Exploiting PROMs data for Cost-Effectiveness Analysis: a case study comparing different types of artificial hip prosthesis

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Structure of presentation

• Introduction to Total Hip Replacement
• Strengths and Limitations of the PROMs data
• Use of PROMs to compare health related quality of life (QoL) outcomes across treatments
• Application to a cost-effectiveness analysis
• Conclusions and further work
Total Hip Replacement (THR)

- Undertaken primarily for Osteoarthritis in elderly patients
- Highly effective at relieving pain and improving mobility
- 70,000 hip replacements performed annually in the UK
- Global implant market worth $4.7 billion in 2010
Evidence for prosthesis selection

• Three main types of prosthesis for THR:
  – Cemented (£700-800)
  – Cementless (£1400 – 1800)
  – Hybrid (cemented stem, cementless cup, £1200 – 1500)

• Cementless now the most popular type in the UK and US

• Evidence of lower failure rates for cemented prostheses (NJR Annual Report 2010)

• Weak evidence of differences in quality of life across prosthesis types

• Three economic evaluations recommended cementless hips but all either ignored quality of life (QoL) differences (Marinelli 2008, Di Tanna 2010), or failed to adjust for casemix (Givon 1998)
PROMs data: strengths and challenges

Strengths
- Representative - all providers and high recruitment and response rates
- Rich in patient characteristics
- Linkage to HES and to the National Joint Register (NJR)

Challenges:
- Missing data – incomplete response and linkage issues with NJR
- Non-randomised data – requires careful control for casemix
- Single follow-up at six months post-op
State of the art methods used to control for casemix whilst allowing for missing data

- Six subgroups pre-specified: men and women aged 55-64, 65-74, 75-84
- Missing data handled with Multiple Imputation
- Each patient paired with two similar patients but different prosthesis types
- Regression adjustment after matching to control for any remaining differences in casemix
- Matching undertaken with GenMatch – superior method to propensity scores (Sekhon & Grieve 2011; Diamond & Sekhon 2012)
## Mean post-op QOL by subgroup

<table>
<thead>
<tr>
<th></th>
<th>Women</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Age</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>EQ5D</td>
<td>0.750</td>
<td>0.763</td>
<td>0.739</td>
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<tr>
<td>OHS</td>
<td>38.5</td>
<td>37.7</td>
<td>36.1</td>
</tr>
</tbody>
</table>

|                  | Men              |         |         |
|                  | Age              | 60      | 70      | 80      |
| EQ5D             | 0.765            | 0.790   | 0.775   |
| OHS              | 38.9             | 39.4    | 38.2    |
# Impact of prosthesis type on post-op QOL

<table>
<thead>
<tr>
<th>Post-op EQ-5D-3L compared to cemented</th>
<th>Women</th>
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</thead>
<tbody>
<tr>
<td>Age</td>
<td>60</td>
<td>70</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Cementless</td>
<td>0.002</td>
<td>0.018</td>
<td>-0.005</td>
<td></td>
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<tr>
<td>Hybrid</td>
<td>0.015</td>
<td>0.023</td>
<td>-0.003</td>
<td></td>
</tr>
</tbody>
</table>

| Men |  |  |  |
| Age | 60 | 70 | 80 |
| Cementless | 0.010 | 0.017 | 0.008 |
| Hybrid | 0.013 | 0.029 | 0.027 |
Cost-effectiveness Analysis: methods

Need to extrapolate post-op QoL over patient lifetime and model prosthesis survival

- Adapted well-known Markov model (Briggs 2004)
- QoL after THR estimated from PROMs data
- Assumes differences in post-op QoL at six months maintained for prosthesis lifetime
- Prosthesis survival parameterised from HES/NJR
- Prosthesis costs supplied by NHS SupplyChain
- Six subgroups considered: men and women aged 60, 70, 80.
Cost-effectiveness Analysis: results

- Hybrids most cost-effective prosthesis type for all subgroups except women aged 80 (cemented best)
- Cementless never cost-effective
- Greater uncertainty for men aged 60
- QoL differences drive the results – far more important than differences in prosthesis longevity
- Sensitivity analysis using only OLS regression to adjust for casemix in analysis of post-op QoL gives the same results for each subgroup except men aged 80
- Results robust for 70 year olds in sensitivity analysis in which differences in post-op QoL were assumed to last two years
Cost-effectiveness Acceptability Curve for women aged 70

- **Hybrid**
- **Cementless**
- **Cemented**

Willingness to pay per QALY, £ thousands

Probability of being cost-effective
Conclusions

• PROMs allows quantification of small differences in QoL across treatments which may be difficult to capture in trials
• These differences can drive cost-effectiveness results
• Potential to improve outcomes for routine surgical procedures
• Care is needed to control for casemix
• Further work will compare top ten brands of hip prostheses and examine Total Knee Replacement
References

• National Joint Registry, 8th Annual Report: National Joint Registry for England and Wales, 2011