

ACE Prevention Briefing Paper : Vision Screening

Researcher: Sandra Younie

1.1 Definition of intervention/s

The proposed ACE intervention is a vision screening program for people aged 40 years of age or older. A search of the literature was performed to assess eye screening programs that had been undertaken in a population based on age and that were not disease targeted screening programs. The purpose of doing the search was as a guide to the most effective design of a screening program, the quality of the study design and for effectiveness data.

Who is the population?

Who is the population for a general eye screen for those aged 40+. The proportion of the population that would need to be excluded are all those patients who are currently having regular eye screens (usually 2 yearly) for eye conditions such as:

- Refractive error—it is recommended that all Australians who require spectacles for conditions such as myopia or reading have biennial eye examinations fully funded on MBS. However, anybody can have their eyes examined on at least a 2 yearly basis by an optometrist without charge (cost borne by the government), so it would be necessary to look at the available evidence to estimate the proportion of people who have “normal sight” but have also had their eyes tested (so may be uninterested in another eye screen).
- Diabetics—the recommendation is dilated fundus examination by trained examiner, with adequate sensitivity and specificity, at time of diagnosis and every 2 years thereafter¹.
- Glaucoma—any patients with a family history of glaucoma will receive GP advice to have 2 yearly eye examinations.
- Diagnosed with Cataract
- Diagnosed with AMD
- Other eye conditions

There may be significant cross over in these population groups. For example, having diabetes is also a risk factor for glaucoma (twice as likely to get glaucoma as other adults) and also for cataract (which develops earlier in patients with diabetes)². Patients who are not following their GPs advice to have regular eye examinations can be excluded from the likely population for an eye screen (ie. diagnosed diabetics who are not following their doctor’s advice to have regular eye examinations).

Evidence for the effectiveness of eye screening

A search of the literature found that the majority of population based eye screening interventions are in elderly people. The assumption is that because the prevalence of

ACE Prevention Briefing Paper : Vision Screening

Researcher: Sandra Younie

vision disorders increases with increasing age then the greatest benefit from a screening program is likely to be in elderly patients.

A search of the literature found a Cochrane systematic review and a randomised controlled trial based in Australia (that reported on two trial outcomes; visual acuity and falls) that was not included in the Cochrane review as it was reported at a later time. The Cochrane review is presented first.

- 1) Smeeth L, Iliffe S. Community screening for visual impairment for the elderly. Cochrane Database of Systematic Reviews 2006. Issue 3. Art. No: CD001054. DOI: 10.1002/14651858.CD001054.pub2.

The aim of this systematic review of the literature was to assess the effects on vision of mass screening of older people for visual impairment. Improvement in vision was the outcome of interest. The type of studies included were all randomised trials of visual screening alone or as part of a multicomponent screening of people aged 65 years or over, not identified as belonging to a particular risk group, in a community setting. Five randomised trials were identified in which visual screening was undertaken as part of a broad assessment of older people's health and functioning. Six trials in total were included in the systematic review:

- Vetter NJ, Jones DA, Victor CR. Effects of health visitors working with elderly patients in general practice. A randomised controlled trial. *BMJ* 1984;288:369-72. Individually randomised trial undertaken in the UK.
- McEwan RT, Davison N, Forster DP, Pearson P, Stirling E. Screening elderly people in primary care: a randomised controlled trial. *British Journal of General Practice* 1990;40:94-7. This was an individually randomised trial undertaken in the UK.
- Vetter NJ, Lewis PA, Ford D. Can health visitors prevent fractures in elderly people? *BMJ* 1992;304:888-90. Individually randomised trial undertaken in the UK.
- Van Rossum E, Frederiks CM, Philipsen H, Portengen K, Wiskerke J, Knipschild P. Effects of preventive home visits to elderly people. *BMJ* 1993;307:27-32. An individually randomised trial in The Netherlands, with patients recruited from a defined geographic area.
- Wagner EH, LaCroix AZ, Grothaus L, Leveille SG, Hecht JA, Artz K et al. Preventing disability and falls in older adults: a randomised controlled trial. *American Journal of Public Health* 1994;84:1800-6. An individually randomised trial in the United States, with patients recruited from a HMO.

