Policy Changes to Reduce Motor Vehicle Collisions via Earlier Cataract Surgery

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Cataract Facts

- About 40% of White and 60% of African Americans age 65 to 74 have cataracts.
- Cataracts cause visual deficits in
  - Useful Field of Vision
  - Visual Acuity
  - Contrast Sensitivity
  - Disability Glare

Quality of Life with Cataracts

- Tengs & Wallace (2000)
  - “Mild” = .59; “Moderate” = .45; “Severe” = .29
  - “Perfect Health” = 1.0
- Kaplan et al (2010) found that Quality of Life improvement following cataract surgery ranged from virtually zero to about 9% (median 3.7%) depending on which survey instrument was used.
Motor Vehicle Crashes

- Older adults drive less but have twice the rate of crashes per mile driven compared with other age groups.
- Older drivers involved in a crash are more likely than younger adults to receive injuries that lead to disability and death.
- Driving mileage declines with age for older drivers but crash rate rises.
- Surprisingly, mileage does not increase after cataract surgery despite improved vision.

Crash Rates at follow-up
per million person miles, age 55-84

<table>
<thead>
<tr>
<th>After Cataract Surgery</th>
<th>Comparison Cataract Group without Surgery</th>
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<tbody>
<tr>
<td>N=174</td>
<td>N=103</td>
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<tr>
<td>5.77</td>
<td>8.95</td>
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RR  95% CI
0.64 (0.37 – 1.13) crude
0.47 (0.23 – 0.94) adjusted

Owsley et al. JAMA 2002
Criteria for Cataract Surgery

- In the U.S., Reimbursement is allowed when the individual with cataract complains of significant difficulty in driving or performing other life activities due to poor vision.
- Technical measures of vision, by themselves, do not trigger an intervention.

Simulation Question

- How many motor vehicle collisions would be avoided in the U.S. if threshold vision measurements such as the Activities of Daily Vision Scale (ADVS) were used to determine when cataract surgery ought to be performed?
- What is the societal cost effectiveness or net benefit of earlier cataract surgery compared to current practice?
Benefits & Cost of earlier surgery

- Financial present value of **accidents avoided** and **cost of surgery** both increase with earlier surgery.
- More members of a cohort are alive in earlier years
  - 6% die from age 60 to 65
  - 15% die from age 60 to 70

Cataract Surgery

- Intraocular lens transplant is now highly effective at improving vision with low (≈ 1%) risk of complications.
- Cost per eye, typical Medicare rates (Alabama 2008, CPT code 66984)
  - Ophthalmologist's fee: $581
  - Anesthesiology fee: $70
  - Facility Fee: $956
  - Glasses Fee: $144 (bifocal)
  - Total = $1,751
**Data Source:** Impact of Cataract on Mobility (ICOM) study

- Prospective Cohort Study
- 377 patients from ophthalmology clinics in Birmingham AL.
  - 103, no cataract at baseline
  - 140, scheduled for cataract surgery at baseline
  - 137, with cataract, no surgery intended at baseline (but 34 chose surgery later)

**ICOM**

- 5 Year history of previous motor vehicle crashes collected at baseline from police reports.
- Cohort followed for subsequent crashes post-enrollment & post-surgery.
- Vision & related tests at baseline and follow-up at 1 and 2 years.
- At baseline, no differences in driving mileage or crash rates between surgery and no-surgery groups.
Driving Behavior

- Increased age and/or declining vision cause reductions in
  - Miles driven
  - Driving at night, in rain, in heavy traffic etc.
- Surprisingly, miles driven per week did not increase after cataract surgery for ICOM participants even though vision improved.

