Risk factors for glaucoma: what do they really mean?

Anthea Worley and Karen Grimmer-Somers

Abstract. Glaucoma is an insidious eye disease, potentially putting 4% of older Australians at risk of blindness, unless detected sufficiently early for initiation of effective treatment. This paper reports on the strengths of evidence and glaucoma risk factors that can be identified by primary health care providers from a patient’s history. A comprehensive search of peer-reviewed databases identified relevant secondary evidence published between 2002 and 2007. Risk factors that could be determined from a patient’s history were identified. A novel glaucoma risk factor reference guide was constructed according to evidence strength and level of concern regarding risk of developing glaucoma. The evidence is strong and consistent regarding the risk of developing glaucoma, and elevated intraocular pressure, advancing age, non-Caucasian ethnicity and family history of glaucoma. There is moderate evidence of association with glaucoma, and migraine, eye injury, myopia and long-term use of corticosteroids. There is conflicting evidence for living in a rural location, high blood pressure, diabetes and smoking. Early detection of people at risk of developing glaucoma can be initiated using our risk factor guide coupled with a comprehensive patient history. Timely future assessment and subsequent management strategies for at-risk individuals can then be effectively and efficiently actioned.

Additional keywords: detection, primary open angle glaucoma.

Introduction

Glaucoma is chronic and progresses over time, involves optic nerve damage and a loss of optic nerve fibres (Goldberg et al. 2002). Early identification of individuals potentially at risk of glaucoma can viably occur in any primary health care setting. Optometrists and ophthalmic nurses are primary health care providers who routinely assess for glaucoma during regular eye health checks. However, for other primary health care providers such as GPs, community nurses and allied health providers, whose focus may be on different health matters, the insidious and usually slow onset of the disease may mean that screening for glaucoma is not commonly ‘on their radar’. While diagnosis of glaucoma, and ongoing disease monitoring, requires specific skills, knowledge and equipment, the most efficient approach for many primary health care providers to identify individuals potentially at risk of glaucoma is to focus on external or predictive risk factors that can be identified by primary health care providers from a patient’s history. A comprehensive search of peer-reviewed databases identified relevant secondary evidence published between 2002 and 2007. Risk factors that could be determined from a patient’s history were identified. A novel glaucoma risk factor reference guide was constructed according to evidence strength and level of concern regarding risk of developing glaucoma. The evidence is strong and consistent regarding the risk of developing glaucoma, and elevated intraocular pressure, advancing age, non-Caucasian ethnicity and family history of glaucoma. There is moderate evidence of association with glaucoma, and migraine, eye injury, myopia and long-term use of corticosteroids. There is conflicting evidence for living in a rural location, high blood pressure, diabetes and smoking. Early detection of people at risk of developing glaucoma can be initiated using our risk factor guide coupled with a comprehensive patient history. Timely future assessment and subsequent management strategies for at-risk individuals can then be effectively and efficiently actioned.
care providers to calculate the likelihood of an individual developing glaucoma or progressing to another disease stage. Current risk calculators assign risk-prediction coefficients from multivariate analysis reported in clinical trials to risk-modelling formulae that are applied to individuals to quantify their glaucoma risk (Medeiros et al. 2007). However, the psychometric properties and clinical utility of risk calculators are still under development. In the interim, there is a need for a simple tool for primary health care providers to identify individuals at risk of glaucoma, as part of routine health assessments.

We recently undertook an extensive meta-synthesis of the secondary literature for the National and Medical Research Council (NHMRC), which distilled the current evidence for diagnosis, risk identification and management of glaucoma. The secondary literature included systematic reviews of primary studies, meta-analyses of experimental studies and clinical guidelines. This approach was justified, given the large amount of recent and high quality secondary evidence available for this topic. The systematic review was conducted following the NHMRC required criteria, which included input from an expert multidisciplinary reference group, classification of the literature of hierarchy, quality and precision of evidence, applicability and relevance to the Australian setting, and the use of the strength of the evidence matrix (National Health and Medical Research Council 2009). The review methodology is reported in detail on the NHMRC website (Centre for Allied Health Evidence 2009). This paper reports on one aspect of the review, presenting a novel glaucoma risk-factor reference guide of patient history-related risks of developing glaucoma, based on evidence strength and level of concern in the literature included in the review. This reference guide has the potential to assist primary health care providers during regular health assessments, to efficiently and effectively identify individuals who are potentially at high risk of glaucoma and who should be considered for specific ocular assessment, management and/or monitoring.

