	General review (prospective cohorts)	Beaver Dam Eye Study, Blue Mountains Eye Study, Barbados Eye Study	Diabetes	NA	NA	II (LPS)	High fatty acid levels, associated with type 2 diabetes, have been linked to cataract development.	
462	Robman and Taylor 2005	General review (clinical studies, cross-sectional and prospective cohort)	Beaver Dam Eye Study, Blue Mountains Eye Study, Barbados Eye Study	Diabetes	NA	NA	II (LPS)	Biochemical and experimental studies have shown that diabetes mellitus and galactosaemia are associated with some types of cataract. Higher prevalence and early onset of cortical cataract and posterior subcapsular opacities in diabetic patients was confirmed by clinical studies. A cross-sectional study attributed around 4% of all cataracts to diabetes. The author notes that diabetes as a risk factor for cataract fitted all epidemiological tests for causality except for reversibility.	
2245	Altan 2003	General review (discusses biochemical studies of potential mechanisms for diabetes-induced cataract)	People with cataract	Diabetes	NA	NA	NA	Diabetes is linked with high sorbitol concentrations, which in turn are associated with cataract. Oxidative stress during hyperglycaemia in diabetes has also been cited as a factor in cataract formation.	
634	Negahban and Chem 2002	General review (prospective cohort, retrospective cohort, case studies, case-control)	Blue Mountains Eye Study	Diabetes	NA	NA	II (LPS)	Case studies have reported patients with diabetes developing cataracts when their symptoms are uncontrolled. Once symptoms were controlled, the cataracts resolved. Patients with type 1 diabetes had a higher rate of	

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
								cataract than age-matched control subjects.	

Summary	Group
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.	<p><b>Group 1 — Clear association/causality</b></p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 81 — diabetes and glaucoma**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	<i>N</i>	Level (quality)	Results	Other notes
2227	Bonovas et al 2004	Systematic review (5 case–controls and 7 cross-sectional)	People with diabetes	Diabetes	NA	NA	III-3 (Adequate)	Eleven studies reported a positive association (OR > 1) between diabetes and glaucoma. One reported a negative association (OR < 1). Only 5 of the positive studies had ORs that were statistically significant and the study reporting negative association was not significant. Meta-analysis indicated that diabetes was a positive indicator for POAG (OR 1.55; 95%CI 1.13 to 12.13).	
2233	Krueger and Ramos-Esteban 2007	Systematic review (population cohort studies)	People with diabetes	Diabetes	NA	NA	I (Poor)	In several studies diabetes was shown to have a protective effect against glaucoma progression. Large epidemiological studies have shown varied results, with some showing diabetes as a risk factor for open-angle glaucoma (OAG) and others not finding it a significant risk factor.	Poor quality review but included studies were good quality (LPS)
2236	Nakamura et al 2005	General review (population-based frequency and rate studies, laboratory testing)	People with diabetes	Diabetes	NA	NA	NA	Population studies found mixed results, with some linking diabetes and OAG and others not. Diabetes does cause retinal nerve damage that could make the eye more susceptible to OAG.	Extracted from abstract. Frequency and rate studies

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2243	Wu et al 2006	Prospective cohort	People of African descent without glaucoma or on IOP-lowering treatments studied over 9 years	Diabetes	NA	2298	II	The mean change in IOP (intraocular pressure) was small over the 9-year period and had a relatively large dispersion (mean $\pm$ SD, $0.4 \pm 4.0$ mmHg). Mean IOP increases were greatest in people aged 50–59 at the start of the study (mean $\pm$ SD, $0.9 \pm 4.3$ mmHg) and decreased in the over 70s (mean $\pm$ SD, $-0.6 \pm 4.2$ mmHg). IOP changes were positively associated with males, hypertension, diabetes and increases in blood pressure over the 9 years ( $P < 0.05$ ).	
2240	Pasquale et al 2006	Prospective cohort	Nurses' Health Study (females aged $\geq 40$ with no POAG at baseline, 20-year follow-up)	Diabetes	NA	76,318	II (LPS)	Type 2 diabetes was positively associated with POAG (RR 1.82; 95%CI 1.23 to 2.70). It did not strengthen with longer duration of diabetes; RR 2.24; 95%CI 1.31 to 3.84 for duration $< 5$ years versus RR 1.54; 95%CI 0.92 to 2.62 for duration $> 5$ years.	
2230	De Voogd et al 2006	Prospective cohort	Rotterdam Eye Study, Netherlands (participants age $\geq 55$ years without OAG at baseline, 7-year follow-up)	Diabetes	NA	3837	II (LPS)	OAG developed in 87 of the cohort. The relative risk of OAG associated with baseline diabetes was 0.82; 95%CI 0.33 to 2.05. After adjustment for age, sex, body mass index and hypertension, the relative risk was 0.65; 95%CI 0.25 to 1.64	

Summary	Group
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.	<p><i>Group 1</i> — Clear association/causality</p> <p><i>Group 2</i> — Possible association/causality (more research needed)</p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><b><i>Group 5</i> — Conflicting results</b></p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

**Summary table 82 — diabetes and macular degeneration**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
725	Clemons et al 2005	Prospective cohort	Patients from 11 retinal specialty clinics enrolled from 1992 through 1998. Aged 55 to 80 years old at enrolment and had best corrected visual acuity of 20/32 or better in at least 1 eye.	Diabetes	NA	4757	II	Diabetes was not linked to macular degeneration.	
2224	Voutilainen-Kaunisto et al 2000	Prospective cohort	Newly diagnosed type 2 diabetic patients diagnosed between 1979 and 1981	Diabetes	Nondiabetic controls from the general population	133 diabetics, 144 controls	II	The rate of macular degeneration was similar in both diabetic and control populations.	

Summary	Group
Diabetes appears not to be a risk factor for macular degeneration.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 84 — diabetes and trachoma**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1448	Durkin et al 2006	Cross-sectional	Aboriginal patients in remote South Australia seen between 1999 and 2004.	Diabetes	NA	1651	IV	1.2% of people had active trachoma and 15.7% had symptoms associated with having had trachoma. 46.7% had diabetes. 22% of the patients with diabetes had diabetic retinopathy and of these patients 77 had background diabetic retinopathy (46%) and 92 (54%) had either proliferative diabetic retinopathy or maculopathy. Prevalence of clinically significant macula oedema among those with maculopathy (14 of 50 patients) was 28%.	

Summary	Group
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.	<p><i>Group 1</i> — Clear association/causality</p> <p><b><i>Group 2</i> — Possible association/causality (more research needed)</b></p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><i>Group 5</i> — Conflicting results</p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

**Summary table 85 — heredity and cataract**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
462	Robman and Taylor, 2005	Review (including 4 studies of the heritability of cataract)	Patients with cataracts	Heredity	NA	NA	111-3 /IV	Based on a number of family studies, twin studies and case studies (levels III-3 and IV), heredity is a major determinant for the development of cataract, with the heredity component being responsible for at least 50% of cases (age and environmental factors being the other major determinants). The high level of relatedness suggests the action of dominant genes.	

Summary	Group
Heredity is a major factor in determining cataract development.	<p><b>Group 1 — Clear association/causality</b></p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 86 — heredity and amblyopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2354	Abrahamsson et al 1999	Prospective cohort	Six-year follow-up of Swedish children with a family history of strabismus, plus controls without a family history of strabismus	Heredity	Children without a family history of strabismus	1571 (632 cases and 939 controls)	II	A family history of squint combined with high hyperopia was an effective screen for children with an increased risk of 4 to 6 times for developing strabismus.	

Summary	Group
Heredity strabismus appears to be linked with amblyopia.	<i>Group 1</i> — Clear association/causality <b><i>Group 2</i> — Possible association/causality (more research needed)</b> <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 88 — heredity and glaucoma**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	<i>N</i>	Level (quality)	Results	Other notes
2356	Budde 2000	General review (including 2 population and 2 clinic-based studies of the effect of genes on rates of POAG)	Patients with glaucoma	Heredity	NA	NA	II–III (based on ind studies)	<p>Several loci in the human genome have been linked to primary open-angle glaucoma (POAG). Studies of twins have shown a clear link between genetics and POAG.</p> <p>A prospective cohort study of an entire twin cohort in Iceland compared heterozygous twins with other twin and spouse, Hereditary factors were more important than environmental factors for development of POAG. Confirmed by population study in Rotterdam of lifetime risk of POAG (22% in relatives of POAG vs 2.3% in relatives of controls).</p> <p>Clinic based studies of family history showed higher rates of family history of POAG but this may have been because people with glaucoma are more likely to report a family history of glaucoma than people without glaucoma.</p> <p>As glaucoma has different phenotypes (sometimes due to corneal thickness, sometimes due to increased intraocular pressure, etc) it more difficult to associate a particular case with heredity than for cataract (see Summary table 85).</p>	
2360	Wadhwa and Higginbotham 2005	General review (including retrospective cohort and cross-sectional studies)	Patients with glaucoma from African American, Hispanic and Asian backgrounds	Heredity	NA	NA	III	<p>African Americans have a disproportionately high rate of glaucoma (in the Baltimore Study of people age 40–49 years, a prevalence of 1.23% compared with 0.92% in the white population). Barbados Eye Study reported similar findings. Studies have shown that African Americans and whites have the same rate of mutation of genes associated with POAG. Other studies have found rates of POAG in Hispanics to be higher than in the white population.</p>	

								Central corneal thickness varies across ethnic groups. Thin central corneas are linked to POAG; Hispanics and African Americans have been found to have thinner central corneas than whites.
2357	Budde 1999	Cross-sectional	Patients with chronic open-angle glaucoma	Heredity	NA	1176	IV	24.5% of patients with primary open-angle glaucoma had a family history of glaucoma. This correlation decreased with age (35.8% in patients younger than 50, 25% in patients between 51 and 70 years and 11.7% in patients older than 70 years). Family history did not have a correlation with secondary open-angle glaucoma.

Summary	Group
<p>Development of primary open-angle glaucoma appears to be strongly linked to heredity factors in some cases.</p> <p>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.</p>	<p><b>Group 1 — Clear association/causality</b></p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 92 — hypertension and cataract**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
626	Durant et al 2006	Nested case-control	The Somerset and Avon Eye Study (age and gender stratified random sample of subjects aged over 55 years registered at general practices)	Hypertension	Patients without hypertension	197 watercleft cases and 199 retrodot cases	III-3	A self-reported history of hypertension was not found to be a significant risk factor for either waterclefts or retrodots (cataract subtypes).	
2678	Schaumberg et al 2001	Prospective cohort	Physician's Health Study (male US physicians aged 40-84 years)	Hypertension	Patients without hypertension	17,762	II (LPS)	No significant relationship was found between hypertension and incident cataract. A modest, but statistically significant, association was found between high systolic blood pressure and cataract.	
2604	Klein et al 2004	Prospective cohort	Beaver Dam Eye Study	Hypertension	Patients without hypertension	4926	II	This study showed that retinal vascular characteristics associated with hypertension, such as focal and generalised arteriolar narrowing, are related to the incidence of nuclear cataract. Relationships, however, were weak and inconsistent.	
613	Delcourt et al 2000	Cross-sectional	POLA study (residents of Sète, southern France aged 60-95 years)	Hypertension	NA	2468	IV	Hypertension was associated with a decreased risk of cataract surgery (OR 0.57). The authors note that these results conflict with previous studies, 4 of which found no significant association between hypertension and cataract, while 2 studies found an increased risk of cataract with hypertension.	

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2018	Leske et al 1999	Cross-sectional	Barbados Eye Study (random sample aged 40–84 years)	Hypertension	NA	4314	NA	Systolic blood pressure was not associated with lens opacities but diastolic blood pressure greater than 95 mmHg was related to an increase in cortical opacities. This was especially significant for those aged less than 60 years (OR 1.49; 95%CI 1.00 to 2.23).	Rate/frequency study
2670	Goodrich et al 1999	Cross-sectional	Blue Mountains Eye Study (people aged 49–97 years living in the Blue Mountains)	Hypertension	NA	3654	IV	Hypertension was associated with a lower incidence of nuclear cataract (adjusted OR 0.8; 95%CI 0.6 to 0.9).	

Summary	Group
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.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <b><i>Group 5</i> — Conflicting results</b> <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 94 — hypertension and diabetic retinopathy**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2566	Leske et al 2005	Prospective cohort	Barbados Eye Study: African population (40–84 years, 9-year follow-up). Diabetes at baseline and at risk of developing diabetes during follow-up.	High blood pressure	No treatment for high blood pressure	324	II	<p>Antihypertensive treatment halved the risk of diabetic retinopathy (DR) vs no treatment (RR 0.5; 95%CI 0.3 to 0.9). DR risk increased by 30% for every 10 mm Hg of higher systolic blood pressure at baseline (RR 1.3; 95%CI 1.1 to 1.4).</p> <p>Overall, incidence of DR among hypertensive participants varied with hypertensive treatment, with a trend towards decreased risk with treatment.</p>	
2002	van Leiden et al 2003	Prospective cohort	People aged 50–74 years, selected from the larger cohort used in the Hoorn Study (1995). Examined at baseline and followed up after 10 years	Hypertension	Those in the cohort who did not develop hypertension	233	II	<p>Hypertension was a significant determinant of retinopathy in a general population: adjusted odds ratio for retinopathy was 2.36 (95%CI 1.02 to 5.49) for hypertension.</p> <p>Estimated risk for developing retinopathy after the 10-year period in people with hypertension was twice as high as in people without hypertension, even after adjusting for age, sex and glucose metabolism.</p> <p>At the end of the 10-year period, 51.9% of the 27 people who developed retinopathy had hypertension (<math>P = 0.02</math>).</p>	

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2582	Matthews et al 2004 [UKPDS 69]	Prospective cohort	UK Prospective Diabetes Study: people with hypertension and type II diabetes mellitus (DM) in 19 hospital-based clinics in the UK; mean age and blood pressure: 56 years, 160/94. 758 people were allocated to tight blood pressure control group; 390 allocated to less-tight blood pressure control group	Hypertension	Less tight blood pressure control	1148	II (LPS)	<p>Measured various aspects of DR and compared results between tightly controlled group and less-tightly controlled group.</p> <p>Highly significant difference in microaneurysm count (<math>\geq 5</math> microaneurysms), with 23.3% in tight group cf 33.5% in less tight at 4.5 years (RR 0.70; <math>P = 0.003</math>); same at 7.5 years (RR 0.66; <math>P &lt; 0.001</math>)</p> <p>Fewer hard exudates in tight group (RR 0.53, <math>P &lt; 0.01</math> (although increased in both groups).</p> <p>Fewer cotton wool spots in tight group (RR, 0.53; <math>P &lt; 0.01</math>).</p> <p>Fewer people in tight group progressed <math>\geq 2</math> steps deterioration on ETDRS scale (RR 0.75; <math>P = 0.02</math>).</p> <p>Less likely in tight blood pressure-controlled group to undergo photocoagulation (RR 0.65; <math>P = 0.03</math>).</p> <p>Overall, high blood pressure worsens each aspect of DR.</p> <p>Tightly controlling blood pressure decreases risks of diabetic eye disease.</p> <p>Describes other studies with similar findings.</p>	Caveats to study: few nonwhite participants, oldest participant was 65 years.

