Vision Changes with Aging

Mark Swanson, OD, MSPH
Professor
UAB School of Optometry

Visual Impairment Low Vision and Blindness

- **Blindness**
  - USA <20/100 or 20 degrees VF
  - WHO <20/400
  - The Chart Issue

- **Low Vision**
  - Various definitions <20/40 to <20/60
  - Varies by State and At Times Agency within the State

- **Legal Driving**
  - Varies by State

Visual Acuity Reduction in the Elderly

- Increased risk of 5 year mortality
- Increased risk of nursing home placement
- Increases hospital length of stay in by two days
- Increased risk of falls
- Increased risk of hip fracture
- 50% of low vision patients have clinical depression
- Increased risk social Isolation
- Decrease in physical activity
Vision and Nursing Home Placement

- Beaver Dam Eye Study population
  - 4.6% placement over 10 yr period (Klein et al 2000)
- Binocular Acuity 3.20 (95% CI 1.85-5.56)
- Better Eye Acuity 4.23 (95% CI 2.34-7.64)
- Near Vision Acuity 5.00 (95% CI 2.28-10.9)
- Contrast Sensitivity 2.40 (95% CI 1.96-5.92)
- Multiple other studies show vision is a risk factor for NH placement

Vision Among Residents

- Visual Impairment 2-8X more common
- Blindness 13-15x more common in nursing home residents
- 37-57% BVA < 20/40 (Tielsch et al 1995)
- 40% have less than 20/60 binocular (Owsley 1997)
- 75% have contrast sensitivity <1.5 (Swanson 2009)
- Staff poorly predict visual status (Swanson 2009)

Refractive Error
Refractive Error

- 50% of US population wears optical correction for distance viewing- $20B/yr
- Hyperopia increases (farsightedness) with aging
- Shift to myopia (nearsightedness) with cataracts
- Astigmatism shifts with aging
- Leading cause of correctable visual impairment in older adults along with cataracts

Refractive Error and Visual Impairment

Estimates of Visual Impairment in the US Population Due to Uncorrected Refractive Error (<20/30 better eye)

<table>
<thead>
<tr>
<th>Age Groups</th>
<th>Rate/1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persons aged 12 to 19 years</td>
<td>155.9</td>
</tr>
<tr>
<td>Persons aged 20 to 39 years</td>
<td>96.6</td>
</tr>
<tr>
<td>Persons aged 40 to 59 years</td>
<td>84.3</td>
</tr>
<tr>
<td>Persons aged 60 years and older</td>
<td>145.7</td>
</tr>
</tbody>
</table>

Estimates of Visual Impairment in the US Population Due to Uncorrected Refractive Error (<20/30 better eye)

<table>
<thead>
<tr>
<th>Category of Impairment</th>
<th>Number of people visually impaired (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blind from all causes</td>
<td>8.226</td>
</tr>
<tr>
<td>Low vision from refractive errors</td>
<td>36.657</td>
</tr>
<tr>
<td>Low vision from all other causes, 20/500 or worse vision</td>
<td>43.203</td>
</tr>
<tr>
<td>Blind from all causes</td>
<td>114.610</td>
</tr>
<tr>
<td>Low vision from all causes, 20/100 or worse vision</td>
<td>168.123</td>
</tr>
<tr>
<td>Blind from all causes</td>
<td>214.210</td>
</tr>
</tbody>
</table>

Note: These estimates were based on the corrected visual acuity of the population in 2002; the global population examined from 2002 to 2004 is estimated to be around 75%.

Source: WHO

Table 1. Health-Related Quality of Life, Visual Task Difficulty, and Impairment at 2 Months Follow-up

<table>
<thead>
<tr>
<th>Variables</th>
<th>No Refractive Error Population Group (N = 78)</th>
<th>Refractive Error Population Group (N = 78)</th>
<th>0.05 Level Unpaired t-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>QoL subscale scores mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual quality</td>
<td>27.4</td>
<td>18.9</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Ocular symptoms</td>
<td>27.4</td>
<td>26.4</td>
<td>32.7</td>
<td>0.02</td>
</tr>
<tr>
<td>Nausea</td>
<td>27.4</td>
<td>23.1</td>
<td>0.03</td>
<td>0.31</td>
</tr>
<tr>
<td>Psychiatric distress</td>
<td>27.4</td>
<td>24.3</td>
<td>32.7</td>
<td>0.02</td>
</tr>
<tr>
<td>Appetite when eating</td>
<td>27.4</td>
<td>24.3</td>
<td>0.03</td>
<td>0.31</td>
</tr>
<tr>
<td>Ambulation and coping</td>
<td>27.4</td>
<td>26.4</td>
<td>32.7</td>
<td>0.02</td>
</tr>
<tr>
<td>Pain intensity</td>
<td>27.4</td>
<td>23.1</td>
<td>0.03</td>
<td>0.31</td>
</tr>
<tr>
<td>Olfactory function</td>
<td>27.4</td>
<td>24.3</td>
<td>32.7</td>
<td>0.02</td>
</tr>
<tr>
<td>Motor function</td>
<td>27.4</td>
<td>26.4</td>
<td>32.7</td>
<td>0.02</td>
</tr>
<tr>
<td>Physical component summary</td>
<td>27.4</td>
<td>26.4</td>
<td>32.7</td>
<td>0.02</td>
</tr>
<tr>
<td>SF-36 total score</td>
<td>27.4</td>
<td>26.4</td>
<td>32.7</td>
<td>0.02</td>
</tr>
</tbody>
</table>


