Falls prevention strategies for people with visual impairment

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Vision loss in Australia

- 480,000 visually impaired in both eyes (visual acuity <6/12); 50,000 are blind (<6/60)
  - Age related macular degeneration (AMD) is leading cause of irreversible blindness
  - Cataract (2.7M in 2021)
  - Diabetic eye disease
  - Glaucoma (1 person in 11)
  - Under corrected refractive error (300,000)

Eye Research Australia 2004

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Vision loss in Australia

Figure 1-5: Visual impairment and blindness, % agegroup, Australia, 2004

Eye Research Australia 2004
Risk factors for falls
Mean RR/OR (95%CI)

- **Muscle weakness** 4.4 (1.5–10.3)
- **History of falls** 3.0 (1.7–7.0)
- **Balance deficit** 2.9 (1.6–5.4)
- **Visual deficit** 2.5 (1.6–3.5)
- **Psychotropic drugs** 1.7 (1.5–2.0)
- **Age >80 years** 1.7 (1.1–2.5)

Visual function and falls

- Visual acuity
- Contrast sensitivity
- Visual fields
- Depth perception

Vision interventions

• Prevention
  - Modifiable risk factors (eg smoking cessation, antioxidants, avoid UV exposure)

• Detection
  - Regular eye examinations (→less decline in vision, function)

• Treatment
  - Cataracts, glaucoma management, AMD, free glasses/magnifier (→vision specific QoL↑)

Multifocal glasses and falls

- N=156 men & women aged 63 to 90 years
- 56% regularly wore multifocal (bifocal, trifocal, progressive) glasses
- Multifocal versus non-multifocal glasses fallers at 1 year:
  - OR 2.29, 95% CI 1.06-4.92
- Distant depth perception & distant edge-contrast sensitivity tests worse for multifocal wearers

1. Vision improvement

- N=1,090 men & women aged ≥70 years
- Brochure; referral to eye care provider, GP, optometrist
- 5% new glasses (N=20) or surgery (N=6)
- First fall after 18 months:
  - Hazard ratio 0.89, 95% CI 0.75-1.04, p=0.13
- Effective when combined with group exercise programme

Day L et al. BMJ 2002;325:128
2. First eye cataract surgery

- N=306 women ≥70 years
- Expedited (4 weeks) versus routine (12 months) cataract removal
- Number of fallers at 1 year:
  - 49% operated vs 45% non-operated fell, NS
- Rate of falls at 1 year:
  - IRR 0.66, 95% CI 0.45-0.96, p=0.03

3. Second eye cataract surgery

- **N=239 women ≥70 years**
- Expedited (4 weeks) *versus* routine (12 months) cataract removal
- Number of fallers at 1 year:
  - 40% operated vs 34% non-operated fell, NS
- Rate of falls at 1 year:
  - IRR 0.68, 95% CI 0.39-1.19, p=0.18

Foss AJE et al. Age Ageing 2006;35:66-71
4. Vision assessment & treatment

• N=616 men & women ≥70 years
• Comprehensive vision & eye examination
  - new glasses (30%)
  - referred to OT (8%)
  - glaucoma management (6%)
  - cataract surgery (5%)


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4. Vision assessment & treatment

- Number of fallers at 1 year:
  - 65% intervention vs 50% control fell, p=0.002
- Rate of falls at 1 year:
  - IRR 1.57, 95% CI 1.20–2.05, p=0.001
- More fractures in intervention group
  - 31 vs 18, p=0.06

Hot off the press!


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4. Vision assessment & treatment

- Differential quality of reporting of falls in the 2 groups?
- Controls more frail at baseline (less time walking about/more cautious)
- Controls visited eye professional?
- Major changes in prescriptions for new glasses
- Only 1 person new bi- or multifocals
- Improving vision/reassurance → behaviour change?

5. Visually Impaired Persons’ (VIP) fall prevention trial

Funding: NZ Health Research Council

Campbell AJ et al. BMJ 2005;331:817-20
VIP falls prevention trial

- Physiotherapists delivered the Otago Exercise Programme for 1 year
- Occupational therapists delivered a home safety programme and facilitated modifications. Assessment adapted from Westmead (glare, lighting, contrast)
Strength and balance retraining

http://www.acc.co.nz/otagoexerciseprogramme

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Previous evidence
Otago Exercise Programme

- 4 controlled trials
  - 2 research setting, 2 routine healthcare services
- N = 1,016 women and men, 65 to 97 years
- Meta-analysis showed falls↓ 35%, injurious falls↓ 35%
- Effective when delivered by a physiotherapist, and trained nurses
- Most cost effective: ≥80 years + previous fall

Otago Exercise Programme adapted for low vision
Previous evidence
Home safety intervention

- Recruited on hospital discharge
- OT assessment, advice, facilitation
- Falls↓ 25%, 31% in previous fallers
- Cost saving in previous fallers

Home safety programme

<table>
<thead>
<tr>
<th>LIGHTING/VISIBILITY</th>
<th>Not relevant</th>
<th>No hazard</th>
</tr>
</thead>
</table>

