The Need for Routine Eye Examinations

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PURPOSE. To determine the incidence and causes of vision loss to assist in the objective determination of the preferred frequency of routine screening for those with normal vision.

METHODS. A prospective, population-based study of people aged 40 or more years. Standardized examination protocols were used that included presenting and best corrected visual acuity, visual field testing, and comprehensive eye examination with dilation.

RESULTS. There were 2529 people with a full data set, including 1590 with a normal baseline examination. The 5-year incidence of vision loss (≤6/12 presenting acuity in the worse eye) was 2.39%. Overall, 24 (6.5%) of 38 of those with vision loss had noticed a change in their vision, and 18 (75%) of these 24 had attended an eye examination. This left only 14 (0.88%) people who had normal baseline examination results and had asymptomatic vision loss develop over this 5-year period.

CONCLUSIONS. Frequent routine eye examinations of those with normal examination results will have a low yield and may not be cost effective. Health promotion messages should target those who notice a change in vision and those at higher risk such as those with diabetes or a family history of eye disease.

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Much useful information has come from the group of population-based epidemiologic studies of eye disease conducted over the past decade or so.¹–⁷ They have revealed the exponential increase in eye disease and vision loss with age; the overall similarities in different populations; and some consistent risk factors and care issues, although these have been confused at times by the multiplicity of analyses and reports. Among the most important findings have been the linkage between cigarette smoking and age-related macular degeneration (AMD) and nuclear cataract,⁶–¹² the finding that half of those with glaucoma are undiagnosed and that half of those with diabetes have not had a regular eye examination,¹²–¹³ and even that undercorrected refractive error may cause half of the presenting visual impairment.¹⁴–¹⁵ Possibly the most important finding is the negative impact that even a relatively modest reduction in vision (≤6/12) has on quality and length of life and the ability of the individual to enjoy healthy and independent aging.⁶–¹⁶–²¹

Although all this information has been very interesting in its own right, it has also provided very clear public health messages regarding poor vision in the community. These messages included the need for people to protect their eyes from UV-B and cease cigarette smoking, to enhance screening for diabetes and glaucoma, to pay attention to the vision of the elderly, and so forth.²⁰

One key component to improving eye health is the need for regular eye examinations, as many eye diseases can exist and progress without the individual being aware of the problem until much vision is lost. Glaucoma is a classic example. However, the recognition that reduced vision can have a serious impact on health has made the need to detect poor vision from any cause important.

There are clear, evidence-based recommendations for the frequency of eye examinations in people with diabetes and also evidence or consensus-based recommendations for those with other eye diseases.²²–²⁴ Similarly, anyone who notices a change in his or her vision is advised to be examined without delay. This leaves the group of those who have had normal vision. How often should they be examined?

Organizations including the American Academy of Ophthalmology and the American Optometry Academy have consensus-based recommendations for biannual examinations for those aged 40 to 60 and then annual examinations for those 60 years of age.²⁵–²⁶ These are as much based on tradition and opinion as they are based on evidence.

In the present study, we examined population-based data to assess the incidence and causes of vision loss, to assist in the objective determination of the preferred frequency of routine screening of those with normal vision.

METHODS

The methodology for the Melbourne Visual Impairment Project (VIP) has been reported in detail.¹⁴,¹⁶,²⁸ The baseline study of the urban cohort was conducted from 1992 to 1994 and the follow-up study from 1997 to 1999. The protocol was approved by the Human Research and Ethics Committee of the Royal Victorian Eye and Ear Hospital and complied with the Declaration of Helsinki for research involving human subjects.

Briefly, the participants were recruited from nine adjacent pairs of census collector districts randomly selected from the Melbourne Statistical Division. The eligible participants were identified during a door-to-door private household census as being resident for 6 months or longer at the current address and aged 40 years or more. Basic demographic characteristics were collected, and the participants were invited to the local examination center.

Standardized examination included an ophthalmic examination and an interview covering sociodemographic characteristics, history and current symptoms of eye disease, medical history, and medication use.²⁸ The ophthalmic examination comprised assessment of visual acuity, visual field, and intraocular pressure and slit lamp examination, dilated ophthalmoscopy, and photography of the lens and the fundus. Home visits were conducted when participants were unable to attend the local examination center.
Visual impairment was determined by either presenting visual acuity or visual field loss in the better eye. In cases in which presenting visual acuity was improved by subjective refraction to up to five letters on the 4-m logMAR chart (equivalent to one line) to the best corrected visual acuity, refractive error was assigned as the cause of visual impairment. If presenting visual acuity in the better eye could not be improved by subjective refraction or could be improved to less than five letters on the 4-m logMAR chart, then the accompanying disease in this eye was assigned as the cause of the visual impairment. If there was more than one disease in the better eye, the disease with the most clinically significant and irreversible influence was chosen as the primary cause. For example, if the better eye was affected by macular degeneration and cataract, macular degeneration would be chosen as the primary cause, because if the surgery was performed the eye would still have visual impairment.