Summary	Group
Hypertension is a risk factor for retinopathy in both people with diabetes and people without diabetes.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 95 — hypertension and glaucoma**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2610	Maier 2005	Systematic review (5 randomised controlled trials)	Meta-analysis of randomised controlled trials with a concurrent untreated control group and information on time-to-glaucomatous changes to visual field and optic disc.	Ocular hypertension	No treatment	NA	I (Good)	<p>Trials showed significant preventative effect of reducing intraocular pressure on the progression of glaucoma (hazard ratio 0.56, 95%CI 0.39 to 0.81; <math>P = 0.01</math>; NNT = 12) [Note: this was only in patients with ocular hypertension <math>\geq 24</math> mm Hg]</p> <p>Pooled data of studies in manifest glaucoma showed significant delay of visual field deterioration (0.65, 0.49 to 0.87, <math>P = 0.003</math>; NNT = 7)</p> <p>Combining the results of the trials in a meta-analysis showed beneficial treatment effects of lowering ocular pressure.</p>	

Summary	Group
Ocular hypertension is a risk factor for glaucoma in the general population.	<p><b>Group 1 — Clear association/causality</b></p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 96 — hypertension and age-related macular degeneration**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2643	Klein et al 2003	Prospective cohort	Population (69–97 years) of 1998 whites and 363 blacks in the US (studied between 1997–98)	Hypertension	NA	2361	II	<p>Early ARM was present in 15.5% and late ARM in 1.3 % at follow-up.</p> <p>There was no association between hypertension and blood pressure with AMD.</p> <p>After controlling for age, sex, race, there was no association of mean arterial, average systolic and diastolic blood pressure over the 10-year period, and hypertension status with prevalent early ARM.</p>	A range of cardiovascular risk factors was studied
1536	Klein et al 2003	Prospective cohort	Beaver Dam Eye Study (people aged 43–86 years, 10-year follow-up period)	High blood pressure	NA	2764	II	<p>After controlling for age, sex, drinking and smoking histories, and vitamin use, higher systolic pressure at baseline was associated with the 10-year incidence of retinal pigment epithelial depigmentation (RR per 10-mm Hg systolic blood pressure, 1.1; 095%CI 1.01 to 1.18, <math>P = 0.02</math>) and exudative AMD (RR 1.22; 95%CI 1.06 to 1.41; <math>P = 0.006</math>).</p> <p>Higher pulse pressure at baseline was associated with incidence of retinal pigment epithelial depigmentation, exudative AMD, progression of ARM.</p> <p>Study showed association between higher pulse pressure and systolic blood pressure with an increase in the 10-year incidence of some lesions characteristic of early ARM and exudative AMD.</p> <p>In summary, when other factors were controlled for, people with controlled hypertension were twice as likely, and</p>	Included other risk factors

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
								<p>people with uncontrolled hypertension were thrice as likely, to develop exudative AMD compared with people without hypertension.</p> <p>Mentions other studies with similar findings, as well as studies with conflicting findings.</p>	
2659	van Leeuwen 2003	Prospective cohort	Part of the Rotterdam Study. Population from Netherlands (55+ years), follow-up at approximately 2 and 6.5 years. Free from ARM at baseline	Hypertension/high blood pressure	NA	4822	II (LPS)	<p>Increased systolic blood pressure/pulse pressure was associated with a higher risk of ARM.</p> <p>After adjusting for age, sex, smoking, cholesterol, body mass index (BMI), AMD, the odds ratio per 10-mm Hg increase were 1.08 (95%CI 1.3 to 1.14) and 1.11 (95%CI 1.04 to 1.18).</p> <p>After adjusting for age and sex, elevated systolic blood pressure was associated with increased risk ARM (OR per 10-mm Hg increase: 1.06; 95%CI 1.01 to 1.12).</p> <p>Lists other studies that <i>did find</i> an association between blood pressure/hypertension and AMD (these were case-control studies).</p> <p>Also lists other studies that <i>did not find</i> an association between blood pressure and prevalence of ARM (these were population-based studies).</p> <p>Notes that the only prospective population-based study (the Beaver Dam Eye Study) found that both systolic blood pressure and hypertension were significantly related to the incidence of retinal pigment epithelial depigmentation but not of drusen. However, this study only had about half the number of</p>	

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
								incident cases of early ARM compared with this study.	

Summary	Group
<p>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 two were of comparable size).</p>	<p><i>Group 1</i> — Clear association/causality  <i>Group 2</i> — Possible association/causality (more research needed)  <i>Group 3</i> — Lack of association/causality  <i>Group 4</i> — Possible lack of association/causality (more research needed)  <b><i>Group 5</i> — Conflicting results</b>  <i>Group 6</i> — Possible protection  <i>Group 7</i> — No studies</p>

**Summary table 100 — squint and amblyopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Quality	Results	Other notes
2714	Webber and Wood 2005	General review (previous reviews and cross-sectional studies)	Mostly the UK and USA	Strabismus (squint)	NA	NA	NA	Strabismus (squint) is one of the common predisposing conditions for amblyopia, due to its effects on the development in visual acuity after birth. Strabismus may not be cosmetically obvious, meaning that screening is important.	
2686	Adams and Sloper 2003	General review (population studies and intervention studies)	Mostly UK	Strabismus	NA	NA	NA	A squint is one of the most common causes of amblyopia, causing strabismic amblyopia. Some studies recommend very early squint surgery to give the best chance of stereopsis while others recommend waiting to see if the problem will resolve itself. This often depends on the severity of the squint.	
3392	Tong 1997	General review (laboratory studies)	NA	Strabismus	NA	NA	NA	The various kinds of amblyopia are not only disturbances of the development of the visual system at different points but also different pathologic processes. It is hypothesised that strabismic amblyopia is the result of earlier disturbance than other forms of amblyopia.	

Summary	Group
Although there is debate about different intervention and screening programs, strabismus is clearly a cause of amblyopia.	<p><b>Group 1 — Clear association/causality</b></p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 106 — anisometropia and cataract**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2128	Guzowski et al 2003	Cross-sectional	Blue Mountains Eye Study	Anisometropia	NA	3654	IV	Refractive asymmetry was associated with age and cataract. Refractive asymmetry is associated with unilateral cataract (OR 1.9; 95%CI 1.3 to 2.7) and bilateral cataract (OR 2.4; 95%CI 1.8 to 3.2). Unilateral mixed cataract was associated with higher refractive asymmetry than each type separately.	Frequency/rate study

Summary	Group
This study shows that anisometropia is associated with the presence of cataract. Further research would be required, however, to confirm causality.	<p><i>Group 1</i> — Clear association/causality</p> <p><b><i>Group 2</i> — Possible association/causality (more research needed)</b></p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><i>Group 5</i> — Conflicting results</p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

**Summary table 107 — anisometropia and amblyopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2463	Attebo et al 1998	Cross-sectional	People 49 years of age or older from an area west of Sydney	Anisometropia	NA	3654	IV	Amblyopia was diagnosed in 3.2% of the population and anisometropia was the underlying cause of amblyopia in 50% of the observed cases. The most frequent refractive error in amblyopic eyes was hyperopia.	
1805	Huynh et al 2006	Cross-sectional	The Sydney Myopia Study (mostly 6-year-old children from 34 randomly selected Sydney schools)	Anisometropia	NA	1765	IV	Anisometropia was significantly associated with amblyopia (OR 29; 95%CI 8.7 to 99). The overall prevalence of anisometropia was 1.6%.	
2465	Brown et al 2000	Cross-sectional	The Visual Impairment Project (residents of Victoria aged 40–92)	Anisometropia	NA	4721	IV	This study demonstrated that amblyopia was a significant cause of unilateral reduced visual acuity in a population aged 40 years and older. The population-weighted prevalence of amblyopia was 3.06%. Anisometropia was more prevalent and the degree of anisometropia was greater in the amblyopic group compared with the normal population.	

Summary	Group
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.	<p><b>Group 1 — Clear association/causality</b></p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 114 — cataract and amblyopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
3063	Birch et al 1998	Comparative study (compared the visual acuity of patients who had received early or later treatment for unilateral or bilateral cataract — not randomised)	Comparison of children with unilateral and bilateral cataracts treated at different stages (1–8 weeks or 12–30 weeks)	Early treatment	Late treatment	29	III-2 (small study)	Dense congenital bilateral cataracts can compromise visual development and cause amblyopia, through visual deprivation. Dense congenital unilateral cataracts can also compromise visual development through visual deprivation, but if treatment is delayed to 12–30 weeks, biased intraocular competition also plays a role in amblyogenesis.	
3396	Wheeler et al 1999	Case series (retrospective)	Patients presenting to a pediatric ophthalmology clinic		NA	15	–	Patients with pyramidal anterior polar cataracts, which are present from birth, are likely to require cataract surgery to treat or prevent amblyopia. Amblyopia can result from unilateral occurrence or asymmetry of bilateral opacities and can be worsened by surrounding cortical opacification.	
2722	Zetterström et al 2005	General review (accepted surgical practice)	NA		NA	NA	NA	Surgery must be performed promptly in cases with dense congenital cataract to prevent irreversible amblyopia. The development of amblyopia can also depend on the size, location and density of the cataract. Partial cataract may not require surgery but should be carefully monitored to prevent amblyopia. Even mild unilateral cataract can cause amblyopia in the affected eye if not treated.	

Summary	Group
It is well known that congenital cataracts cause abnormal or reduced visual stimulation during the sensitive period of visual development, which can result in amblyopia.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 117 — cataract and age-related macular degeneration**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Quality	Results	Other notes
2645	Klein et al 2004	General review (prospective cohort)	Beaver Dam Eye Study and Blue Mountains Eye Study	Cataract	NA	NA	II (LPS)	In the Beaver Dam Eye Study, cataract surgery before the baseline examination was associated with a fourfold increase in the incidence of neovascular AMD. However, the Blue Mountains Eye Study did not report similar findings. Surgical trauma and inflammation due to cataract surgery may cause AMD.	
2735	Velez and Weiter 2002	General review (prospective cohort)	Beaver Dam Eye Study, Chesapeake Bay Watermen Eye Study, Age-Related Eye Disease Study	Cataract	NA	NA	II (LPS)	The association between lens opacities and AMD have not been consistent. Both, however, are recognised as diseases of the ageing eye. Several studies have suggested an association between cataract extraction and increased severity of AMD, although other studies have not found the same relationship. Given the role of inflammation in the pathogenesis of AMD, cataract extraction could be expected to affect the course of the disease. There is difficulty confirming this, however, as patients with AMD may have unrecognised symptoms due to the presence of cataract.	

Summary	Group
It is not clear whether incidence of cataracts or cataract surgery is linked to age-related macular degeneration.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <b><i>Group 5</i> — Conflicting results</b> <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 120 — physical activity and cataract**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1530	Paunksnis et al 2006	Case-control	Patients admitted to an eye clinic for cataract surgery	Physical activity	Controls, admitted to a skin clinic	110 cataracts; 50 controls	III-3	The study found that less active patients were significantly more likely to develop cataract than physically active patients. This held true for both right eyes (OR 7.00; 95%CI 2.93 to 16.74) and left eyes (OR 4.43; 95%CI 1.97 to 9.98).	

Summary	Group
Physically active people may be less likely to develop cataract than those who are inactive, although more research is needed.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 124 — physical activity and age-related macular degeneration (AMD)**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1537	Knudtson et al 2006	Prospective cohort	Beaver Dam Eye Study (residents aged 43–84 years)	Physical activity	Less active	4926	II (LPS)	People with an active lifestyle (regular activity more than 3 times per week) were less likely to develop exudative AMD (OR 0.3; 95%CI 0.1 to 0.7) than less active people. Increased categories of numbers of blocks walked per day also decreased the risk of exudative AMD (OR 0.7; 95%CI 0.6 to 0.97). This study controlled for factors such as age, systolic blood pressure, body mass index, smoking and education. The incidence of early AMD and pure geographic atrophy were not related to physical activity.	

Summary	Group
Physical inactivity may be associated with exudative AMD, independent of body mass index and other confounders.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <b><i>Group 6</i> — Possible protection</b> <i>Group 7</i> — No studies



Paper no.	Reference	Type of study	Population/ study information	Risk factor/ intervention	Comparator	N	Level (quality)	Results	Other notes
1559	Voon et al 2001	Case series	Patients seen at ophthalmic unit, Singapore General Hospital's emergency department	Eye protection		870 patients out of 1631	IV	Trauma cases were more likely to be male (OR 4.2; 95%CI 3.2 to 5.4), nonresident (OR 6.2; 95%CI 3.7 to 10.5) and younger than 40 years (OR 3.2; 95%CI 2.7 to 4.1). Work-related injuries accounted for 590 (74.1%) of all injuries. More than 90% of work-related injuries resulted from grinding, cutting metal or drilling. Of the work-related injuries, only 21.7% used eye protection, 43.7% were offered it and had refused and 34.6% reported that they had not been offered eye protection. Use of eye protection resulted in fewer cases requiring hospital admission or follow up (11% compared to 20% who did not use eye protection).	
2118	Yu et al 2004	Case-control	Patients with work-related eye injuries in Hong Kong	Eye protection	Controls selected from the general population	239 cases, 253 controls	IV	Most of the patients (85.4%) did not wear any protective devices at the time of eye injury. Subjects who wore safety glasses regularly were less likely to have eye injuries (OR 0.29; 95%CI 0.14 to 0.62). Requirement for safety glasses was negatively associated with eye injuries (OR 0.31; 95%CI 0.15 to 0.62).	
2095	Farrier et al 2006	Cross-sectional	Survey of general dental practitioners and their staff	Eye protection	NA	200	IV	87% of general dental practitioners wore eye protection regularly, but it was not always adequate for the task. 48% had experienced ocular trauma or infection and 75% of these injuries resulted from not wearing eye protection. Almost all dental hygienists (96%) wore protection when doing procedures with patients.	

Paper no.	Reference	Type of study	Population/ study information	Risk factor/ intervention	Comparator	N	Level (quality)	Results	Other notes
1917	Jain et al 2007	Case report	Single case of 16-year-old boy injured playing sport	Eye protection	NA	1	–	The wearing of spectacles with polycarbonate lenses is not necessarily an adequate protection against eye injuries, and further eye protection is still required for spectacle wearers.	

Summary	Group
Eye injury is associated with lack of eye protection, often occurs at work and is particularly prominent in young men. The use of eye protection leads to a marked decrease in eye injuries.	<p><b>Group 1 — Clear association/causality</b></p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 135 — work and eye injuries (impact, blunt force, foreign bodies)**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results
1568	Catalano and Maus 2004	Case series (registry)	Reported cases of eye injury in Alabama	Work	NA	6847 cases	–	18% of injuries occurred at work and 38% at home. The incidence of work-related injuries increased as more people entered the workforce.
1547	Baker et al 1999	Case series (registry)	All admissions of ocular trauma to acute care hospitals in California in 1988.	Work	NA	455 cases	–	59.1% of work-related admissions were due to ocular trauma. Open globe injury accounted for 45.9% of all work-related ocular traumas. The next most common were traumatic hyphema (16%) and open wound adnexa (14.1%). The major causes of work-related ocular trauma were associated with foreign body intrusion (19%), transport vehicles (18%), cutting or piercing tools (17%), assaults (9%), falls (8.6%) and caustic/corrosive substances (8.6%).
2095	Farrier et al 2006	Cross-sectional	Survey of general dental practitioners and their staff	Work	NA	200	IV	87% of general dental practitioners wore eye protection regularly, but it was not always adequate for the task. 48% had experienced ocular trauma or infection and 75% of these injuries resulted from not wearing eye protection. Almost all dental hygienists (96%) wore protection when doing procedures with patients.
1563	Andreotti et al 2001	Cross-sectional	Survey of USA active duty military personnel in 1998.	Work	NA	1.6 million	IV	The rate of walk-in eye injury cases was 58 times higher than the rate of hospitalisations (983/100,000 person years compared to 17/100,000 person years). Contusions and open wounds accounted for 85% of injuries resulting in hospitalisation and 80% of walk-in injuries were due to superficial wounds and foreign bodies. Younger men (17 – 24) were more likely to be hospitalised and tradespeople (eg welders, metalworkers) were 3–4 times more likely to present walk-in cases than any other group.

