The Measurement of Health-Related Quality of Life (HRQoL)

First German Findings from the Multi-Instrument Comparison (MIC) Study

Michael Schlander, Munir A. Khan, Angelo Iezzi, Aimee Maxwell, Oliver Schwarz, Jeff Richardson

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“Generic” Multi-Attribute Utility Instruments for the Measurement of HRQoL:

Are they all the same?

- Coverage of descriptive system
- Sensitivity of dimensions
- Model used to combine the dimensions / items
- Valuation method
  (scaling instrument [VAS, SG, TTO, …])
# HRQoL:

## Comparison of Generic Index Instruments

RS, Rating Scale (Visual Analogue Scale, VAS); SG, Standard Gamble; TTO, Time-Trade Off

<table>
<thead>
<tr>
<th>Instrument</th>
<th>15D</th>
<th>A QoL8D</th>
<th>EQ-5D</th>
<th>HUI-3</th>
<th>QWB</th>
<th>SF12 (SF-6D)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scaling</strong></td>
<td>RS</td>
<td>TTO</td>
<td>TTO</td>
<td>SG</td>
<td>RS</td>
<td>SG</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td>15</td>
<td>8</td>
<td>5</td>
<td>8</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td><strong>Levels</strong></td>
<td>4-5</td>
<td>4</td>
<td>3</td>
<td>5-6</td>
<td>2-3</td>
<td>4-6</td>
</tr>
<tr>
<td><strong>No. of Health States</strong></td>
<td>31bn</td>
<td>16.8m</td>
<td>243</td>
<td>972,000</td>
<td>945</td>
<td>7,500</td>
</tr>
</tbody>
</table>
Primary MIC Study Objectives

Generic HRQoL Index Instruments

- EQ-5D-5L; SF-6D, HUI-3, 15D, QWB\(^1\), AQoL-4D/-8D
- Summary Statistics and Internal Reliability
- Assessing the Convergence and Predictive Consistency
  - Intraclass Correlations with Other Instruments
- Exploring the Sensitivity of Instruments
  - to Summary Physical and Psychosocial Dimensions
  - to SF-36 Dimensions
  - Pairwise Comparisons of Sensitivity

\(^1\)QWB not included in German analysis;
MIC Study: Countries and Chief Investigators

- **Australia:**
  - Jeff Richardson (Monash University, Australia)
  - Robert Cummins (Deakin University, Australia)

- **Canada / United States of America:**
  - Robert Kaplan (University of California Los Angeles, USA)

- **Germany:**
  - Michael Schlander (University of Heidelberg, Germany)

- **Norway:**
  - Jan Abel Olsen (University of Tromso, Norway)

- **United Kingdom:**
  - Joanna Coast (University of Birmingham, England)

The MIC Study was funded by an Australian National Health and Medical Research Council (NHMRC) project grant (ID 1006334); the German arm was further supported by the German Cancer Research Center (Heidelberg / Germany) and conducted with the Institute for Innovation & Valuation in Health Care (Wiesbaden / Germany); the Norwegian arm was facilitated by a grant from the University of Tromso.
MIC Study: Respondents

- Australia, Canada, Germany, Norway, UK, USA
  - net sample size: \( N=8,022 \); hereof, Germany (D), \( n=1,269 \)
- Samples of the healthy public (net, \( N=1,760 \); hereof D, \( n=260 \))
  - representative in terms of age group, gender, education
- Patient samples (\( N=6,262 \); hereof D, \( n=1,009 \)):
  - no quota; resulting sample highly skewed with respect to age
    - asthma (\( N=856 \); D, \( n=147 \))
    - cancer (\( N=772 \); D, \( n=115 \))
    - depression (\( N=917 \); D, \( n=160 \))
    - diabetes (\( N=924 \); D, \( n=140 \))
    - hearing problems (\( N=852 \); D, \( n=136 \))
    - arthritis (\( N=929 \); D, \( n=159 \))
    - chronic heart disease (\( N=943 \); D, \( n=152 \))
MIC Study: Questionnaire Administration
# MIC Study: Summary Statistics

