**Developing a new version of the SF-6D health state classification system from the SF-36v2: SF-6Dv2:**

**Supplementary materials**

Prepared by John Brazier, Brendan Mulhern, Jakob Bue Bjorner, Barbara Gandek, Donna Rowen, Jordi Alonso, Gemma Vilagut and John Ware

17/06/2019

**Supplementary appendix 1 – Further data descriptions**

**The HODAR dataset (for full details see Currie et al 2005):**

The HODaR data were collected from both inpatient and outpatients at a large university hospital trust in Cardiff, Wales, with the vast majority of respondents living in the hospital’s catchment area. The survey data was collected by post following patient discharge, and then linked to existing routine hospital data. The inclusion and exclusion criteria ensured a wide range of eligibility within ethical requirements. All adult inpatients (aged 18 or older) were included, but people with a history of mental health problems or a learning disability were excluded if their primary diagnosis was for a mental health issue. Outpatients were recruited from different clinics at different time periods.

The self-report survey pack included a range of measures and other relevant questions. This includes demographic, behavioural, impact on employment and care satisfaction questions, the EQ-5D-3L, the SF-36, and some condition specific quality of life questionnaires. The data linked from routine records included some demographics, hospital presentation history, features of the admission and characteristics of the stay, treatment history, and diagnoses using the International Classification of Diseases.

The data underwent strict quality control processes involving an external auditing process of the data coding, and additional quality checks for anomalies and other issues by a data reviewer. The linking process used unique identifiers, with the matching checked for duplication.

The dataset is a large and unique data source with high internal consistency including people with a range of health conditions. Currie et al report some possibility of differences between responders and non responders, where across conditions, responders and have had an elective procedure. However, the size of the dataset means that any potential differences are small. The diversity of conditions and severity impacts as reported by the SF-36 means that the wide ranging responses have a level of validity for use in the generation of the SF-6Dv2 (which will be used across many different health conditions with differing severity profiles).

**Multi Instrument Comparison Study (MIC) data (for full details see Richardson et al 2012).**

The MIC data was collected online from respondents who were members of an online panel managed by the survey company CINT, who invited people to take part. Data were collected in six countries (Australia, Canada, Germany, Norway, UK and the US), with data from the four majority English speaking countries included here. Those who responded completed a range of questionnaires assessing wellbeing, satisfaction, and generic and condition specific (if relevant) health and quality of life. Wellbeing questionnaires included the Personal Wellbeing Index (PWI), the Integrated Household Survey (IHS) and the Satisfaction with Life Survey (SWLS). Generic measures of health and quality of life included the EQ-5D, AQoL-8D and 4D, HUI3, 15D, QWB, SF-36 and self TTO. The measure of capabilities ICECAP was also included. Disease specific measures for seven conditions were also included, and administered to respondents reporting the condition. These were Arthritis (AIMS2), Asthma (AQLQ), Cancer (QLQ C-30), Depression (DASS21 and K10), Diabetes (Diabetes-39), Hearing Loss (APHAB), and Heart Disease (Macnew). A level of randomisation was imposed to tackle potential order effects.

Richardson and colleagues attempted to ensure high quality responses in a number of ways, including in the introductory materials to respondents. Eight other criteria were used including:

1. Excluding people completing the survey in less than 20 minutes. The median completion time was noted as 32 minutes
2. Substantial variation in responses to a question (EQ-5D mobility) that was repeated in the survey.
3. Substantial variation in responses to SF-36 question 1 and question the concerning own health (which were identical).
4. Substantial variation in responses to SF-36 question 1 and QWB question 9a (which were identical).
5. Substantial variation in responses to own health question and QWB question 9a (which were identical).
6. Substantial variation in EQ-5D question 4 (pain) and AQoL-8D question 22 (pain) which were very similar
7. Inconsistencies from criteria 2 to 6 were summed. Those with two or more inconsistencies and a short completion time (of below 25 minutes) were removed
8. Respondents with three or more inconsistencies (from criteria 2 to 6) were removed

Although there is the potential for bias in responses due to any unobservable characteristics linked to those people who belong to online panels, the MIC data recruited respondents with a range of conditions, and a range of associated severities and impacts on quality of life. Therefore the use of these data alongside HODaR result in a core set of responses to the SF-36 that vary substantially as they include respondents with a range of diseases, and associated severity levels, that have different impacts on QoL as measured by the SF-36. This provides a basis for the development of the SF-6Dv2.

**Supplementary Appendix 2 – Exploratory Factor Analysis models with between 2 and 9 factors on overall HODaR and MIC datasets**

**Table 1: Two factor** **EFA models**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Item** | **Dim\*** | **Factors and their loading** | | | |
|  |  |  | **HODaR**† | | **MIC**‡ | |
|  |  |  | **1** | **2** | **1** | **2** |
| 3 | Limited vigorous activities | PF | **0.943** | -0.148 | **0.925** | -0.153 |
| 4 | Limited moderate activities | PF | **0.938** | -0.026 | **0.931** | -0.023 |
| 5 | Limited lifting | PF | **0.904** | -0.001 | **0.894** | 0.002 |
| 6 | Limited several flights of stairs | PF | **0.953** | -0.077 | **0.954** | -0.090 |
| 7 | Limited one flight of stairs | PF | **0.930** | -0.041 | **0.944** | -0.064 |
| 8 | Limited bending, kneeling | PF | **0.910** | -0.097 | **0.901** | -0.104 |
| 9 | Limited walking more than one mile | PF | **0.985** | -0.088 | **0.966** | -0.084 |
| 10 | Limited walking several hundred yards | PF | **0.963** | -0.045 | **0.947** | -0.038 |
| 11 | Limited walking 100y | PF | **0.918** | -0.016 | **0.904** | -0.016 |
| 12 | Limited bathing | PF | **0.802** | 0.081 | **0.757** | 0.082 |
| 13 | Cut down time spent on work/other activities | RP | **0.756** | 0.180 | **0.673** | 0.280 |
| 14 | Accomplished less | RP | **0.771** | 0.195 | **0.646** | 0.325 |
| 15 | Limited in work | RP | **0.820** | 0.131 | **0.779** | 0.198 |
| 16 | Difficulty work | RP | **0.813** | 0.165 | **0.742** | 0.249 |
| 17 | Cut down time spent on work/other activities | RE | 0.222 | **0.709** | 0.180 | **0.746** |
| 18 | Accomplished less | RE | 0.212 | **0.716** | 0.121 | **0.779** |
| 19 | Didn’t do work/other activities carefully | RE | 0.237 | **0.691** | 0.162 | **0.752** |
| 20 | Emotion/physical health interfere social | SF | **-0.451** | **-0.514** | -0.263 | **-0.670** |
| 32 | Last 4 weeks emotion/physical health | SF | **0.462** | **0.505** | 0.308 | **0.641** |
| 21 | Bodily pain last four weeks | P | **-0.536** | -0.205 | **-0.671** | -0.131 |
| 22 | Pain interfere with normal work | P | **-0.645** | -0.260 | **-0.712** | -0.203 |
| 24 | Very nervous | MH | -0.115 | **0.818** | -0.177 | **0.800** |
| 25 | Down dumps | MH | -0.149 | **0.954** | -0.171 | **0.927** |
| 26 | Calm/peaceful | MH | 0.100 | **-0.800** | 0.138 | **-0.813** |
| 28 | Down/depressed | MH | -0.212 | **0.972** | -0.183 | **0.958** |
| 30 | Been happy | MH | 0.105 | **-0.805** | 0.134 | **-0.816** |
| 23 | Full of life | V | -0.350 | **-0.525** | -0.140 | **-0.665** |
| 27 | Energy | V | **-0.426** | **-0.424** | -0.287 | **-0.523** |
| 29 | Worn out | V | 0.167 | **0.582** | 0.131 | **0.659** |
| 31 | Feel tired | V | 0.217 | **0.518** | 0.179 | **0.588** |

\* Original SF-36 dimension; † Health Outcomes Data Repository dataset; ‡Multi Instrument Comparison Study dataset; PF = Physical functioning; RP = Role physical; RE = Role emotional; SF = Social functioning; P = Pain; MH = Mental health; V = Vitality; Promax rotation with polychoric correlations