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results
1559	Voon et al 2001	Cross-sectional	Patients seen at ophthalmic unit, Singapore General Hospital's emergency department	Work	NA	870 patients out of 1631	IV	Trauma cases were more likely to be male (OR 4.2; 95%CI 3.2 to 5.4), non resident (OR 6.2; 95%CI 3.7 to 10.5) and younger than 40 years (OR 3.2; 95%CI 2.7 to 4.1). Work-related injuries accounted for 590 (74.1%) of all injuries. More than 90% of work-related injuries resulted from grinding, cutting metal or drilling. Of the work-related injuries, only 21.7% used eye protection, 43.7% were offered it and had refused and 34.6% reported that they had not been offered eye protection. Use of eye protection resulted in fewer cases requiring hospital admission or follow up (11% compared to 20% who did not use eye protection). Foreign bodies accounted for 80% of trauma cases.
1542	Karaman et al 2004	Case series (registry)	Patients with eye injuries admitted to Split University Hospital between 1998 and 2002	Work	NA	383 cases	–	27.7% of injuries occurred at work. 67.3% of injuries were due to foreign body intrusion. Injuries resulting in monocular blindness made up 17.9% of cases. Of those cases, 16.9% were due to foreign body lacerations.
1554	Lombardi et al 2005	Cross-sectional (survey)	Worker's compensation claims in 2000 from welders to a large US insurance provider	Work	822 nonwelders	1353 welders	IV	Eye injuries as the main claim accounted for 5% of all compensation claims. Eye injuries accounted for 25% of all claims by welders. The majority of injuries were due to foreign bodies in the eye (71.7%).
1544	Xiang et al 2005	Case series (registry)	Work-related eye injuries reported in emergency departments in USA in 1999	Work	NA	280,000	–	Individuals aged 20 to 34 years were most at risk for work-related eye injuries (51.0%). Work-related eye injury was significantly greater for males (31+8/10,000) than females (9+2/10,000). Males 20–24 had the highest eye injury rate (60+21/10,000). Foreign bodies in the eye accounted for 37.6% of injuries and were the most common cause.

Summary	Group
<p>Eye injury is a common hazard in certain jobs, and is particularly prominent in males between 20 and 34 years. Foreign bodies in the eye are the most common work-related injury</p> <p>Regular wearing of appropriate eye protection can reduce the incidence of eye injury (see summary table 135).</p>	<p><b>Group 1 – Clear association/causality</b></p> <p>Group 2 – Possible association/causality (more research needed)</p> <p>Group 3 – Lack of association/causality</p> <p>Group 4 – Possible lack of association/causality (more research needed)</p> <p>Group 5 – Conflicting results</p> <p>Group 6 – Possible protection</p> <p>Group 7 – No studies</p>

**Summary table 137 — work and chemical injury**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1540	Islam et al 2000	Cross-sectional (survey)	Workers compensation claims, Virginia USA in the year July 1997 to June 1998.	Work	NA	60,718	IV	The rate of ocular injuries was 567/100,000 employees. Burns and conjunctivitis were the second most common injuries, behind foreign body penetration.	
1541	Islam et al 2000	Cross-sectional (survey)	Workers compensation claims, Virginia USA in the year July 1994 to June 1995.	Work	NA	64,646	IV	65% of lost-time burn cases were to the face and/or eye. Most burns to the eye were due to chemicals. Burns to the eye were the third-most common injury in female workers and the most common in male workers.	
1544	Xiang et al 2005	Cross-sectional (survey)	Work related eye injuries reported in emergency departments in USA in 1999	Work	NA	280,000	IV	Individuals aged 20 to 34 were most at risk for work-related eye injuries (51.0%). Work-related eye injury was significantly greater for males (31±8/10,000) than females (9±2/10,000). Males 20–24 had the highest eye injury rate (60±21/10,000). Foreign bodies in the eye accounted for 37.6% of injuries and were the most common cause. Burns accounted for 11.7% and dermatitis/conjunctivitis for 10.6% of eye injuries.	Injury rates are per 10,000 full-time equivalent (FTE) workers

Summary	Group
Chemical injury to the eye is the second most common cause of eye trauma, after foreign bodies. Males are more at risk from this type of injury than females.	<p><b>Group 1 — Clear association/causality</b></p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 139 — sport and injury**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1924	Drolsum 1999	Case series (registry)	Casualty records for a hospital in Norway from 1988–1998	Sport	NA	553	–	Young men were predominant recipients of sports-related eye injuries. Sports involving small balls or clubs caused the most injuries, and the most common injury was bulb contusion. Injuries tend to occur in unorganised activities, as many organised sports required the use of eye protection.	General sports
1929	Barr et al 2000	Case series (registry)	Patients in Scotland requiring hospital admission for ocular injuries during a 1-year period	Sport	NA	416	–	During the year, 12.5% of all cases of ocular trauma requiring hospital admission were sports related. Racquet sports such as squash accounted for most injuries, although soccer was the single most common sport associated with injury. The most common clinical finding was macroscopic hyphema. Most of the patients were male and most achieved good visual recovery.	General sports
1926	Filipe et al 2003	Case series	Athletes with ‘modern’ sports related ocular injuries presenting to a Portuguese hospital over a 10-year period	Sport	NA	24	–	This study examined the severity of ocular injuries from sports that are relatively new to Portugal, including health clubs, war games and new forms of soccer. Injuries from these ‘modern’ sports accounted for 8.3% of total eye injuries. Squash, paintball and motocross were common sources of injury. The most common diagnosis was retinal breaks.	General sports

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
795	Fineman et al 2000	Case series	Analysis of the records for patients admitted with ocular injuries from paintball in Philadelphia, USA.	Sport	NA	35	–	The most common injuries sustained during paintball were choroidal rupture, traumatic hyphema and commotio retinae. On follow-up, 46% of the patients had visual acuity of 20/200 or worse in the affected eye. Of the 35 patients, 27 required hospital admission and 14 required surgery. Some of the injuries were sustained during commercial war games while others were using paintball weapons in informal games. Although a few of the patients were wearing eye protection devices at the time of injury it was found that these did not meet industry standards. Other patients had removed their eye protection due to fogging or paint preventing clear vision.	Paintball
1927	Filipe et al 2003	Case series (registry)	Patients attending a sports ophthalmology unit over an 8-year period		NA	163	–	Most eye injuries incurred by soccer players were severe, and injury severity was independent of level of athletic expertise, age, sex and player position on the field. Hyphema and peripheral vitreoretinal lesions (most commonly in the superotemporal quadrant) were the most frequent injuries.	Soccer
1931	Alfaro et al 2005	Case series (registry)	Information on patients from the United States Eye Registry with fishing-related ocular injuries		NA	143	–	Fishing accounted for almost 20% of sport-related ocular injuries in the United States. Most common diagnoses were corneal penetration, hyphema and globe rupture caused by fishing hooks, lures and weights. Several of the patients were injured bystanders.	Fishing
1916	Jayasundera et al 2003	Case series	Information on patients with golf-related ocular injuries at the Auckland and Waikato hospitals during a 5-year period		NA	11	–	Golfing injuries were uncommon but were associated with severe ocular trauma and poor visual outcome. Most injuries were from golf balls, although injury from swinging clubs also occurred in children. Five patients incurred globe rupture and the other 6 had complications of blunt ocular trauma.	Golf

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
851	Flynn et al 2004	Case series (registry)	Patients who attended Cork University Hospital or Waterford Regional Hospital in Ireland for hurling-related injuries between 1994 and 2002		NA	310	–	Hurling related injury is a significant and preventable cause of ocular injury in Ireland, which could be prevented with the use of appropriate headgear and faceguards. At the time of the study the regulatory body for hurling did not have any required standards for protective equipment. Hyphema accounted for most hospital admissions. Spectators and referees were also among the injured.	
1928	Bianco 2005	Case–control	Professional and amateur boxers in Italy, examined over a 16-year period	Boxing	Nonboxers	956 boxers; 80 controls	III-3	There was no significant difference in the prevalence of serious ocular findings between boxers and controls. However, the presence of minor lesions (such as conjunctival and corneal alterations) was more prevalent in boxers ( $P \leq 0.0001$ ).	Boxing
2114	Waicus and Smith 2002	Cross-sectional	Survey of participants in a intercollegiate lacrosse tournament			667	IV	Of the 667 players surveyed, 125 eye injuries were reported, 53 requiring medical attention. Injuries occurred during both games and practice. Eye protection is not compulsory in women’s lacrosse in the United States, although in men’s lacrosse helmets and faceguards are mandatory.	Lacrosse

Summary	Group
A high number of high injuries occur during sporting activity, with young men being most at risk. The sports resulting in the most number of injuries usually reflect their popularity in the country in question, rather than their inherent danger, although sports using hard, small balls warrant particular caution. Eye injury is less likely to occur in established sports with compulsory and well-designed eye protection.	<p><b>Group 1 — Clear association/causality</b></p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 140 — sport and foreign bodies in the eye**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1905	Jaycock et al 2004	Case report	Patients presenting with eye injury	Sport	NA	3	–	Three patients who had been walking or running next to a road later required pars plana vitrectomy and removal of intraocular foreign bodies, most likely metallic debris projected from the road by passing cars.	

Summary	Group
Activities such as walking or running near roads may carry a small risk to eye health due to the potential for metallic foreign bodies to be projected from the road by passing cars.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 143 — assault and eye injury**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	<i>N</i>	Level (quality)	Results	Other notes
1941	Holland et al 2004	Case series	Airgun injuries to the head and neck presenting to Alder Hey Children's Hospital, Liverpool over a 5-year period	Assault	NA	16	–	The majority of injuries due to airguns were violent assaults.	
1938	Kuhn et al 2006	Case series (registry)	Analysis of information from the United States Eye Injury Registry database	Assault	NA	11,320 eyes	–	Injury by assault statistically significantly increased the chance of eye trauma resulting in blindness. Assaults were responsible for 19.5% of all injuries and the rate of blindness from assault was 41.2%. Many of the assault injuries were due to domestic violence.	
1937	Oum et al 2004	Case series (registry)	Patients with an ocular traumatic emergency presenting to a university hospital in Korea	Assault	NA	1809 (1183 male; 626 female)	–	The main sources of injury were work (35%), assault (22%), play (15%), traffic accidents (8%) and sports (7%). By gender, the largest cause for males was work-related events (27%), and the largest cause for females was assault (9%). The fist was the most common method of injury in assault. Blunt instruments and the foot were the second and third most common methods. Assault was the largest cause of ocular traumatic injury for females, although for males it was work-related injuries.	
1946	Scheufele and Blomquist 2004	Case series	Patients with ocular trauma presenting to a hospital or eye clinic in Dallas, Texas	Assault	NA	157	–	Assault was the most common setting for injury (31%). Blunt trauma was the usual method of assault injury. Alcohol was involved more often in assault than accidental injuries ( $P < 0.001$ ).	Extracted from abstract

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1933	Young et al 2002	Case series	Admissions to a regional burns unit in Hong Kong following chemical assault, over a 10-year period	Assault (chemical)	NA	19	–	All victims of chemical assault during the study period suffered burns to the head and neck. The victim's eyes were damaged in 47% of incidences, often leading to blindness, severe visual impairment and enucleation. The authors suggest that public awareness should be raised about the importance of immediate first aid after chemical injury.	

Summary	Group
The type of eye injury resulting from an assault depends on the method of assault. Blunt trauma was the most common type of injury. Most assaults, particularly chemical assaults, result in serious injury or blindness. Further studies would be required to evaluate the severity and incidence of eye trauma from assault in Australia.	<p><b>Group 1</b> — Clear association/causality</p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 167 — age or ageing and myopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2139	Edwards 1999	Prospective cohort	7-year-old children in Hong Kong, 5-year follow-up	Ageing	NA	123	II	Myopia in the group increased over the 5-year period. The incidence of myopia at the start of the study was 9% and was 18–20% at the end.	
2145	Matsumara and Hirai 1999	Cross-sectional (annual) + prospective cohort	Mass survey of Japanese students from age 3 to 17 years annually from 1984–96 + cohort of 12-year-olds with 6-year follow-up	Ageing	NA	17,320 + 346 (cohort)	II/IV	Cross-sectional study: over the 13 years of the study, the incidence of myopia in children older than 7 increased, and this increase was statistically significant for children over 10 years old. The prevalence of myopia in 17-year-old students increased from 49.3% to 65.5%. Authors suggest that this increased prevalence was due to changes in physique over this period and trends to more intensive schooling. Cohort study: the prevalence of myopia increased from 43.5% at 12 years to 66% at 17 years. The annual mean progression towards myopia was statistically significantly more rapidly for boys than girls.	
2137	Bullimore et al 2002	Retrospective cohort	Wearers of soft contact lenses aged between 20 and 40 in Georgia, USA, 5-year follow-up	Ageing	NA	291	III-2	21.3% of the group had a progressive increase in their myopia over the 5-year period. Myopia progression was greater in the subjects in their 20s (41.75%) compared with those in their 30s (26.15%). There was no difference in the reading, computer use and television viewing habits of the progressors and the nonprogressors.	
2135	Bengtsson and Grodum 1999	Cross-sectional	Swedish pensioners age 65 to 74 years in 3 separate population studies	Ageing	NA	35,618	IV (LPS)	An increase in myopia was observed over 10 years. Changes in myopia from one generation to the next were smaller, indicating that the change was specifically age related.	
982	Buch et al 2004	Cross-sectional	Adults age 20 to 84 from the general population of Copenhagen,	Ageing	NA	9980	IV (LPS)	Myopia was the biggest cause of visual problems in the under 65-year-olds.	

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
			Denmark.						
2142	Lee et al 1999	Prospective cohort	Beaver Dam Eye Study (people aged 43 to 84, 5-year follow-up)	Ageing	NA	3684	II (LPS)	Before the age of 70, people became more hyperopic and after 70, more myopic. 39% of the under 70 group became more hyperopic over the 5-year period. Only 24% of the over 70 group became hyperopic.	
2133	Lee et al 2002	Prospective cohort	All people age 43 to 84 in Beaver Dam, Wisconsin studied in 1988-1990 and then 5 and 10 years later	Ageing	NA	2937	II (LPS)	Before the age of 70 people became more hyperopic and after 70, more myopic. 39% of the under-70 group became more hyperopic over the 10-year period. Only 24% of the over-70 group became hyperopic.	

Summary	Group
Myopia increases with age up to the age of 30 and again for people over the age of 70.	<p><b>Group 1 — Clear association/causality</b></p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 168 — age or ageing and hyperopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2130	Haegerstrom-Portnoy et al 2002	Cross-sectional	Population aged between 58 and 102 from Marin County, California, USA	Ageing	NA	569	IV	Hyperopia increased to age 70, stabilised for 10 years and then increased further in the oldest group (85 years plus).	
2133	Lee et al 2002	Prospective cohort	All people age 43 to 84 in Beaver Dam, Wisconsin studied in 1988-1990 and then 5 and 10 years later	Ageing	NA	2937	IV (LPS)	Before the age of 70, people became more hyperopic and after 70 years, more myopic. 39% of the under-70 group became more hyperopic over the 10-year period. Only 24% of the over-70 group became hyperopic. 50% of the population under 60 years had a shift to hyperopia greater than 0.5D. This trend reversed in the over 70s.	
1860	Wang et al 1998	Cross-sectional	Residents over 49 years in Blue Mountains, west of Sydney.	Ageing	NA	3654	IV (LPS)	There was a significant link between hyperopia and age-related maculopathy (OR 2.0; 95%CI 1.2 to 3.4).	