Owsley et al. JAMA 2002

ADVS

- Activities of Daily Vision Scale – well validated questionnaire for assessing visual difficulties due to cataract from patient’s perspective.
- 0= No sight  100= No visual Difficulties
- Subscales for
  - Day and Night Driving
  - Glare
  - Near & Far vision

Mangione et al., 1992)
Total Cost

- MVC Cost *
  - Property Damage
  - Medical and Emergency Services
  - Market Productivity
  - Household Productivity
  - Insurance Administration, Workplace, Legal, Travel
  - Delay
- Surgery Cost

* Blincoe et al. 2002

Model

- Vision = f(Age, Surgery, W)
- Miles = f(Vision, X)
- Pr(Crash) = f(Miles, Vision, Y)
- Death = f(Crash, Age)
- Other Costs = f(Pr(Crash))
- QoL = f(Vision, Z)
Monte Carlo Model Structure

- Compare Current Practice to Earlier Surgery
- Randomly draw a “person” who ages from 60 to 89 and who risks having a MVC; Repeat drawing for 100,000 persons & average the results.
- Race, Gender probability from US Pop
- Annual Mortality from US Life Tables
- Randomly assign ADVS vision score based on population in ICOM study. Vision then randomly declines 0% to 3% per year until death or improvement (usually) due to cataract surgery.

Model Structure (con.)

- Miles Driven depends on Age & Vision
  - Miles do not increase after Cataract Surgery
- Probability of MVC depends on age, mileage (+), male (+), ADVS (-), cataract surgery (-).
- Surgery Threshold
  - “Current Practice” ADVS <= 80
  - “Earlier Surgery” ADVS <=70
Sensitivity Analyses

- Improve life expectancy
- Change thresholds to make Early Surgery earlier and Current Practice later.
- Triple the cost of cataract surgery
- Faster decline in vision before cataract surgery

Results (base model)

- Over a 30 year period from age 60 to 89, undiscounted, a policy change from Current Practice to Earlier Surgery results in:
  - MVCs decline 21% (from 14,601 to 11,487 per 100,000 persons)
  - Fatalities decline 21% (from 33 to 26 per 100k)
  - MVC costs decline 21% (from $129 to $102 million per 100k persons)
Results (con., base case)

- Mean age at surgery falls (from 64.7 to 63.6) and the lifetime probability of having cataract surgery rises from 0.55 to 0.77.
- Pre-Medicare (age 60-64) surgery costs rise (from $862 per $1,266 per person) (46.8%)
- Medicare age (65 to 89) surgery costs rise from $243 to $264 per person (8.8%)

Results (con., base case)

- Total costs (all MVC costs plus cataract surgery costs) fall 16.3% from $140 to $118 million per 100k persons
- Quality of Life (QALYs) improves from 15.7 to 16.5 per person due to better vision.
- Discounting at 3% or 5% has very similar results.
- Sensitivity analyses have predictable results.
ABSTRACT
Older adults who undergo cataract extraction have roughly half the rate of motor vehicle collision (MVC) involvement per mile driven compared to cataract patients who do not elect cataract surgery. Currently in the U.S., most insurers do not allow payment for cataract surgery based upon the findings of a vision exam unless accompanied by an individual's complaint of visual difficulties that seriously interfere with driving or other daily activities. As a consequence, surgery tends to occur after significant vision problems have emerged. We hypothesize that a policy encouraging cataract surgery earlier for a lesser level of complaint would significantly reduce MVCs among older drivers. We used a Monte Carlo model to simulate the MVC experience of the U.S. population from age 60 to 89 under alternative protocols for the timing of cataract surgery which we call “Current Practice” (CP) and “Earlier Surgery” (ES). Our base model finds, from a societal perspective with undiscounted 2010 dollars, that switching to ES from CP reduces by about 21 percent the average number of MVCs, fatalities, and MVC cost per person. The net effect on total cost— all MVC costs plus cataract surgery expenditures—is a reduction of about 16%. Quality adjusted life years would increase by about 5%. From the perspective of payers for healthcare, the switch would increase cataract surgery expenditure for ages 65+ by about 8% and for ages 60 to 64 by about 47% but these expenditures are substantially offset after age 65 by reductions in the medical and emergency services component of MVC cost. Similar results occur with discounting at 3% and with various sensitivity analyses. We conclude that a policy of ES would significantly reduce MVCs and their associated consequences.

Summary
Older adults who undergo cataract extraction have roughly half the rate of motor vehicle collision (MVC) involvement per mile driven compared to cataract patients who do not elect cataract surgery. Currently in the U.S., most insurers do not allow payment for cataract surgery based upon the findings of a vision exam unless accompanied by an individual's complaint of visual difficulties that seriously interfere with driving or other daily activities.
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Questions?
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