**Table 2: Three factor EFA models (models produced with Eigenvalues > 1)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Item | Dim\* | Factors and their loading | | | | | |
|  |  |  | **HODaR**† | | | **MIC**‡ | | |
|  |  |  | **1** | **2** | **3** | **1** | **2** | **3** |
| 3 | Limited vigorous activities | PF | **0.922** | -0.067 | 0.051 | **0.928** | -0.208 | -0.087 |
| 4 | Limited moderate activities | PF | **0.914** | 0.015 | -0.003 | **0.913** | -0.022 | -0.049 |
| 5 | Limited lifting | PF | **0.879** | 0.031 | -0.013 | **0.867** | 0.047 | -0.007 |
| 6 | Limited several flights of stairs | PF | **0.933** | -0.107 | -0.064 | **0.948** | -0.132 | -0.084 |
| 7 | Limited one flight of stairs | PF | **0.907** | -0.028 | -0.028 | **0.923** | -0.030 | -0.012 |
| 8 | Limited bending, kneeling | PF | **0.889** | -0.063 | 0.001 | **0.889** | -0.099 | -0.034 |
| 9 | Limited walking more than one mile | PF | **0.963** | -0.077 | -0.025 | **0.955** | -0.100 | -0.060 |
| 10 | Limited walking several hundred yards | PF | **0.939** | -0.027 | -0.024 | **0.923** | 0.001 | -0.011 |
| 11 | Limited walking 100y | PF | **0.983** | 0.021 | -0.008 | **0.870** | 0.082 | 0.047 |
| 12 | Limited bathing | PF | **0.777** | 0.119 | -0.013 | **0.717** | 0.192 | 0.057 |
| 13 | Cut down time spent on work/other activities | RP | **0.726** | 0.304 | 0.059 | **0.602** | **0.519** | 0.167 |
| 14 | Accomplished less | RP | **0.742** | 0.273 | 0.011 | **0.590** | **0.443** | 0.041 |
| 15 | Limited in work | RP | **0.791** | 0.247 | 0.054 | **0.720** | 0.381 | 0.116 |
| 16 | Difficulty work | RP | **0.783** | 0.254 | 0.024 | **0.685** | 0.395 | 0.073 |
| 17 | Cut down time spent on work/other activities | RE | 0.165 | **0.886** | 0.030 | 0.086 | **0.913** | 0.049 |
| 18 | Accomplished less | RE | 0.158 | **0.865** | 0.004 | 0.038 | **0.873** | -0.020 |
| 19 | Didn’t do work/other activities carefully | RE | 0.188 | **0.805** | -0.020 | 0.074 | **0.889** | 0.023 |
| 20 | Emotion/physical health interfere social | SF | **-0.425** | -0.339 | 0.261 | -0.221 | **-0.580** | 0.186 |
| 32 | Last 4 weeks emotion/physical health | SF | **0.437** | 0.296 | -0.292 | 0.264 | **0.569** | -0.166 |
| 21 | Bodily pain last four weeks | P | **-0.520** | -0.052 | 0.201 | **-0.657** | -0.065 | 0.120 |
| 22 | Pain interfere with normal work | P | **-0.622** | -0.149 | 0.173 | **-0.683** | -0.191 | 0.078 |
| 24 | Very nervous | MH | -0.133 | **0.481** | **-0.430** | -0.205 | **0.625** | -0.260 |
| 25 | Down dumps | MH | -0.167 | **0.480** | **-0.578** | -0.189 | **0.634** | -0.391 |
| 26 | Calm/peaceful | MH | 0.116 | -0.191 | **0.702** | 0.104 | -0.167 | **0.758** |
| 28 | Down/depressed | MH | -0.227 | **0.467** | **-0.608** | -0.191 | 0.589 | **-0.470** |
| 30 | Been happy | MH | 0.119 | -0.243 | **0.652** | 0.102 | -0.177 | **0.751** |
| 23 | Full of life | V | -0.335 | 0.024 | **0.626** | -0.188 | 0.020 | **0.797** |
| 27 | Energy | V | -0.415 | 0.118 | **0.608** | -0.341 | 0.120 | **0.740** |
| 29 | Worn out | V | 0.153 | 0.000 | **-0.660** | 0.133 | 0.328 | **-0.417** |
| 31 | Feel tired | V | 0.204 | -0.071 | **-0.660** | 0.183 | 0.263 | **-0.406** |

\* Original SF-36 dimension; † Health Outcomes Data Repository dataset; ‡Multi Instrument Comparison Study dataset; PF = Physical functioning; RP = Role physical; RE = Role emotional; SF = Social functioning; P = Pain; MH = Mental health; V = Vitality; Promax rotation with polychoric correlations

**Table 3: Four factor EFA models**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Item | Dim\* | Factors and their loading | | | | | | | |
|  |  |  | **HODaR**† | | | | **MIC**‡ | | | |
|  |  |  | **1** | **2** | **3** | **4** | **1** | **2** | **3** | **4** |
| 3 | Limited vigorous activities | PF | **0.672** | 0.307 | -0.025 | -0.147 | **0.734** | 0.200 | -0.258 | -0.154 |
| 4 | Limited moderate activities | PF | **0.719** | 0.250 | -0.040 | -0.024 | **0.785** | 0.168 | -0.051 | -0.070 |
| 5 | Limited lifting | PF | **0.731** | 0.194 | -0.032 | 0.014 | **0.777** | 0.144 | 0.026 | -0.009 |
| 6 | Limited several flights of stairs | PF | **0.948** | -0.035 | -0.057 | -0.037 | **0.934** | -0.018 | -0.065 | -0.071 |
| 7 | Limited one flight of stairs | PF | **0.990** | -0.096 | 0.014 | 0.064 | **0.994** | -0.087 | 0.064 | 0.041 |
| 8 | Limited bending, kneeling | PF | **0.894** | -0.010 | 0.009 | -0.012 | **0.809** | 0.086 | -0.093 | -0.047 |
| 9 | Limited walking more than one mile | PF | **0.938** | 0.023 | -0.026 | -0.031 | **0.928** | 0.013 | -0.050 | -0.050 |
| 10 | Limited walking several hundred yards | PF | **0.972** | -0.036 | 0.004 | 0.045 | **0.978** | -0.058 | 0.082 | 0.040 |
| 11 | Limited walking 100y | PF | **0.953** | -0.057 | 0.037 | 0.101 | **0.979** | -0.093 | 0.177 | 0.127 |
| 12 | Limited bathing | PF | **0.762** | 0.049 | 0.027 | 0.163 | **0.796** | -0.029 | 0.254 | 0.135 |
| 13 | Cut down time spent on work/other activities | RP | 0.213 | **0.729** | -0.017 | 0.089 | 0.241 | **0.679** | 0.218 | 0.103 |
| 14 | Accomplished less | RP | 0.247 | **0.692** | -0.066 | 0.074 | 0.192 | **0.686** | 0.150 | -0.040 |
| 15 | Limited in work | RP | 0.284 | **0.709** | -0.033 | 0.035 | 0.323 | **0.685** | 0.081 | 0.026 |
| 16 | Difficulty work | RP | 0.307 | **0.665** | -0.054 | 0.062 | 0.279 | **0.693** | 0.095 | -0.017 |
| 17 | Cut down time spent on work/other activities | RE | 0.092 | 0.278 | 0.167 | **0.848** | 0.052 | 0.312 | **0.793** | 0.137 |
| 18 | Accomplished less | RE | 0.097 | 0.255 | 0.144 | **0.839** | 0.014 | 0.275 | **0.779** | 0.071 |
| 19 | Didn’t do work/other activities carefully | RE | 0.136 | 0.230 | 0.118 | **0.794** | 0.060 | 0.274 | **0.793** | 0.119 |
| 20 | Emotion/physical health interfere social | SF | -0.163 | -0.378 | 0.241 | -0.293 | -0.128 | -0.259 | **-0.515** | 0.134 |
| 32 | Last 4 weeks emotion/physical health | SF | 0.197 | 0.338 | -0.271 | 0.269 | 0.179 | 0.249 | **0.509** | -0.112 |
| 21 | Bodily pain last four weeks | P | -0.326 | -0.238 | 0.220 | -0.031 | -0.397 | -0.360 | 0.067 | 0.190 |
| 22 | Pain interfere with normal work | P | -0.334 | -0.379 | 0.204 | -0.081 | -0.380 | **-0.462** | -0.010 | 0.152 |
| 24 | Very nervous | MH | -0.020 | -0.084 | -0.259 | **0.632** | -0.041 | -0.099 | **0.747** | -0.098 |
| 25 | Down dumps | MH | -0.007 | -0.157 | -0.379 | **0.687** | 0.014 | -0.175 | **0.819** | -0.203 |
| 26 | Calm/peaceful | MH | 0.050 | 0.104 | **0.570** | -0.374 | 0.098 | 0.092 | -0.329 | **0.675** |
| 28 | Down/depressed | MH | -0.064 | -0.168 | **-0.410** | **0.678** | -0.028 | -0.145 | **0.762** | -0.301 |
| 30 | Been happy | MH | 0.053 | 0.088 | **0.515** | **-0.416** | 0.076 | 0.115 | -0.351 | **0.659** |
| 23 | Full of life | V | -0.152 | -0.170 | **0.619** | -0.040 | -0.057 | -0.033 | -0.083 | **0.792** |
| 27 | Energy | V | -0.210 | -0.180 | **0.629** | 0.067 | -0.140 | -0.108 | 0.073 | **0.789** |
| 29 | Worn out | V | 0.012 | 0.117 | **-0.637** | 0.081 | 0.054 | 0.128 | 0.348 | -0.371 |
| 31 | Feel tired | V | 0.042 | 0.129 | **-0.659** | 0.001 | 0.087 | 0.136 | 0.275 | -0.376 |