Summary	Group
Hyperopia appears to increase with age up to the age of 70. Some studies report a stabilising and then a further increase with extreme old age, whereas others report a shift to myopia between 70 and 85 years.	<p><i>Group 1</i> — Clear association/causality</p> <p><b><i>Group 2</i> — Possible association/causality (more research needed)</b></p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><i>Group 5</i> — Conflicting results</p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

**Summary table 169 — age or ageing and astigmatism**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2126	Atchison et al 2005	Cross-sectional	Younger and older people (Queensland, Australia)	Older people (59+ years)	Students (21–27 years)	41 (older) 55 (young)	III-3	Complicated study design — not very useful. Age did not affect peripheral refraction. Authors note that this finding was contrary to two previous findings in the late 1980s but claim that these previous studies were flawed.	Paper not very relevant as looks are peripheral refraction only
2131	Topuz et al 2004	Prospective cohort	Patients, employees and students, all with normal corneas, at a hospital in Turkey	Ageing	NA	120	II	Mean astigmatism values were similar in all age groups, but the type of astigmatism varied between age groups.	
2130	Haegerstrom-Portnoy et al 2002	Cross-sectional	Population aged between 58 and 102 from Marin County, California, USA	Ageing	NA	569	IV	Astigmatism increased with age by a factor of 3.5. Age-related corneal changes contributed to the increase in astigmatism in people older than 70 years.	
2127	Gudmundsdottir et al 2000	Cross-sectional	Random selection of people 50 years and over in Reykjavik, Iceland	Ageing	NA	1045	IV (LPS)	Astigmatism increased with age. 38% females and 36% males in the group 50–54 years compared with 89% females and 87% males older than 80 years. On average, the increase in prevalence was 7.7% in 5 years.	
2128	Guzowski et al 2003	Cross-sectional	Residents over 49 years in Blue Mountains, west of Sydney	Ageing	NA	3654	IV	Prevalence and severity of anisometropia increased with age (10% at < 60 years to 31% at 80+ years; $P < 0.01$ ), increasing astigmatism or ametropia. Associated with age, ametropia and cataract.	Not directly about ageing and astigmatism

Summary	Group
It is not clear whether ageing affects the incidence of astigmatism or just the type of astigmatism present.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — <b>Conflicting results</b> <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 175 — diabetes and myopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	<i>N</i>	Level (quality)	Results	Other notes
2158	Logstrup et al 1997	Retrospective cohort	45 twin pairs (16 MZ, 14 DZ same sex, 15 DZ opposite sex) with one or both partners affected by insulin-dependent diabetes melitis (IDDM), born 1953–82, from the Danish Twin Register	Duration of IDDM	Interpair differences of IDDM duration correlated with interpair diffs in refraction and each of its components	45 twin pairs (=90 people) 16 MZ, 14 DZ same sex [DZss], 15 DZ opposite sex [DZos] From total of 20888 twin pairs	III-2	<p>Median and mean refractive values were more myopic in diabetic than in nondiabetic subjects (<math>P &lt; 0.05</math>, Mann-Whitney test).</p> <p>Refraction was negatively correlated with the duration of IDDM in DZss and axial length was correspondingly positively correlated (ie axial lengths longer in twins with longer duration IDDM, corresponding to the more myopic refractive power).</p> <p>No statistically significant correlations with other groups of twins (eg MZ twins had decreased axial length and were therefore more longsighted with increased duration IDDM; however, could be due to chance as sample size small [not significant]).</p> <p>Were not able to test the correlation of the severity of IDDM and refractive error.</p> <p>Refraction in MZ (<math>n = 16</math>):  <math>R = +0.39</math> (<math>P = 0.135</math>)  <math>L = +0.46</math> (<math>P = 0.075</math>)</p> <p>Refraction in DZss (<math>n = 14</math>):  <math>R = -0.76</math> (<math>P = 0.02</math>)  <math>L = -0.65</math> (<math>P = 0.012</math>)</p> <p>Refraction in DZos (<math>n = 15</math>):  <math>R = -0.14</math> (<math>P = 0.612</math>)  <math>L = -0.11</math> (<math>P = 0.703</math>)</p>	Did not adjust for all the confounding effects because of the small size of the study. Paper slightly off topic (ie investigating duration of diabetes, rather than presence or absence as a risk factor).

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2142	Lee et al 1999	Prospective cohort	196 people with diabetes were included within a total study sample of 3684 people aged 43–84 years from Beaver Dam (total sample included anyone in the appropriate age range). First sample 1988–1990; second sample 1993–95.	Diabetes	No diabetes (note: this was only one component; other factors were studied)	2994	II (LPS)	Those with diabetes (adjusted for confounding factors) were more likely to have hyperopic shifts (ie become more farsighted rather than shortsighted). After adjusting for age and sex, diabetic people had a $-0.22$ -D change in spherical equivalent ( $P = 0.02$ ). Those without diabetes had a $+0.10$ -D change in spherical equivalent.	Diabetes as a risk factor for refraction changes was only a small component of the study. Study primarily looked at time as a risk factor for refractive change.

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	<i>N</i>	Level (quality)	Results	Other notes
2133	Lee et al 2002	Prospective cohort	133 people with diabetes from a total sample of 2937 people aged over 40 years from the Beaver Dam study (total sample from the general population — anyone over 40 years). Measures taken 1988– 90, 1993–95 (5-year interval) and 1998–2000 (10-year interval)	Diabetes	No diabetes (note: this was only one component; other factors were studied)	133	II	Same as Lee et al 1999: people with diabetes had a greater shift towards hyperopia than those without diabetes.  The 10-year change in spherical equivalent (measured in diopters) for people with diabetes ( $n = 133$ ) was +0.42.  Adjusting for age, the estimated change in refractive power was +0.49 ( $P = 0.008$ ) (without diabetes = 0.26).	Study primarily looked at time as a risk factor for refractive change.

Summary	Group
Diabetes does not appear to be a risk factor for myopia.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 176 — diabetes and hyperopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	<i>N</i>	Level (quality)	Results	Other notes
2151	Giusti 2003	Case series	Teenagers ( $< 20$ years) with hyperopia and type 1 diabetes (poor metabolic control was an inclusion factor). Four-month study with fortnightly follow-up.	Juvenile (type 1) diabetes	None	20 (40 eyes)	–	<p>Transient hyperoptic changes were highly dependent on magnitude of plasma glucose concentration, as well as HbA1c percentages (<math>P &lt; 0.001</math>).</p> <p>Rapid glycaemic control in early stages of juvenile diabetes minimised refractive changes.</p> <p>Contrasts with earlier studies that showed that myopia was more often associated with hyperglycaemia, and hyperopia with hypoglycaemia.</p>	<p>Note: study assessed transient hyperopia caused by juvenile diabetes.</p> <p>Also measured refractive components</p>

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2153	Fumiki et al 2000	Case series	Patients with persistent diabetes presenting to hospital (consecutive; selected according to high plasma glucose level and high HbA1c)	Diabetes	None	14 patients (28 eyes)	–	<p>Transient hyperopic changes occurred in all patients receiving improved control after hyperglycaemia (transient change of 0.5D or more in all eyes) (occurred at a mean of 3–4 days after treatment onset; peaked at a mean of 10.3 days)</p> <p>Maximum hyperopic change in an eye = 1.47 (+ 0.87)D</p> <p>Significant positive correlation between maximum hyperopic change of an eye and plasma glucose concentration (<math>r = 0.49</math>, <math>P &lt; 0.01</math>)</p> <p>Significant positive correlation between maximum hyperopic change of an eye and HbA1c (<math>r = 0.57</math>, <math>P &lt; 0.005</math>).</p> <p>During transient hyperopia, no significant changes were observed in refractive components (corneal curvature, axial length, lens thickness, depth of anterior chamber).</p> <p>Degree of transient hyperopia associated with rapid correction of hyperglycaemia is highly dependent on rate of reduction of plasma glucose level.</p>	Study assesses transient hyperopia, not permanent damage.

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2158	Logstrup et al 1997	Retrospective cohort	45 twin pairs (16 MZ, 14 DZ same sex [DZss], 15 DZ opposite sex [DZos]) with one or both partners affected by insulin-dependent diabetes melitis (IDDM), born 1953–82, from the Danish Twin Register	Duration of IDDM	Interpair differences of IDDM duration correlated with interpair diffs in refraction and each of its components	45 twin pairs (= 90 people) 16 MZ, 14 DZss, 15 DZos) From total of 20,888 twin pairs	III-2	<p>Median and mean refractive values were more myopic in diabetic than in nondiabetic subjects (<math>P &lt; 0.05</math>, Mann-Whitney test).</p> <p>Refraction was negatively correlated with the duration of IDDM in DZss and axial length was correspondingly positively correlated (ie axial lengths longer in twins with longer duration IDDM, corresponding to the more myopic refractive power).</p> <p>No statistically significant correlations with other groups of twins (eg MZ twins had decreased axial length and were therefore more longsighted with increased duration IDDM; however, could be due to chance as sample size small (not significant).</p> <p>Were not able to test the correlation of the severity of IDDM and refractive error.</p> <p>Refraction in MZ (<math>n = 16</math>):  <math>R = +0.39</math> (<math>P = 0.135</math>)  <math>L = +0.46</math> (<math>P = 0.075</math>)</p> <p>Refraction in DZss (<math>n = 14</math>):  <math>R = -0.76</math> (<math>P = 0.02</math>)  <math>L = -0.65</math> (<math>P = 0.012</math>)</p> <p>Refraction in DZos (<math>n = 15</math>):  <math>R = -0.14</math> (<math>P = 0.612</math>)  <math>L = -0.11</math> (<math>P = 0.703</math>)</p>	<p>Did not adjust for all the confounding effects because of the small size of the study.</p> <p>Paper slightly off topic (ie investigating duration of diabetes, rather than presence or absence as a risk factor).</p>

Summary	Group
Diabetes can cause transient hyperopia. This effect is corrected when hyperglycaemia is corrected.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 179 — heredity and myopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1788	Schwarz et al 2002	Case series	School-aged children in Bradford, English, with visual impairments			72	–	The study concluded that high myopia is possibly genetically linked. It confirmed the results of previous studies which suggested that there is a high incidence of hereditary visual disease in a population with a high proportion of consanguineous marriages.	

Summary	Group
High myopia may have a genetic link, but more research is needed.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

## Summary table 181 — heredity and astigmatism

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2159	Mandalos et al 2002	Cross-sectional	Students from Northern Greece	Heredity		1738	IV	Females ran a significantly higher risk of astigmatism than males, and heredity seemed to be an important predisposing factor for astigmatism.	Extracted from abstract

Summary	Group
Heredity may be a predisposing factor for astigmatism.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 186 — hyperopia and presbyopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2361	Spierer and Shalev 2003	Case series	Male pilots who suffered from presbyopia	Hyperopia		100	—	A number of ocular variables were compared between those who needed reading glasses at 45 or earlier, and those who needed reading glasses after 45. The authors concluded that hyperopia and low amplitude of accommodation at the age of 20 might predispose to early development of presbyopia in normal individuals	

Summary	Group
Hyperopia may predispose to early development of presbyopia in normal individuals.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 187 — occupation that requires near vision and myopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1873	Kinge et al 2000	Prospective cohort study	Norwegian students mean age 20.6 years. 70 males, 79 females (right eye) 3-year follow-up	Near work (assessed by questionnaire examining: lecture time, calculation tasks, reading, video viewing, television watching)	NA	149 (70 male, 79 female)	II	<p>The prevalence of myopic right eye in these 192 students increased significantly over the 3 years, from 48% to 65%. The mean refractive change of -0.51 +/- 0.49 D was significant (<math>P = 0.0001</math>).</p> <p>A statistically significant relationship (Pearson's <math>r</math>) was found between mean refractive change and average time spent at lecture (<math>r = -0.24</math>), reading scientific literature (<math>r = -0.25</math>) and practical near-work during holidays (<math>r = -0.17</math>).</p> <p>No relationship was found between mean refractive change and time spent at computer work or watching television.</p> <p>This study supports earlier work showing that the prevalence of myopia increases in groups exposed to high educational demands.</p>	
2141	Kinge et al 1999	Prospective cohort study	Norwegian students mean age 20.6 years. (right eye) 3-year follow-up	Students (reading, writing, etc)	NA	149 (70 male, 79 female)	II	<p>Over the 3-year period, the prevalence of myopic right eyes increased from 49% to 66% in this group. The increase was observed in all 3 subgroups (initially myopic, emmetropic and hyperopic eyes).</p> <p>The biometric changes</p>	The study examines related biometric changes, not the influence of any risk factor. However, subjects were

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	<i>N</i>	Level (quality)	Results	Other notes
								examined were corneal radius, anterior chamber depth, lens thickness and vitreous chamber depth. There was a highly significant correlation between an increase in vitreous chamber elongation and an increase in mean refractive change towards myopia ( $P = 0.0001$ ) No such relationship was found with other biometric characteristics.	students (ie high study demands).
1870	Gwiazda et al 2004	Prospective cohort	469 children (aged 6–11 years) 3-year follow-up	Near work (assessed by questionnaire)	NA	469	II	The study examined a number of risk factors for progression of myopia over 3 years, and their interaction with treatment using progressive addition lenses (PALs) ( $n = 235$ ) or single vision lenses (SVLs) ( $n = 234$ ). The most significant risk factor for progression of myopia in these children was accommodation lag, which was slowed using PALs. For children with larger accommodation lags, more hours of near work tended to increase the usefulness of PALs but the effect was not significant with the small numbers examined.	The study is not an effective or rigorous examination of near work on progression of myopia in children.
1874	Mutti et al 2002	Cross-sectional	366 eighth grade children who participated in a longitudinal	1. Heredity 2. Intellectual ability 3. Near work — assessed by survey of parents	NA	366	IV	The study examined the relative importance of heredity, near work, and intellectual ability on the incidence of myopia in	The authors suggest prospective longitudinal studies are

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
			study of myopia 1991–96	examining (i) reading and studying (ii) reading for pleasure (iii) television watching (iv) computer/videogames (v) sport				<p>children.</p> <p>In the study sample, 67 were myopes, 28 were hyperopes and 271 emmetropes. Children with myopia spent more time in near activities (OR = 1.018) and less time in sport (OR = 0.936), and scored higher in reading (OR = 1.013) and language scores (OR = 1.014). Watching television and computer work did not differ between myopes and emmetropes. Parents with myopia tended to have children with myopia.</p> <p>These risk factors interconnect and therefore confound one another; however, near work had little influence on the association between heredity and myopia, suggesting heredity is the dominant risk factor.</p>	needed to examine these risk factors.
1872	Khader et al 2006	Cross-sectional	1777 secondary students in Amman, Jordan, aged 12–17 years	Near work (assessed by questionnaire and included reading, writing, television watching, and computer work)	NA	1777 (1081M, 696F)	IV	In the study, there were 313 students with myopia (20.3%F, 15.9%M). The activities outside school associated with myopia were age, family history, computer work (OD = 1.16), and reading/writing (OD = 1.24).	