Methods

The systematic review methods were previously reported in detail (Worley and Grimmer-Somers 2009), thus an overview is provided here.

Objective

To report findings of a recent meta-synthesis of the secondary literature regarding risk factors for developing glaucoma.

Literature inclusion criteria

- Publication date 2002–07 (inclusive)
- English language publications only
- Level I evidence from the NHMRC hierarchy of evidence (Merlin et al. 2009).

Exclusion criteria

- Primary literature unless otherwise indicated
- Clinical guidelines in which glaucoma was not the primary focus
- Literature dealing exclusively with cost-based outcomes
- Literature only available in abstract form or conference presentations.

Search strategy

A comprehensive electronic library database search was undertaken, supplemented by pearlring and manual searching of reference lists.

Methodological quality

All included literature was critically appraised (clinical guidelines with the AGREE instrument (AGREE Collaboration 2001), and systematic reviews and meta-analyses were appraised using the CASP instrument (Public Health Resource Unit 2006)). Two independent reviewers were involved in scoring all included literature. The systematic reviews and meta-analyses were scored using the eight quantitative questions in the relevant CASP instrument.

Risk factors

The risk factors for glaucoma, potentially available from patient histories, were identified. These were quantified in two ways. First, the estimated strength of association for each risk factor with glaucoma was established, using the central tendency of the reported range of relative risks (RR) or odds ratios (OR). Second the strength of the body of evidence for each risk factor was established, using the NHMRC strength of the body of evidence matrix (National Health and Medical Research Council 2009). This was expressed initially as the composite overall grade given to the five matrix elements (hierarchy/quality, consistency, impact, applicability and generalisability) (National Health and Medical Research Council 2009), and then as a visual reference using a star rating (three stars = Grade of Evidence A, two stars = Grade of Evidence B, one star = Grade of Evidence C or D).

We constructed a primary health care professionals’ reference guide by listing each risk factor and correlating the evidence star rating with the probability that the risk factor was associated with developing glaucoma.

Results

Volume of literature

The literature search identified 65 potentially relevant systematic reviews and 14 clinical guidelines. Of these, 17 systematic reviews and nine clinical guidelines reported on risk factors for developing glaucoma that could be identified from a patient history and/or an ocular examination. This paper reports on the patient history findings from these studies.

Methodological quality

The average AGREE domain scores ranged from 22 to 48%. The scores were not consistent across all domains for all guidelines, highlighting the variable and surprisingly low quality of guideline construction. The overall average quality score for the systematic reviews and meta-analyses using the CASP tool was 5.2 (s.d. 1.8; of a possible total of 8), which indicated the moderate and consistent quality overall of the reviews.

Types of glaucoma

The number of relevant systematic reviews and meta-analyses were weighted towards open angle glaucoma, with 10 dealing
specifically with this disease type, while the remaining seven articles either looked at glaucoma as a generic term, or all forms of glaucoma.

**Risk factors**

Overall, the evidence is strong and consistent regarding the significant association between developing most types of glaucoma and four risk factors that can be identified in primary health care settings from a patient’s history (a history of elevated intraocular pressure (IOP), advancing age, non-Caucasian race/ethnicity and a family history of glaucoma). There is moderate evidence of association between glaucoma, and migraine and peripheral vasospasm, eye injury, myopia and long-term use of corticosteroids. There is conflicting evidence regarding the association between glaucoma and living in a rural location, high blood pressure, diabetes and current smoking.

Evidence for each risk factor is outlined below. There is scant information in the literature about the interaction between risk factors and the development of glaucoma. There is limited secondary evidence concerning the risk factors for angle closure and secondary forms of the disease in adults, or for any type of glaucoma in children.