* Adjusted for baseline values of outcome under investigation and covariates in the model.
Figure Legend:
Spectacle-wear compliance in the refractive error correction group: Amount of time overall in the previous week residents reportedly wore spectacles as judged separately by the resident and the certified nursing assistant.

Alabama

- Alabama Medicaid cover adults for “routine” eye exam and eye glasses every 3 years… till October 1

- Reduced Visual Acuity
- Reduced Accommodation
- Reduced Contrast Sensitivity
- Reduced Dark Adaptation
- Reduced Light Adaptation
- Increased Intraocular Light Scatter
- Reduced Light Transmission
- Reduced Retinal Sensitivity
Visual Acuity

My arms are too short?

Presbyopia
- Loss of Accommodation
- Prevalence 100%
- Symptomatic at 40-45
- By 55 completely dependent on reading glasses
- Anti-cholinergic drugs make it worse

By 55, 50% lose ability to see well from arm's length distance; progress is modest by 60. This has remained true.
Light and Dark Adaptation

Going Outside (6am bar?)  Going In to The Movie

Visual Processing Speed

- A decline in cognitive processing across a variety of domains with aging
- Speed of visual processing declines with age
- Associated with a variety of functional tasks
  - Driving
  - Falls
  - General Mobility

UFOV

[Diagram of UFOV test]
Color Vision

- Yellowing of lens – subtracts blue light
- Color confusion of blues and blue greens

Glare

- Changes in the crystalline lens results in light scatter
- Reported glare 2X increased odds of reduced night driving
- Night driving reduction most common driving adaptation

Lighting
Psychophysical Summary

Eyelids
- Ptosis
- Entropion
- Ectropion
- Blepharitis
- Lumps and Bumps
- Poor Tear Production
Dry Eye

- Ubiquitous
- Prevalence 30-50% by age 85
- Multi-factorial: Drugs, Environment, Hormonal
- Artificial Tears
- Plugs
- Anti-inflammatory Drugs

What’s Newer

- Emphasis on Inflammatory Nature
- Steroids for one month/Cyclosporine Ophthal Emulsion (Restasis) BID
- Reduced dry eye with Omega 3 supplementation
- Xiidra (lifitegrast) lymphocyte function-associated antigen-1 (LFA-1) antagonist
Main Causes of Visual Impairment

- Cataracts
- Refractive Error
- Age related macular degeneration
- Glaucoma
- Diabetic Retinopathy
- Optic Nerve Disease
Cataract

- Leading cause of blindness worldwide
- Most frequently performed surgery in the United States
- Accounts for 1% of total Medicare budget
- Prevention is becoming an issue
- Cortical cataract: direct sun link
- Nuclear cataracts: most common form needing surgery – sun link is less linked to antioxidant levels in anterior chamber
- 70-80% of NH residents have clinical cataract
Mortality - 90 day mortality is lower than age matched adults who don’t have surgery
Cost Benefit  Women 96/ Men 95
Dementia- No clear guidelines on when there is or isn’t a benefit, some studies suggest a cognitive benefit, may have a higher day of surgery cancellation rate
Complications 90 yo’s no greater complication rate than 80 yo’s

Other Points
- Decision making capacity/surrogates
- Can have same day eval /surgery
- Anticoagulants/anti-platelets don’t have to be stopped
- Post op care can be done at the facility
What’s New

- Ocular Hypertension Treatment Study
- 50% reduced risk of developing glaucoma with pressure lowering in those at risk (with borderline pressure and findings)
- A variety of new topical drops

Diabetic Retinopathy
What’s New

- New Instrumentation
- Screening – who, how, how often
- AGS recommendation is low risk elderly every two years
- Severe retinopathy is uncommon in NH residents
Macular Degeneration

- Wet 20%
- Dry 80%
- Dry slowly progressive, with better acuity
What’s New

- Prevention - Age Related Eye Disease Study
  25% Risk reduction with vitamin combination
  500 mg Vit C, 400 IU Vit E, 15 mg Beta Carotene (15,000 IU Vit A), 80 mg Zinc, 2mg cupric Oxide
- ARMD susceptibility genes discovered and the controversy
- New Treatments
  - Injection, Injections and Injections
  - Dry ARMD treatments

Injections for macular degeneration 16% of Medicare drug budget and increasing
Done by retina specialists at the office, won’t go to facilities
Low vision can help cognitively able residents

Questions?