Summary	Group
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The studies are not sufficient to examine in detail the relationship between the effect of near work and incidence and progression of myopia. Two studies suggest that near work has less effect than heredity; one study suggests that intensive near work could initiate myopia or lead to its progression in young adults. Further longitudinal studies are needed to examine the effect of near work.

*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

**Summary table 191 — ocular disease and myopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2392	Smith and Tasman 2005	Case series	Patients (age 45+) diagnosed with untreated retinopathy of prematurity (ROP)	Retinopathy of prematurity (low birthweight and gestational age)	NA	47 (33 female, 14 male )	–	86 eyes were examined: refractive index could be determined for 43 eyes. 39 eyes (90.7%) showed some degree of myopia. 14 eyes (32.67%) were highly myopic. 19 eyes (44.2%) were moderately myopic. 6 eyes (14.0%) were mildly myopic.	This study is very specific to ROP patients and not relevant to the general population.
2399	Wu et al 2005	Prospective cohort	Barbados-born citizens 49+ years (original study 40–84 yrs) 9-year follow-up	Nuclear lens opacities; glaucoma; ocular hypertension	NA	2792	II (LPS)	The presence of nuclear lens opacities at baseline increased the risk of myopia (RR 1.7; 95%CI 1.01 to 2.89) and moderate-high myopia (RR 3.6; 2.0 to 6.7). Myopia risk also increased with increasing severity of nuclear opacities ( $P < 0.05$ ). The baseline incidence of glaucoma (RR 6.0; 95%CI 3.9 to 9.3) and ocular hypertension (RR 2.0 95%CI 1.3 to 3.0) also increased the risk of myopia.	

Summary	Group
Nuclear opacities (cataract) and glaucoma (and ocular hypertension) may increase the risk of myopia. Further studies are needed to examine the effect of ocular diseases on myopia. Untreated retinopathy of prematurity (ROP) leads to a high incidence of myopia in adults.	<p><i>Group 1</i> — Clear association/causality</p> <p><b><i>Group 2</i> — Possible association/causality (more research needed)</b></p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><i>Group 5</i> — Conflicting results</p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

**Summary table 192 — ocular disease and hyperopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2399	Wu et al 2005	Prospective cohort (9-year follow-up)	Barbados-born citizens 49+ years (original study 40–84 yrs)	Glaucoma and ocular hypertension	NA	2793 (original study 4631 participants)	II	<p>Glaucoma was negatively associated with the incidence of hyperopia (RR 95%CI 0.4; 0.2 to 0.8) in males and females. Ocular hypertension showed a similar negative trend but the association was not statistically significant. The incidence of hyperopia was slightly less in males than in females.</p> <p>Increasing age also decreased the risk of hyperopia.</p> <p>There was no statistically significant association between baseline lens opacities of any type and the incidence of hyperopia.</p>	

Summary	Group
Hyperopia incidence decreased with incidence of glaucoma and ocular hypertension.	<p><i>Group 1</i> — Clear association/causality</p> <p><i>Group 2</i> — Possible association/causality (more research needed)</p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><i>Group 5</i> — Conflicting results</p> <p><b><i>Group 6</i> — Possible protection</b></p> <p><i>Group 7</i> — No studies</p>

**Summary table 193 — ocular disease and astigmatism**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2401	Mombaerts et al 2006	Case-control study	Patients under 55 years with inactive Grave's ophthalmopathy in Belgium	Ocular disease, specifically Grave's ophthalmopathy	109 controls without Grave's ophthalmopathy	109 cases, 109 controls	III-3	Grave's ophthalmopathy is a disease that affects the extraocular muscles that rotate the eyeball. It is related to Grave's disease (hyperthyroidism). Prevalence is 0.25% in US.  This study is the first to demonstrate that patients with Grave's ophthalmopathy have a significantly greater steepening of the central cornea (astigmatism) in the with-the-rule meridian (horizontal) compared with control eyes.	

Summary	Group
Grave's ophthalmopathy may be associated with greater with-the-rule (horizontal) astigmatism. However, given the low prevalence of Grave's ophthalmopathy, it is unlikely to be a significant risk factor for astigmatism in the general population.	<p><i>Group 1</i> — Clear association/causality</p> <p><b><i>Group 2</i> — Possible association/causality (more research needed)</b></p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><i>Group 5</i> — Conflicting results</p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

**Summary table 197 — trauma and astigmatism**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
835	Ludwig et al 2002	Case report	Child	Trauma	NA	1	–	A 6-year-old boy suffered a scleral perforation with vitreous prolapse, which was repaired during surgery. Within 6 weeks he developed lenticular astigmatism, presumably caused by anterior vitreous fibres and anterior hyaloid, which were removed. Full visual acuity was restored. Lenticular astigmatism following penetrating eye injury has been described on only one other occasion.	

Summary	Group
Although rare, a wound can lead to secondary problems such as lenticular astigmatism.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 211 — excessive reading and myopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	<i>N</i>	Level (quality)	Results	Other notes
1787	Saw et al 2006	Prospective cohort	Singaporean (Chinese, Malay, Indian) schoolchildren age 7–9 years with no myopia studied over 3 years	Reading books (no. per week)	Few books read	1478	IV	The relative risk for myopia was 1.55 (95%CI 1.18 to 2.04) for two versus no myopic parents and 1.1 (95%CI 0.97 to 1.05) for every unit increase in books read per week. Reading was not causally linked to myopia.	
2178	Saw et al 2001	Cross-sectional	Singapore military conscripts	Excessive reading	NA	429	IV	The odds ratio (OR) of myopia was 3.8 (95%CI 2.0 to 7.3) in conscripts who had gone through the gifted educational stream. University-educated conscripts had an OR for myopia of 4.1 (95%CI 1.4 to 4.9). Increased close work (reading, etc) did not correlate with increased myopia.	
1872	Khader et al 2006	Cross-sectional	Students aged 12–17 in Amman, Jordan	Screens (television/computer)	NA	1777	IV	Myopia was associated with computer use (OR 1.16; 95%CI 1.06 to 1.26; $P < 0.0001$ ) as well as reading and writing outside of school hours (OR 1.24; 95%CI 1.14 to 1.35; $P < 0.001$ ). There was no association with hours spent watching television but time spent playing sports was inversely associated with myopia (OR 0.89; 95%CI 0.89 to 0.93; $P < 0.0001$ ).	
1873	Kinge et al 2000	Prospective cohort study	University students in Norway	Reading	NA	192	II	No relationship was found between refractive change and time spent working with video display terminals or watching television. Time spent reading scientific papers, on practical near work, or in lectures was all statistically significantly associated with refractive change towards myopia. This work agreed with previous studies on the relation between development of myopia and computer or television use.	

Summary	Group
There are conflicting results about the relationship between reading and other near work and development of myopia.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — <b>Conflicting results</b> <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 215 — TV/computer and myopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1872	Khader et al 2006	Cross-sectional	Students aged 12–17 in Amman, Jordan	Screens (TV/computer)		1777	IV	Myopia was associated with computer use (OR 1.16; 95%CI 1.06 to 1.26; $P < 0.0001$ ) as well as reading and writing outside of school hours (OR 1.24; 95%CI 1.14 to 1.35; $P < 0.001$ ). There was no association with hours spent watching television but time spent playing sports was inversely associated with myopia (OR 0.89; 95%CI 0.89 to 0.93; $P < 0.0001$ ).	
1873	Kinge et al 2000	Prospective cohort study	University students in Norway	TV/computer		192	II	No relationship was found between refractive change and time spent working with video display terminals or watching television. Time spent reading scientific papers, on practical near work, or in lectures was all statistically significantly associated with refractive change towards myopia. This work agreed with previous studies on the relation between development of myopia and computer or television use	

Summary	Group
<p>There appears to be no relationship between computer and television use and myopia, although further prospective studies would be useful to confirm this result.</p> <p>However, ‘near work’ such as reading and writing or practical near work is associated with a refractive change towards myopia (see summary table 211). (In one study, sport was protective for myopia development.)</p>	<p><i>Group 1</i> — Clear association/causality</p> <p><i>Group 2</i> — Possible association/causality (more research needed)</p> <p><i>Group 3</i> — Lack of association/causality</p> <p><b><i>Group 4</i> — Possible lack of association/causality (more research needed)</b> (computer/TV screens)</p> <p><i>Group 5</i> — Conflicting results</p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

**Summary table 216 —TV/computer and hyperopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2194	Grignolo et al 1998	Prospective cohort	Visual display unit operators	TV/computer		6000	II	Changes in the refractive state seemed to be mainly age-related. There was a slight tendency toward hyperopia, but no effect on ocular motility.	Extracted from abstract

Summary	Group
In one study of visual display unit operators, extended use of visual display units caused a slight tendency toward hyperopia, but there is not other research data to support or refute this finding.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 220 — do eye tests reduce the incidence of eye disease in the general population?**

Paper no.	Reference	Type of study	Population/ study information	Intervention	Comparator	<i>N</i>	Level (quality)	Results	Other notes
3400	Smeeth and Iliffe 2006	Systematic review (Cochrane) — 5 RCTs	Community-based studies of people aged 65 years or over	Mass screening	No screening	3494	I (Good)	Community-based screening of asymptomatic older people did not result in improvements in vision. The results in all five trials were very similar. The pooled RR for people in the intervention and control groups having self-reported visual problems when outcome assessments were performed was 1.03 (95%CI 0.92 to 1.15); the pooled odds ratio was 1.04 (95%CI 0.89 to 1.22). Three to five years after screening, the RR for visual acuity less than 6/18 in either eye comparing universal with targeted screening, was 1.07 (95%CI 0.84 to 1.36, <i>P</i> = 0.58). The mean composite score of the NEI VFQ-25 was 85.6 in the targeted screening group and 86.0 in the universal group, difference 0.4 (95%CI -1.7 to 2.5, <i>P</i> = 0.69).	
3399	Hatt et al 2006	Systematic review (Cochrane) — no RCTs found	Any population except for people already diagnosed with OAG, under the care of an eye specialist or with known visual impairment.	Any type of screening for OAG	No screening	NA	NA (Good review but no studies)	The search found no RCTs of population-based screening for OAG. High-quality RCTs are needed.	
3401	Powell et al 2005	Systematic review (Cochrane) — no RCTs	School children	Formal visual acuity testing	No screening	NA	NA (good review but no	The search found no RCTs of the impact of screening programs on amblyopia in school age children. High-quality RCTs are needed.	

Paper no.	Reference	Type of study	Population/ study information	Intervention	Comparator	N	Level (quality)	Results	Other notes
		found					studies)		
3048	Taylor et al 2004	Prospective cohort	People with normal vision and no eye disease $\geq$ 40 years (Melbourne Vision Impairment Project) followed over 5 years	Testing change in vision /eye disease over 5 years Eye tests (baseline and 5 years)	NA	1590	II	<p>38 people had reduced vision at 5 years. Only 8–14 of these people (up to 0.88% to whole cohort) had not noticed a change in vision (asymptomatic vision loss) over the 5-year period. This showed how small the target group is for frequent eye screening examinations.</p> <p>Of the 38 with reduced vision, 10 had a family history of cataract, 1 of glaucoma and 1 of AMD. One of the 38 had developed glaucoma but it is not stated whether this person noticed a vision loss or was the person with a family history of glaucoma.</p> <p>Authors concluded that ‘frequent routine eye examinations of those with normal examination results will have a low yield and may not be cost-effective’.</p> <p>Also, it may be more effective (in terms of outcomes and costs) to target people who notice a change in vision or who have a family history of eye disease than to screen people with normal vision regularly.</p> <p>American Academy of Ophthalmology (AAO) and American Optometry Academy have consensus-based recommendations for <i>biannual</i> eye exams for people 46–60 years and <i>annual</i> exams for &gt; 60 years<sup>a</sup>; however, these are based as much on tradition/opinion as on evidence.</p>	Did not come to a conclusion about frequency; only made recommendations about effectiveness of testing people with normal vision.

a American Academy of Ophthalmology (2006). Policy statement

Summary	Evidence
Community-based screening of asymptomatic older people did not result in improvements in vision.	Cochrane review (Level 1)
A cohort study in Melbourne found that regular eye examinations in people with normal vision only identified very few people (maximum of 0.88%) with vision loss that could not have been identified by symptoms and/or family history. Further research is needed.	Prospective cohort (Level III-2)
There are no RCTs to show the effectiveness or otherwise of population-based screening for glaucoma, or for amblyopia in childhood. No studies were found that properly addressed the issue of frequency of eye testing.	2 Cochrane reviews (more research needed)

**Summary table 221 — do eye tests improve outcomes for diabetic retinopathy?**

Paper no.	Reference	Type of study	Population/ study information	Intervention	Comparator	N	Level (quality)	Results	Other notes
3049	Bachmann 1998	Systematic review (numerous papers for different questions)	General practice-based diabetic population in the UK	Screening test of diabetic retinopathy (DR)	Various	NA	NA (Adequate)	<p>Sensitivity of screening tests in detecting diabetic retinopathy (DR) requiring treatment was 50–88% in the study population.</p> <p>Of those screened, about 4% would be correctly detected as requiring treatment during an initial screening round, but this yield could decrease to about 1% in subsequent annual rounds.</p> <p>Of those treated, about 6% would be prevented from going blind within a year of treatment and 34% within 10 years of treatment.</p> <p>Concluded that it is effective to screen and treat early DR; however, there is only a small portion of screened patients who would benefit.</p> <p>Recommend increasing efficiency of screening programs by making sure high-risk patients are screened more often, and making sure low-risk patients/patients with negative test results are screened less often — eg by increasing the interval between screenings. However, this may mean that treatable cases are missed and different intervals may be confusing for patients and difficult for health care professionals to administrate.</p>	
3047	Puent et al 2005	Prospective cohort	Diabetic population in Ohio, selected from 82 optometric practices. Charts reviewed over 10 years	Adherence to guidelines	NA	1497	NA	<p>Examines how well optometrists adhere to guidelines for eye examinations in diabetic patients, rather than tests the optimal frequency of eye tests. Age not taken into account.</p> <p>Mentions that US Dept of Health and Human Services’ ‘Healthy Vision 2010’ initiative has a goal of increasing the % of diabetic patients receiving <i>annual</i> dilated eye examinations. Also, American Optometric Association (AAO) recommends <i>annual</i> dilated eye examinations for diabetic patients to prevent vision loss (based on expert clinical opinion and available research data).<sup>a</sup></p>	Off topic

Paper no.	Reference	Type of study	Population/ study information	Intervention	Comparator	N	Level (quality)	Results	Other notes
3054	Stefansson 2000	Review (not systematic; background paper)	Reviews background information on public health approach to DR, and the organisation and methods of screening programs	Type and organisation of screening program	None (review of information on different programs)	NA	NA (Background)	<p>States that blindness incidence and prevalence is lower in populations that have established screening programs for diabetic eye disease than in populations without established screening.</p> <p>Screening for diabetic eye disease is one of the most cost-effective health procedures available.</p> <p>Various recommendations for screening intervals:</p> <p>Children:</p> <p>DR is generally not seen before puberty, therefore there is no regular screening of young children who are diabetic.</p> <p>American Academy of Ophthalmology (AAO) recommends regular screening from 10 years.</p> <p>American Diabetic Association (ADA) recommends starting screening from 12 years in people with diabetes for &gt; 5years.</p> <p>European Retinopathy Working Party (RWP) recommends regular screening only at puberty.</p> <p>In Iceland, regular screening not started until 12 years (easier to use an age limit rather than the more variable onset of puberty).</p> <p>Type 1 diabetes:</p> <p>American College of Physicians, ADA and AAO recommend all people with type I are examined annually (and type II examined at diagnosis, 4 years later if no DR is detected, and annually after that).</p> <p>This may fail to detect onset of DR because the 4-year interval is too long.</p> <p>RWP has more appropriate guidelines: examine at diagnosis then at least biannually/annually if DR appears (DR usually takes 2 years to progress from nonsight-threatening to sight-threatening).</p> <p>Paper also gives some intervals for photographic screening programs.</p>	