## Distribution of total German sample by age and gender:

<table>
<thead>
<tr>
<th>Disease</th>
<th>Distribution of diseases by age group and gender</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>18-24  25-34  35-44  45-54  55-64  65+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M   F  M   F  M   F  M   F  M   F  M   F  M   F  T</td>
<td></td>
</tr>
<tr>
<td>Asthma</td>
<td>10  10  7  14  28  20  15  17  8  9  7  2  75  72  147</td>
<td></td>
</tr>
<tr>
<td>Cancer</td>
<td>0   0  3   7  11  9   9   19  16 10  24  7  63  52  115</td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>4   12 10  20  16  26  21  28 11  9   1   2  63  97  160</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>3   3   4   4  8   6  32  15  21 16  21  7  89  51  140</td>
<td></td>
</tr>
<tr>
<td>Hearing problems</td>
<td>3   3   1   5  12  10  28  23  21 13  17  0  82  54  136</td>
<td></td>
</tr>
<tr>
<td>Arthritis</td>
<td>0   0   2   4  11  8  33  44  20 22  9   6  75  84  159</td>
<td></td>
</tr>
<tr>
<td>Heart problems</td>
<td>2   3   2   2  9   3  19  17  45 23  23  4  100 52  152</td>
<td></td>
</tr>
<tr>
<td>No disease-Healthy public</td>
<td>6   11  22  30  24  24  28  33  25 20  26  11 131 129  260</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>28  42  51  86 119 106 185 196 167 122 128 39 678 591 1269</td>
<td></td>
</tr>
</tbody>
</table>
### MIC Study: Internal Reliability

#### Reliability of instruments

(tests carried out with public data, using Cronbach’s alpha):

<table>
<thead>
<tr>
<th>Instrument</th>
<th>No of items</th>
<th>Cronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>AQoL-4D</td>
<td>12</td>
<td>0.82</td>
</tr>
<tr>
<td>AQoL-8D</td>
<td>35</td>
<td>0.96</td>
</tr>
<tr>
<td>HUI3</td>
<td>8</td>
<td>0.74</td>
</tr>
<tr>
<td>EQ-5D</td>
<td>5</td>
<td>0.82</td>
</tr>
<tr>
<td>15D</td>
<td>15</td>
<td>0.88</td>
</tr>
<tr>
<td>ICECAP</td>
<td>5</td>
<td>0.84</td>
</tr>
<tr>
<td>SF-36</td>
<td>36</td>
<td>0.68*</td>
</tr>
<tr>
<td>IHS</td>
<td>4</td>
<td>0.47*</td>
</tr>
<tr>
<td>SWLS</td>
<td>5</td>
<td>0.92</td>
</tr>
</tbody>
</table>
MIC Study: Summary Statistics

Mean values by instrument (total n=1,269):

- EQ-5D
- HUI3
- SF-6D
- 15D
- AQoL4D
- AQoL8D

Error Bars: 95% CI
MIC Study: Summary Statistics

Mean EQ-5D values by disease group (total n=1,269):

Error Bars: 95% CI
### MIC Study: Correlations

Pearson correlation between MAU Instruments (public sample, n=260):

<table>
<thead>
<tr>
<th></th>
<th>EQ-5D</th>
<th>HUI3</th>
<th>SF-6D</th>
<th>15D</th>
<th>AQoL-4D</th>
<th>AQoL-8D</th>
</tr>
</thead>
<tbody>
<tr>
<td>EQ-5D</td>
<td>1</td>
<td>.649**</td>
<td>.595**</td>
<td>.654**</td>
<td>.530**</td>
<td>.514**</td>
</tr>
<tr>
<td>HUI3</td>
<td>.649**</td>
<td>1</td>
<td>.515**</td>
<td>.649**</td>
<td>.540**</td>
<td>.522**</td>
</tr>
<tr>
<td>SF-6D</td>
<td>.595**</td>
<td>.515**</td>
<td>1</td>
<td>.569**</td>
<td>.450**</td>
<td>.648**</td>
</tr>
<tr>
<td>15D</td>
<td>.654**</td>
<td>.649**</td>
<td>.569**</td>
<td>1</td>
<td>.558**</td>
<td>.597**</td>
</tr>
<tr>
<td>AQoL-4D</td>
<td>.530**</td>
<td>.540**</td>
<td>.450**</td>
<td>.558**</td>
<td>1</td>
<td>.623**</td>
</tr>
<tr>
<td>AQoL-8D</td>
<td>.514**</td>
<td>.522**</td>
<td>.648**</td>
<td>.597**</td>
<td>.623**</td>
<td>1</td>
</tr>
<tr>
<td>Ave</td>
<td>0.59</td>
<td>0.58</td>
<td>0.56</td>
<td>0.61</td>
<td>0.54</td>
<td>0.58</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed).
### MIC Study: Correlations

Pearson correlation between MAU Instruments (total sample, n=1,269):