ACE Prevention Briefing Paper : Vision Screening

Researcher: Sandra Younie

-
- Smeeth I, Fletcher AE, Hanciles S, Evans J, Wormald R. Screening older people for impaired vision in primary care: cluster randomised trial. *BMJ* 2003;327;1027-30 . A cluster randomised trial undertaken in the UK. This was the only included study that used visual acuity for screening.

The results obtained from the six trials were remarkably similar. The conclusion of the review was that “there is no evidence that community-based screening of asymptomatic older people results in improvements in vision”. The Cochrane report proposed a number of factors that may have contributed to the lack of evidence;

- The lack of optimal tools to be used for screening for visual impairment
- A need for better methods of diagnosis of refractive error,
- The use of visual acuity as a screening tool
- Including within screening other measures such as visual fields or contrast sensitivity
- That, single questions about self-reported visual difficulties are poor predictors of low visual acuity
- The need for the development of brief screening instrument that assess visual function

Randomised controlled trial undertaken in Australia. This one RCT is reported twice, firstly for the trial outcome of visual acuity and secondly for the primary outcome of falls.

- 2) Swamy BN, Cumming RG, Ivers R, Clemson L, Cullen J et al. Vision screening for frail older people: a randomized trial. 38th Annual Congress, Royal Australia and New Zealand College of Ophthalmology (RANZCO), *Br J Ophthalmol*. Published online 9 Jul 2008

The purpose of this randomized controlled trial was to assess the effects of vision screening, and subsequent management of visual impairment, on visual acuity and vision-related quality of life among frail older people. Vision screening was conducted by an optometrist. **It was hypothesised that the lack of a benefit observed by the Cochrane review may have been due to the poor quality of the vision testing undertaken in the included studies.** There have been no trials of vision screening for older people conducted by optometric or other professionally trained personnel. Participants (N=616) were independently living, aged 70 years or over, and recruited mainly from outpatient aged care services in Sydney, between August 2002 and July 2004 with no history of cataract surgery or new spectacle prescription in the previous three months. This is the same group of patients discussed in the study below. Subjects randomised to intervention received comprehensive vision and eye examinations conducted by a study optometrist, while the control group received usual care. The main outcome measure was distance and near visual acuity (LogMAR) and composite scores on the 25-item version of the VFQ-

ACE Prevention Briefing Paper : Vision Screening

Researcher: Sandra Younie

25¹. Patients were followed up at 12 months by research assistants unaware of their randomisation. Demographic results were that nearly all subjects wore glasses, 60% used bifocals or multifocals, 20% used reading glasses only, and 11% used both single vision reading and distance glasses. 82% had reported seeing an ophthalmologist or optometrist in the previous 24 months and 56% had their glasses changed at that time.

The trial did not find any evidence that vision screening of older people by an optometrist, with subsequent management of any identified visual impairment, lead to improved visual acuity or vision-related quality of life after one year follow-up. This finding is consistent with the Cochrane review above. The authors conclude that the most likely explanation of failing to detect an effect is that 73% of subjects in the controls group reported seeing an eye care professional during the study follow-up period and this suggests that the level of support for older people by the Medicare system (vision testing by an optometrist is provided-but not treatment) is adequate and no additional benefit would be obtained.