Summary	Evidence
Regular eye tests appear to be effective for decreasing the incidence of diabetic retinopathy in high-risk patients (although it is not clear how frequent such tests should be), but there appears to be less benefit to frequent screening of low-risk patients or those with negative test results.	Large review from general practitioner-based diabetic population in UK (Level 1)

**Summary table 222 — nutritional supplements and cataract**

Paper no.	Reference	Type of study	Population/ study information	Intervention	Comparator	N	Level (quality)	Results	Other notes
2781	West et al 2006	Systematic review of nutrient supplement use for eye diseases (6 RCTs and many large observational studies included for cataract)	Studies included: Age-Related Eye Disease Study (RCT) Womens Health Study (RCT) Linxian Study (RCT) Blue Mountains Study (cross- sectional) Beaver Dam Study Physicians Health Study Nurses Health Study and Health Professionals Follow-up Study + Others	Multivitamin /antioxidant (diet or supplements	Less vitamin/ antioxidants, or no supplements	NA	I (Good)	Consumption of multivitamins; vitamins E, C and $\beta$ -carotene; vitamin E alone; vitamin C alone; carotenoids) was not shown to reduce the risk of cataracts. Supplements with riboflavin and niacin were associated with decreased numbers of cataracts (see also review of Huang et al below).	This paper includes a very well set out and detailed summary table of all studies with different supplement combinations

Paper no.	Reference	Type of study	Population/ study information	Intervention	Comparator	N	Level (quality)	Results	Other notes
2757	Huang et al 2006	Systematic review of nutritional supplement use (total of 20 RCTs) included 4 RCTs that studied cataract	General community-based population with no special nutritional needs	Nutritional supplements (several multivitamin and mineral combinations)	Placebo	total of approx 4000 per group	I (Good)	<p>The largest RCT (the Age-Related Eye Disease Study, with 2300 participants per group) showed no significant effect of any multivitamin supplements on any form of cataract development (nuclear, cortical, posterior subcapsular, cataract surgery, severe lens events, loss of visual acuity score).</p> <p>The second largest study (Linxian Physicians Health Study [China] with approximately 1600 people per group) showed no significant effect for any supplements on cortical cataracts, but riboflavin + niacin showed a decrease in nuclear cataracts (but only in 65–74-year-olds), and an increase in posterior subcapsular cataracts (although the latter were very rare events and the increase not statistically significant).</p> <p>The other two, smaller studies showed some conflicting results.</p> <p>Skin yellowing was reported more frequently in the groups taking antioxidants than in the placebo groups.</p>	

Paper no.	Reference	Type of study	Population/ study information	Intervention	Comparator	N	Level (quality)	Results	Other notes
1515	Seddon 2007	Review (6 randomised controlled trials, 8 prospective cohorts, 3 case-control)	General population	Nutritional supplements	Placebo or no supplements	NA	II (RCTs)	As noted above, the largest RCT of eye disease (the Age-Related Eye Disease Study), showed no statistically significant effect on prevalence of any types of cataract or cataract indicators from taking nutrient supplements containing vitamins C, E, and $\beta$ -carotene, and zinc with cupric oxide. Other RCTs and observational studies showed mixed results; some cohort studies (including the Beaver Dam Study showed some benefit for taking vitamin C, E or multivitamins, especially for longer use (> 10 years).	Review was not systematic (poor quality). Level assigned on basis of individual studies.
2752	Chiu and Taylor 2007	Review (7 randomised controlled trials, 13 prospective cohorts)	General population	Nutritional supplements	Placebo or no supplements	NA	II (RCTs)	Includes AREDS and Linxian studies described above. Other studies showed inconsistent results for vitamin C and E and carotenoid intake. Some positive effects found in the observational studies. (Although this review does not present proper systematic review methods, it does provide a very detailed analysis of the studies included with outcomes analysed for a wide range of vitamin combinations.)	Review was not systematic (poor quality). Level assigned on basis of individual studies

Paper no.	Reference	Type of study	Population/ study information	Intervention	Comparator	N	Level (quality)	Results	Other notes
2749	Bartlett and Eperjesi 2004	Systematic review (RCTs + observational studies)	General population	Nutritional supplements	Placebo or no supplements	NA	I (Adequate)	The effects of vitamin A and C supplementation showed mixed results, with vitamin C shown by many studies to give a decreased risk of nuclear cataract, but a higher risk of cortical cataract, with some studies showing no link at all. Vitamin E supplementation results were also mixed, with positive effects only being shown when high (potentially toxic) doses were given.	
2767	Meyer 2005	Systematic review (no details given of the studies used)	General population	Nutritional supplements	No/less supplements	NA	NA (Poor)	Studies looking at the effect of retinol, zinc or vitamin C supplementation on cataract formation showed mixed results, with some reporting lower cataract, others reporting higher risks and some reporting no significant effect either way.	
1518	Trumbo and Ellwood 2006	Systematic review (12 RCTs, 23 prospective cohort)	General population	Nutritional supplements	Placebo or no/less supplements	NA	NA (Poor)	None of the studies found any link between lutein or zeaxanthin intake and cataract risk.	
2773	Williams 2006	Systematic review (not detailed clearly — mix of epidemiological studies and animal studies)	General population	Nutritional supplements	No/less supplements	NA	NA (Poor)	Mixed results were found for the effects of vitamin E, vitamin C and carotenoid supplements in animal models and human studies.	

Summary	Group
<p>Major studies show no association between vitamins E, C and <math>\beta</math>-carotene; vitamin E alone; vitamin C alone; or carotenoid supplements and the risk of any type of cataract development.</p> <p>One 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.</p> <p>NB: Adverse effects of supplements need to be taken into account (eg <math>\beta</math>-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).</p>	<p><i>Group 1</i> — Clear association/causality</p> <p><i>Group 2</i> — Possible association/causality (more research needed)</p> <p><i>Group 3</i> — Lack of association/causality</p> <p><b><i>Group 4</i> — Possible lack of association/causality (more research needed) (vitamins C, E, carotenoids)</b></p> <p><i>Group 5</i> — Conflicting results</p> <p><b><i>Group 6</i> — Possible protection (multivitamins, riboflavin + niacin)</b></p> <p><i>Group 7</i> — No studies</p>

**Summary table 224 — nutritional supplements and glaucoma**

Paper no.	Reference	Type of study	Population/ study information	Intervention	Comparator	N	Level (quality)	Results	Other notes
2781	West et al 2006	Systematic review of nutrient supplement use for eye diseases (many included studies but only 1 prospective cohort with glaucoma outcomes)	Nurses Health Study and Health Professionals Follow-up Study (US)	Antioxidant consumption t (diet /supplement)	Fewer antioxidants	NA	Good quality review II (LPS)	Increased consumption of antioxidants, whether through diet or supplement, was not shown to reduce the risk of glaucoma.	
2749	Bartlett and Eperjesi 2004	Systematic review (RCTs and observational studies)	General population	Nutritional supplements	No supplements	NA	I (Adequate)		

Summary	Group
Supplements (in the form of antioxidants) do not significantly reduce the risk of glaucoma.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <b><i>Group 3</i> — Lack of association/causality</b> <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 226 — nutritional supplements and macular degeneration**

Paper no.	Reference	Type of study	Population/ study information	Intervention	Comparator	N	Level (quality)	Results	Other notes
2796	Evans 2006	Systematic review (Cochrane review) (8 RCTs)	Includes Age-Related Eye Disease Study (AREDS) and others	Nutritional supplements	Placebo/no supplements	NA	I (Good)	Supplementation with antioxidants and zinc may give a small but significant benefit to patients with AMD (OR 0.77; 99%CI 0.58 to 1.03). There was an increased risk of genitourinary problems in patients taking the supplements. Authors also note that other adverse effects of supplements should be taken into account (eg $\beta$ -carotene has been shown to increase risk of lung cancer in smokers; vitamin E has increased the risk of heart disease in people with vascular disease or diabetes).	
2781	West et al 2006	Systematic review of nutrient supplement use for eye diseases (2 RCTs and several large cohort studies included for cataract)	Age-Related Eye Disease Study (AREDS) (RCT) Blue Mountains Study (cross-sectional) and others	Multivitamin/antioxidant (diet or supplements)	Fewer vitamins/ antioxidants	NA	I (Adequate)	Some positive endpoints were reports for AMD with consumption of vitamins E + C + $\beta$ -carotene, the results were not adequate to draw a firm conclusion (see also review of Huang et al below).	This paper includes a very well set out and detailed summary table of all studies with different supplement combinations

Paper no.	Reference	Type of study	Population/ study information	Intervention	Comparator	N	Level (quality)	Results	Other notes
2752	Chiu and Taylor 2001	Systematic review (7 RCTs, 13 prospective cohort)	General population	Nutritional supplements	NA	NA	I (Adequate)	Studies investigating the effect of vitamins A, C, B and E on AMD gave mixed results, with some finding a positive effect, some negative and some no significant effect.	
2757	Huang 2006	Systematic review of nutritional supplement use (included 1 RCT that studied AMD)	Age-Related Eye Disease Study (AREDS) [RCT]				NA	Not analysed further as only includes RCTs and Cochrane review is more recent.	
2788	Bartlett and Eperjesi 2003	Systematic review (7 RCTs)					NA	Not analysed further as only includes RCTs and Cochrane review is more recent.	
2806	Mares-Perlamm et al 2002	Systematic review					NA	Not analysed further as only includes RCTs and Cochrane review is more recent.	
3405	Evans and Henshaw 1999	Systematic review (3 RCTs)					NA	Not analysed further as only includes RCTs and Cochrane review is more recent.	
3407	Evans 1999	Systematic review (2 RCTs)	General population	Ginkgo	Placebo or lower dose	RCT1: 10/group RCT2: 50/group	I (Good)	Not analysed further (treatment).	Off topic (treatment study)

Summary	Group
<p>It is not clear whether supplements (vitamins, antioxidants, lutein, zeaxanthin and zinc) have a positive, negative or no effect on macular degeneration.</p> <p>Other adverse effects of supplements should be taken into account (eg <math>\beta</math>-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).</p>	<p><i>Group 1</i> — Clear association/causality</p> <p><i>Group 2</i> — Possible association/causality (more research needed)</p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><b><i>Group 5</i> — Conflicting results</b></p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

**Summary table 227 — nutritional supplements and retinitis pigmentosa**

Paper no.	Reference	Type of study	Population/ study information	Intervention	Comparator	N	Level (quality)	Results	Other notes
2741	Hoffman and Birch 1998	Systematic review (does not detail the studies used)		Nutritional supplements	NA	NA	NA (Poor)	Patients with retinitis pigmentosa (RP) had lower omega 3 levels than the control subjects.	
2738	Berson et al 2004	RCT	Patients aged 18–55 years were evaluated over a 4-year period. The trial was randomised, controlled and double-blind. All patients were given vitamin A supplements.	DHA (an omega 3 fatty acid)	Placebo	221	II	No significant differences in decline in ocular function were found between the DHA group and the control group.	
2737	Aleman et al 2001	Case-control	Patients diagnosed with RP or Usher syndrome were compared with normal subjects given lutein supplements.	RP or Usher patients + nutritional supplements	Normal subjects + nutritional supplements	47 RP, 11 Usher, 27 normal	III-2	Macular pigment (MP — thought to be a protective factor against RP), was similar across all patients. Only 50% of patients treated with lutein showed a significant increase in MP. Only a third of the normal subjects showed an increase in MP after lutein supplements. Foveal sensitivity did not change after supplementing.	
2740	Dagnelie et al 2000	Case series	Participants with RP or other retinal degradations. Visual acuity was measured by a self-run computer test and wall chart test.	26-week course of lutein supplements	NA	13 RP, 3 other retinal degradation	NA	Mean visual acuity began to improve 2 to 4 weeks after the treatment began and plateaued at 6–14 weeks. Blue-eyed participants showed the strongest gains in visual acuity.	

Paper no.	Reference	Type of study	Population/ study information	Intervention	Comparator	N	Level (quality)	Results	Other notes
2743	Sibulesky 1999	Prospective cohort	Adults age 18–55 years with RP were supplemented with a high dose of vitamin A for $\leq 12$ y and compared with a group given a trace amount of vitamin A	Nutritional supplements	Patients on trace dosage of vitamin A	146 high dose, 149 trace dose	NA (off topic)	Patients given the higher dose showed an 8% increase in mean serum retinol at 5 years and 18% at 12 years. No toxicity signs were visible.	Does not mention effect on visual acuity.

Summary	Group
It is not clear whether lutein supplements are beneficial in retinitis pigmentosa. DHA (omega 3) supplements do not appear to be beneficial.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <b><i>Group 5</i> — Conflicting results</b> <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 229 — use of contact lenses and incidence of eye infections in the general population**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	<i>N</i>	Level (quality)	Results	Other notes
2931	Hammersmith 2006	General review (international papers since 1998)	People with <i>Acanthamoeba</i> infections/ contact lens (CL) wearers	CL wear	No CLs	NA	NA (general review)	<p>Contact lenses are a major risk factor for <i>Acanthamoeba</i> infections (in one study, contact lens wear was reported in 80–86% of cases).</p> <p>Silicone hydrogel lenses may have the greatest risk because they are increasingly prescribed and may be more ‘sticky’ to <i>Acanthamoeba</i>.</p> <p>Lowest risk soft contact lenses are daily disposables because have least amount of handling (in cases where infection was reported for daily disposables, other risk factors may have contributed — eg noncompliance with disinfection, swimming).</p> <p>Incidence of <i>Acanthamoeba</i> keratitis in hard lenses is 9.5 times that of soft (increasing because of the use of hard lenses for orthokeratology).</p> <p>Additional risk factors for 40–91% of contact lens wearers include swimming with lenses, irregular/inadequate disinfection, cleaning lens cases with tap water, minor corneal trauma, and exposure to contaminated water.</p> <p>For noncontact lens wearers, the diagnosis of <i>Acanthamoeba</i> keratitis is longer and more difficult, and less expected; therefore, the delay produces worse visual outcomes.</p> <p>Lists a number of major reviews on contact lens-associated <i>Acanthamoeba</i> keratitis: Schaumberg et al 1998, Lindquist 1998, Illingworth and Cook 1998 (see paper #2391 for details).</p>	Orthokeratology is wearing CLs overnight for the correction of myopia

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	<i>N</i>	Level (quality)	Results	Other notes
2902	Butler 2005	Case series	6-year review of <i>Acanthamoeba</i> keratitis (AK) in New South Wales (1997–2002) (retrospective review of all cases of AK from Sydney Eye Hospital)	Levels of contact lens wear	None	20	NA	<p>Of the cases, 80% (<i>n</i> = 16) wore contact lenses (CLs); of these, 81% (13) wore soft lenses.</p> <p>40% (<i>n</i> = 8) had additional risk factors (contact of CL/case with tap water, corneal abrasion, continuous wear, inappropriate cleaning solutions).</p> <p>AK is rare, but CL wear is the most significant risk factor.</p> <p>Delay in diagnosis and non-CL wearers have an increased risk of recurrent infection.</p> <p>Study notes that there are few large clinical series of AK in the literature (and the ones that exist are from UK).</p> <p>In a prospective UK study, the incidence of AK was 17.53–21.14/million CL wearers (compared with 1.13–1.26/million adults).</p> <p>Summarises data showing how the series in this paper compares with 2 others from the UK (numbers of CL-wearer AK cases for all 3 studies were 80% [<i>n</i> = 16], 97% [<i>n</i> = 102], 89% [<i>n</i> = 64]).</p> <p>Need more education about importance of disinfection, especially CL cases.</p>	