\* Original SF-36 dimension; † Health Outcomes Data Repository dataset; ‡ Multi Instrument Comparison Study dataset; PF = Physical functioning; RP = Role physical; RE = Role emotional; SF = Social functioning; P = Pain; MH = Mental health; V = Vitality; Promax rotation with polychoric correlations

**Table 4: Five factor EFA models**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Item | Dim\* | Factors and their loading | | | | | | | | | |
|  |  |  | **HODaR**† | | | | | **MIC**‡ | | | | |
|  |  |  | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| 3 | Limited vigorous activities | PF | **0.675** | 0.323 | -0.151 | -0.039 | -0.044 | **0.742** | 0.197 | -0.245 | -0.118 | 0.018 |
| 4 | Limited moderate activities | PF | **0.724** | 0.260 | -0.027 | -0.039 | -0.023 | **0.792** | 0.162 | 0.048 | -0.040 | 0.031 |
| 5 | Limited lifting | PF | **0.737** | 0.200 | 0.014 | -0.020 | -0.007 | **0.783** | 0.137 | 0.029 | 0.004 | 0.011 |
| 6 | Limited several flights of stairs | PF | **0.956** | -0.039 | -0.037 | -0.010 | 0.041 | **0.938** | -0.018 | -0.075 | -0.039 | 0.035 |
| 7 | Limited one flight of stairs | PF | **0.999** | -0.105 | 0.067 | 0.034 | 0.013 | **0.997** | -0.085 | 0.057 | 0.038 | -0.010 |
| 8 | Limited bending, kneeling | PF | **0.901** | -0.010 | -0.012 | 0.012 | -0.011 | **0.814** | 0.082 | -0.092 | -0.017 | -0.026 |
| 9 | Limited walking more than one mile | PF | **0.945** | 0.022 | -0.029 | 0.003 | 0.015 | **0.932** | 0.014 | -0.053 | -0.034 | 0.008 |
| 10 | Limited walking several hundred yards | PF | **0.980** | -0.041 | 0.047 | 0.026 | 0.011 | **0.982** | -0.056 | 0.078 | 0.027 | -0.024 |
| 11 | Limited walking 100y | PF | **0.961** | -0.063 | 0.103 | 0.039 | -0.008 | **0.982** | -0.092 | 0.175 | 0.091 | -0.052 |
| 12 | Limited bathing | PF | **0.767** | 0.050 | 0.160 | -0.002 | -0.040 | **0.804** | -0.028 | 0.265 | 0.062 | -0.104 |
| 13 | Cut down time spent on work/other activities | RP | 0.214 | **0.743** | 0.103 | 0.024 | -0.005 | 0.251 | **0.653** | 0.254 | 0.095 | 0.000 |
| 14 | Accomplished less | RP | 0.251 | **0.700** | 0.091 | 0.024 | 0.051 | 0.201 | **0.660** | 0.173 | -0.006 | 0.064 |
| 15 | Limited in work | RP | 0.287 | **0.721** | 0.050 | 0.026 | 0.012 | 0.334 | **0.660** | 0.118 | 0.037 | 0.013 |
| 16 | Difficulty work | RP | 0.312 | **0.672** | 0.081 | 0.036 | 0.049 | 0.288 | **0.667** | 0.125 | 0.011 | 0.046 |
| 17 | Cut down time spent on work/other activities | RE | 0.089 | 0.270 | **0.843** | 0.091 | -0.072 | 0.056 | 0.305 | **0.810** | 0.028 | -0.100 |
| 18 | Accomplished less | RE | 0.094 | 0.245 | **0.836** | 0.091 | -0.047 | 0.017 | 0.267 | **0.782** | -0.018 | -0.062 |
| 19 | Didn’t do work/other activities carefully | RE | 0.134 | 0.221 | **0.790** | 0.068 | -0.042 | 0.063 | 0.265 | **0.800** | 0.025 | -0.071 |
| 20 | Emotion/physical health interfere social | SF | -0.164 | -0.394 | -0.276 | 0.214 | -0.031 | -0.136 | -0.254 | **-0.512** | 0.186 | 0.027 |
| 32 | Last 4 weeks emotion/physical health | SF | 0.201 | 0.349 | 0.256 | -0.199 | 0.079 | 0.185 | 0.238 | **0.492** | -0.120 | 0.046 |
| 21 | Bodily pain last four weeks | P | -0.331 | -0.249 | -0.023 | 0.156 | -0.062 | -**0.404** | -0.346 | 0.067 | 0.125 | -0.093 |
| 22 | Pain interfere with normal work | P | -0.339 | -0.393 | -0.075 | 0.146 | -0.047 | -0.390 | **-0.444** | 0.066 | 0.125 | -0.093 |
| 24 | Very nervous | MH | -0.016 | -0.093 | **0.613** | -0.186 | 0.122 | -0.045 | -0.117 | **0.671** | -0.018 | 0.226 |
| 25 | Down dumps | MH | -0.003 | -0.164 | **0.657** | -0.292 | 0.152 | 0.011 | -0.186 | **0.732** | -0.137 | 0.214 |
| 26 | Calm/peaceful | MH | 0.058 | 0.075 | -0.271 | **0.733** | 0.054 | 0.087 | 0.077 | -0.291 | 0.760 | 0.056 |
| 28 | Down/depressed | MH | -0.057 | -0.182 | **0.655** | -0.265 | 0.214 | -0.031 | -0.160 | **0.663** | -0.191 | 0.286 |
| 30 | Been happy | MH | 0.067 | 0.055 | -0.302 | **0.790** | 0.158 | 0.062 | 0.103 | -0.323 | **0.815** | 0.144 |
| 23 | Full of life | V | -0.149 | -0.207 | 0.033 | **0.589** | -0.095 | -0.068 | -0.049 | -0.041 | **0.790** | -0.039 |
| 27 | Energy | V | -0.211 | -0.209 | 0.125 | **0.531** | -0.154 | -0.151 | -0.118 | 0.112 | **0.723** | -0.112 |
| 29 | Worn out | V | 0.005 | 0.042 | 0.100 | 0.110 | **0.918** | 0.010 | 0.086 | 0.171 | 0.033 | **0.806** |
| 31 | Feel tired | V | 0.045 | 0.073 | 0.013 | 0.011 | **0.802** | 0.053 | 0.103 | 0.117 | -0.022 | **0.695** |

\* Original SF-36 dimension; † Health Outcomes Data Repository dataset; ‡Multi Instrument Comparison Study dataset; PF = Physical functioning; RP = Role physical; RE = Role emotional; SF = Social functioning; P = Pain; MH = Mental health; V = Vitality; Promax rotation with polychoric correlations

