



# Modeling the Societal Costs of Poor Glaucoma Medication Adherence

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## PURPOSE

- At least half of people diagnosed with glaucoma do not take their prescribed medications<sup>1</sup> though these medications have been proven to decrease glaucoma related vision loss.<sup>2</sup>
- Poor medication adherence remains an important contributor to why glaucoma remains a leading cause of blindness in the US and worldwide.
- Our purpose was to understand the societal economic impact of poor glaucoma medication adherence.

## METHODS

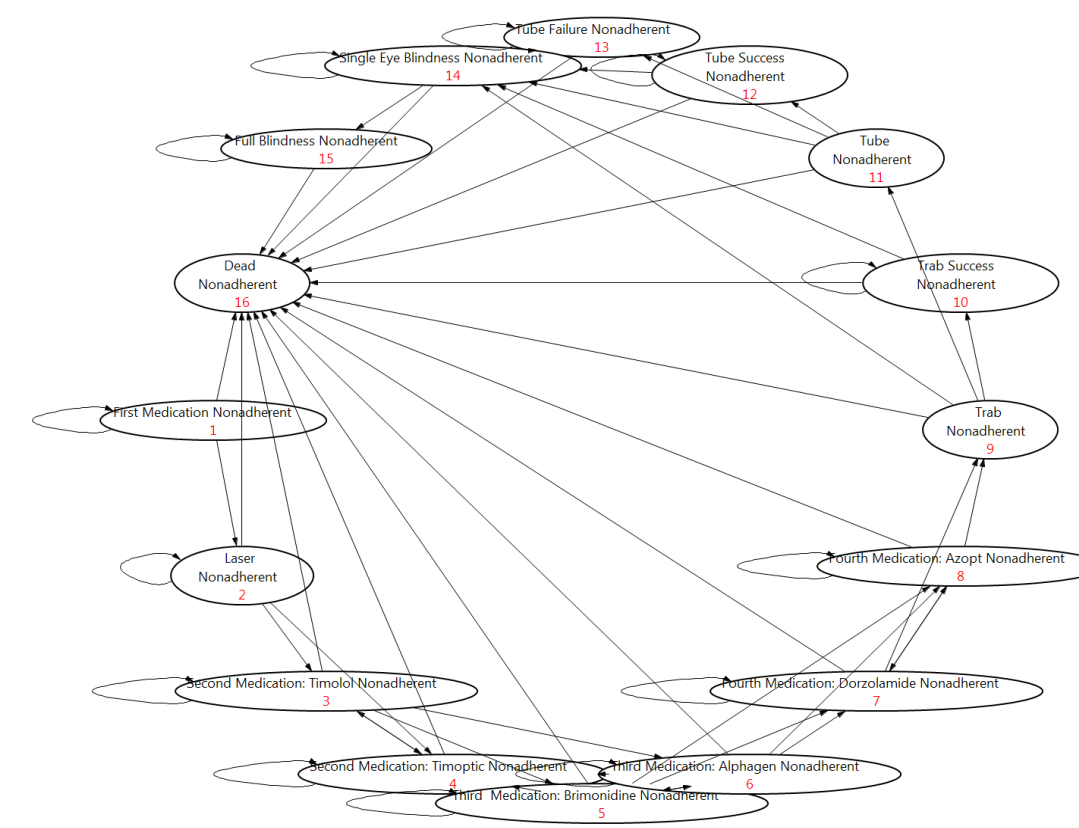
- We conducted a cost-utility analysis that assessed the societal costs of poor adherence to glaucoma medications among people ≥40 years of age with newly diagnosed glaucoma on a 60-year (full life) time horizon.
- Glaucomatous progression was based on data from the recent United Kingdom Glaucoma Treatment Study.<sup>3</sup>
- Participants with glaucoma entered the model at age 40 with a mean deviation in the better seeing eye of -1.4dB ±1.9d and -4.3dB ± -3.4dB in the worse seeing eye.<sup>3</sup>
- Participants who worsened each year accumulate -0.8Db loss among those with mild and moderate disease and -1.6Db loss among those with severe disease compared to -0.1dB loss for those who remain stable.<sup>4</sup>
- Probabilities of worsening disease were assigned among treated patients according to clinical trial data.<sup>5 6 7</sup>
- Medication adherence values were assigned, and those with poor adherence were modeled as having outcomes similar to the placebo arm.<sup>8</sup>
- As patients' mean deviation deteriorated, they transitioned between health states from mild (≥-6dB), to moderate (<-6dB to ≥-12dB), to severe glaucoma (<-12dB to ≥23dB) to unilateral (<-23dB) and bilateral blindness.
- At each health state, patients incurred direct and indirect medical costs and established health utilities.