Summary	Group
Contact lens wear appears to be a significant risk factor for acanthamoebic keratitis.	<p><b>Group 1</b> — Clear association/causality</p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

**Summary table 230 — effect of education on the use and misuse of contact lenses and the incidence of eye infections**

Paper no.	Reference	Type of study	Population/ study information	Intervention	Comparator	N	Level (quality)	Results	Other notes
2817	Claydon 1997	Randomised controlled, double-blinded trial	Experienced contact lens (CL) wearers in UK (17–55 years both sexes); assessment period of 12 months	Received educational package on lens care	Not given educational package	80 (only 72 completed study)	II	Education strategy included video, booklets, posters, checklist and a health care contract. Strategy had little significant effect on compliance levels (Mann Whitney U tests). This might have been because the assessment of noncompliance was not sensitive enough to detect small changes, or because the groups were overall very compliant anyway.	Does not assess incidence of infection; only looks at education and compliance
2823	Foulks 2006	Review (background only; not systematic)	Literature review of Ovid MEDLINE from 1966–2005. Gives keywords used, but does not give details of studies included (47 references listed in ref list).	None (just summarises current levels of safety and efficacy of CL use)	None	NA	NA (Poor)	Patient and health care practitioner participation in managing CL use is crucial for safety (proper use and care) in extended-wear contact lenses. Describes the risks associated with CL wear (highlighting the two most important categories: extended wear and unsupervised wear). However, does not examine incidence of eye infections.	Background

Summary	Group
One RCT showed that education did not significantly increase compliance with correct contact lens use in lens users; however, no studies looked specifically at incidence of eye infections.	NA

**Summary table 231 — do infection control measures reduce the incidence of eye disease?**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
3402	Rabiu et al 2005	Systematic review (Cochrane review) — 3 RCTs/quasi-RCTs	Villagers in Mali and Gambia	Antibiotics, health education & insecticide sprays for reduction of trachoma	No interventions	Approx 10 000	I (Good)	Two studies that assessed insecticide spray as a control measure found that trachoma is reduced by at least 55% to 61% with this measure compared to no intervention. One study found that another control measure, latrine provision, reduced trachoma by 29.5% compared with no intervention, but the reduction was not statistically significant. In another study, health education on personal and household hygiene reduced the incidence of trachoma such that the odds of reducing trachoma in the health education village were about twice that of the no intervention village. All the studies have some methodological concerns relating to concealment of allocation and nonconsideration of clustering effect in data analysis.	
3403	Ejere et al 2004	Systematic review (Cochrane review) — 2 RCTs/quasi-RCTs	Participants from Kongwa, Tanzania, and the Northern Territory, Australia	Face washing + topical antibiotic for reduction of trachoma	No face washing	2560 children with active trachoma	I (Good)	Overall face washing combined with tetracycline treatment reduced trachoma compared to topical tetracycline alone at 12 months follow-up in villages in Tanzania. This effect was statistically significant for reducing 'severe' trachoma (OR 0.62, CI 0.40 to 0.97) but not for 'nonsevere' trachoma (OR 0.81, CI 0.42 to 1.59). The number of clean faces was consistently higher in villages where face washing was combined with tetracycline treatment. The trial of aboriginal children in the Northern Territory found no statistically significant benefit of eye washing alone or in combination with tetracycline drops in reducing active trachoma.	

Summary	Group
In the case of trachoma, there is conflicting evidence as to whether infection control methods, such as insecticide sprays, antibiotics, health education and face washing reduce the incidence of the disease.	NA

### Summary table 233 — obesity and hyperopia

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Quality	Results	Other notes
3394	Saw et al 2002	Cross-sectional	Singapore Chinese children	Height, weight and body mass index (BMI)	Height, weight and BMI	1449	IV	Heavier and more obese children had refractions that were more hyperopic ( $P = 0.01$ , $P = 0.08$ ) after analyses controlling for age, parental myopia, reading and school.	

Summary	Group
Obesity may be a risk factor for hyperopia, although more research is required in this area.	<p><i>Group 1</i> — Clear association/causality</p> <p><b><i>Group 2</i> — Possible association/causality (more research needed)</b></p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><i>Group 5</i> — Conflicting results</p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

**Summary table 240 — diet and myopia**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	<i>N</i>	Level (quality)	Results	Other notes
3393	Cordain et al 2002	General review					NA	Cordain et al take an evolutionary perspective and propose that chronic hyperinsulinaemia, resulting from consumption of high glycaemic carbohydrates, has a key role in the pathogenesis of juvenile-onset myopia. They cite studies demonstrating increased myopia in people with type II diabetes and propose that the higher prevalence of myopia in Asian populations is due to increased genetic susceptibility to insulin resistance.	Background

Summary	Group
The link between a high glycaemic diet and myopia remains a theory but would be an interesting area for future research.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 244 — obesity and cataract**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1532	Schaumberg et al 2000	Prospective cohort	Physicians' Health Study (male US physicians aged 40–84 years in 1982)	Higher body mass index (BMI), height, waist-to-hip ratio (WHR)	Lower BMI, height or WHR	17,150	II (LPS)	Body mass index (RR 1.25 for BMI of $\geq 27.8$ compared with $< 22$ ) height (RR 1.23 for $\geq 184$ cm compared with $\leq 170$ cm) and WHR (RR 1.31 for WHR of $\geq 0.986$ compared with $< 0.897$ ) were each independently associated with incident cataract. Therefore, men who are very tall or obese (measured either by BMI or WHR, which focuses on abdominal obesity) may be at greater risk of cataract.	
3096	Weintraub et al 2002	Prospective cohort	Nurses' Health Study and Health Professionals Follow-up Study (people aged $\geq 45$ years without diagnosed cataract at baseline)	BMI $\geq 30$	BMI $< 23$	87,682 women and 45,549 men	II (LPS)	After adjustment for established risk factors such as age and smoking, participants with a BMI $\geq 30$ were at a greater risk of developing cataract than those with a BMI $< 23$ (RR 95%CI 1.23 to 1.49). The association was strongest for posterior subcapsular cataract, even when adjusted for diabetes (RR 1.68; 95%CI 1.30 to 2.17). Obesity was not significantly associated with nuclear cataract. Obesity increases the risk of developing cataract overall, and PSC cataract in particular.	

Summary	Group
Although causality has not been established, these studies suggest that obesity is associated with an increased risk of cataract, especially posterior subcapsular cataract.	<i>Group 1</i> — clear evidence of causality <b><i>Group 2</i> — possible causality (more research needed)</b> <i>Group 3</i> — clear evidence of no causality <i>Group 4</i> — possible lack of causality (more research needed) <i>Group 5</i> — conflicting results <i>Group 6</i> — possible protective effect <i>Group 7</i> — no studies

**Summary table 246 — obesity and diabetic retinopathy**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2002	van Leiden 2003	Prospective cohort	The Hoorn Study (both people with and without diabetes, aged 50–74 years, 10-year follow-up)	Higher body mass index (BMI), high waist-to-hip ratio (WHR) in normal and abnormal glucose metabolism people	Lower BMI/WHR	233	II	Those with a WHR between 0.957 and 1.133 were at a greater risk of developing retinopathy than those with a WHR of 0.5829 and 0.8772. In contrast, there was no consistent or statistically significant association between BMI and the risk of developing retinopathy ( $P > 0.05$ ). This means that abdominal obesity is a better measure of retinopathy risk than general obesity. The authors note that this conclusion was supported by previous studies of retinopathy, and recommend that screening and management of abdominal obesity should be conducted on those who are at risk of developing this condition.	

Summary	Group
Abdominal obesity appears to be a risk factor for retinopathy in people with and without diabetes; however, body mass index is not.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 247 — obesity and glaucoma**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1980	Gasser et al 1999	Case-control	People with or without glaucoma	Body mass index (BMI)	People without glaucoma	288 controls; 186 patients	III-3	There was no statistical difference in BMI between patients with glaucoma and control subjects.	Extracted from abstract

Summary	Group
Glaucoma does not appear to be a risk factor for glaucoma, although more research is required in this area.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 248 — obesity and macular degeneration**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
3108	Schaumberg 2001	Prospective cohort	Physicians' Health Study (male physicians 40–84 years, follow-up mean 14.5 years)	Obesity (measured by BMI). Four groups: Lean (BMI < 22) normal (22–24.9), overweight (25–29.9), obese (> 30)	See 4 groups	21,071	II (LPS)	<p>Incidence of ARM was lowest in men with normal BMI, after adjustment for age, smoking and aspirin and beta-carotene supplementation. Obesity was a risk factor for visually significant ARM in males (especially dry ARM) but lean people also had an increased risk, indicating a J-shaped relationship.</p> <p>BMI was not significantly related to neovascular ARM; however, there were only a small number of cases, which may have affected this finding.</p> <p>Relative risks (95% CIs) compared with normal BMI:</p> <p>Lean: 1.43 (1.01 to 2.04)                      Overweight: 1.24 (0.93 to 1.66)                      Obese: 2.15 (1.3 to 3.45)</p>	The Physician's Health Study was a randomised trial of aspirin and beta-carotene for prevention of cardiovascular disease and cancer
1538	Seddon 2003	Prospective cohort	Elderly population ( $\geq 60$ years); hospital-based retina practice; all had some signs of nonadvanced AMD and visual acuity of 20/200 or better in at least 1 eye at baseline. Follow-up of 4.6 years	Obesity (measured using BMI, waist circumference and waist-to-hip ratio — WHR)	BMI, waist circumference, WHR	261	II	<p>After controlling for other risk factors, patients with a BMI between 25 and 29 (RR 2.32; 95%CI 1.32 to 4.07) and BMI <math>\geq 30</math> (RR 2.35; 95%CI 1.27 to 4.34) were at an increased risk of progression to advanced forms of AMD, compared with those with a BMI &lt; 25.</p> <p>Higher WHR was also associated with an increased risk of progression to advanced ARM (RR 1.85; 95%CI 1.07 to 3.15 for the highest tertile compared to the lowest tertile).</p> <p>In summary, overall obesity and abdominal obesity were risk factors for increased progression to advanced forms of AMD.</p>	

Summary	Group
<p>High BMI is a risk factor for visually significant AMD (but possibly not neovascular) in males and in all elderly people; however, a lower than average BMI is also associated with increased risk of visually significant ARM indicating a J-shaped relationship. A BMI and WHR within the normal range offer the lowest risk of ARM.</p>	<p><i>Group 1</i> — Clear association/causality  <i>Group 2</i> — Possible association/causality (more research needed)  <i>Group 3</i> — Lack of association/causality  <i>Group 4</i> — Possible lack of association/causality (more research needed)  <i>Group 5</i> — Conflicting results  <i>Group 6</i> — Possible protection  <i>Group 7</i> — No studies</p>

**Summary table 251 — fatty acids and cataracts**

Paper no.	Reference	Type of study	Population/study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
3194	Iwig 2004	In vitro	Human epithelial cells in culture (from 177 cataract patients)	Albumin concentration in aqueous humour	NA	Samples from 177 cataract patients ( <b>in vitro</b> )	NA	<p>Human epithelial cells are very sensitive to damage from low concentrations of unsaturated cis-configured fatty acids in vitro such as linoleic acid and oleic acid. Human epithelial cells are not as sensitive to <i>saturated</i> fatty acids.</p> <p>Various factors indicate that fatty acid binding proteins in the cytoplasm help fatty acid uptake in human lens cells, and that the uptake of fatty acids is influenced by concentrations of albumin in physiological solutions.</p> <p>This study measured the concentration of albumin in aqueous humour and showed that there was a significant age-dependent increase in albumin from approximately 2 µmol/L (<math>\leq 40</math> years) to approximately 4 µmol/L (80–90 years).</p> <p>Lens cell damage caused by fatty acids was increased due to high concentrations of albumin in aqueous humour in the elderly who already have cataracts. This may mean that lens cell damage caused by free fatty acids is a possible risk factor for age-related cataracts.</p> <p>The paper's results support the hypothesis that unsaturated fatty acids are cytotoxic to lens epithelial cells <i>in culture</i>. However, this is at a physiological level, not a clinical level.</p> <p>In normal cases, blood fatty acid:albumin molar ratios can increase up to 1 (eg after meals); however, in people with risk factors for cataracts, such as diabetes, the ratio can rise even higher because of a decrease in albumin concentration or an increase in concentrations of fatty acids in the blood.</p>	This is an in vitro experiment (looking at a mechanism of fatty acid toxicity to lens)

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
								In summary, it is possible that excessive fatty acid uptake (ie in excess of the body's requirements) causes lens cell damage; however it is still unclear how or if unsaturated fatty acids cause lens damage or cataract formation in vivo.	
3196	Lu 2005	Prospective cohort	Nurses' Health Study (women in Boston area aged 53–73 years with no previously diagnosed cancer, diabetes or cataract)	Long-term dietary fat intake (10–15 years)	Long-term dietary fat intake (10–15 years)	440	II (LPS)	<p>The study looked at whether long-term dietary fat intake affected the prevalence of nuclear opacities. The 18-carbon polyunsaturated fatty acids linoleic acid and linolenic acid were significantly associated with the prevalence of nuclear opacities. The ORs for developing nuclear opacities (comparing the highest and lowest quartiles of intake) were:</p> <ul style="list-style-type: none"> <li>• Linoleic acid: 2.2 (95%CI 1.1 to 4.6; P[trend] = 0.02).</li> <li>• Linolenic acid: 2.2 (95%CI, 1.1 to 4.5; P[trend] = 0.05).</li> </ul> <p>However, there were no significant associations of other types of fat intake with cortical or posterior subcapsular opacities.</p> <p>Discussion refers to three previous studies:</p> <p>(i) in the cross-sectional phase of the Blue Mountains Study (2000) the intake of polyunsaturated fatty acids reduced the prevalence of cortical cataracts</p> <p>(ii) in the Beaver Dam cohort study (1995) there was no association between nuclear opacities and total fat intake</p> <p>(iii) in a case-control study, Tavani et al (1996) showed that total fat intake was related to a higher risk of cataract extractions.</p>	
3343	Cummings et al 2000	Cross-sectional	Blue Mountains Eye Study	Dietary fat intake in the past year calculated from a food	NA	2900	IV (LPS)	<p>Intake of poly-unsaturated fatty acids was associated with reduced prevalence of cortical cataract. Compared with the lowest quintile, whose median intake was 6.8 g/day, the highest quintile, whose median intake was 17.4 g/day, had a slight, but</p>	

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
				frequency questionnaire, including supplements				statistically significant, reduction in risk of cortical cataract (OR 0.7; 95%CI 0.6 to 1.2). This association remained after adjustment for multiple potential confounders ( <i>P</i> for trend = 0.007).	