**Elevated IOP**

The literature is clear that high IOP is a significant risk factor for all forms of glaucoma, with 21 mmHg commonly cited as the upper limit for ‘normal’ IOP. Sommer *et al.* (1991) report that for individuals with IOP between 20 mmHg and 23 mmHg, the risk of developing glaucoma is four times greater than for individuals with IOP below 16 mmHg. This risk increases exponentially to 10 times when the IOP is ≥24 mmHg, and to more than 40 times when IOP is ≥30 mmHg. There is strong evidence from both the Ocular Hypertension Treatment Study and the Early Manifest Glaucoma Treatment Trial analysis that every 1 mmHg increase in mean IOP level was associated with a 10% increased risk of progression from ocular hypertension to glaucoma and in progressive glaucomatous damage (Leske *et al.* 2003; Friedman *et al.* 2004).

If a ‘normal’ IOP has previously been recorded on a patient’s notes or patients have been advised of a ‘normal’ IOP by an optometrist or ophthalmologist in the past, primary health care providers should consider the last date of the IOP reading to determine whether it could reflect current risk status (i.e. a ‘normal’ IOP reading 10 years ago compared with a ‘normal’ IOP reading 3 months ago).

**Ethnicity**

‘Black’ and ‘white’ were commonly reported terms in the literature. In the majority of cases, ‘black’ referred to individuals of African descent and ‘white’ to those of Caucasian descent. There was nothing to imply that ‘black’ populations included Indigenous populations relevant to the Australian context. There was strong, consistent evidence that non-Caucasian ethnicity is a risk factor for developing glaucoma. Despite concerns regarding the lack of a universal definition of glaucoma and therefore associated differences in diagnosis (Worley and Grimmer-Somers 2009), the prevalence of open angle glaucoma for African descent and angle closure glaucoma for Asian (unspecified country of origin) and Inuit populations is elevated compared with Caucasian-descent populations, with most reports suggesting an approximate threefold increase (Friedman and Vedula 2006; Burr *et al.* 2007; Schmier *et al.* 2007).

There were limited data regarding the prevalence and incidence of glaucoma within the Indigenous population of Australia (Worley and Grimmer-Somers 2009), and nothing to indicate that the risk of glaucoma was higher for Indigenous Australians compared with other Australians of Caucasian descent.

**Age**

Advancing age is a significant risk factor for the development of open angle glaucoma. The prevalence of open angle glaucoma is four to 10 times higher in older age groups than in individuals in their 40s (Hollows and Graham 1966; Leibowitz *et al.* 1980; Tielsch *et al.* 1991). In the Australian Melbourne Visual Impairment Project, participants aged 80 years and older were 17 times more likely to have glaucoma compared with participants younger than 50 years (Weih *et al.* 2001). Pooled data reported by Burr *et al.* (2007) indicate that the overall prevalence of open angle glaucoma is 0.3% (95% CI 0.1–0.5%) in people aged 40 years, which increases to 3.3% (95% CI 2.5–4.0%) in people aged 70 years.

**Family history**

A family history of glaucoma puts an individual at significantly greater risk of developing open angle glaucoma (American Optometric Association 2002). In close relatives of individuals with primary open angle glaucoma, the prevalence of the disease is three to six times that of the general population (Netland *et al.* 1993). The 22% lifetime risk for glaucoma found in relatives of patients with glaucoma is almost 10 times that of controls (Wolfs *et al.* 1998). Burr *et al.* (2007) conducted a meta-analysis of four studies that indicated a strong association between developing open angle glaucoma and a positive family history, with the strongest association observed between siblings. This finding was supported by Wolfs *et al.* (1998) and Tielsch *et al.* (1994). However, Burr *et al.* (2007) expressed reservations about this association, noting that most of the studies relied on the verbal reporting of family history of glaucoma rather than clinical examination.

**Systemic blood pressure**

The literature is equivocal on the association between systemic hypertension and primary open angle glaucoma (Royal College of Ophthalmologists 2004; American Academy of Ophthalmology 2005). There is a complex relationship between primary open angle glaucoma and systemic blood pressure, as patient age and systemic hypertension duration potentially confound this relationship.

**Migraine and peripheral vasospasm**

In the Ocular Hypertension Treatment Study (Budenz *et al.* 2006) and the Blue Mountains Eye Study (Mitchell *et al.* 1996), migraine headache and peripheral vasospasm were identified as risk factors for progressive glaucomatous optic nerve damage. Vasospasm has been proposed as a possible factor contributing to optic nerve damage in glaucoma. This theory is supported by evidence of an association of normal tension glaucoma with...
migraine headaches and Raynaud’s syndrome (Phelps and Corbett 1985). However, the evidence for this association is neither strong nor consistent.