**Table 5: Six factor EFA models**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Item | Dim\* | Factors and their loading | | | | | | | | | | | |
|  |  |  | **HODaR**† | | | | | | **MIC**‡ | | | | | |
|  |  |  | **1** | **2** | **3** | **4** | **5** | **6** | **1** | **2** | **3** | **4** | **5** | **6** |
| 3 | Limited vigorous activities | PF | **0.685** | 0.308 | -0.143 | 0.035 | -0.096 | -0.033 | **0.746** | -0.246 | 0.171 | -0.029 | -0.136 | 0.034 |
| 4 | Limited moderate activities | PF | **0.721** | 0.234 | -0.021 | -0.033 | -0.055 | -0.015 | **0.784** | -0.046 | 0.118 | -0.082 | -0.039 | 0.029 |
| 5 | Limited lifting | PF | **0.729** | 0.175 | 0.018 | -0.049 | -0.024 | -0.003 | **0.770** | 0.031 | 0.090 | -0.099 | 0.012 | 0.003 |
| 6 | Limited several flights of stairs | PF | **0.960** | -0.019 | -0.026 | 0.075 | -0.049 | 0.047 | **0.945** | -0.072 | 0.011 | 0.076 | -0.067 | 0.056 |
| 7 | Limited one flight of stairs | PF | **0.989** | -0.089 | 0.071 | 0.021 | 0.026 | 0.014 | **0.995** | 0.060 | -0.054 | 0.063 | 0.020 | 0.002 |
| 8 | Limited bending, kneeling | PF | **0.873** | -0.032 | -0.024 | -0.109 | 0.036 | -0.020 | **0.795** | -0.094 | 0.030 | -0.120 | -0.005 | 0.013 |
| 9 | Limited walking more than one mile | PF | **0.944** | 0.032 | -0.022 | 0.045 | -0.031 | 0.020 | **0.934** | -0.052 | 0.030 | 0.043 | -0.055 | 0.024 |
| 10 | Limited walking several hundred yards | PF | **0.970** | -0.033 | 0.051 | 0.008 | 0.015 | 0.012 | **0.977** | 0.080 | -0.035 | 0.040 | 0.014 | -0.015 |
| 11 | Limited walking 100y | PF | **0.946** | -0.059 | 0.104 | -0.018 | 0.045 | -0.008 | **0.970** | 0.177 | -0.074 | 0.021 | 0.087 | -0.050 |
| 12 | Limited bathing | PF | **0.747** | 0.025 | 0.158 | -0.100 | 0.036 | -0.043 | **0.788** | 0.268 | -0.041 | -0.043 | 0.078 | -0.113 |
| 13 | Cut down time spent on work/other activities | RP | 0.227 | **0.674** | 0.109 | -0.074 | -0.007 | 0.006 | 0.265 | 0.257 | **0.578** | -0.094 | 0.075 | 0.014 |
| 14 | Accomplished less | RP | 0.266 | **0.646** | 0.101 | -0.037 | -0.021 | 0.061 | 0.223 | 0.180 | **0.606** | -0.047 | -0.039 | 0.089 |
| 15 | Limited in work | RP | 0.299 | **0.654** | 0.057 | -0.069 | -0.010 | 0.022 | 0.350 | 0.120 | **0.584** | -0.091 | 0.012 | 0.032 |
| 16 | Difficulty work | RP | 0.319 | **0.608** | 0.084 | -0.080 | 0.007 | 0.055 | 0.306 | 0.129 | **0.595** | -0.083 | -0.015 | 0.067 |
| 17 | Cut down time spent on work/other activities | RE | 0.106 | 0.298 | **0.873** | 0.100 | 0.070 | -0.068 | 0.074 | **0.830** | 0.351 | 0.113 | 0.007 | -0.075 |
| 18 | Accomplished less | RE | 0.114 | 0.281 | **0.870** | 0.123 | 0.063 | -0.043 | 0.039 | **0.806** | 0.328 | 0.144 | -0.044 | -0.034 |
| 19 | Didn’t do work/other activities carefully | RE | 0.147 | 0.246 | **0.816** | 0.080 | 0.055 | -0.040 | 0.079 | **0.819** | 0.308 | 0.101 | 0.008 | -0.050 |
| 20 | Emotion/physical health interfere social | SF | -0.153 | -0.330 | -0.289 | 0.168 | 0.159 | -0.027 | -0.116 | **-0.529** | -0.175 | 0.185 | 0.137 | 0.057 |
| 32 | Last 4 weeks emotion/physical health | SF | 0.187 | 0.287 | 0.268 | -0.168 | -0.144 | 0.073 | 0.169 | **0.509** | 0.169 | -0.158 | -0.081 | 0.018 |
| 21 | Bodily pain last four weeks | P | -0.218 | -0.105 | 0.062 | **0.654** | -0.022 | -0.003 | -0.303 | 0.106 | -0.109 | **0.649** | 0.013 | -0.002 |
| 22 | Pain interfere with normal work | P | -0.200 | -0.254 | 0.016 | **0.727** | -0.046 | 0.022 | -0.278 | 0.016 | -0.208 | **0.678** | -0.014 | 0.026 |
| 24 | Very nervous | MH | -0.024 | -0.095 | **0.641** | -0.063 | -0.106 | 0.113 | -0.061 | **0.701** | -0.133 | -0.069 | 0.029 | 0.185 |
| 25 | Down dumps | MH | -0.019 | -0.176 | **0.690** | -0.114 | -0.180 | 0.138 | -0.006 | **0.768** | -0.195 | -0.059 | -0.083 | 0.172 |
| 26 | Calm/peaceful | MH | 0.057 | 0.084 | -0.325 | 0.043 | **0.655** | 0.052 | 0.094 | -0.321 | 0.092 | 0.064 | **0.701** | 0.065 |
| 28 | Down/depressed | MH | -0.066 | -0.180 | **0.691** | -0.065 | -0.172 | 0.202 | -0.041 | **0.698** | -0.152 | -0.019 | -0.153 | 0.251 |
| 30 | Been happy | MH | 0.059 | 0.062 | -0.365 | 0.017 | **0.710** | 0.148 | 0.064 | -0.355 | 0.099 | 0.022 | **0.756** | 0.141 |
| 23 | Full of life | V | -0.168 | -0.202 | -0.011 | -0.058 | **0.628** | -0.099 | -0.084 | -0.069 | -0.058 | -0.027 | **0.780** | -0.057 |
| 27 | Energy | V | -0.237 | -0.219 | 0.090 | -0.119 | **0.614** | -0.162 | -0.172 | 0.099 | -0.143 | -0.075 | **0.755** | -0.143 |
| 29 | Worn out | V | 0.011 | 0.044 | 0.110 | -0.007 | 0.079 | **0.879** | 0.022 | 0.203 | 0.085 | 0.010 | 0.006 | **0.780** |
| 31 | Feel tired | V | 0.056 | 0.079 | 0.028 | 0.037 | -0.031 | **0.789** | 0.066 | 0.143 | 0.109 | 0.027 | -0.050 | **0.688** |

\* Original SF-36 dimension; † Health Outcomes Data Repository dataset; ‡Multi Instrument Comparison Study dataset; PF = Physical functioning; RP = Role physical; RE = Role emotional; SF = Social functioning; P = Pain; MH = Mental health; V = Vitality; Promax rotation with polychoric correlations