- 3) Cumming RG, Ivers R, Clemson L, Cullen J, Hayes MF, Tanzer M, Mitchell P. Improving vision to prevent falls in frail older people: a randomized trial. *J Am Geriatr Soc* 55:175-181,2007

The objective of this RCT was to assess whether vision and eye examinations with subsequent treatment of diagnosed vision problems, prevented falls and fractures in frail older people. Subjects living in the community who attended outpatient aged care services in the central Sydney area were randomized, between August 2002 and July 2004, to either intervention or control groups (study group identified above). Patients in the intervention group had comprehensive vision tests and eye examinations conducted by an optometrist who treated patients to improve visual acuity or referred them if ocular pathology was present. Arrangements had been made with local ophthalmologists for expedited treatment. If corrected vision was worse than 0.5 logMAR units (20/63 Snellen equivalent) or substantial field impairment, then the subject was referred to the study occupational therapist, for home modifications to improve visibility or if indicated specific mobility training and canes. The primary outcome was falls during the 12 months of follow-up (self-reported). Visual acuity was assessed at the end of follow-up. Patients in the control group received eye and vision examinations at baseline.

There were some differences in baseline characteristics between patients randomised to the intervention and control groups, which favoured the intervention group. Patients in the control group were statistically more likely to require help with ADLs and to require psychotropic medications, in particular, greater than 4 medications. They were also more likely to require glasses for both distance and reading. Patients in both groups were as

¹ The 25-item version of the National Eye Institute Visual Function Questionnaire is a measure of visual function designed to capture the influence of vision on multiple dimensions of health-related quality of life, including emotional well-being. The VFQ-25 produces scores on 11 vision-related sub-scales, as well as a single composite score. The sub-scales are general vision, ocular pain, near activities, distance activities, social functioning, mental health, role difficulties, dependency, colour vision, peripheral vision and driving.

ACE Prevention Briefing Paper : Vision Screening

Researcher: Sandra Younie

likely to have had falls in the previous 12 months. The results of the study are presented in Table 1.

Table 1: Falls during follow-up and relative risks for falls using various statistical methods

Falls	Intervention (n=309)	Control (n=307)	RR (95% CI)	Statistical Method
Fall, n	758*	516*	1.57 (1.20-2.05) 1.35 (1.18-1.55)	Negative binomial model* Andersen-Gill model±
≥1 falls, n(%)	201 (65.0)	153 (49.8)	1.31 (1.13-1.50) 1.54 (1.25-1.91)	Cumulative incidence Cox model
≥2 falls, n(%)	117 (37.9)	94 (30.6)	1.24 (0.99-1.54)	Cumulative incidence
fractures	31 (10.0)	18 (5.7)	1.74 (0.97-3.11)	Cox model

*Excludes four subjects (two intervention, two control) who each had more than 100 falls during follow-up.

±Up to five falls included for each subject

Based on the results the authors concluded that in frail older people, comprehensive vision and eye assessment, with appropriate treatment, does not reduce and may even increase, the risk of falls and fractures.

Literature of mass screening in younger patients

A RCT of a mass screening of asymptomatic people aged 40 years or above was not identified from the literature search. The study described below is of a screening program of asymptomatic people to identify impaired visual acuity. This study is presented because the greatest cause of vision impairment at any age, and particularly in younger people, is refractive error and also because of its findings in relation to self identified visual acuity problems.

- 4) Stone DH, Shannon DJ. Screening for impaired visual acuity in middle age in general practice. *BMJ*, 1978, 2, 859-863.

The purpose of this study was to attempt to detect and treat defects of distant visual acuity in middle-aged people. In this study, all people, aged 40-64, registered in 1967 with two south London general practices were identified and randomly allocated into two groups, designated screening and control. The screening group (n=3297) was invited by letter to attend a screening clinic in which a series of questions was asked, two years later this group was invited to a second, similar screening clinic. The control group (n=3353) was not asked to either of these sessions. At the screening clinic, the intervention group were asked the question "Do you have difficulty in seeing distant objects (with spectacles if you have them)?" and "Do you normally wear glasses for distant vision?" Distant visual acuity was then measured using a standard Snellen card. Impaired visual acuity was defined as 6/18 or worse in the better eye, both eyes using best correction.