**Eye injury**

Although eye trauma is widely accepted as a risk factor for glaucoma, there is a paucity of research evidence concerning the relationship between eye injury and developing glaucoma.

**Myopia**

Burr et al. (2007) identified several studies that reported, after adjustment for age, a two to fivefold higher prevalence of primary open angle glaucoma in patients with myopia. The pooled RR of open angle glaucoma among participants with myopia (any definition) compared with non-myopic participants was estimated at 1.88 (95% CI 1.53–2.31). Burr et al. (2007) highlighted that studies involving myopia are potentially subject to selection bias, due to the lack of a standardised definition of myopia, the association between myopia and several non-glaucomatous visual field defects, and the difficulty of assessing myopic discs for glaucomatous damage.

**Diabetes**

A review by Bonovas et al. (2004a) presented a detailed meta-analysis of 12 relevant primary sources and concluded that the association was statistically significant, assuming either a random-effects model (OR = 1.50, 95% CI 1.16–1.93, n = 12) or a fixed-effects model (OR = 1.27, 95% CI 1.10–1.45, n = 12). Burr et al. (2007) also demonstrated approximately twice the risk of open angle glaucoma onset among people with diabetes when compared with people without diabetes (RR 1.93, 95% CI 1.38–2.69). However, the biological mechanisms of how diabetes status and longevity is associated with glaucoma, requires further research (Bonovas et al. 2004a).

**Smoking**

Many clinicians and researchers believe that primary open angle glaucoma has a vascular origin involving compromised blood flow to the optic nerve head. However, according to Bonovas et al. (2004b, p. 256), ‘the evidence for involvement of smoking in the pathogenesis of primary open angle glaucoma is controversial. Although, several studies have indicated that smoking is a risk factor for its development, others have failed to do so’. Six studies were included in a systematic review and meta-analysis by Bonovas et al. (2004b). They reported that current smoking results in a significant increase in the risk of primary open angle glaucoma (OR = 1.37, 95% CI 1.00–1.87), while past smoking does not appear to influence this risk (OR = 1.03, 95% CI 0.77–1.38). Bonovas et al. (2004b) concluded that the meta-analysis findings support an association between current cigarette smoking and primary open angle glaucoma. However, many questions remain, largely because knowledge about the biological mechanisms of this effect is incomplete.

**Long-term use of corticosteroids**

Corticosteroids are the main cause of drug-induced glaucoma (a secondary form of glaucoma) (Adis International 2004). Administration of corticosteroids by any route is associated with increased IOP. Tripathi et al. (2003) report that 46–92% subjects with open angle glaucoma experience an increase in IOP after topical ocular administration of corticosteroids lasting 2–4 weeks. Case-control and retrospective data suggest that prolonged inhaled corticosteroid use is a significant risk for developing glaucoma; however, the cumulative inhaled corticosteroid use dosage that poses a risk has not been ascertained (Leone et al. 2003).

**Location**

Key findings relevant to the Australian population reported by Madden et al. (2002) were that rural populations have an increased prevalence of glaucoma. The RR for age-adjusted rural populations is 1.7 (95% CI 1.1–2.7) for having undiagnosed or probable glaucoma. Madden et al. (2002) were unable to explain why this was found. The finding may indicate a relationship between glaucoma and rural environmental issues, or to a lack of ready access to early specialist testing for glaucoma.

For the benefit of readers of this paper, Appendix 1 summarises information on risks for developing glaucoma that can be identified from a patient history. This information informed the development of the reference guide for primary healthcare providers (Table 1), which organises risk factors for developing glaucoma according to strength of risk and strength of evidence. This guide may be useful for primary healthcare providers who are without the facilities and/or expertise to undertake a full ocular examination. Intraocular pressure is included in this guide, even though it is an objective measure, as it may be mentioned by patients, or information on previous assessments may be contained in medical records.