**Table 6: Seven factor EFA models**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **SF-36 item** | **Dim\*** | **Factors and their loadings** | | | | | | | | | | | | | |
|  |  |  | **HODaR**† | | | | | | **MIC**‡ | | | | | | | |
|  |  |  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **3** | Limited vigorous activities | PF | **0.669** | 0.261 | 0.012 | 0.007 | -0.201 | -0.138 | -0.016 | **0.739** | 0.107 | -0.079 | -0.062 | -0.208 | -0.111 | 0.045 |
| **4** | Limited moderate activities | PF | **0.733** | 0.286 | -0.051 | 0.011 | 0.013 | -0.032 | 0.027 | **0.782** | 0.140 | -0.052 | -0.065 | -0.013 | -0.036 | 0.024 |
| **5** | Limited lifting | PF | **0.741** | 0.228 | -0.037 | -0.005 | 0.046 | -0.001 | -0.017 | **0.817** | 0.115 | -0.008 | -0.079 | 0.037 | 0.010 | -0.002 |
| **6** | Limited several flights of stairs | PF | **0.945** | -0.062 | 0.026 | 0.038 | -0.053 | -0.083 | 0.053 | **0.942** | -0.069 | 0.032 | 0.027 | -0.093 | -0.049 | 0.072 |
| **7** | Limited one flight of stairs | PF | **0.985** | -0.088 | 0.030 | 0.018 | 0.050 | 0.018 | 0.012 | **0.993** | -0.094 | 0.075 | 0.036 | 0.019 | 0.026 | 0.012 |
| **8** | Limited bending, kneeling | PF | **0.854** | -0.088 | 0.036 | -0.140 | -0.060 | -0.005 | -0.003 | **0.785** | -0.041 | -0.004 | -0.158 | -0.067 | 0.010 | 0.029 |
| **9** | Limited walking more than one mile | PF | **0.929** | -0.010 | 0.038 | 0.013 | -0.070 | -0.068 | 0.029 | **0.933** | 0.014 | -0.017 | 0.030 | -0.040 | -0.046 | 0.027 |
| **10** | Limited walking several hundred yards | PF | **0.965** | -0.029 | 0.021 | 0.008 | 0.032 | 0.006 | 0.009 | **0.980** | -0.001 | 0.014 | 0.053 | 0.079 | 0.010 | -0.021 |
| **11** | Limited walking 100y | PF | **0.953** | -0.018 | 0.008 | 0.010 | 0.105 | 0.060 | -0.020 | **0.977** | -0.010 | 0.042 | 0.054 | 0.163 | 0.074 | -0.061 |
| **12** | Limited bathing | PF | **0.770** | 0.113 | -0.016 | -0.029 | 0.197 | 0.094 | -0.065 | **0.796** | 0.045 | 0.082 | 0.010 | 0.212 | 0.054 | -0.129 |
| **13** | Cut down time spent on work/other activities | RP | 0.240 | **0.758** | 0.069 | 0.004 | -0.021 | -0.011 | -0.017 | 0.258 | **0.711** | 0.121 | 0.006 | 0.036 | 0.070 | -0.022 |
| **14** | Accomplished less | RP | 0.272 | **0.677** | 0.106 | 0.007 | -0.062 | -0.031 | 0.046 | 0.216 | **0.698** | 0.104 | 0.032 | -0.041 | -0.039 | 0.060 |
| **15** | Limited in work | RP | 0.311 | **0.725** | 0.045 | 0.001 | -0.055 | -0.003 | 0.002 | 0.344 | **0.711** | 0.034 | 0.004 | -0.034 | 0.012 | -0.004 |
| **16** | Difficulty work | RP | 0.325 | **0.642** | 0.087 | -0.032 | -0.059 | -0.005 | 0.040 | 0.300 | **0.678** | 0.076 | -0.010 | -0.058 | -0.012 | 0.039 |
| **17** | Cut down time spent on work/other activities | RE | 0.048 | 0.086 | **0.832** | -0.005 | 0.117 | 0.004 | -0.026 | 0.044 | 0.062 | **0.924** | 0.004 | -0.002 | 0.006 | -0.026 |
| **18** | Accomplished less | RE | 0.044 | 0.028 | **0.895** | -0.001 | 0.069 | -0.022 | 0.007 | 0.002 | -0.032 | **1.001** | 0.009 | -0.072 | -0.035 | 0.028 |
| **19** | Didn’t do work/other activities carefully | RE | 0.097 | 0.055 | **0.747** | -0.014 | 0.145 | 0.000 | -0.004 | 0.053 | 0.050 | **0.860** | 0.004 | 0.046 | 0.002 | -0.004 |
| **20** | Emotion/physical health interfere social | SF | -0.177 | **-0.443** | -0.021 | 0.068 | -0.349 | 0.044 | 0.011 | -0.111 | -0.209 | -0.298 | 0.138 | -0.237 | 0.184 | 0.063 |
| **32** | Last 4 weeks emotion/physical health | SF | 0.213 | **0.405** | -0.006 | -0.067 | 0.355 | -0.031 | 0.031 | 0.168 | 0.246 | 0.237 | -0.092 | 0.275 | -0.127 | 0.002 |
| **21** | Bodily pain last four weeks | BP | -0.151 | 0.032 | -0.006 | **0.769** | 0.015 | 0.007 | -0.030 | -0.253 | 0.053 | 0.006 | **0.775** | 0.038 | -0.000 | -0.031 |
| **22** | Pain interfere with normal work | BP | -0.162 | -0.168 | -0.030 | **0.723** | -0.011 | -0.015 | -0.005 | -0.250 | -0.107 | -0.039 | **0.698** | 0.007 | -0.010 | 0.001 |
| **24** | Very nervous | MH | 0.012 | 0.021 | 0.152 | 0.030 | **0.666** | 0.060 | 0.062 | -0.053 | -0.027 | 0.268 | -0.002 | **0.518** | 0.033 | 0.166 |
| **25** | Down dumps | MH | 0.030 | -0.026 | 0.088 | 0.003 | **0.838** | 0.043 | 0.072 | 0.012 | -0.036 | 0.233 | 0.035 | **0.618** | 0.160 | 0.141 |
| **26** | Calm/peaceful | MH | 0.064 | 0.105 | -0.048 | 0.053 | **-0.548** | **0.464** | 0.050 | 0.091 | 0.079 | -0.130 | 0.051 | -0.158 | **0.764** | 0.061 |
| **28** | Down/depressed | MH | -0.023 | -0.049 | 0.116 | 0.036 | **0.802** | 0.028 | 0.138 | -0.033 | -0.075 | 0.281 | 0.029 | **0.490** | -0.220 | 0.236 |
| **30** | Been happy | MH | 0.050 | 0.029 | -0.015 | -0.008 | **-0.633** | **0.466** | 0.152 | 0.056 | 0.044 | -0.118 | -0.014 | -0.182 | **0.832** | 0.148 |
| **23** | Full of life | VT | -0.135 | -0.098 | -0.018 | 0.010 | -0.153 | **0.574** | -0.110 | -0.086 | -0.046 | -0.011 | -0.024 | 0.029 | **0.816** | -0.060 |
| **27** | Energy | VT | -0.192 | -0.081 | -0.009 | -0.029 | -0.025 | **0.620** | -0.180 | -0.170 | -0.072 | 0.021 | -0.037 | 0.178 | **0.769** | -0.157 |
| **29** | Worn out | VT | 0.010 | 0.039 | -0.012 | -0.017 | 0.171 | -0.004 | **0.775** | 0.020 | 0.069 | 0.050 | -0.165 | 0.205 | -0.004 | **0.754** |
| **31** | Feel tired | VT | 0.031 | 0.005 | 0.014 | -0.013 | 0.048 | -0.117 | **0.767** | 0.052 | -0.004 | 0.120 | -0.136 | 0.071 | -0.029 | **0.729** |

\* Original SF-36 dimension; † Health Outcomes Data Repository dataset; ‡Multi Instrument Comparison Study dataset; PF = Physical functioning; RP = Role physical; RE = Role emotional; SF = Social functioning; P = Pain; MH = Mental health; V = Vitality; Promax rotation with polychoric correlations