Statistical analyses were conducted on computer (SAS, ver. 8.2; SAS Institute Inc., Cary, NC) and P < 0.05 was considered statistically significant.

**RESULTS**

The baseline study included 3271 eligible residents with 83% participation rate. The mean age at baseline was 59 ± 12 years (range, 40–98; 54% female). The mean time duration between baseline and follow-up examination was 4.5 ± 0.64 years (range, 4–7). Two hundred thirty-one (7%) participants examined at baseline died before the 5-year follow-up examination. Participants with presenting visual acuity less than 6/12 at baseline were 2.3 times as likely to have died during the 5-year follow-up period. Follow-up participation rate was 85% (2594) of 3040 eligible participants. Non-English-speakers, older participants, and people born in southern Europe were less likely to be reexamined. There were no other significant differences between those participants who were reexamined and those who were not. Data on visual field and visual acuity were not available for 64 participants, and they were excluded from the analysis. Data analyses included 2529 participants.

The mean age at follow-up examination was 62.5 ± 10.9 years (range, 44–101). A subset of participants who had had normal findings in an eye examination at baseline was selected according to the following criteria: (1) attendance at both the baseline and follow-up surveys; (2) no evidence of diabetic retinopathy, cataract, glaucoma, or AMD in the baseline survey; (3) normal visual field and best corrected visual acuity (BCVA) ≥ 6/12 in both eyes at the baseline survey; and (4) measurements of BCVA in both eyes available for the follow-up survey. This subset consisted of 1590 residents, and of these 38 had at least one eye with either visual field loss or BCVA < 6/12 in the follow-up survey (Tables 1, 2a, 2b).

Of the 38 with reduced vision in at least one eye, eight participants (21%) had not noticed any change in vision. The age distributions of these groups were similar. Of the 24 participants who had noticed a change in vision, six had not sought an eye examination. The reason given by one person in the 50 to 59 age group was, "I was too busy and did not get around to it"; another person in the 50 to 59 age group considered that "[the change] was not severe enough"; and one person in the 70 to 79 age group had made an appointment but had not yet been seen. Eighteen had been examined by an ophthalmologist, an optometrist, or both (Table 4).

Of these 38 participants, 8 knew that they had a family history of cataract, 1 of both cataract and glaucoma, and 1 of cataract and AMD. The presence of a family history increased the risk of vision loss, but was not statistically significant.
There was a wide range of causes of vision loss among these 38 participants with vision loss (Table 6). Among those with other causes of vision loss, seven had uncertain causes and four had had cataract surgery in the intervening period, but still had vision less than 6/12. Five had a neurologic cause of vision loss.

**DISCUSSION**

In this population cohort of those aged 40 years and more, 38 (2.39%) of the cohort of 1590 who had normal findings in a baseline eye examination had vision loss (visual field loss or BCVA < 6/12) develop over 5 years. Of the 38 who had a change in vision, the change had been noticed in 24 (63%). This leaves only 14 (0.88%) of the whole cohort who had unrecognized vision loss develop in this 5-year period. These are the target group that a routine screening program would be designed to detect.

Obviously, people with established eye disease or decreased vision should have ongoing care according to their specific conditions and individual needs. Guidelines for the frequency of these examinations are often set down in evidence-based or consensus-based guidelines, of which the American Academy of Ophthalmology Preferred Practice guidelines are an example. In the present study, we did not examine this issue, and the results should not be misinterpreted to imply any change in the recommended frequency of reexamination of patients with established eye disease. Of the 2529 people in this population-based study, 813 (32%) participants were in the ongoing-care category.

Similarly, people who notice a change in their vision are universally counseled to seek an eye examination without delay. In our study, 1.5% of our participants were in this category, and 75% of those had been examined.

We were particularly interested in the number of people who had normal baseline eye examination results and had asymptomatic and unrecognized vision loss. Presumably, these are the people whom a mandated frequency of routine eye examinations is designed to benefit, because those with presenting eye disease should be given a specific time for reexamination, and those with symptomatic incident vision loss should be seen when the vision loss is first noted. As it turns out, only 8 to 14 of 1590 had reduced vision over the 5-year period.

This raised the question of how often people who have been found to have normal vision should be advised to have a routine eye examination. Should it be every year, every 2 years, or every 5 years? The cost benefits of routine eye examinations may vary greatly in different jurisdictions according to the cost of the eye examination and the costs and impact of vision loss. Clearly, however, eye health promotion messages should target those who notice a change in vision, those with diabetes, and those who have a family history of eye disease.