<table>
<thead>
<tr>
<th></th>
<th>EQ-5D</th>
<th>HUI3</th>
<th>SF-6D</th>
<th>15D</th>
<th>AQoL-4D</th>
<th>AQoL-8D</th>
</tr>
</thead>
<tbody>
<tr>
<td>EQ-5D</td>
<td>1</td>
<td>.805**</td>
<td>.774**</td>
<td>.817**</td>
<td>.767**</td>
<td>.789**</td>
</tr>
<tr>
<td>HUI3</td>
<td>.805**</td>
<td>1</td>
<td>.720**</td>
<td>.837**</td>
<td>.784**</td>
<td>.816**</td>
</tr>
<tr>
<td>SF-6D</td>
<td>.774**</td>
<td>.720**</td>
<td>1</td>
<td>.783**</td>
<td>.749**</td>
<td>.806**</td>
</tr>
<tr>
<td>15D</td>
<td>.817**</td>
<td>.837**</td>
<td>.783**</td>
<td>1</td>
<td>.788**</td>
<td>.846**</td>
</tr>
<tr>
<td>AQoL-4D</td>
<td>.767**</td>
<td>.784**</td>
<td>.749**</td>
<td>.788**</td>
<td>1</td>
<td>.842**</td>
</tr>
<tr>
<td>AQoL-8D</td>
<td>.789**</td>
<td>.816**</td>
<td>.806**</td>
<td>.846**</td>
<td>.842**</td>
<td>1</td>
</tr>
<tr>
<td>Ave</td>
<td>0.79</td>
<td>0.79</td>
<td>0.77</td>
<td>0.81</td>
<td>0.79</td>
<td>0.82</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed).
MIC Study: Average Pearson Correlations

Pearson correlation with other MAU Instruments (total, n=1,269):

- EQ-5D
- HUI3
- SF-6D
- 15D
- AQoL-4D
- AQoL-8D
MIC Study: Pearson Correlations with SF-36

Pearson correlation of MAU Instruments with SF-36 (public, n=260):

- EQ-5D: 0.60
- HUI3: 0.55
- SF-6D: 0.85
- 15D: 0.60
- AQoL-4D: 0.45
- AQoL-8D: 0.55
MIC Study: Pearson Correlations with SF-36

Pearson correlation of MAU Instruments with SF-36 (total, n=1,269):

- EQ-5D
- HUI3
- SF-6D
- 15D
- AQoL-4D
- AQoL-8D
### MIC Study: Intraclass Correlations

Intraclass correlation with other MAU Instruments (total, n=1,269):

<table>
<thead>
<tr>
<th>Instrument</th>
<th>EQ5D</th>
<th>HUI3</th>
<th>SF-6D</th>
<th>15D</th>
<th>AQoL-4D</th>
<th>AQoL-8D</th>
</tr>
</thead>
<tbody>
<tr>
<td>EQ5D</td>
<td></td>
<td>0.79</td>
<td>0.70</td>
<td>0.58</td>
<td>0.7</td>
<td>0.79</td>
</tr>
<tr>
<td>HUI3</td>
<td>0.79</td>
<td></td>
<td>0.60</td>
<td>0.53</td>
<td>0.76</td>
<td>0.80</td>
</tr>
<tr>
<td>SF-6D</td>
<td>0.70</td>
<td>0.60</td>
<td></td>
<td>0.51</td>
<td>0.59</td>
<td>0.74</td>
</tr>
<tr>
<td>15D</td>
<td>0.58</td>
<td>0.53</td>
<td>0.51</td>
<td></td>
<td>0.40</td>
<td>0.60</td>
</tr>
<tr>
<td>AQoL-4D</td>
<td>0.70</td>
<td>0.76</td>
<td>0.59</td>
<td>0.40</td>
<td></td>
<td>0.77</td>
</tr>
<tr>
<td>AQoL-8D</td>
<td>0.79</td>
<td>0.80</td>
<td>0.74</td>
<td>0.60</td>
<td>0.77</td>
<td></td>
</tr>
<tr>
<td>Ave</td>
<td><strong>0.71</strong></td>
<td><strong>0.70</strong></td>
<td><strong>0.63</strong></td>
<td><strong>0.52</strong></td>
<td><strong>0.64</strong></td>
<td><strong>0.74</strong></td>
</tr>
</tbody>
</table>
MIC Study: Intraclass Correlations

Average intraclass correlation with other MAU Instruments (total sample, n=1,269):