**Table 7: Eight factor EFA models**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Items | Dim\* | Factors and their loadings | | | | | | | | | | | | | | | |
|  |  |  | **HODaR**† | | | | | | | | **MIC**‡ | | | | | | | |
|  |  |  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 3 | Limited vigorous activities | PF | **0.666** | 0.163 | 0.014 | 0.000 | -0.014 | -0.057 | -0.024 | **0.443** | **0.783** | 0.170 | -0.037 | -0.049 | -0.091 | -0.034 | 0.004 | -0.306 |
| 4 | Limited moderate activities | PF | **0.731** | 0.243 | -0.061 | 0.005 | 0.119 | 0.023 | -0.031 | 0.224 | **0.789** | 0.163 | -0.041 | -0.064 | -0.026 | -0.008 | 0.053 | -0.069 |
| 5 | Limited lifting | PF | **0.738** | 0.192 | -0.044 | -0.012 | 0.132 | 0.046 | -0.019 | 0.182 | **0.768** | 0.129 | -0.002 | -0.080 | 0.019 | -0.023 | 0.069 | -0.018 |
| 6 | Limited several flights of stairs | PF | **0.937** | -0.083 | 0.026 | 0.031 | -0.014 | -0.061 | 0.054 | 0.121 | **0.955** | -0.036 | 0.050 | 0.032 | -0.039 | 0.034 | 0.012 | -0.136 |
| 7 | Limited one flight of stairs | PF | **0.979** | -0.073 | 0.031 | 0.016 | 0.016 | 0.003 | 0.014 | -0.019 | **0.986** | -0.078 | 0.077 | 0.034 | 0.030 | -0.003 | 0.043 | -0.009 |
| 8 | Limited bending, kneeling | PF | **0.846** | -0.104 | 0.036 | -0.146 | -0.023 | 0.015 | -0.002 | 0.096 | **0.798** | -0.012 | 0.014 | -0.158 | 0.023 | -0.010 | 0.027 | -0.119 |
| 9 | Limited walking more than one mile | PF | **0.923** | -0.006 | 0.041 | 0.011 | -0.085 | -0.074 | 0.030 | 0.034 | **0.914** | 0.006 | -0.020 | 0.027 | -0.056 | 0.046 | -0.074 | 0.058 |
| 10 | Limited walking several hundred yards | PF | **0.971** | 0.000 | 0.026 | 0.016 | -0.051 | -0.034 | 0.012 | -0.093 | **0.948** | -0.046 | -0.010 | 0.051 | -0.013 | 0.039 | -0.069 | 0.230 |
| 11 | Limited walking 100y | PF | **0.978** | 0.029 | 0.008 | 0.027 | -0.019 | 0.003 | -0.019 | -0.190 | **0.945** | -0.067 | 0.007 | 0.052 | 0.052 | 0.006 | -0.023 | 0.306 |
| 12 | Limited bathing | PF | **0.772** | 0.143 | -0.017 | -0.025 | 0.134 | 0.066 | -0.064 | -0.088 | **0.769** | 0.021 | 0.064 | 0.002 | 0.048 | -0.104 | 0.101 | 0.199 |
| 13 | Cut down time spent on work/other activities | RP | 0.242 | **0.760** | 0.072 | 0.006 | -0.047 | 0.002 | -0.015 | 0.021 | 0.254 | **0.696** | 0.124 | 0.005 | 0.070 | -0.022 | 0.013 | 0.064 |
| 14 | Accomplished less | RP | 0.274 | **0.677** | 0.109 | 0.008 | -0.083 | -0.037 | 0.047 | 0.030 | 0.221 | **0.698** | 0.111 | 0.034 | -0.037 | 0.047 | -0.012 | -0.017 |
| 15 | Limited in work | RP | 0.313 | **0.717** | 0.049 | -0.001 | -0.061 | -0.002 | 0.004 | 0.057 | 0.350 | **0.718** | 0.043 | 0.007 | 0.017 | -0.023 | 0.000 | -0.016 |
| 16 | Difficulty work | RP | 0.326 | **0.641** | 0.090 | -0.032 | -0.076 | -0.010 | 0.042 | 0.032 | 0.304 | **0.679** | 0.085 | -0.009 | -0.009 | 0.026 | -0.027 | -0.022 |
| 17 | Cut down time spent on work/other activities | RE | 0.048 | 0.087 | **0.825** | -0.004 | 0.126 | 0.006 | -0.027 | 0.005 | 0.040 | 0.054 | **0.915** | 0.004 | 0.003 | -0.016 | -0.014 | 0.035 |
| 18 | Accomplished less | RE | 0.044 | 0.028 | **0.887** | -0.001 | 0.083 | -0.018 | 0.006 | 0.012 | 0.007 | -0.027 | **0.999** | 0.011 | -0.036 | 0.024 | -0.037 | -0.042 |
| 19 | Didn’t do work/other activities carefully | RE | 0.097 | 0.063 | **0.743** | -0.013 | 0.137 | -0.006 | -0.004 | -0.022 | 0.052 | 0.047 | **0.851** | 0.004 | 0.001 | -0.003 | 0.040 | 0.030 |
| 20 | Emotion/physical health interfere social | SF | -0.178 | **-0.475** | -0.019 | 0.061 | -0.280 | 0.076 | 0.013 | 0.085 | -0.074 | -0.161 | -0.261 | 0.153 | 0.202 | 0.015 | -0.070 | -0.272 |
| 32 | Last 4 weeks emotion/physical health | SF | 0.215 | **0.442** | -0.009 | -0.060 | 0.280 | -0.067 | 0.029 | -0.101 | 0.125 | 0.195 | 0.190 | -0.106 | -0.146 | 0.060 | 0.086 | 0.309 |
| 21 | Bodily pain last four weeks | P | -0.148 | 0.031 | -0.006 | **0.774** | 0.011 | 0.005 | -0.029 | 0.002 | -0.252 | 0.054 | 0.008 | **0.774** | -0.001 | -0.036 | 0.041 | 0.002 |
| 22 | Pain interfere with normal work | P | -0.163 | -0.173 | -0.029 | **0.715** | -0.013 | -0.016 | -0.005 | -0.002 | -0.244 | -0.097 | -0.035 | **0.703** | -0.008 | -0.009 | 0.032 | -0.038 |
| 24 | Very nervous | MH | 0.010 | 0.005 | 0.147 | 0.026 | **0.700** | 0.077 | 0.059 | 0.020 | -0.034 | -0.001 | 0.244 | 0.001 | -0.005 | 0.105 | **0.551** | 0.027 |
| 25 | Down dumps | MH | 0.027 | -0.035 | 0.086 | -0.001 | **0.847** | 0.047 | 0.070 | -0.019 | 0.037 | 0.001 | 0.195 | 0.042 | -0.125 | 0.065 | **0.670** | 0.038 |
| 26 | Calm/peaceful | MH | 0.064 | 0.103 | -0.045 | 0.054 | **-0.519** | **0.474** | 0.050 | -0.003 | 0.089 | 0.080 | -0.118 | 0.052 | **0.756** | 0.068 | -0.161 | -0.019 |
| 28 | Down/depressed | MH | -0.025 | -0.071 | 0.107 | 0.032 | **0.852** | 0.054 | 0.135 | 0.030 | -0.002 | -0.033 | 0.254 | -0.037 | -0.185 | 0.157 | **0.588** | -0.050 |
| 30 | Been happy | MH | 0.051 | 0.031 | -0.014 | -0.007 | **-0.601** | **0.477** | 0.151 | -0.012 | 0.050 | 0.040 | -0.107 | -0.014 | **0.820** | 0.163 | -0.197 | -0.017 |
| 23 | Full of life | V | 0.136 | -0.109 | -0.017 | 0.008 | -0.101 | **0.596** | -0.109 | -0.015 | -0.084 | -0.043 | -0.006 | -0.022 | **0.816** | -0.067 | 0.007 | 0.029 |
| 27 | Energy | V | -0.193 | -0.093 | -0.009 | -0.031 | 0.030 | **0.645** | -0.180 | -0.022 | -0.147 | -0.043 | 0.029 | -0.037 | **0.802** | -0.209 | 0.225 | -0.017 |
| 29 | Worn out | V | 0.010 | 0.041 | -0.014 | -0.017 | 0.180 | -0.003 | **0.768** | -0.021 | 0.011 | 0.058 | 0.025 | -0.008 | -0.019 | **0.751** | 0.175 | 0.016 |
| 31 | Feel tired | V | 0.031 | 0.008 | 0.012 | -0.012 | 0.054 | -0.117 | **0.761** | -0.006 | 0.031 | -0.034 | 0.100 | -0.037 | -0.041 | **0.786** | 0.018 | 0.015 |

\* Original SF-36 dimension; † Health Outcomes Data Repository dataset; ‡ Multi Instrument Comparison Study dataset; PF = Physical functioning; RP = Role physical; RE = Role emotional; SF = Social functioning; P = Pain; MH = Mental health; V = Vitality; Promax rotation with polychoric correlations