### Table 1. Risk factors from patient history organised according to both strength of risk and strength of evidence (3 stars greater strength), linking them to developing glaucoma

<table>
<thead>
<tr>
<th>Strength of risk</th>
<th>Strength of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely high risk (at least 12×)</td>
<td>IOP &gt; 21 mmHg, age over 80 years</td>
</tr>
<tr>
<td>High risk (at least 3×)</td>
<td>Age over 50 years, family history, specific ethnic origin</td>
</tr>
<tr>
<td>Moderate risk (at least 1.5×)</td>
<td>Diabetes myopia</td>
</tr>
<tr>
<td>Low risk (approximately 1×)</td>
<td>Current smoking</td>
</tr>
<tr>
<td>Risk status inferred without statistical evidence</td>
<td>Steroid use</td>
</tr>
</tbody>
</table>
Discussion
This paper presents a novel approach that integrates the strength of risk and the strength of evidence for risk factors associated with developing glaucoma into a visual reference guide for preliminary glaucoma risk assessment. Our preliminary risk assessment reference guide could fill the current gap until computer-based risk calculators become more robust and become more widely used in primary health care settings.

It is of note that despite the large amount of available secondary evidence, there is little information on clinically useful risk profiling, or risk accumulation, that could assist primary health care providers to estimate an individual’s risk of developing glaucoma, and if it is likely, when glaucoma might occur (i.e. within the next year, 5 years, 10 years). Our risk assessment reference guide is designed for primary health care providers who are unable to undertake objective ocular assessments and can rely only on an individual’s history to assess the risk of developing glaucoma. It should assist such providers to determine whether the risk is such that the individual warrants referral for further objective assessment.

Our approach allows an efficient subjective prioritisation of risks. A history of high IOP (particularly if it is currently not being managed) should warrant immediate referral to a specialist for re-assessment and subsequent management. Age, family history and ethnic origin are non-modifiable and significant risk factors for developing glaucoma. It appears that, given the strength of evidence and risk, the presence of any one of these factors in a patient’s history could warrant immediate referral for objective and specialised assessment. However, making decisions on how to manage glaucoma risk using the lower-strength and/or lower-evidenced risk factors, when these do not present in conjunction with stronger risk factors, is less clear. Individuals with lower strength risk factors may be amenable to a ‘watchful waiting’ approach (National Cancer Institute 2010), which could aim to optimise general health in the first instance by better controlling diabetes, migraine, steroid use and/or high blood pressure. Furthermore, while advice to cease smoking may have a greater effect on the development of other chronic diseases than on developing glaucoma risk, on this basis alone it is a useful preventative approach (Bonovas et al. 2004b).

Why living in a rural location is considered a risk is unclear, as there are potentially several features of rural Australian living that may incur the risk. Glaucoma prevalence may appear higher, as rural patients are more likely to present acutely due to limited availability of health services and resources. However, other rural risks could include physical factors, such as prolonged exposure to heat or dust. Factors underlying locational risk require further research.

This review identified that the literature base is limited, particularly in regard to the scant evidence for Australian populations. As such, we need to cautiously interpret the international evidence for Australian contexts. There is a need for research to specifically consider the current Australian population.

Conclusion
This paper outlines the first known attempt to establish a hierarchy of risk factors for the development of glaucoma to assist primary health care providers who only have access to a patient’s history. This approach to synthesising risk factors should assist primary health care providers to put glaucoma on their ‘radars’. This will assist them in determining which individuals are at high-risk of glaucoma and should be referred immediately for specific eye examination, and which patients are at lower risk of glaucoma and may require monitoring only.

Conflicts of interest
None declared.

Acknowledgements
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References
Appendix 1. Risk information on factors for developing glaucoma
IOP, intraocular pressure; OAG, open angle glaucoma