- EQ5D
- HUI3
- SF-6D
- 15D
- AQoL-4D
- AQoL-8D

The graph shows the average intraclass correlations between different health-related quality of life (HRQoL) instruments, with EQ5D having the highest correlation at 1.00 and 15D having the lowest at 0.00.
MIC Study: Linear Relationships

Pairwise geometric regression results (total, n=1,269):

- **EQ5D**
  - EQ5D: HUI3
    - $y = 0.135 + 0.843x$
    - Correlation: 0.8
  - EQ5D: SF6D
    - $x = 0.38 + 1.517y$
    - Correlation: 0.77
  - EQ5D: D15
    - $x = 0.19 + 1.181y$
    - Correlation: 0.82
  - EQ5D: AQoL4D
    - $x = 0.19 + 1.181y$
    - Correlation: 0.77
  - EQ5D: AQoL8D
    - $x = 0.02 + 1.04y$
    - Correlation: 0.79

- **HUI3**
  - HUI3: SF6D
    - $x = -0.62 + 1.869y$
    - Correlation: 0.84
  - HUI3: D15
    - $x = -1.067 + 2.083y$
    - Correlation: 0.84
  - HUI3: AQoL4D
    - $x = 0.07 + 1.004y$
    - Correlation: 0.78
  - HUI3: AQoL8D
    - $x = -0.189 + 1.231y$
    - Correlation: 0.85

- **SF6D**
  - SF6D: D15
    - $x = -0.37 + 0.537y$
    - Correlation: 0.75
  - SF6D: AQoL4D
    - $x = 0.371 + 0.537y$
    - Correlation: 0.75
  - SF6D: AQoL8D
    - $x = 0.231 + 0.659y$
    - Correlation: 0.81

- **D15**
  - D15: AQoL4D
    - $x = -1.13 + 2.075x$
    - Correlation: 0.79
  - D15: AQoL8D
    - $x = 0.42 + 0.591x$
    - Correlation: 0.85

- **AQoL4D**
  - AQoL4D: AQoL8D
    - $x = 0.01 + 0.852y$
    - Correlation: 0.69

- **AQoL8D**
  - AQoL8D: AQoL4D
    - $x = 0.26 + 1.226y$
    - Correlation: 0.69
### MIC Study: Linear Relationships

**Discrepancies in marginal change between instruments** based on pairwise geometric regression results (total, n=1,269):

(coefficients b for “instrument A = a + b instrument B”)

<table>
<thead>
<tr>
<th>Instrument</th>
<th>EQ-5D</th>
<th>HUI3</th>
<th>SF-6D</th>
<th>15D</th>
<th>AQoL-4D</th>
<th>AQoL-8D</th>
</tr>
</thead>
<tbody>
<tr>
<td>EQ-5D (EQ)</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUI3 (H)</td>
<td></td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SF-6D (SF)</td>
<td>EQ=1.58(SF)</td>
<td>H=1.87(SF)</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15D (D)</td>
<td>EQ=1.76(D)</td>
<td>H=2.08(D)</td>
<td>SF=1.12(D)</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AQoL-4D (A4)</td>
<td>A4=1.18(EQ)</td>
<td>H=1.00(A4)</td>
<td>A4=1.86(SF)</td>
<td>A4=2.08(D)</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>AQoL-8D (A8)</td>
<td>EQ=1.04(A8)</td>
<td>H=1.23(A8)</td>
<td>A8=1.51(SF)</td>
<td>A8=1.69(D)</td>
<td>A4=1.23(A8)</td>
<td>1.00</td>
</tr>
<tr>
<td>Ave % Diff</td>
<td>35.0</td>
<td>47.4</td>
<td>58.8</td>
<td>74.6</td>
<td>47.0</td>
<td>34.0</td>
</tr>
</tbody>
</table>

Note that constant terms in equations have been dropped. Equations are arranged to obtain b>1 as a consistent index of deviation, which is permitted due to the use of geometric mean regressions.
Some Implications at a Glance:

- The MIC Study probably offers the most comprehensive comparison of MAU instruments done in Germany to date.

- **Differences between MAU instruments**
  - in constructs and descriptive systems
  - necessarily lead to differences in utility values.

- **Incremental utilities**
  - form the basis of “cost utility analysis”
  - but may vary by up to 100 percent between MAU instruments
  - according to geometric regression analyses.
Thank you for your attention!

Professor Michael Schlander, M.D., Ph.D., M.B.A.

Contact
www.innoval-hc.com
www.michaelschlander.com
michael.schlander@innoval-hc.com
michael.schlander@medma.uni-heidelberg.de

Address
An der Ringkirche 4
D-65197 Wiesbaden / Germany

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