The findings of this study were that the question "Do you have difficulty seeing distant objects?" had a low sensitivity and a high specificity, rendering it unsatisfactory for use in mass population screening for visual impairment. The prevalence of impaired visual acuity in the screening and control groups at the survey in 1972 showed no significant

ACE Prevention Briefing Paper : Vision Screening

Researcher: Sandra Younie

differences in any age group. The authors conclude by stating that: “mass screening for defects of visual acuity in the course of multiphasic examination is thus unlikely to reduce the prevalence of impaired distant visual acuity in the community”.

A finding from this study, which would be of concern for any mass media campaign encouraging people to get their eyes tested, is the poor subjective assessment by participants of their visual acuity. Acclimatisation may be a factor in this finding.

Information provided from the Access Economics reports

Included in this review of the evidence is the report produced by Eye Research Australia and Access Economics—Investing in Sight: Strategic Interventions to Prevent Vision Loss in Australia³. Within this report multiple interventions are promoted as being of benefit in reducing eye disease or vision impairment. The purpose of including this report in the review of the evidence is because of its prominence in promoting particular types of eye interventions as preventive, and to look at the evidence used in support of its recommendations. The two-relevant interventions to this review are the benefit of regular eye screening for people aged greater than 75 and for those aged 40 or older.

2-yearly eye exam for population greater than 75

Access Economics reported that 2-yearly eye exams for the population greater than 75 years would be cost effective, costing \$9,651 per QALY. The assumptions used in the analysis are presented below.

- 54.5% of Australians of this age have had an eye test in the last two years, so 22.8% would need to be screened each year.
- The intervention, as proposed, would have a reach of 75%
- The weighted average cost of an eye exam is \$68.86 (weighted by proportion who visit an optometrist and those who visit an ophthalmologist) a total cost of \$14.9 million in 2005-06
- 10.6% of patients who are examined will have eye disease/visual impairment.
- Patients are assigned an eye disease based on prevalence data by age.
- Health costs for treating the diagnosed eye diseases will be \$45 million in 2005-06
- Treatment effectiveness in the first year for the diagnosed eye conditions was assumed to be, 99% for cataract, 96% for DR, 99.7% for glaucoma, 3.8% for AMD, 99.1% for RE and 50% for other eye conditions. This effectiveness data gradually declined (except for the ‘other’ conditions).
- Gross indirect benefits of \$52.5million in 2005-06 will be derived by diagnosing these eye diseases (direct health benefits averted and indirect financial benefits such as a reduced need for care and low vision devices)

ACE Prevention Briefing Paper : Vision Screening

Researcher: Sandra Younie

- QoL is measured by the disability adjusted life years (DALYs) averted, converted to a financial measure using a value of a statistical life.
- 1,499 DALYs will be averted
- DALYs are converted to QALYS to produce an ICER of \$9,651/ QALY over a lifetime.

There are some issues identified with this analysis which make its conclusions contentious.

- The analysis did not include any costs associated with running a mass screening program. These costs would differ depending on the type of mass screening program implemented (e.g the type of personnel who will implement the program (nurses, or optometrists or ophthalmologist) but at a minimum would involve some media costs to reach people to inform them of this option.
- Total effectiveness is assumed of the screening program to detect eye conditions and to improve visual acuity but this is not referenced nor borne out by the literature
- Sensitivity and specificity of the eye tests are not included
- The assumed reach of the intervention is at the high end.
- It is assumed that asymptomatic patients who are targeted by a mass screening program would have the same prevalence/incidence of eye diseases (and the same severity with associated DALYs) as the general public which includes patients who have already been diagnosed with these conditions. The literature does not support this assumption.
- The analysis does not look at the cost of forgoing the next best option (ie. it is not a comparative analysis where it compares to standard medical treatment, in this case either opportunistic screening by a GP or the patient referring themselves to an optometrist). The effect of this is that the potential benefits of this approach over the current care are overestimated.
- The assumption that DALYs and QALYs are interchangeable.
- These patients would not have been diagnosed with vision impairment but for the mass screening program

Five-year eye exams for 'normal risk' Australians aged 40 or over

Access Economics reported that five year exams for 'normal risk' Australians aged 40 or over would be cost saving, that is would both prevent vision loss and would save money for the Australian Health System.