Table 1. Model Costs and Utilities

Cost Parameter	Base Case Value
CPT Codes	
Level IV Office Visit, New Patient (CPT 99204) <sup>9</sup>	\$166.16
Gonioscopy (CPT 92020) <sup>9</sup>	\$27.28
Pachymetry (CPT 76514) <sup>9</sup>	\$15.43
Visual Field Testing (CPT 92083) <sup>9</sup>	\$65.32
Fundus Photography (CPT 92250) <sup>9</sup>	\$66.75
Optical Coherence Tomography (CPT 92134) <sup>9</sup>	\$41.63
Level IV Office Visit, Return Patient (CPT 99214) <sup>9</sup>	\$108.74
Level III Office Visit, Return Patient (CPT 99213) <sup>9</sup>	\$73.93
Low Vision Services, New Patient (CPT 99205) <sup>9</sup>	\$209.23
Low Vision Services, Return Patient (CPT 99214) <sup>9</sup>	\$108.74
Occupational Therapy, Initial Evaluation (CPT 97166) <sup>9</sup>	\$92.52
Occupational Therapy Home Visits (CPT 97530 & CPT 97535) <sup>9</sup>	\$76.93
Trabeculectomy with Anti-metabolite (CPT 66170) + \$275 Anesthesia fee* <sup>9</sup>	
Trabeculectomy Revision (CPT 66185) + \$275 Anesthesia <sup>9</sup>	\$1,133.46
Tube Shunt Implant (CPT 66180) + \$275 Anesthesia <sup>9</sup>	\$1,431.69
Tube Shunt Implant Complications (CPT 66185) + \$275 Anesthesia <sup>9</sup>	\$1,133.46
Laser Trabeculoplasty (CPT 65855) <sup>9</sup>	\$248.35
Facility Fees for Glaucoma Surgery <sup>10</sup>	\$3,000-\$7,000
Medication Costs	
Latanoprost 2.5 mL <sup>11</sup>	\$15.55 (Akron, Inc)
Xalatan 2.5 mL <sup>11</sup>	\$203.78 (Pharmacia)
Timolol 0.5% 10 mL <sup>11</sup>	\$5.92 (Akron, Inc)
Timolol 0.5% GFS 5mL <sup>11</sup>	\$173.81 (Sandoz)
Brimonidine 0.2% 10 mL <sup>11</sup>	\$27.44 (Akron, Inc)
Alphagan P 0.1% 10 mL <sup>11</sup>	\$292.04 (Allergan)
Dorzolamide 2% 10 mL <sup>11</sup>	\$35.00 (Akron, Inc)
Azopt 2% 10 mL <sup>11</sup>	\$284.54 (Novartis)
Moxifloxacin 3 mL <sup>11</sup>	\$39.00 (Akron, Inc)
Vigamox 3 mL <sup>11</sup>	\$164.26 (Novartis)
Prednisolone 10 mL x 2 bottles <sup>11</sup>	\$176.86 (Sandoz)
Pred Forte 10 mL x 2 bottles <sup>11</sup>	\$554.78 (Allergan)
Ketorolac tromethamine 0.5% 5mL x 2 bottles <sup>11</sup>	\$64.04 (Akorn)
Acular 0.5% 5mL x 2 bottles <sup>11</sup>	\$524.62 (Allergan)
Atropine 2 mL <sup>11</sup>	\$8.21 (Pharmedium Services)
Other Costs	
Direct Non-Medical Costs for the Blind <sup>12</sup>	\$15,047/year
Lost Productivity for the Blind for those <Age 65 <sup>12</sup>	\$10,866/year
Low Vision Aids for those with ≥ 1 Eye Blind <sup>10</sup>	\$200/year
Travel to appointments <sup>13</sup>	\$22.10/appointment
Utilities	
Mild Glaucoma <sup>14</sup>	0.92
Moderate Glaucoma <sup>14</sup>	0.89
Severe Glaucoma <sup>14</sup>	0.86
Single eye blindness <sup>15</sup>	0.47
Bilateral blindness <sup>15</sup>	0.26