**Table 8: Nine factor EFA models**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Items | Dim\* | Factors and their loadings | | | | | | | | | | | | | | | | | |
|  |  |  | **HODaR**† | | | | | | | | | **MIC**‡ | | | | | | | | |
|  |  |  | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| 3 | Limited vigorous activities | PF | **0.677** | 0.221 | -0.013 | -0.014 | -0.037 | 0.072 | 0.126 | -0.048 | 0.501 | **0.797** | 0.178 | -0.023 | -0.066 | -0.072 | -0.067 | 0.053 | -0.017 | -0.371 |
| 4 | Limited moderate activities | PF | **0.648** | 0.099 | -0.007 | 0.024 | -0.010 | -0.028 | 0.418 | 0.010 | 0.136 | **0.711** | 0.120 | -0.048 | -0.016 | -0.047 | 0.035 | -0.017 | 0.247 | -0.023 |
| 5 | Limited lifting | PF | **0.648** | 0.024 | 0.019 | 0.010 | 0.012 | -0.037 | 0.441 | 0.030 | 0.079 | **0.670** | 0.070 | -0.015 | -0.016 | -0.010 | 0.038 | -0.030 | 0.320 | 0.059 |
| 6 | Limited several flights of stairs | PF | **0.927** | -0.035 | 0.008 | 0.022 | -0.051 | 0.035 | 0.017 | 0.040 | 0.146 | **0.944** | -0.031 | 0.056 | 0.023 | -0.030 | 0.023 | 0.029 | 0.017 | -0.164 |
| 7 | Limited one flight of stairs | PF | **0.943** | -0.071 | 0.034 | 0.015 | 0.001 | 0.011 | 0.050 | 0.014 | -0.025 | **0.948** | -0.085 | 0.078 | 0.040 | 0.027 | 0.008 | 0.024 | 0.091 | -0.007 |
| 8 | Limited bending, kneeling | PF | **0.819** | -0.091 | 0.034 | -0.151 | 0.017 | -0.018 | 0.070 | -0.005 | 0.091 | **0.760** | -0.028 | 0.012 | -0.142 | 0.018 | 0.005 | 0.001 | 0.109 | -0.102 |
| 9 | Limited walking more than one mile | PF | **0.938** | 0.076 | 0.003 | 0.001 | -0.051 | 0.018 | -0.093 | 0.002 | 0.098 | **0.978** | 0.050 | -0.008 | -0.022 | -0.031 | -0.005 | 0.014 | -0.175 | -0.040 |
| 10 | Limited walking several hundred yards | PF | **0.971** | 0.062 | -0.004 | 0.009 | -0.014 | 0.028 | -0.096 | -0.010 | -0.043 | **1.000** | -0.002 | -0.006 | 0.004 | 0.006 | -0.003 | 0.004 | -0.168 | 0.156 |
| 11 | Limited walking 100y | PF | **0.946** | 0.040 | 0.002 | 0.025 | 0.009 | 0.002 | -0.037 | -0.024 | -0.166 | **0.953** | -0.036 | 0.011 | 0.024 | 0.059 | -0.012 | 0.011 | -0.049 | 0.252 |
| 12 | Limited bathing | PF | **0.703** | 0.036 | 0.026 | -0.010 | 0.037 | 0.006 | 0.215 | -0.034 | -0.181 | **0.678** | -0.036 | 0.036 | 0.067 | 0.013 | -0.042 | -0.013 | 0.304 | 0.323 |
| 13 | Cut down time spent on work/other activities | RP | 0.245 | **0.771** | 0.059 | 0.003 | 0.011 | -0.014 | 0.000 | -0.025 | 0.032 | 0.247 | **0.691** | 0.125 | -0.001 | 0.069 | -0.023 | 0.011 | 0.029 | 0.057 |
| 14 | Accomplished less | RP | 0.284 | **0.715** | 0.087 | 0.004 | -0.023 | -0.026 | -0.043 | 0.031 | 0.056 | 0.230 | **0.704** | 0.112 | 0.020 | -0.032 | 0.034 | 0.007 | -0.022 | -0.039 |
| 15 | Limited in work | RP | 0.319 | **0.746** | 0.028 | -0.005 | 0.012 | -0.012 | -0.007 | -0.011 | 0.076 | 0.350 | **0.717** | 0.045 | -0.005 | 0.021 | -0.033 | 0.012 | 0.008 | -0.034 |
| 16 | Difficulty work | RP | 0.330 | **0.667** | 0.073 | -0.036 | 0.003 | -0.031 | -0.018 | 0.029 | 0.050 | 0.300 | **0.674** | 0.087 | -0.015 | -0.009 | 0.022 | -0.024 | 0.017 | -0.031 |
| 17 | Cut down time spent on work/other activities | RE | 0.038 | 0.070 | **0.855** | -0.002 | 0.003 | 0.103 | -0.001 | -0.021 | -0.001 | 0.040 | 0.052 | **0.921** | 0.004 | 0.002 | -0.013 | -0.013 | -0.012 | 0.030 |
| 18 | Accomplished less | RE | 0.034 | 0.014 | **0.918** | 0.002 | -0.022 | 0.061 | -0.009 | 0.013 | 0.007 | 0.012 | -0.027 | **1.005** | 0.012 | -0.034 | 0.025 | -0.030 | -0.028 | -0.049 |
| 19 | Didn’t do work/other activities carefully | RE | 0.082 | 0.039 | **0.774** | -0.009 | -0.013 | 0.104 | 0.006 | 0.004 | -0.033 | 0.043 | 0.038 | **0.855** | 0.010 | -0.002 | 0.006 | 0.031 | 0.017 | 0.035 |
| 20 | Emotion/physical health interfere social | SF | -0.154 | -**0.427** | -0.035 | 0.058 | 0.097 | -0.225 | -0.063 | 0.003 | 0.109 | -0.068 | -0.161 | -0.262 | 0.153 | 0.207 | 0.010 | -0.069 | -0.022 | -0.253 |
| 32 | Last 4 weeks emotion/physical health | SF | 0.184 | 0.383 | 0.011 | -0.054 | -0.090 | 0.212 | 0.080 | 0.043 | -0.134 | 0.116 | 0.195 | 0.191 | -0.106 | -0.153 | 0.065 | 0.084 | 0.027 | 0.289 |
| 21 | Bodily pain last four weeks | P | -0.146 | 0.016 | 0.002 | **0.798** | -0.001 | -0.006 | 0.040 | -0.022 | -0.012 | -0.260 | 0.042 | 0.011 | **0.749** | 0.001 | -0.033 | 0.032 | -0.011 | 0.014 |
| 22 | Pain interfere with normal work | P | -0.158 | -0.169 | -0.031 | **0.711** | -0.013 | -0.009 | -0.013 | -0.006 | 0.001 | -0.253 | -0.096 | -0.039 | **0.744** | -0.021 | 0.010 | 0.006 | 0.032 | -0.004 |
| 24 | Very nervous | MH | 0.011 | 0.006 | 0.147 | 0.023 | 0.071 | **0.679** | 0.044 | 0.054 | 0.015 | -0.036 | -0.004 | 0.227 | -0.001 | 0.003 | 0.094 | **0.555** | 0.033 | 0.035 |
| 25 | Down dumps | MH | 0.050 | 0.011 | 0.057 | -0.008 | 0.056 | **0.881** | -0.036 | 0.048 | 0.009 | 0.061 | 0.017 | 0.169 | 0.022 | -0.103 | 0.028 | **0.721** | -0.024 | 0.017 |
| 26 | Calm/peaceful | MH | 0.069 | 0.120 | -0.053 | 0.052 | **0.515** | -0.455 | -0.016 | 0.044 | 0.009 | 0.097 | 0.087 | -0.109 | 0.044 | **0.764** | 0.061 | -0.150 | -0.021 | -0.028 |
| 28 | Down/depressed | MH | 0.006 | -0.013 | 0.072 | 0.024 | 0.070 | **0.905** | -0.039 | 0.111 | 0.066 | 0.022 | -0.020 | 0.235 | 0.021 | -0.165 | 0.123 | **0.637** | -0.032 | -0.075 |
| 30 | Been happy | MH | 0.043 | 0.022 | -0.007 | -0.005 | **0.513** | **-0.566** | 0.015 | 0.156 | -0.018 | 0.052 | 0.044 | -0.099 | -0.015 | **0.822** | 0.163 | -0.195 | -0.010 | -0.018 |
| 23 | Full of life | V | -0.127 | -0.098 | -0.021 | 0.006 | **0.632** | -0.064 | 0.011 | -0.116 | -0.014 | -0.072 | -0.036 | -0.001 | -0.031 | **0.826** | -0.076 | 0.015 | -0.018 | 0.030 |
| 27 | Energy | V | -0.178 | -0.074 | -0.017 | -0.035 | **0.684** | 0.075 | 0.003 | -0.191 | -0.016 | -0.149 | -0.049 | 0.027 | -0.035 | **0.810** | -0.213 | 0.214 | 0.044 | 0.008 |
| 29 | Worn out | V | 0.005 | 0.031 | -0.011 | -0.016 | -0.003 | 0.172 | 0.007 | **0.769** | -0.028 | 0.010 | 0.062 | 0.013 | -0.004 | -0.026 | **0.735** | 0.187 | -0.012 | 0.010 |
| 31 | Feel tired | V | 0.018 | -0.016 | 0.023 | -0.009 | -0.122 | 0.028 | 0.015 | **0.781** | -0.020 | 0.004 | -0.053 | 0.091 | -0.015 | -0.046 | **0.840** | -0.011 | 0.027 | 0.032 |

\* Original SF-36 dimension; † Health Outcomes Data Repository dataset; ‡ Multi Instrument Comparison Study dataset; PF = Physical functioning; RP = Role physical; RE = Role emotional; SF = Social functioning; P = Pain; MH = Mental health; V = Vitality; Promax rotation with polychoric correlations