The strengths of this study include its population-based, prospective design; its use of standardized methods; and the performance of a comprehensive ophthalmic examination at each time point. Its weaknesses include the lack of objective data about the timing of changes that occurred between the baseline and follow-up examinations and the unknown status of those who died or were not reexamined. Although the overall number enrolled was large and the estimates robust, the number losing vision was still quite small, as was the number of the most elderly who had normal baseline examination findings. This results in large confidence intervals, especially in the elderly. In this study, we did not try to perform a comprehensive health economic analysis of the preferred frequency of routine eye examinations, because that would vary greatly with the costs involved in any particular region or situation. Rather, we examined the incidence of vision loss, so that it may be taken into account when others formulate their recommendations.

**Table 3. Frequency of Noticing a Change in Vision in Those with a Change in Vision, by Age Group**

<table>
<thead>
<tr>
<th>Noticed a Change in Vision</th>
<th>Age Group (y)</th>
<th>40–49</th>
<th>50–59</th>
<th>60–69</th>
<th>70–79</th>
<th>80–90</th>
<th>90+</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Missing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Data are the number of those noticing a change in vision, with the column percentage of the total in parentheses. Fisher exact tests are not significant.

**Table 4. Frequencies of Seeing Someone when Change in Vision Was Noticed by Age Group**

<table>
<thead>
<tr>
<th>Action</th>
<th>Age Group (y)</th>
<th>40–49</th>
<th>50–59</th>
<th>60–69</th>
<th>70–79</th>
<th>80–90</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saw ophthalmologist only</td>
<td></td>
<td>1 (20)</td>
<td>5 (71)</td>
<td>1 (55)</td>
<td>1 (100)</td>
<td>8 (37)</td>
<td>35</td>
</tr>
<tr>
<td>Saw optometrist only</td>
<td></td>
<td>3 (60)</td>
<td>3 (58)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>6 (28)</td>
</tr>
<tr>
<td>Saw ophthalmologist and optometrist</td>
<td></td>
<td>0 (0)</td>
<td>2 (25)</td>
<td>1 (14)</td>
<td>1 (33)</td>
<td>0 (0)</td>
<td>4 (14)</td>
</tr>
<tr>
<td>No action</td>
<td></td>
<td>1 (20)</td>
<td>3 (58)</td>
<td>1 (14)</td>
<td>1 (33)</td>
<td>0 (0)</td>
<td>6 (25)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>5</td>
<td>8</td>
<td>7</td>
<td>5</td>
<td>1</td>
<td>24</td>
</tr>
</tbody>
</table>

Data are the number of those who took each action or who took no action, with the column percentage of the total in each group in parentheses.

**Table 5. Risks of Vision Loss in those with a Family History of Eye Disease**

<table>
<thead>
<tr>
<th>Family History</th>
<th>Vision Loss/NormalVision</th>
<th>Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataract</td>
<td>Yes</td>
<td>10/272</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>33/1133</td>
</tr>
<tr>
<td>Glaucoma</td>
<td>Yes</td>
<td>1/83</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>29/1279</td>
</tr>
<tr>
<td>AMD</td>
<td>Yes</td>
<td>1/14</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>26/1301</td>
</tr>
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</table>
Table 6. Causes of Vision Loss

<table>
<thead>
<tr>
<th>Age Group (y)</th>
<th>Cause</th>
<th>Refractive error</th>
<th>Cataract</th>
<th>Diabetic retinopathy</th>
<th>Glaucoma</th>
<th>AMD</th>
<th>Others</th>
<th>Unknown</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>40–49</td>
<td></td>
<td>2 (22)</td>
<td>2 (22)</td>
<td>0 (0)</td>
<td>1 (11)</td>
<td>0 (0)</td>
<td>4 (44)</td>
<td>0 (0)</td>
<td>7 (18)</td>
</tr>
<tr>
<td>50–59</td>
<td></td>
<td>2 (22)</td>
<td>4 (33)</td>
<td>2 (22)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>5 (42)</td>
<td>1 (8)</td>
<td>12</td>
</tr>
<tr>
<td>60–69</td>
<td></td>
<td>2 (22)</td>
<td>2 (22)</td>
<td>2 (33)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>3 (33)</td>
<td>0 (0)</td>
<td>9</td>
</tr>
<tr>
<td>70–79</td>
<td></td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1 (17)</td>
<td>6</td>
</tr>
<tr>
<td>80–90</td>
<td></td>
<td>1 (100)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>5 (50)</td>
<td>0 (0)</td>
<td>1 (100)</td>
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<tr>
<td>90+</td>
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<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1 (00)</td>
<td>0 (0)</td>
<td>2 (5)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>9</td>
<td>12</td>
<td>9</td>
<td>6</td>
<td>1</td>
<td>16 (42)</td>
<td>38</td>
<td></td>
</tr>
</tbody>
</table>

Data are the number of subjects with each cause of vision loss, by age group, with the percentage of the total in each group in parentheses.

References