Hazards | Time observed: a.m./p.m. |
|---------|-------------------------|

<table>
<thead>
<tr>
<th>Location</th>
<th>Lounge</th>
<th>Dining</th>
<th>Kitchen</th>
<th>Laundry</th>
<th>Hall</th>
<th>Bed 1</th>
<th>Bed 2</th>
<th>Other:</th>
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<tr>
<td>Dark / dim</td>
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<td></td>
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<td>Shadowy</td>
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<tr>
<td>Abrupt changes</td>
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<td></td>
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<td></td>
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<tr>
<td>Glare</td>
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<tr>
<td>Clutter/complexity</td>
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<tr>
<td>Lack of contrast</td>
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VIP falls prevention trial

- Randomised controlled trial
- 2 by 2 factorial design
- Recruited from Royal NZ Foundation of the Blind and low vision clinics in Dunedin and Auckland, New Zealand
- Visual acuity 6/24 or worse, ≥75 years
- 88% with AMD (self reported)
VIP falls prevention trial

Women and men ≥75 years; vision ≤6/24

n = 708

Randomisation n = 391

Home safety + Exercise programme

n = 98

n = 100

n = 97

Social visits

n = 96

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Fall calendars

- Prospective, daily recall for 1 year
- Monthly follow up
- Independent monitor
- Circumstances & consequences by telephone
- Independent assessor

Participants filled in ‘F’ for a fall or ‘N’ for no fall each day

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Eye tests in the home
VIP results
Otago Exercise Programme

<table>
<thead>
<tr>
<th></th>
<th>Exercise (n=195)</th>
<th>No exercise (n=196)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of falls</td>
<td>228</td>
<td>215</td>
</tr>
<tr>
<td>Falls per person year</td>
<td>1.23</td>
<td>1.13</td>
</tr>
<tr>
<td>No. of injurious falls</td>
<td>114</td>
<td>104</td>
</tr>
</tbody>
</table>

IRR 1.15, 95% CI 0.82–1.61, p=0.418

Campbell AJ et al. BMJ 2005;331:817-20

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<table>
<thead>
<tr>
<th>Frequency</th>
<th>IRR</th>
<th>(95% CI)</th>
</tr>
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<tbody>
<tr>
<td>&lt; 1 session per week</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>1 – &lt; 2</td>
<td>0.79</td>
<td>(0.42–1.50)</td>
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<tr>
<td>2 – &lt; 3</td>
<td>0.37</td>
<td>(0.23–0.60)</td>
</tr>
<tr>
<td>≥ 3</td>
<td>0.23</td>
<td>(0.12–0.45)</td>
</tr>
</tbody>
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Campbell AJ et al. BMJ 2005;331:817-20
VIP results

Home safety programme compliance

- Telephone interview by OT at 6 months
- 152 of 169 (90%) complied at least partially with $\geq 1$ home safety recommendation(s)

Campbell AJ et al. BMJ 2005;331:817-20

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## VIP results

### Home safety programme

<table>
<thead>
<tr>
<th></th>
<th>Home safety (n=198)</th>
<th>No home safety (n=193)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of falls</td>
<td>172</td>
<td>271</td>
</tr>
<tr>
<td>Falls per person year</td>
<td>0.91</td>
<td>1.47</td>
</tr>
<tr>
<td>No. of injurious falls</td>
<td>100</td>
<td>118</td>
</tr>
</tbody>
</table>

**IRR 0.59, 95% CI 0.42–0.83, p=0.002**

Campbell AJ et al. BMJ 2005;331:817-20
<table>
<thead>
<tr>
<th></th>
<th>Separate intervention groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Home safety + exercise programmes (n=98)</td>
</tr>
<tr>
<td>No of falls</td>
<td>108</td>
</tr>
<tr>
<td>Falls per person year</td>
<td>1.17 (1.02 to 1.37)</td>
</tr>
<tr>
<td>No (% of group) with ≥1 fall(s)</td>
<td>47 (48)</td>
</tr>
</tbody>
</table>

Campbell AJ *et al.* BMJ 2005;331:817-20

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Hazard related falls

- Home safety programme → falls ↓41%
  - At home
  - Away from home

- Hazard related falls at home
  - IRR 0.40, 95% CI 0.21–0.74

- Non-hazard related falls at home
  - IRR 0.43, 95% CI 0.21–0.90

How did it work?

• In addition to removal or modification of hazards / new equipment:
  – Individual advice given by OT?
  – Overall reduction in activity?
  – Combination of reasons that vary with each individual?

Visual impairment & falls - a challenge!

Credit: DAVID MONTFORD/PHOTOFUSION
Key messages - vision loss

• People with vision loss are at double the risk of falls (hip # ↑↑)
• Vision specific interventions
  - Wear monofocal glasses while walking
  - New glasses could cause falls
  - First cataract removal reduces falls
• Home safety assessment & modification (experienced OT) reduces falls

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Key messages - general

- Effective strategies in those with normal sight do not necessarily work in people with severe vision loss
- Two components not necessarily better than one single intervention
- Value for money requires careful targeting (general population versus specific risk factor)