The assumptions used in the analysis:

- Population—normal risk aged 40-74 or 50-74, (high risk groups are subtracted)
- Impact of the intervention is 5.76%

ACE Prevention Briefing Paper : Vision Screening

Researcher: Sandra Younie

- 464 of 40-74 year olds and 209 of 50-74 year olds are estimated to require treatment each year (from screening)
- The Total cost of delivering the program in 2005-06 to 40-74 year olds is \$2.1m and the Total cost of delivering the program to 50-74 year olds is \$1.0m (Table 2.8 of the report)
- The net benefit of delivering the program in 2005-06 to 40-74 year olds is \$0.7m and to 50-74 year olds \$0.3m (Table 2.8)
- For 40-74 year olds, the total cost is assumed to be \$41.3 million over a lifetime but generating net benefits of 4.4 million. The program is assumed to be cost-saving.
- For 50-74 year olds, the total cost is assumed to be \$16.2 million over a lifetime but generating net benefits of 2.4 million. The program is assumed to be cost-saving.
- These patients would not have been diagnosed with vision impairment but for the mass screening program

Again there are some issues identified that make the conclusions of the analysis contentious.

- The level of detail provided by the analysis is sparse.
- The actual cost of running and promoting a screening program is not included.
- Total effectiveness is assumed of the screening program to detect eye conditions and to improve visual acuity but this is not referenced nor borne out by the literature
- The analysis does not look at the cost of forgoing the next best option (ie. it is not a comparative analysis where it compares to standard medical treatment, in this case either opportunistic screening by a GP or the patient referring themselves to an optometrist). The effect of this is that the potential benefits of this approach over the current care are overestimated.
- Sensitivity and specificity of the tests are not included.

As can be seen from the above analysis, including in the screening 40-50 year olds increases the Total cost of the screening program by \$25million (includes treatment costs) but generates, an extra \$27 million of indirect savings.

The report doesn't state what conditions the screening program will pick up, however, using the assumptions above (ie the same prevalence of eye disease in the to be newly screened population as in the general population) the prevalence of vision impairment conditions in this population of 40-50 year olds (as reported in the Access Economics report, Table 1.1) is for refractive error (0.5%) and other (0.2%), which would include congenital, childhood diagnosed conditions and eye injuries.

The stated costs and benefits appear quite inflated. For example, if the first year of the program is looked at (2005-06) then the additional annual cost for including 40-50 year olds in the screening program is \$1.1 million (\$2.1m-\$1.0m) for a Total benefit of 1.5 m

ACE Prevention Briefing Paper : Vision Screening

Researcher: Sandra Younie

(\$0.7m-\$0.3m+1.1m). The average yearly cost per patient (ie for the extra 255 patients diagnosed in this age group) is \$4,314 and they generate for the first year of the program a total benefit of \$5,882 in avoidable pain, health costs, suffering and lost productivity for a net benefit of \$1,568. This is a lot of cost and benefit in one year for patients who are asymptomatic (normal risk) and overwhelmingly will be diagnosed with needing spectacles.

Screening for prevention of glaucoma

The purpose in assessing the evidence for population based screening for the prevention of vision loss due to glaucoma was because the onset of open angle glaucoma can be without symptoms and progression occurs silently until the advanced stages of the disease. The blindness caused by open angle glaucoma (OAG) is irreversible. However, it should be noted that in the majority of patients the structural and functional abnormalities associated with chronic glaucoma progress slowly over a period of years. The prevalence of OAG depends on ethnicity so care should be used in extrapolating from other countries.

