The Relationship Between Compliance and Blindness Prevention in Economic Models for Diabetic Retinopathy Screening

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Objective

- To quantify the relationship between improvements in diabetic retinopathy (DR) screening compliance and reductions in blindness outcomes in published economic modeling studies evaluating new DR screening programs or technologies.

Background

- DR is a leading cause of blindness in the United States and globally despite annual DR screening recommendations and the availability of effective treatments.

- Compliance with DR screening recommendations has remained between 45% and 60% in recent decades, motivating policy initiatives and technological innovations seeking to improve access to and compliance with DR screening.

- Relating DR screening compliance to long-term blindness outcomes depends on a complex intersection of population characteristics, DR risk factors, and the effectiveness of available DR screening technologies.

- Acknowledging this complexity, studies estimating the impact of improvements in compliance on reduction in blindness tend to rely on modeling analyses as these conduct valid economic evaluations of DR screening policies or technologies.

- Published economic models for DR screening represent a unique resource to investigate the relationship between screening compliance and blindness across a variety of populations, settings, and comparators.

Methods

- Recently published systematic literature reviews of economic models for DR screening were supplemented with a targeted PubMed search to examine this analysis.

- To be considered for this analysis, the identified studies were required to satisfy the following criteria:
  - Use an economic model to compare two annual DR screening programs or compare an annual DR screening program with no screening.
  - Report on compliance with annual DR screening and associated blindness outcomes (percent of blindness or years of blindness in one year).
  - Provide sufficient detail on compliance input parameters and how compliance is calculated to be able to calculate percentage point increases in compliance and percentage reductions in blindness outcomes.

- Data extraction for studies meeting these criteria was performed by collecting site, study year, and country of the year, target population, time horizon, screening technologies compared, compliance levels, and blindness outcomes.

- For each pair of DR screening alternatives compared, the difference in compliance and the percentage reduction in blindness outcomes were calculated.

- Prior to analysis, all blindness outcomes were converted to a per-person basis.

- For studies comparing three DR screening alternatives, the two-pair comparisons with the lowest compliance screening alternative (e.g., no screening) were selected.

- Trends in the relationship between improvements in compliance and reductions in blindness outcomes and between improvements in compliance and reductions in years of blindness were analyzed separately.

Results

- Of the 21 economic modeling studies for DR screening identified, 6 studies reported compliance levels and blindness outcomes in sufficient detail for subsequent analysis (Figure 1).

- Nine studies were excluded because they did not report compliance levels or the DR screening alternative evaluated did not provide screening for DR.

- Five studies were excluded because they did not report sufficient detail to estimate percentage reductions in blindness outcomes (i.e., providing an average annual reduction without specifying the population or country).

- One additional study was excluded because the modeled alternative (no screening) was not appropriate as the comparator group in a head-to-head analysis.

- The studies exhibited a consistent trend in the relationship between annual DR screening compliance and reductions in blindness outcomes, with each 10-percentage-point increase in compliance predicted to translate to an approximate 6% reduction in cases and years of blindness.

CONCLUSIONS

- Published economic modeling studies have evaluated the health benefits associated with annual DR screening across a range of populations, health plan settings, and time horizons.

- The relationship of diabetes population size and DR screening compliance progression with added with inclusion of the provision of care over time can make the interpretations of published DR screening economic analyses challenging.

- Despite these factors, the analysis presented here suggests a consistent trend in the relationship between annual DR screening compliance and blindness outcomes, with each 10-percentage-point increase in compliance predicted to translate to an approximately 6% reduction in cases and years of blindness.

- This analysis provides a guide to health-care decision makers evaluating new DR screening policies or technologies in their local contexts and highlights the ongoing importance of reporting detailed and transparent blindness outcomes in future DR screening economic analyses.

REFERENCES

1. Davies et al., 2002 United Kingdom; 6 studies reported compliance levels and blindness outcomes in the subsequent analysis.

2. Prior to analysis, all blindness outcomes were converted to a per-person basis.

3. Note: Dotted line shows best-fit trend line with intercept fixed at 0 (i.e., no increase in compliance = no reduction in blindness).

4. Davie et al., 2012 United Kingdom; 6 studies reported compliance levels and blindness outcomes in the subsequent analysis.

Figure 1. Flow Diagram for Study Selection

<table>
<thead>
<tr>
<th>Study</th>
<th>Country, Year</th>
<th>DR Screening Strategy</th>
<th>Outcomes</th>
<th>Improvement in Compliance (%-point)</th>
<th>Reduction of Blindness (E: % Reduction)</th>
<th>Reduction of Years of Blindness (E: % Reduction)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Dilated eye exam (100%) vs. no screening (0%)</td>
<td>0.232 vs. 0.327</td>
<td>10%</td>
<td>25%</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Mobile photography (75%) vs. dilated eye exam (25%)</td>
<td>0.124 vs. 0.205</td>
<td>25%</td>
<td>6%</td>
<td>6%</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Office-based photography (95%) vs. no screening (0%)</td>
<td>0.0002 vs. 0.0006</td>
<td>40%</td>
<td>25%</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Dilated eye exam (82%) vs. no screening (0%)</td>
<td>0.0003 vs. 0.0006</td>
<td>60%</td>
<td>25%</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Dilated eye exam (43%) vs. no screening (57%)</td>
<td>0.0003 vs. 0.0006</td>
<td>80%</td>
<td>25%</td>
<td>25%</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Study Details, Compliance Levels, and Blindness Outcomes for Included Studies

Table 2. Improvements in Compliance Versus Reductions in Cases of Blindness

Figure 2. Improvements in Compliance Versus Reductions in Years of Blindness

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