**Supplementary appendix 3 – Item by item summary of performance split by dimension**

**Table 9: Summary of the performance of each SF-36 item**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **SF-36 item** | **Summary of performance** | **Selected for Health state classifier** |
| **Physical functioning** | | | |
| **3** | Limited vigorous activities | Good fit, and limited evidence of DIF. Covers mild range of underlying severity scale. Selected for HSC | √ |
| **4** | Limited moderate activities | Evidence of misfit, no DIF, and covers the moderate range of the severity scale. Selected for HSC for that reason | √ |
| **5** | Limited lifting/carrying | Evidence of DIF by gender and some misfit. Excluded at Rasch stage | X |
| **6** | Limited several flights of stairs | Evidence of DIF by gender and substantial misfit. Excluded at Rasch stage | X |
| **7** | Limited one flight of stairs | No DIF but substantial misfit. Excluded at Rasch stage | X |
| **8** | Limited bending, kneeling, stooping | No evidence of DIF or misfit. But covers a very specific action in the moderate severity range, and the word ‘stooping’ does not translate internationally. Excluded at Rasch stage. | X |
| **9** | Limited walking more than one mile | Evidence of DIF by age, and substantial misfit. Excluded at Rasch stage | X |
| **10** | Limited walking several hundred yards | Misfit across all samples tested. Excluded at Rasch stage | X |
| **11** | Limited walking 100y | No evidence of DIF and some misfit. Excluded at Rasch stage | X |
| **12** | Limited bathing/dressing | Minor evidence of DIF by age and no misfit. Covers more severe PF limitations. Selected for HSC. | √ |
| **Role Physical** | | | |
| **13** | Cut down time on work/other activities | No evidence of DIF and slight misfit. Appears on both RP and RE, but covers work and other activities which might be specific. Wide range coverage, but not as wide as item selected. Excluded at Rasch stage. | X |
| **14** | Accomplished less | No evidence of DIF and no misfit. Covers widest range of severity and appears on both RP and RE. Selected for HSC. | √ |
| **15** | Limited in kind of work/activities | No evidence of DIF, but some misfit. Does not appear on both RP and RE. Excluded at Rasch stage | X |
| **16** | Difficulty work/activities | No evidence of DIF or misfit. Does not appear on both RP and RE. Excluded at Rasch stage | X |
| **Role Emotional** | | | |
| **17** | Cut down time on work/other activities | No evidence of DIF or misfit. Appears on both RP and RE, but covers work and other activities which might be specific. Wide range coverage, but not as wide as item selected. Excluded at Rasch stage. | X |
| **18** | Accomplished less | Minor DIF by age and misfit. Covers widest range of severity and appears on both RP and RE. Selected for HSC. | √ |
| **19** | Didn’t do work/other activities carefully | No evidence of DIF or misfit. Does not appear on both RP and RE. Excluded at Rasch stage | X |
| **Social Functioning** | | | |
| **20** | Physical/emotional health interfere social | No evidence of DIF or misfit. Covers wide severity range. Excluded at Rasch stage. | X |
| **32** | Physical/emotional health interfere frequency social | No evidence of DIF or misfit. Covers wide severity range. Selected for HSC over 20 for consistency with SF-6Dv1 | √ |
| **Pain** | | | |
| **21** | Severity bodily pain | No evidence of DIF, but reasonable misfit. Covers very wide range of severity scale. Selected for HSC. | √ |
| **22** | Pain interfere with normal work | Evidence of DIF and substantial misfit. Covers smaller severity range. Excluded at Rasch stage. | X |
| **Mental Health** | | | |
| **24** | Very nervous | No DIF and some misfit. Reasonable severity range coverage. Selected for HSC. | √ |
| **25** | Down in dumps | No DIF but substantial misfit. Terminology quite colloquial. Excluded at Rasch stage | X |
| **26** | Calm/peaceful | Excluded at dimensionality stage (positively worded) | X |
| **28** | Down/depressed | No DIF or misfit. Reasonable severity range coverage. Selected for HSC. | √ |
| **30** | Been happy | Excluded at dimensionality stage (positively worded) | X |
| **Vitality** | | | |
| **23** | Full of life | Excluded at dimensionality stage (positively worded) | X |
| **27** | Energy | Excluded at dimensionality stage (positively worded) | X |
| **29** | Worn out | No DIF and slight misfit. Covers more severe range of severity scale. Selected for HSC. | √ |
| **31** | Feel tired | Limited evidence of DIF and misfit. Very general terminology. Excluded at Rasch stage. | X |
| **General Health and health transition** | | | |
| **1** | General health | Excluded prior to analysis. Unsuitable for HSC as assesses general health rather than a specific issue. | X |
| **2** | Health transition over last year | Excluded prior to analysis. Unsuitable for HSC as assesses general health rather than a specific issue. | X |
| **33** | Sick a little easier than other people | Excluded prior to analysis. Unsuitable for HSC as assesses general health rather than a specific issue. | X |
| **34** | Healthy as anybody I know | Excluded prior to analysis. Unsuitable for HSC as assesses general health rather than a specific issue. | X |
| **35** | Expect health to get worse | Excluded prior to analysis. Unsuitable for HSC as assesses general health rather than a specific issue. | X |
| **36** | Health is excellent | Excluded prior to analysis. Unsuitable for HSC as assesses general health rather than a specific issue. | X |

**Supplementary appendix 4 – Converting items into a descriptive system**

This appendix demonstrates how the items selected for each dimension were converted into dimension level descriptions

**Table 10: Physical Functioning dimension development**

|  |  |  |  |
| --- | --- | --- | --- |
| **SF-36 item** | **Response level** | **Action** | **SF-6Dv2 dimension** |
| Question stem: Does your health now limit you in these activities? If so, how much? | | | |
| Vigorous activities | No, not limited at all | Mapped directly to: | Limited in vigorous activities not at all |
|  | Yes, limited a little | Mapped directly to: | Limited in vigorous activities a little |
|  | Yes, limited a lot | Excluded (covered within other levels)1 |  |
| Moderate activities | No, not limited at all | Excluded (covered within other levels)2 |  |
|  | Yes, limited a little | Mapped directly to: | Limited in moderate activities a little |
|  | Yes, limited a lot | Mapped directly to: | Limited in moderate activities a lot |
| Bathing and dressing | No, not limited at all | Excluded (covered within other levels)3 |  |
|  | Yes, limited a little | Excluded (covered within other levels and ambiguous in v1)4 |  |
|  | Yes, limited a lot | Mapped directly to: | Limited in bathing and dressing a lot |

1. “Limited in vigorous activities a lot” excluded as covered within “Limited in moderate activities a little” and “Limited in moderate activities a lot”
2. “Limited in moderate activities not at all” excluded as covered within “Limited in vigorous activities not at all” and “Limited in vigorous activities a little”
3. “Limited in bathing and dressing not at all” excluded as covered within “Limited in vigorous activities not at all” and “Limited in vigorous activities a little”
4. “Limited in bathing and dressing not at all” excluded as covered within other levels and ambiguous

**Table 11: Role Functioning dimension development**

|  |  |  |  |
| --- | --- | --- | --- |
| **SF-36 item** | **Response level** | **Action** | **SF-6Dv2 dimension** |
| **RP question stem:** During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of your physical health? | | | |
| **RE question stem:** During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)? | | | |
| Accomplished less than you would like | None of the time | Mapped directly to: | Accomplish less than you would like none of the time |
| A little of the time | Mapped directly to: | Accomplish less than you would like a little of the time |
| Some of the time | Mapped directly to: | Accomplish less than you would like some of the time |
| Most of the time | Mapped directly to: | Accomplish less than you would like most of the time |
| All of the time | Mapped directly to: | Accomplish less than you would like all of the time |

**Table 12: Social Functioning dimension development**

|  |  |  |  |
| --- | --- | --- | --- |
| **SF-36 item** | **Response level** | **Action** | **SF-6Dv2 dimension** |
| During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)? | None of the time | Mapped directly to: | Social activities are limited none of the time |
| A little of the time | Mapped directly to: | Social activities are limited a little of the time |
| Some of the time | Mapped directly to: | Social activities are limited some of the time |
| A little of the time | Mapped directly to: | Social activities are limited most of the time |
| All of the time | Mapped directly to: | Social activities are limited all of the time |

**Table 13: Pain dimension development**

|  |  |  |  |
| --- | --- | --- | --- |
| **SF-36 item** | **Response level** | **Action** | **SF-6Dv2 dimension** |
| How much bodily pain have you had during the past 4 weeks? | None | Mapped directly to: | No pain |
| Very mild | Mapped directly to: | Very mild pain |
| Mild | Mapped directly to: | Mild pain |
| Moderate | Mapped directly to: | Moderate pain |
| Severe | Mapped directly to: | Severe pain |
| Very severe | Mapped directly to: | Very severe pain |

**Table 14: Mental health dimension development**

|  |  |  |  |
| --- | --- | --- | --- |
| **SF-36 item** | **Response level** | **Action** | **SF-6Dv2 dimension** |
| Item stem: How much of the time during the past 4 weeks. | |  |  |
| Have you been very nervous? | None of the time | Items combined and mapped to: | Depressed or very nervous none of the time |
|  | A little of the time | Items combined and mapped to: | Depressed or very nervous a little of the time |
| Have you felt downhearted and depressed? | Some of the time | Items combined and mapped to: | Depressed or very nervous some of the time |
|  | Most of the time | Items combined and mapped to: | Depressed or very nervous most of the time |
|  | All of the time | Items combined and mapped to: | Depressed or very nervous all of the time |

**Table 15: Vitality dimension development**

|  |  |  |  |
| --- | --- | --- | --- |
| **SF-36 item** | **Response level** | **Action** | **SF-6Dv2 dimension** |
| How much of the time  during the past 4 weeks:  Did you feel worn out? | None of the time | Mapped directly to: | Worn out none of the time |
| A little of the time | Mapped directly to: | Worn out a little of the time |
| Some of the time | Mapped directly to: | Worn out some of the time |
| Most of the time | Mapped directly to: | Worn out most of the time |
| All of the time | Mapped directly to: | Worn out all of the time |

**References**

Brazier J, Roberts J, Deverill M. The estimation of a preference-based measure of health from the SF-36. J Health Econ 2002;21:271-92.

Currie CJ, McEwan P, Peters JR, et al. The routine collation of health outcomes data from hospital treated subjects in the Health Outcomes Data Repository (HODaR): descriptive analysis from the first 20,000 subjects. Value Health 2005;8(5):581-90.

Mulhern B, Norman R, Bansback N, et al. Valuing SF-6Dv2 in the UK using a discrete choice experiment with duration. Med Care, submitted.

Richardson J, Iezzi A, Maxwell A. Cross-national comparison of twelve quality of life instruments: MIC Paper 1 Background, questions, instruments. Melbourne: Centre for Health Economics, Monash University, 2012.