Cost-effectiveness of tiotropium in the treatment of chronic obstructive pulmonary disease at the Veterans Affairs Medical Health Care System

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Motivation

- Tiotropium is once daily vs. ipratropium four times daily
- Convenience has its price
  - National: $91m per year
  - Baltimore VA: $1.6m per year
- Perhaps cost effective, but affordable?
- Current VA policy: non-formulary
Disease burden

- Total cost: $32.1 billion\(^1\)
- Highest cost component: hospitalizations and medications\(^2\)
- Hospitalizations also reflect poor control of disease
Overview of VA

- VA runs largest healthcare system in the world\(^3\)
- Drug benefit program
  - Covered 4.2 Million veterans in 2004\(^4\)
  - $4.2 Billion in drug spending in 2003
Literature review

- Effectiveness of tiotropium\textsuperscript{5-7}
  - Reduced exacerbations; improved dyspnea; improved QoL

- Cost-effectiveness of tiotropium vs. ipratropium\textsuperscript{8-10}
  - Higher cost / reduced exacerbations
  - ICER = €667 ($563 in 2001 dollars)\textsuperscript{8}
Objectives

- To examine the cost-effectiveness of tiotropium versus ipratropium in treating chronic obstructive pulmonary disease at the VA Medical Center
  - Disease severity
  - Clinical practice rules
Study design overview

- Retrospective study
- Payer perspective: direct costs
- Year: 2004
- Baltimore VA Medical Center
- Electronic medical records
- Resource utilization for tiotropium was imputed (N=46 in 2004)
Filled Rx  
N=2927

PFT  
N=862

Evaluable PFT  
N=847

Ipratropium patients  
N=702

No PFTs  
N=2065

Un-evaluable PFT  
N=15

Normal PFT  
N=145

Ipratropium patients  
N=702

Adjust resource utilization based on findings in literature

Hypothetical tiotropium patients  
N=702

Unit cost data

Full dataset of resource utilization and costs for ipratropium and tiotropium patients
Filled Rx N=2927

PFT N=862

Evaluable PFT N=847

Ipratropium patients N=702

Unit cost data

Full dataset of resource utilization and costs for ipratropium and tiotropium patients

Ipratropium patients N=702

Adjust resource utilization based on findings in literature

Hypothetical tiotropium patients N=702
Methods: VA data source

- Electronic chart review
  - Home oxygen use: review clinic notes as far back as 1994
  - COPD-related exacerbation (ER/hosp)
  - Exacerbation visits resulting from failure to take medication
Methods: Outcome measures (I)

- Reviewed 1,291 ER notes and 638 discharge summary notes
- Why not use ICD-9-CM 491.21?
  - Not sensitive: use of 496 instead of 491.21
  - Not specific: Use of 491.21 for a social work visit
- Sensitivity/specificity even worse for ER visits than hospitalizations
Methods: Outcome measures (II)

- **Definition of COPD exacerbation**
  - Sputum production/quality
  - Shortness of breath

- **Definition of COPD exacerbation**
  - Asthma, CXR-proven pneumonia, CHF, arrhythmias, new and severe anemia,…

- **Fraction of exacerbations will lead to emergent care or hospitalization**
  - Estimates: 7%-12%
Methods: Data from literature

- Insufficient tiotropium patients
- Relative ratio of COPD-related exacerbations
- Vincken et al. (2002): COPD-exacerbation-related hospitalizations 38% lower
- Adjustment on a per-patient basis
Unit costs

- Unit cost of a hospitalization: $1,619
- Unit cost of an ER visit: $277
- Monthly cost of ipratropium: $20
- Monthly cost of tiotropium: $68
- No discounting of costs or effects
ICERs: sub-groups

- Disease severity groups
  - Mild
  - Moderate
  - Severe
  - very severe

- Hospital utilization rule: at least one hospitalization

- ER utilization rules: among those without a hospitalization
Results
# ICERs

<table>
<thead>
<tr>
<th>Group</th>
<th>ICER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full sample</strong></td>
<td>538</td>
</tr>
<tr>
<td><strong>Disease severity</strong></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>2,233</td>
</tr>
<tr>
<td>Moderate</td>
<td>2,696</td>
</tr>
<tr>
<td>Severe</td>
<td>431</td>
</tr>
<tr>
<td>Very severe</td>
<td>-2,635</td>
</tr>
</tbody>
</table>
## ICERs by utilization rule

<table>
<thead>
<tr>
<th>Group</th>
<th>ICER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Previous hospitalization</td>
<td>-4295</td>
</tr>
<tr>
<td>ER rule</td>
<td>191-597</td>
</tr>
</tbody>
</table>
Cost-effectiveness acceptability curve

Probability that Tiotropium is cost-effective

Threshold value

- $\leq 500
- $1,000
- $1,500
- $2,000
- $2,500
- $3,000
- $3,500
- $4,000
- $4,500
- $5,000
- $5,500
- $6,000
- $6,500
- $7,000
- $7,500
- $8,000
- $8,500
- $9,000
- $9,500
- $10,000

$0
$500
$1,000
$1,500
$2,000
$2,500
$3,000
$3,500
$4,000
$4,500
$5,000
$5,500
$6,000
$6,500
$7,000
$7,500
$8,000
$8,500
$9,000
$9,500
$10,000

1.00

$2,900
Discussion:

I CER by sub-groups

- Hospital rule is cost-saving
- Stricter ER rules may be cost-saving but are impractical
- Use by very severe patients is cost-saving
- Requirement of a PFT (~20% with normal PFTs)
Limitations

- No actual tiotropium patients
- Relative ratios from clinical trial in a non-veterans population
- External validity of VA sample
Conclusion

- Convenience rule unacceptable due to affordability
- Current rule: COPD diagnosis; ipratropium; ≥2 urgent/emergent care visits or ≥1 hospitalization
- Our analysis suggests: COPD diagnosis; ipratropium; ≥2 urgent/emergent care visits or ≥1 hospitalization or very severe COPD
References

Available upon request
Questions?