A search of the literature found a Cochrane Systematic Review from 2006, and a later (2008) prospective population-based cohort study.

Cochrane review

Harr SR, Wormald R, Burr J. Screening for prevention of optic nerve damage due to chronic open angle glaucoma. Cochrane Database of Systematic Reviews, 2006, Issue4. Art. No.: CD006129. DOI: 10.1002/14651858.CD006129.pub2..

The objective of the review was to determine the impact of screening for OAG compared with opportunistic case findings or current referral practices on the prevalence of and the degree of optic nerve damage due to OAG in screened and unscreened populations. OAG has been assumed to be a condition that fulfils the criteria for population screening, and the focus of the review was to examine the evidence for the effectiveness of screening for OAG.

The review planned to include randomised controlled trials, including cluster RCTs however no trials were identified so no formal analysis was performed. The authors conclude that on the basis of current evidence, population-based screening for chronic OAG cannot be recommended, although much can be done to improve awareness and encourage at risk individuals to see testing.

ACE Prevention Briefing Paper : Vision Screening

Researcher: Sandra Younie

Population based cohort study

Stoutenbeek R, de Voogd S, Wolfs RC, Hofman A, de Jong PT, Jansonius NM. The additional yield of a periodic screening programme for open-angle glaucoma: a population-based comparison of incident glaucoma cases detected in regular ophthalmic care with cases detected during screening. *Br J Ophthalmol*, 2008 Sep;92(9):1222-6

This study used patients aged 55 and over from the population-based Rotterdam study. Most patients were Caucasian. All patients (n=6773) underwent the same ophthalmic examination at baseline (1991-3) including visual field testing and simultaneous stereo optic disc photography. Follow-up examination was 6.5 years later (1997-99).

This study applies a hypothetical situation in which a population is screened periodically at 6.5 year intervals. The study compared iOAG cases (cases with OAG at follow-up but not at baseline) that had already been detected in regular ophthalmic care before the follow-up examination with those who remained undetected until the follow-up examination. From this data, they estimated the number of persons who could be saved from bilateral end-stage OAG by screening.

The study found that detected iOAG cases (detected with regular ophthalmic care) had a faster progressing disease than cases detected by screening. The study estimates that around 0.1% of the white participants in the study, might have become blind before dying if they had remained undetected. The authors report that the real yield of a periodic OAG screening programme in terms of preventing severe visual impairment or blindness (estimated to be 0.1%) is much lower than the yield as estimated from the prevalence of undetected OAG (typically 1%). They conclude that the additional yield of periodic OAG screening is less than expected from published prevalence data because many cases had already been detected at early disease stages in regular ophthalmic care and secondly because only a minority of the undetected cases had severe enough disease to be seriously at risk of reaching end-stage OAG in both eyes during life, were they to remain undetected.

An issue not raised by the authors of this study but which is likely to result in an overestimate by the authors of the likely numbers of patients detected with OAG and therefore prevented from going blind is that this hypothetical study assumes a 100% penetration rate for the screening program. A rate that is unlikely to occur if an eye screening program was likely to be implemented.

Conclusion

The conclusion reached from an assessment of the available literature is that there is no evidence to support the implementation of eye screening programs in asymptomatic people.

ACE Prevention Briefing Paper : Vision Screening

Researcher: Sandra Younie

¹ Mitchell P, Foran S, Wong TY, Chua B, Patel I et al. Guidelines for the management of Diabetic Retinopathy. Prepared by the Australian Diabetes Society for the Department of Health and Ageing. Commonwealth of Australia 2008.

² National Eye Institute. <http://www.nei.nih.gov/health/diabetic/retinopathy.asp> (accessed April 3 2009)

³ Investing in Sight: Strategic Interventions to Prevent Vision Loss in Australia. A report prepared by Access Economics Pty Limited. Centre for Eye Research Australia. University of Melbourne, Melbourne, Australia, June 2005