Multi-Survey Linkage for the Calculation of Occupation-Specific Quality-Adjusted Life Years (QALYs) in the US Workforce

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Background

• Adults aged 65 years and older:
  o Fastest growing demographic group
  o Projected to almost double between the present day and 2050, rising from 6% to 11%
  o 1 in 5 of these elderly are poor

• Proportion of employed workers aged 65 years and older is increasing.

• Increasing health costs reducing retirement savings, and place financial burden on the elderly.

Background

• Blue-collar and elderly more likely than younger or more affluent people to suffer from disabling conditions and live shorter lives.

• Arthritis:
  o Lens to view the convergent social phenomena of aging, workforce globalization, health costs, and falling quality of life among the middle and lower classes.
Study Objective

• Use the burden of disease attributable to arthritis by occupational class to illustrate the challenges faced by the older poor.
Approach

• Quality-Adjusted Life Year (QALY)
  – Main Outcome Measure
  – Two dimensions:
    • Time spent alive
    • One's health-related quality of life (HRQoL)
  – Scaled from 0 (death) to 1 (perfect health) and can be used to adjust the amount of time lived in good health to reflect relatively higher or lower morbidity

Approach

3-step process to estimate quality-adjusted life expectancy (QALE) and to calculate incremental QALYs arising from arthritis

- Estimate mean EQ-5D scores and mortality probabilities in 1-year age intervals by occupational class.

- Used mortality probabilities and these scores to build life tables for each occupational class.

- Subtract QALE by occupational class at different age intervals - difference between QALE values yields the incremental QALYs.

Study Databases Employed

• 1997–2004 National Health Interview Survey (NHIS)
  – Annual population-based survey of the resident non-institutionalized US civilian population.
  – Family and Adult Core

• 2001–2003 Medical Expenditure Panel Survey (MEPS)
  – Linked EQ-5D scores (a health-related quality of life measure) from the NHIS responders that participated in MEPS.

• Linked data from the NHIS to mortality data from the National Death Index to estimate the probability of death.
Occupational and Arthritis classification

- Occupation for the week preceding the NHIS interview.

- Workers grouped according to 2000 Standard Occupational Codes into four major occupational groups:
  - white-collar, Service, Farm and blue-collar workers

- NHIS, arthritis status adults aged 18 years and older assessed by question: “Have you EVER been told by a doctor or other health professional that you have some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?”

Health-related quality of life measure

• Derived from EQ-5D measure in MEPS.
  – Five-items measuring each 5 dimensions of health status
    (mobility, self-care, usual activities, pain or discomfort, and
    anxiety or depression)
  – Three-levels per dimension (no problem, some problems, and
    extreme problems)

• Score function, an EQ-5D index score based on responses to the 5-item questionnaire provided in MEPS.

• Preference scores measured on scale from 0 to 1
  – 0 represents death
  – 1 represents perfect health
Estimating Probability of Death

- Calculate age- and occupation-specific probabilities of death by arthritis status by using the NHIS linked with the National Death Index.


- Study time period:
  - 16,965 deaths among the 242,223 NHIS-participating adults.
  - Calculate probability of death for all adults aged 18 to 88 years by arthritis status and occupational class by using coefficients from these pooled logistic regression models.
Quality-adjusted Life Expectancy Measure

• Construct total of 8 life tables in 1-year age intervals with US mortality data for each of the occupational classes (white-collar, service, farm, and blue-collar workers) by arthritis status.

• QALE at age $a$ is:  
  \[
  \text{QALE}_{acr} = \sum_{j \geq a} B_{jcr} \times X_{jcr} / N_{acr}
  \]

• Calculating incremental QALYs.

# TABLE 1—Occupation- and Age-Stratified Characteristics Among US Workers With Arthritis in the Combined National Health Interview Survey (1997–2004) and Medical Expenditure Panel Survey (2001–2003)

<table>
<thead>
<tr>
<th>Occupational Groups</th>
<th>Sample No.</th>
<th>Estimated Annual US Worker Population</th>
<th>Workers Aged ≥65 Years, %</th>
<th>In Workforce With Arthritis, %</th>
<th>Aged ≥65 Years in Workforce With Arthritis, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>All workers</td>
<td>19699</td>
<td>187,090,449</td>
<td>15</td>
<td>22</td>
<td>53</td>
</tr>
<tr>
<td>Blue-collar workers</td>
<td>5017</td>
<td>431,745,008</td>
<td>16</td>
<td>22</td>
<td>47</td>
</tr>
<tr>
<td>Aged 18-24 y</td>
<td>332</td>
<td>317,4913</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Aged 25-44 y</td>
<td>2215</td>
<td>188,399,844</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Aged 45-64 y</td>
<td>1656</td>
<td>14,005,265</td>
<td></td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Aged 65-74 y</td>
<td>468</td>
<td>3,861,040</td>
<td></td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Aged ≥75 y</td>
<td>346</td>
<td>3,293,305</td>
<td></td>
<td>53</td>
<td></td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Occupational Groups</th>
<th>Respondents With Arthritis, Mean EQ-5D (95% CI)</th>
<th>Respondents Without Arthritis, Mean EQ-5D (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All workers</td>
<td>0.69 (0.67, 0.70)</td>
<td>0.88 (0.87, 0.89)</td>
</tr>
<tr>
<td>White-collar workers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aged 18-24 y</td>
<td>0.72 (0.71, 0.74)</td>
<td>0.90 (0.89, 0.91)</td>
</tr>
<tr>
<td>Aged 25-44 y</td>
<td>0.84 (0.77, 0.92)</td>
<td>0.91 (0.90, 0.93)</td>
</tr>
<tr>
<td>Aged 45-64 y</td>
<td>0.74 (0.71, 0.78)</td>
<td>0.91 (0.90, 0.91)</td>
</tr>
<tr>
<td>Aged 65-74 y</td>
<td>0.74 (0.72, 0.75)</td>
<td>0.88 (0.87, 0.89)</td>
</tr>
<tr>
<td>Aged ≥75 y</td>
<td>0.72 (0.70, 0.75)</td>
<td>0.87 (0.85, 0.88)</td>
</tr>
<tr>
<td></td>
<td>0.67 (0.64, 0.71)</td>
<td>0.79 (0.76, 0.82)</td>
</tr>
</tbody>
</table>
Quality-adjusted life expectancy for worker with and without arthritis

Incremental QALYs

<table>
<thead>
<tr>
<th></th>
<th>Age 65 Arthritis</th>
<th>Age 65</th>
<th>Age 25 Arthritis</th>
<th>Age 25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>10.9</td>
<td>14.7</td>
<td>33</td>
<td>44.2</td>
</tr>
<tr>
<td>Farm</td>
<td>10.5</td>
<td>13.5</td>
<td>35.2</td>
<td>42.4</td>
</tr>
<tr>
<td>Service</td>
<td>12.3</td>
<td>14.1</td>
<td>33.8</td>
<td>44.6</td>
</tr>
<tr>
<td>White</td>
<td>12.6</td>
<td>16.7</td>
<td>39.1</td>
<td>50</td>
</tr>
</tbody>
</table>
Summary / Conclusions

• Arthritis serves as a powerful lens for looking at these convergent phenomena.

• Lower-income workers of older age in the service and farming sectors—more likely to have arthritis than not (58% and 67%).

• Linking multi-survey data allows for powerful investigations into the effect of QALYs on disease morbidity by occupational groups.
Acknowledgements

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