## RESULTS

Figure 1. Markov Model State Transition Diagram



The model was constructed as a series of Markov cycles (10,000 iterations) using treatment, disease progression, resource utilization, and outcomes over one-year time horizons. All patients entered the model with mild glaucoma; the odds of disease progression determined the decibel reduction in each year of the model, the accumulation of which determined each subsequent state transition.

Figure 2. Markov State Probability Diagrams

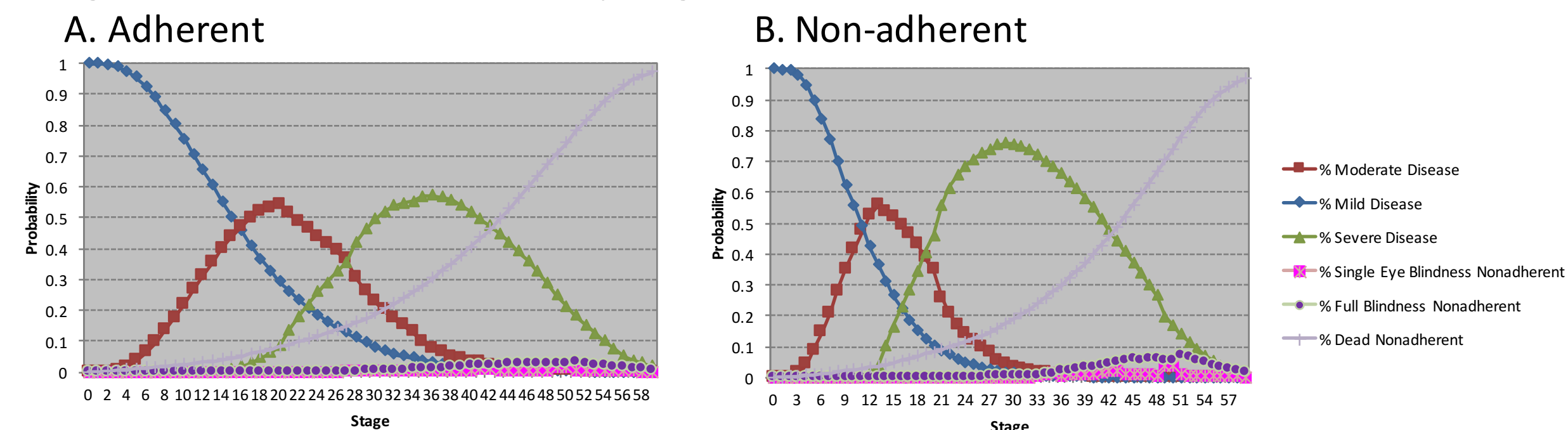
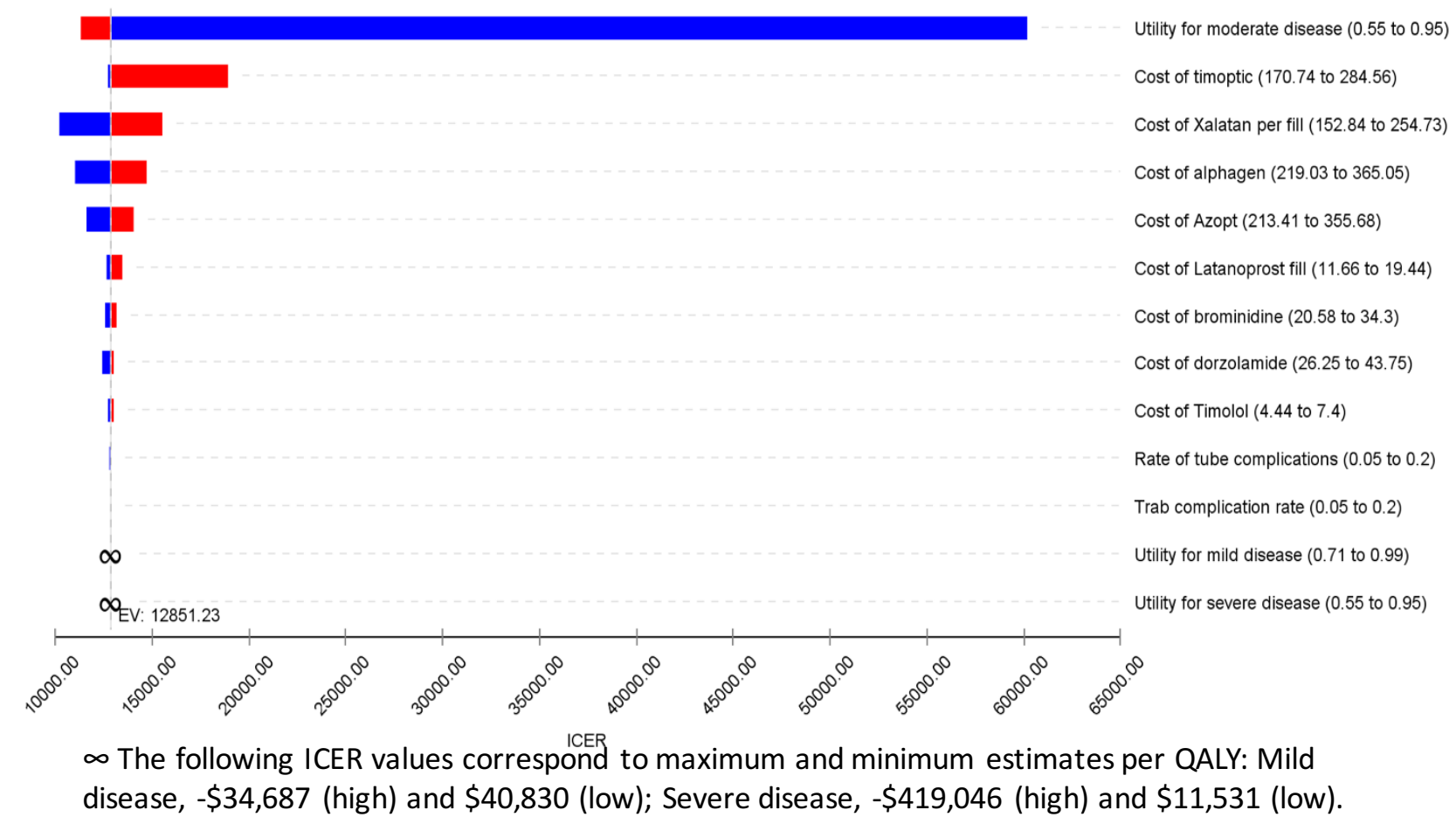


Table 2. Main Outcomes

	Adherent	Non Adherent
Cost, mean (SD)	\$49,661 (\$29,065)	\$46,013 (\$35,820)
Effect, mean (SD)	20.94 (4.25)	20.66 (4.19)
Incremental Cost	\$3,648	
Incremental Effect	0.28	
ICER	\$13,027/QALY	
Time to First Blindness	21 years (age 61)	20 years (age 60)

Figure 3. Tornado Diagram of Sensitivity Analyses Comparing Adherent to Non-adherent Patient Lifetime ICERS



The following ICER values correspond to maximum and minimum estimates per QALY: Mild disease, -\$34,687 (high) and \$40,830 (low); Severe disease, -\$419,046 (high) and \$11,531 (low).

## CONCLUSIONS

- Adherence to glaucoma medications resulted in improved quality of life at an ICER of \$13027/QALY.
- At a standard US willingness to pay of \$50,000/QALY, there would be ample economic value in programs targeted at improving glaucoma medication adherence.
- Future work should focus on epidemiologic estimates of the burden of non-adherence and modeling poor glaucoma follow up adherence.

## SUPPORT



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