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Subcategory</th>
<th>Stated increase</th>
<th>Relative risk (95% CI)</th>
<th>Odds ratio (95% CI)</th>
<th>Prevalence (95% CI)</th>
<th>Evidence source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethnic origin</td>
<td>African descent aged 40–49 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Burr et al. (2007)</td>
</tr>
<tr>
<td></td>
<td>Compared with Caucasian descent over 40 years</td>
<td>Almost 4×</td>
<td>3.80</td>
<td>(2.56–5.64)</td>
<td>1.23% (0.23–2.24)</td>
<td>Burr et al. (2007)</td>
</tr>
<tr>
<td></td>
<td>Asian/Inuit (PACG)</td>
<td>3–10×</td>
<td></td>
<td></td>
<td>9.5% (5.83–12.48)</td>
<td>Burr et al. (2007)</td>
</tr>
<tr>
<td>Age</td>
<td>Advanced age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Burr et al. (2007)</td>
</tr>
<tr>
<td></td>
<td>Aged 40 years</td>
<td></td>
<td></td>
<td>4–10×</td>
<td>0.3% (0.1–0.5)</td>
<td>American Optometric Association (2002)</td>
</tr>
<tr>
<td></td>
<td>Of being diagnosed with definite glaucoma at age:</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>40–49 years (default comparator)</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td>Weih et al. (2001)</td>
</tr>
<tr>
<td></td>
<td>50–59 years</td>
<td></td>
<td>9.5</td>
<td>1</td>
<td>9.5 (1.2–74.9)</td>
<td>Weih et al. (2001)</td>
</tr>
<tr>
<td></td>
<td>60–69 years</td>
<td></td>
<td>21.5</td>
<td></td>
<td>3.3% (2.9–163.7)</td>
<td>Burr et al. (2007)</td>
</tr>
<tr>
<td></td>
<td>Aged 70 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Weih et al. (2001)</td>
</tr>
<tr>
<td></td>
<td>70–79 years</td>
<td></td>
<td>52.7</td>
<td></td>
<td>3.7 (2.5–4.0)</td>
<td>Burr et al. (2007)</td>
</tr>
<tr>
<td></td>
<td>Over 80 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Weih et al. (2001)</td>
</tr>
<tr>
<td></td>
<td>80–89 years</td>
<td></td>
<td>104.3</td>
<td></td>
<td>3.7 (1.6–797.1)</td>
<td>Weih et al. (2001)</td>
</tr>
<tr>
<td>Family history</td>
<td>OAG among participants with a positive family history</td>
<td></td>
<td></td>
<td></td>
<td>6.7% (5.0–8.4)</td>
<td>Burr et al. (2007)</td>
</tr>
<tr>
<td></td>
<td>To general public</td>
<td>3–6×</td>
<td></td>
<td></td>
<td></td>
<td>(pooled result)</td>
</tr>
<tr>
<td></td>
<td>Lifetime risk compared with control</td>
<td>10×</td>
<td></td>
<td></td>
<td></td>
<td>American Optometric Association (2002)</td>
</tr>
<tr>
<td></td>
<td>Of being diagnosed with definite glaucoma</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Burr et al. (2007)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.7 (2.0–6.7)</td>
<td>Weih et al. (2001)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>OAG among participants with diabetes</td>
<td></td>
<td></td>
<td></td>
<td>3.3% (1.8–4.8)</td>
<td>Burr et al. (2007)</td>
</tr>
<tr>
<td></td>
<td>Risk of OAG onset among people with diabetes when</td>
<td>Almost</td>
<td>1.93</td>
<td></td>
<td>3.3% (1.8–4.8)</td>
<td>(pooled result)</td>
</tr>
<tr>
<td></td>
<td>compared with people without diabetes</td>
<td>twice</td>
<td>(1.38–2.69)</td>
<td></td>
<td></td>
<td>Burr et al. (2007)</td>
</tr>
<tr>
<td>Myopia</td>
<td>Risk of OAG in those with myopia</td>
<td></td>
<td></td>
<td></td>
<td>2.7% (1.5–3.9)</td>
<td>Burr et al. (2007)</td>
</tr>
<tr>
<td></td>
<td>Compared with those without myopia</td>
<td>Almost</td>
<td>1.88</td>
<td></td>
<td>2.7% (1.5–3.9)</td>
<td>(pooled result)</td>
</tr>
<tr>
<td></td>
<td>twice</td>
<td></td>
<td>(1.53–2.31)</td>
<td></td>
<td></td>
<td>Burr et al. (2007)</td>
</tr>
<tr>
<td>IOP</td>
<td>IOP &gt; 26 mmHg compared with low IOP</td>
<td>12×</td>
<td>12.58</td>
<td></td>
<td>12× (12.58–31.24)</td>
<td>Burr et al. (2007)</td>
</tr>
<tr>
<td></td>
<td>IOP &gt; 21 mmHg compared with &lt;16 mmHg</td>
<td>16×</td>
<td></td>
<td></td>
<td></td>
<td>American Optometric Association (2002)</td>
</tr>
</tbody>
</table>

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