Summary	Group
<p>Most types of dietary fat do not appear to be 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 which separate different types of polyunsaturated fatty acids, as there is conflicting evidence from cross-sectional studies.</p>	<p><i>Group 1</i> — Clear association/causality  <i>Group 2</i> — Possible association/causality (more research needed)  <i>Group 3</i> — Lack of association/causality  <i>Group 4</i> — Possible lack of association/causality (more research needed)  <b><i>Group 5</i> — Conflicting results</b>  <i>Group 6</i> — Possible protection  <i>Group 7</i> — No studies</p>

**Summary table 254 — fatty acids and glaucoma**

Paper no.	Reference	Type of study	Population/ study information	Risk factor/intervention	Comparator	N	Level (quality)	Results	Other notes
3179	Cellini 1998	Nonrandomised control trial	30 chronic simple glaucoma patients and 30 controls	DHA + vitamin E and vitamin B supplements	Vitamin B	30	III-2	Patients were treated with TROFINERV (DHA, vitamin E and vitamin B complex) for 90 days. At the end of treatment, significant improvements were found in both the perimetric indices ( $P < 0.05$ ) and the retinal contrast sensitivity ( $P < 0.05$ ). These improvements were not noted for the control group, which received only B vitamins.	Intervention
3180	Kang 2004	Prospective cohort	Nurses' Health Study and Health Professionals Follow-Up Study (10-year follow-up)	Higher intake of dietary fatty acids	Lower fatty acid	47	II	<p>Looked at effect of dietary fatty acid consumption on primary open-angle glaucoma.</p> <p>Found that fats were not independently associated with increased POAG risk (no statistically significant risk for any type — total fat, saturated fat, monounsaturated or polyunsaturated).</p> <p>Found that there was a tendency for high ratio of n-3-ton-6 polyunsaturated fat to increase the risk of POAG (RR=1.49; 95%CI 1.11 to 2.01; <math>P</math> trend = 0.10) — this was stronger for high-tension POAG.</p> <p>States that further studies are needed to examine the association.</p>	

Summary	Group
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.	<p><i>Group 1</i> — Clear association/causality</p> <p><i>Group 2</i> — Possible association/causality (more research needed)</p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><b><i>Group 5</i> — Conflicting results</b></p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

**Summary table 255 — fatty acids and macular degeneration**

Paper no.	Reference	Type of study	Population/ study information	Risk factor /intervention	Comparator	N	Level (quality)	Results	Other notes
3164	Hodge et al 2007	Systematic review (1 RCT, 1 prospective cohort study [PC])	Information on Western populations (healthy people with visual impairment, consuming typical Western diet)	Low levels of omega 3 were examined as a risk factor in the PC; omega 3 supplementation was an intervention in the RCT	Higher levels of omega 3 fatty acid consumption in the PC; controls in the RCT	NA	I (Adequate)	<p>Looked at effect of omega 3 fatty acids on progression of ARMD (ie do they slow progression/do they decrease rate of progression to advanced form?).</p> <p>RCT showed that omega 3 fatty acids slowed the progress of AMD.</p> <p>PC only looked at evidence that omega 3 fatty acids decreased the rate of progression to advanced forms of AMD.</p> <p>Study authors concluded that the research was too scanty and of too poor quality to make any firm conclusions.</p>	Intervention studies

Paper no.	Reference	Type of study	Population/ study information	Risk factor /intervention	Comparator	N	Level (quality)	Results	Other notes
3243	Hodge et al 2006	Systematic review (1 prospective cohort, 2 cross-sectional; 1 retrospective cohort; 2 case-control)	Efficacy of dietary/supplementary omega 3 fatty acids in preventing AMD	Higher omega 3 fatty acid consumption	Lower	NA	I (Adequate)	<p>Found 6 observational studies, but the studies differed so much in outcomes, exposures and covariates that no meaningful comparisons or conclusions could be made.</p> <p>One prospective cohort study found that eating canned tuna/fish more than 4 times/week did help to protect against AMD:</p> <ul style="list-style-type: none"> <li>• canned tuna: RR 0.61; 95%CI 0.45 to 0.83</li> <li>• all fish: RR 0.65; 95%CI 0.46 to 0.91</li> <li>• people who ate any type of fish more than 4 times/week had a lower risk than those who ate it &lt; 3 times/month (RR 0.65; 95%CI 0.46 to 0.91).</li> </ul> <p>However, there were some problems with this paper (eg other oily fish failed to show similar effect; no good control group).</p> <p>Overall, the review authors concluded that, because there were only 6 low-quality and disparate studies, no clinical recommendations/conclusions about the association between omega 3 fatty acid consumption and AMD could be made.</p>	

Summary	Group
<p>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.</p>	<p><i>Group 1</i> — Clear association/causality  <i>Group 2</i> — Possible association/causality (more research needed)  <i>Group 3</i> — Lack of association/causality  <i>Group 4</i> — Possible lack of association/causality (more research needed)  <b><i>Group 5</i> — Conflicting results</b>  <i>Group 6</i> — Possible protection  <i>Group 7</i> — No studies</p>

**Summary table 256 — fatty acids and retinitis pigmentosa**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
3142	Hodge et al 2006	Systematic review (3 RCTs, 3 nonrandomised or non-controlled studies)	Retinitis pigmentosa patients, mostly in the United States	Interventions using fatty acid supplements	Placebos were used in the RCTs.	NA	I (Good)	Six studies published between 1995 and 2004 investigated the value of omega 3 fatty acids in slowing the progress of retinitis pigmentosa. Although trends of improvement in some retinitis pigmentosa outcomes were found, more research is required in this area.	

Summary	Group
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.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <b><i>Group 6</i> — Possible protection</b> <i>Group 7</i> — No studies

**Summary table 258 — diet and cataract**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	<i>N</i>	Level (quality)	Results	Other notes
3354	Jacques et al 2005	Prospective cohort	Nurses' Health Study	Nutrient intake	Nutrient intake	408	II (LPS)	Nutrient intake was calculated from food frequency questionnaires and nuclear density was assessed using computer-assisted image analysis. Geometric mean 5-year change in nuclear density was inversely associated with intake of riboflavin ( <i>P</i> trend = 0.03) and thiamin ( <i>P</i> trend = 0.04) and duration of vitamin E supplement use ( <i>P</i> trend = 0.006).	
3370	Schaumberg et al 2004	Prospective cohort	Nurses' Health Study and Health Practitioners Follow-Up Study	High glycaemic load	Lower glycaemic load	4865 incident age-related cataract extractions from an original study of 111,845	II (LPS)	After adjustment for age, cigarette smoking, body mass index, total caloric intake, dietary intake of lutein and zeaxanthin and alcohol consumption, there was no significant relation of dietary glycaemic load to risk of cataract extraction ( <i>P</i> trend = 0.10).	
3336	Chasan-Taber et al 1999	Prospective cohort	Nurses' Health Study	Higher intake of carotenoids and vitamin A	Lower intake	1471 cataract extractions from an original population of 77,466	II (LPS)	After controlling for age and smoking those in the highest quintile of lutein and zeaxanthin intake had a 22% decreased risk of cataract extraction compared with those in the lowest quintile (RR 0.78; 95%CI 0.63 to 0.95). Intake of other carotenoids ( $\alpha$ -carotene, $\beta$ -carotene, $\beta$ -cryptoxanthin, lycopene, vitamin A and retinol) was not associated with cataract. Increasing consumption of spinach and kale, which are high in lutein, was associated with a decreased risk of cataract.	

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
3361	Lyle et al 1999	Prospective cohort	Beaver Dam Eye Study	Higher intake of antioxidant nutrients	Lower intake	246 developed nuclear cataract from 1 354 eligible participants	II (LPS)	Nutrient intake was assessed using a food frequency questionnaire administered at baseline, with questions for the previous year and 10 years in the past. People in the highest quintile for lutein intake for 10 years in the past were half as likely to have an incident nuclear cataract as persons in the lowest quintile. Overall, nuclear cataract and intake of vitamin C or E were not significantly related, but these vitamins were inversely associated with opacities for people who had other suspected risk factors for cataract, such as smoking and hypertension.	
3340	Christen et al 2005	Prospective cohort	Women's Health Study	High fruit and vegetable intake	Lower fruit and vegetable intake	2067 cataracts and 1315 cataract extractions from an eligible cohort of 35,274	II	Compared with women in the lowest quintile of fruit and vegetable intake, women with high intakes had a 10–15% reduced risk of cataract ( <i>P</i> trend < 0.05). However, no significant trend was observed for cataract extraction.	

Summary	Group
<p><b>Fruit and vegetables</b> These studies suggest that a 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.</p> <p><b>Other nutrients</b> Other nutrients such as riboflavin, thiamin, vitamin C and vitamin E may protect against cataract but further studies are required.</p> <p><b>Glycaemic load</b> Glycaemic load does not appear related to the incidence of cataract.</p>	<p><i>Group 1</i> — clear evidence of causality (<b>fruit and vegetables</b>)</p> <p><i>Group 2</i> — possible causality (<b>more research needed</b>) (<b>riboflavin, thiamin, vitamin C, etc</b>)</p> <p><i>Group 3</i> — clear evidence of no causality</p> <p><i>Group 4</i> — possible lack of causality (<b>more research needed</b>) (<b>glycaemic load</b>)</p> <p><i>Group 5</i> — conflicting results</p> <p><i>Group 6</i> — possible protection</p> <p><i>Group F</i> — no studies</p>

**Summary table 260 — diet and diabetic retinopathy**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2780	Millen et al 2004	Prospective cohort	The Atherosclerosis Risk in Communities Study (subjects with type 2 diabetes)	Higher dietary vitamins C and E (or supplements)	Lower dietary vitamins C and E (or no supplements)	224 patients with retinopathy of 1353 subjects	II	No association was found between diabetic retinopathy and intake of vitamin C or E from food, or a combination of food and supplements. A decreased odds of retinopathy was found among users of vitamin C (OR 0.5; 95%CI 0.3 to 0.8), vitamin E (OR 0.5, 95%CI 0.2 to 0.8) or multisupplements (OR 0.4; 95%CI 0.2 to 0.9) compared with those who did not use supplements. Supplements may protect against retinopathy, or supplement use may be associated with lifestyle characteristics that protect against retinopathy. The authors state that only two previous studies investigated the relationship between nutrient intake and diabetic retinopathy. The San Luis Valley Diabetes Study found a direct association between intake of antioxidants and retinopathy, while the National Health and Nutrition Examination Survey found no association of serum ascorbic acid and $\alpha$ -tocopherol concentrations and retinopathy in people with diabetes. However, these studies were limited by cross-sectional designs and focus on short-term dietary recall.	

Summary	Group
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.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <b><i>Group 6</i> — Possible protection</b> <i>Group 7</i> — No studies

**Summary table 261 — diet and glaucoma**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	<i>N</i>	Level (quality)	Results	Other notes
3180	Kang et al 2004	Prospective cohort	Nurses' Health Study and Health Professionals Follow-Up Study	Higher dietary fatty acids	Lower dietary fatty acids	474 confirmed cases of POAG from a total study of 116 505	II (LPS)	Major fats and fat subtypes were not independently associated with risk of developing primary open-angle glaucoma (POAG). There was positive association between a higher ratio of n-3 to n-6 polyunsaturated fat and risk of POAG (RR 1.49; 95%CI 1.11 to 2.0, <i>P</i> = 0.10), a relationship which was stronger for high tension POAG (RR 1.68; 95%CI 1.18 to 2.39, <i>P</i> = 0.009).	
2774	Kang et al 2003	Prospective cohort	Nurses' Health Study and Health Professionals Follow-Up Study	Higher dietary antioxidants	Lower dietary antioxidants	474 confirmed cases of POAG from a total study of 116 505	II (LPS)	There were no strong associations between consumption of antioxidants ( $\alpha$ -carotene, $\beta$ -carotene, $\beta$ -cryptoxanthin, lycopene, lutein/zeaxanthin, vitamin C, vitamin E and vitamin A) and POAG.	

Summary	Group
These prospective studies suggest that diet, specifically fatty acids and antioxidants, is neither a causative nor a protective factor for primary open-angle glaucoma.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <b><i>Group 3</i> — Lack of association/causality</b> <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

**Summary table 262 — diet and macular degeneration**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
3275	Tomany et al 2001	Prospective cohort	The Beaver Dam Eye Study	Higher coffee and caffeine intake	Lower coffee and caffeine intake	3435	II	Coffee and caffeine consumption were not associated with the 5-year incidence of early age-related maculopathy, soft indistinct drusen or pigmentary abnormalities.	
3266	Seddon et al 2003	Prospective cohort	Patients attending a hospital-based clinic specialising in macular degeneration	Higher dietary fat intake	Lower dietary fat intake	261	II	After controlling for other factors, people in the highest quintile of total fat intake had an increased risk of progression to advanced AMD relative to the lowest quintile (RR 2.90; 95%CI 1.15 to 7.32). An increased risk was found for animal, vegetable, saturated, monounsaturated, polyunsaturated and transunsaturated fats. In contrast, fish and nuts were protective against AMD.	
3225	Cho et al 2004	Prospective cohort	Nurses' Health Study and Health Professionals Follow-Up Study	≥ 3 servings of fruit	< 1.5 servings of fruit	464 cases of early ARM and 316 cases of neovascular ARM from 118,428 original participants	II	Participants who had consumed 3 or more servings of fruit per day had a lower risk of neovascular ARM compared with those who consumed fewer than 1.5 servings of fruit per day (RR 0.64; 95%CI 0.44 to 0.93). Significant results for either early or neovascular ARM were not found for vegetables, antioxidant vitamins or carotenoids.	
3222	Chiu et al 2006	Prospective cohort	Nurses' Health Study	Higher carbohydrate quantity or quality (high quality defined as low glycaemic index)	Lower carbohydrate quantity or quality	1036 eyes without previous ARM diagnosis	II	Those in the highest tertile of dietary glycaemic index (≥ 77) were more likely to develop ARM (OR 2.71; 95%CI 1.24 to 5.93) than those in the lowest tertile (< 74.6). This relationship was found for retinal pigmentary abnormalities but not for drusen. Total carbohydrate intake was not related to ARM.	

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2792	Cho et al 2001	Prospective cohort	Nurses' Health Study and Health Professionals Follow-Up Study	Higher zinc	Lower zinc	384 cases of AMD from 104,208 participants	II	Moderate zinc intake, in food or from supplements, was not associated with a reduced risk of AMD.	
2798	Flood et al 2002	Prospective cohort	Blue Mountains Eye Study	Higher antioxidant vitamins and zinc	Lower antioxidant vitamins and zinc	159 eligible participants developed ARM from 2335 people	II	After adjusting for age, sex, family history and smoking, no evidence was found for a protective effect of dietary antioxidant or zinc intake from ARM. However, compared with the lowest quintile, increased intakes of vitamin C were associated with an increased risk of early ARM (OR 1.7; 95%CI 1.0 to 3.0 and OR 2.3; 95%CI 1.3 to 4.0 for the fourth and fifth quintiles). The authors could not explain this association, but suggested that it could be a chance finding.	

Summary	Group
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.	<p><i>Group 1</i> — Clear association/causality</p> <p><i>Group 2</i> — Possible association/causality (more research needed)</p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><i>Group 5</i> — Conflicting results</p> <p><b><i>Group 6</i> — Possible protection</b></p> <p><i>Group 7</i> — No studies</p>

**Summary table 264 — diet and trachoma**

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Quality	Results	Other notes
1962	Fine and West 1997	Cross-sectional	Children under 5 years of age in Tanzania	Malnutrition	NA	189	IV	No association was found between malnutrition (defined by a mid-arm circumference less than 12.5 cm or a value one standard deviation below the age-specific mean) and trachoma.	

Summary	Group
Numerous studies have shown that malnutrition predisposes an individual to infections, due to immunological deficits. Although they share risk factors such as poor hygiene and low socioeconomic status, this study did not find an association between malnutrition and trachoma.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies