EQ-5D

EuroQol Working Paper Series

Number 19001
May 2019

ORIGINAL RESEARCH

eq5d5l: A command to estimate preference-based values

Juan M. Ramos-Goñi[1]
Jesús Oramas-Zarate[1]
Oliver Rivero-Arias[2]

[1] Axentiva Solutions, S.L.
[2] University of Oxford

www.euroqol.org

Abstract

The eq5d5l command computes preference-based index values using the individual mobility, self-care, usual activities, pain or discomfort, and anxiety or depression responses from the EQ-5D-5L quality-of-life instrument. The command calculates at the moment index values using published value sets from thirteen countries: Canada, China, England, Germany, Hong Kong, Indonesia, Ireland, Japan, South Korea, The Netherlands, Spain, Thailand, and Uruguay.

Keywords

eq5d5l, EQ-5D-5L, value sets, preferences, health states

Acknowledgements

This work was funded by the EuroQol Foundation with project number EQ Project 20180240.

Juan M. Ramos-Goñi
Axentiva Solutions, S.L.
Tenerife, Spain
E: juanmanuel.ramosgoni@gmail.com

eq5d5l: A command to estimate preference-based values to health states from the EQ-5D-5L quality-of-life instrument

Juan Manuel Ramos-Goñi, Axentiva Solutions. Tenerife, Spain. (juanmanuel.ramosgoni@gmail.com)

Jesús Oramas Zárate, Axentiva Solutions. Tenerife, Spain. (jesus.oramas.zarate@gmail.com)

Oliver Rivero-Arias, National Perinatal Epidemiology Unit (NPEU), Nuffield Department of Population Health, University of Oxford. Oxford, UK. (oliver.rivero@npeu.ox.ac.uk)

Abstract

The eq5d5l command computes preference-based index values using the individual mobility, self-care, usual activities, pain or discomfort, and anxiety or depression responses from the EQ-5D-5L quality-of-life instrument. The command calculates at the moment index values using published value sets from thirteen countries: Canada, China, England, Germany, Hong Kong, Indonesia, Ireland, Japan, South Korea, The Netherlands, Spain, Thailand, and Uruguay.

Keywords: eq5d5l, EQ-5D-5L, value sets, preferences, health states

1 Description

The eq5d5l command is based on the previously existing eq5d command (Ramos-Goñi and Rivero-Arias 2010). As its predecessor, the eq5d5l computes preference-based index values from individual responses to the EQ-5D-5L quality-of-life instrument. eq5d5l converts health states from the 5-level EQ-5D version (i.e. EQ-5D-5L) whereas eq5d does it for the 3-level EQ-5D version (i.e. EQ-5D-3L). The EQ-5D-5L was developed to overcome ceiling effects and improve the responsiveness of the instrument reported in previous EQ-5D-3L studies (Herdman et al 2011). The EQ-5D-5L instrument includes five domains: mobility, self-care, usual activities, pain or discomfort, and anxiety or depression. Each domain allows five response levels indicating "no problems", "slight problems", "moderate problems", "severe problems", and "unable to/extreme problems". Therefore, the EQ-5D-5L generates 3,125 (or 5^5) health states that can be converted into a preference-based index value or a health-related quality-of-life scores using a validated value set. Recent value sets are produced using a valuation protocol developed by the EuroQol Group (Oppe et al 2014). This valuation protocol included two elicitation techniques: composite time trade-off and discrete choice experiments. Since 2014 thirteen EQ-D5-5L valuation studies in different countries have been completed using that protocol including Canada (Xie et al 2016); China (Luo et al 2017); England (Devlin et al 2017); Germany (Ludwig et al 2018); Hong Kong (Wong et al 2017); Indonesia (Purba et al 2017); Ireland (Hobbins et al 2018) Japan (Shiroiwa et al 2016); South Korea (Kim et al 2016); Netherlands (Versteegh et al 2016); Spain (Ramos-Goñi et al 2018), Thailand (Pattanaphesaj et al 2018) and Uruguay (Augustovski et al 2016). At the time of writing this working paper we are aware of 12 ongoing studies.

Most of EQ-5D-5L value sets have an upper bound equal to 1 that indicates full health (indicated by "no problem" in all domains), whereas 0 represents the dead health state. Negative values are allowed indicating health states worse than death and the lower bound varies depending on the country-specific value set used. The aim of the eq5d5l command is to facilitate index values calculation for users and programmers working with individual participant EQ-5D-5L data in Stata.

2 Syntax

eq5d5l $varname_1$ $varname_2$ $varname_3$ $varname_4$ $varname_5$ [if] [in], [country(CA | CN | DE | EN | ES | HK | IN | IR | JP | KR | NL | TH | UY) saving(newvarname) by(groupvar)]

The variables must be introduced in the same order in which they appear in the EQ-5D-5L questionnaire, for example, "mobility" for varname1, "self-care" for varname2, "usual activities" for varname3, "pain/discomfort" for varname4, and "anxiety or depression" for varname5. In addition, the levels of each EQ-

5D-5L variable need to be coded as follows: 1 for “no problems”, 2 for “slight problems”, 3 for “moderate problems”, 4 for “severe problems”, and 5 for “unable to/extreme problems”. When missing values are present in any of the domains for a particular individual, the index-value calculation for that individual will also be missing.

3 Options

country(CA | CN | DE | EN | ES | HK | IN | IR | JP | KR | NL | TH | UY) specifies the country-specific value set to be used in the estimation of the EQ-5D5L index values. The country code should be specified in capital letters as follows: Canada (CA), China (CN), England (EN), Germany (DE), Hong Kong (HK), Indonesia (IN), Ireland (IR), Japan (JP), South Korea (KR), Netherlands (NL), Spain (ES), Thailand (TH), and Uruguay (UY).

saving(newvarname) specifies the name of the new variable under which the index value will be stored.

by(groupvar) specifies the group variable to be used by eq5d5l when reporting descriptive statistics for each of the groups identified by groupvar.

4 Example

To illustrate how eq5d5l works, a hypothetical dataset of 20 individuals with information on the five domains of the EQ-5D-5L, along with gender and age, has been simulated. The data have been stored in eq5d5l.dta.

```
. use http://www.axentiva.es/stata/eq5d5l.dta, clear

. describe

Contains data from http://www.axentiva.es/stata/eq5d5l.dta
  obs:            20
 vars:             9                          23 Sep 2018 09:36
 size:           240
-------------------------------------------------------------------------------
              storage   display    value
variable name   type    format     label      variable label
-------------------------------------------------------------------------------
ID              long    %12.0g                Individual identifier
age             byte    %8.0g      age        Age
gender          byte    %8.0g      sex        Gender
eqmob           byte    %15.0g     mobility   EQ-5D mobility
eqcare          byte    %15.0g     care       EQ-5D self-care
equact          byte    %15.0g     activity   EQ-5D usual activities
eqpain          byte    %15.0g     pain       EQ-5D pain
eqanx           byte    %15.0g     anxiety    EQ-5D anxiety
eqvas           byte    %8.0g      VAS        Visual Analog Scale
-------------------------------------------------------------------------------
Sorted by: ID
```

```
. list
```

	ID	age	gender	eqmob	eqcare	equact	eqpain	eqanx	eqvas
1.	1	52	Male	-1	2	1	1	1	90
2.	2	48	Male	2	2	2	1	1	83
3.	3	50	Female	1	2	3	1	1	75
4.	4	51	Male	2	2	4	1	1	70
5.	5	62	Male	1	2	5	1	1	76
6.	6	65	Male	2	2	1	1	1	81
7.	7	58	Male	3	3	2	2	5	66
8.	8	48	Male	3	3	3	2	5	68
9.	9	32	Male	4	3	4	2	5	65
10.	10	31	Male	5	3	5	1	4	69
11.	11	68	Female	5	5	1	3	4	75
12.	12	47	Female	5	1	2	3	4	73
13.	13	36	Female	5	3	3	3	5	70
14.	14	49	Female	2	.	4	4	2	64
15.	15	51	Female	3	1	5	3	2	63
16.	16	41	Female	.	1	1	4	2	78
17.	17	41	Female	6	2	2	4	1	83
18.	18	42	Female	2	2	3	4	1	62
19.	19	65	Female	1	2	4	4	1	60
20.	20	49	Female	1	2	5	5	1	50

We can execute the eq5d5l command as follows:

```
. eq5d5l eqmob eqcare equact eqpain eqanx
Error: One or more variables are not coded correctly. EQ-5D-5L variables need to be coded using:
        1 for level 'no problems'
        2 for level 'slight problems'
        3 for level 'moderate problems'
        4 for level 'severe problems'
        5 for level 'unable/extreme problems'
Please tabulate your data and check variables.
r(410);
```

If this error is received, users should tabulate EQ-5D-5L responses in each domain to identify data anomalies.

In our simulated data the variable ‘Mobility’ has not been coded correctly. The error advices users to tabulate the data and check variables.

```
. tabulate eqmob, missing
```

EQ-5D mobility	Freq.	Percent	Cum.
-1	1	5.00	5.00
1	4	20.00	25.00
2	5	25.00	50.00
3	3	15.00	65.00
4	1	5.00	70.00
5	4	20.00	90.00
6	1	5.00	95.00
.	1	5.00	100.00
Total	20	100.00	

Two values of Mobility variable (eqmob) are not correctly coded (values -1 and 6). In real practice, users should attempt to figure out the nature and reasons of these anomalies as they can be corrected avoiding a missing value. In this example, we replaced these two values with missing values.

```
. replace eqmob = . if eqmob < 1 | eqmob > 5
(2 real changes made, 2 to missing)

. tab eqmob, missing
```

EQ-5D mobility	Freq.	Percent	Cum.
1	4	20.00	20.00
2	5	25.00	45.00
3	3	15.00	60.00
4	1	5.00	65.00
5	4	20.00	85.00
.	3	15.00	100.00
Total	20	100.00	

Once all responses are appropriately coded, we are able to execute the command. The mean EQ-5D-5L index value for the whole group using the Dutch value set is calculated and reported as follows:

```
. eq5d5l eqmob eqcare equact eqpain eqanx, country(NL)
```

Variable	Obs	Mean	Std. Dev.	Min	Max
_index	16	.4280875	.2848386	.0475439	.8795144

eq5d5l displays summary statistics for a group variable with the by() option. In the current dataset, for example, we can display summary statistics for the EQ-5D-5L index for the gender variable as follows:

```
. eq5d5l eqmob eqcare equact eqpain eqanx, country(NL) by(gender)

-> gender = Male
```

Variable	Obs	Mean	Std. Dev.	Min	Max
_index	8	.4862855	.3314981	.0475439	.8795144

```
-> gender = Female
```

Variable	Obs	Mean	Std. Dev.	Min	Max
_index	8	.3698896	.2371154	.0898834	.8282129

eq5d5l also displays summary statistics for a specific group of observations determined by the if and in conditions. For example, for a group of participants age 33-69, we could explore the summary statistics for the index values as follows:

```
. eq5d5l eqmob-eqanx if age > 32 & age < 70, country(NL)
```

Variable	Obs	Mean	Std. Dev.	Min	Max
_index	14	.475819	.2713946	.0898834	.8795144

5 Saved results

eq5d5l saves the following in r():

Scalars

r(Nincluded) *number of included observations*

r(Ntotal) *number of total observations*

r(Nvalid) *number of valid observations*

r(mean) *mean*

r(Var) *variance*

r(sd) *standard deviation*

r(min) *minimum*

r(max) *maximum*

6 Methods and formulas

eq5d5l applies the additive linear equation $y = \beta X$ to estimate index values, where β is a vector of coefficients representing decrements from full health and X is a matrix indicating a set of variables representing EQ-5D-5L responses. The algorithm starts with all individuals in full health (that is, the index value equals 1). Depending on the country-specific value set selected, the number of items in β and X varies, reflecting the type of model selected to estimate the value sets in each particular country. A brief description of the items included in β and X in each country is given as follows:

Japan, The Netherlands and Uruguay

β is a 21-parameter vector which represents decrements from full health associated with the items in the X matrix. X is a matrix indicating a main effects specification with the dummy variables for “slight problems”, “moderate problems”, “severe problems”, and “unable to/extreme problems” in each domain of the EQ-5D-5L.

X includes also a dummy variable indicating whether the individual is not in full health. Country-specific coefficients are presented in Table 1.

Table 1.- Country specific coefficients for Japan, The Netherlands and Uruguay

Levels of dimensions	Japan (TTO-based model)	Netherlands (TTO-based model)	Uruguay (TTO-based model)
MO2	-0.064	-0.035	-0.014
MO3	-0.113	-0.057	-0.032
MO4	-0.179	-0.166	-0.108
MO5	-0.243	-0.203	-0.299
SC2	-0.044	-0.038	-0.026
SC3	-0.077	-0.061	-0.061
SC4	-0.124	-0.168	-0.117
SC5	-0.160	-0.168	-0.273
UA2	-0.050	-0.039	-0.042
UA3	-0.091	-0.087	-0.046
UA4	-0.148	-0.192	-0.118
UA5	-0.175	-0.192	-0.231
PD2	-0.045	-0.066	-0.017
PD3	-0.068	-0.092	-0.061
PD4	-0.131	-0.360	-0.187
PD5	-0.191	-0.415	-0.271
AD2	-0.072	-0.070	-0.009
AD3	-0.110	-0.145	-0.044
AD4	-0.168	-0.356	-0.104
AD5	-0.196	-0.421	-0.177
Deviation from full health	-0.061	-0.047	-0.013

China, Germany, England, Spain, Hong-Kong, Indonesia, Ireland, and Thailand

β is a 20-parameter vector which represents decrements from full health associated with the items in the X matrix. X is a matrix indicating a main effects specification with the dummy variables for “slight problems”, “moderate problems”, “severe problems”, and “unable to/extreme problems” in each domain of the EQ-5D-5L. Country-specific coefficients are presented in Table 2.

Table 2.- Country specific coefficients for China, Germany, England, Spain, Hong-Kong, Indonesia, Ireland, and Thailand

Levels of dimensions	China (TTO-based model)	Germany (hybrid-based model)	England (hybrid-based model)	Spain (hybrid-based model)	Hong-Kong (hybrid-based model)	Indonesia (hybrid-based model)	Ireland (hybrid-based model)	Thailand (hybrid-based model)
MO2	-0.066	-0.026	-0.058	-0.084	-0.109	-0.119	-0.063	-0.066
MO3	-0.158	-0.042	-0.076	-0.099	-0.182	-0.192	-0.097	-0.087
MO4	-0.287	-0.139	-0.207	-0.250	-0.371	-0.410	-0.215	-0.211
MO5	-0.345	-0.224	-0.274	-0.337	-0.529	-0.613	-0.344	-0.371
SC2	-0.048	-0.050	-0.050	-0.050	-0.087	-0.101	-0.055	-0.058
SC3	-0.116	-0.056	-0.080	-0.053	-0.113	-0.140	-0.088	-0.071
SC4	-0.210	-0.169	-0.164	-0.164	-0.271	-0.248	-0.229	-0.193
SC5	-0.253	-0.260	-0.203	-0.196	-0.352	-0.316	-0.287	-0.250
UA2	-0.045	-0.036	-0.050	-0.044	-0.067	-0.090	-0.049	-0.058
UA3	-0.107	-0.049	-0.063	-0.049	-0.094	-0.156	-0.072	-0.071
UA4	-0.194	-0.129	-0.162	-0.135	-0.234	-0.301	-0.154	-0.154
UA5	-0.233	-0.209	-0.184	-0.153	-0.282	-0.385	-0.187	-0.284
PD2	-0.058	-0.057	-0.063	-0.078	-0.076	-0.086	-0.068	-0.056
PD3	-0.138	-0.109	-0.084	-0.101	-0.147	-0.095	-0.093	-0.067
PD4	-0.252	-0.404	-0.276	-0.245	-0.307	-0.198	-0.373	-0.207
PD5	-0.302	-0.612	-0.335	-0.382	-0.354	-0.246	-0.510	-0.256
AD2	-0.049	-0.030	-0.078	-0.081	-0.080	-0.079	-0.080	-0.058
AD3	-0.118	-0.082	-0.104	-0.128	-0.140	-0.134	-0.202	-0.096
AD4	-0.215	-0.244	-0.285	-0.270	-0.293	-0.227	-0.535	-0.233
AD5	-0.258	-0.356	-0.289	-0.348	-0.348	-0.305	-0.646	-0.295

Canada

β is a 12-parameter vector which represents decrements of the index value associated with the items in the X matrix. X is a matrix with the variables representing the response levels (1-5). X also has six extra dummy variables: one dummy variable per each domain representing whether it has a response at “severe problems” or “unable to/extreme problems” levels and one dummy variable indicating whether the individual is not in full health. In addition, X includes a variable, which represents the square of the number of domains having a response at “severe problems” or “unable to/extreme problems” level. Canadian specific coefficients are shown in Table 4.

Table 3.- Country specific coefficients for Canada

Levels of dimensions	Canada (TTO-based model)
Intercept	1.1351
MO	-0.0389
SC	-0.0458
UA	-0.0195
PD	-0.0444
AD	-0.0376
MO45	-0.0510
SC45	-0.0584
UA45	-0.1103
PD45	-0.1409
AD45	-0.1277
Num45sq	0.0085

South Korea

β is a 22-parameter vector which represents decrements from full health associated with the items in the X matrix. X is a matrix with dummy variables for "slight problems", "moderate problems", "severe problems", and "unable to/extreme problems" in each domain of the EQ-5D-5L. X also has two extra dummy variables: one dummy variable indicating whether the individual is not in full health and another dummy variable indicating whether any of the dimensions has a response at "severe problems" or "unable to/extreme problems" level. South Korean specific coefficients are shown in Table 4.

Table 4.- Country specific coefficients for South Korea

Levels of dimensions	South Korea (TTO-based model)
MO2	-0.046
MO3	-0.058
MO4	-0.133
MO5	-0.251
SC2	-0.032
SC3	-0.050
SC4	-0.078
SC5	-0.122
UA2	-0.021
UA3	-0.051
UA4	-0.100
UA5	-0.175
PD2	-0.042
PD3	-0.053
PD4	-0.166
PD5	-0.207
AD2	-0.033
AD3	-0.046
AD4	-0.102
AD5	-0.137
Deviation from full health	-0.096
Any dimension at levels 4 or 5	-0.078

For a full description of the models estimated in each country, the reader is referred to the original publications listed on the references section of this working paper.

Note: The health state death in EQ-5D-5L value sets is coded as 0, but eq5d5l will report missing values for deceased participants because no EQ-5D-5L responses are available. Users need to recode these missing values to 0 after implementing eq5d5l for dead participants.

7 Installation

In order to install this command, please open Stata (version 9 or above) and type in the command line:

*" **net install eq5d5l, from(http://www.euroqol.org/STATA)**"*

After installation try "**do http://*www.euroqol.org/STATA*/example_eq5d5l.do**" as an example.

8 Acknowledgments

This work was funded by the EuroQol Foundation with project number EQ Project 20180240.

9 References

1 Ramos-Goni JM, Rivero-Arias O. eq5d: A command to calculate index values for the EQ-5D quality-of-life instrument. The Stata Journal. Volume 11 Number 1: pp. 120-125.

2 Herdman M, Gudex C, Lloyd A, Janssen M, Kind P, Parkin D, Bonsel G, Badia X. Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). Qual Life Res 2011 Dec;20(10):1727-1736.

3 Oppe M, Devlin NJ, van Hout B, Krabbe PFM, de Charro F. A program of methodological research to arrive at the new inter- national EQ-5D-5L valuation protocol. Value Health. 2014;17:445–53.

4 Xie F, Pullenayegum E, Gaebel K, Bansback N, Bryan S, Ohinmaa A, Poissant L, Johnson JA. A Time Trade-off-derived Value Set of the EQ-5D-5L for Canada. Med Care. 2016;54(1):98-105.

5 Luo N, Liu G, Li M, Guan H, Jin X, Rand-Hendriksen K. Estimating an EQ-5D-5L Value Set for China. Value Health. 2017 Apr;20(4):662-669

6 Devlin N, Shah K, Feng Y, Mulhern B, van Hout B. Valuing health-related quality of Life: An EQ-5D-5L Value Set for England. Health Economics. 2017;1-16

7 Ludwig K, Graf von der Schulenburg JM, Greiner W. German Value Set for the EQ-5D-5L. Pharmacoeconomics. 2018 Feb 19. doi: 10.1007/s40273-018-0615-8.

8 Wong ELY, Ramos-Goñi JM, Cheung AWL, Wong AYK, Rivero-Arias O. Assessing the Use of a Feedback Module to Model EQ-5D-5L Health States Values in Hong Kong. Patient. 2017 Oct 10. doi: 10.1007/s40271-017-0278-0.

9 Purba FD, Hunfeld JAM, Iskandarsyah A, Fitriana TS, Sadarjoen SS, Ramos-Goñi JM, Passchier J, Busschbach JJ. The Indonesian EQ-5D-5L Value Set. PharmacoEconomics. 2017 July. pp 1-13.

10 Hobbins A, Barry L, Kelleher D, Shah K, Devlin N, Ramos-Goñi JM, O'Neill C. Utility values for health states in Ireland: a value set for the EQ-5D-5L. PharmacoEconomics. 2018 July. In press.

11 Shiroiwa T, Ikeda S, Noto S, Igarashi A, Fukuda T, Saito S, Shimozuma K. Comparison of Value Set Based on DCE and/or TTO Data: Scoring for EQ-5D-5L Health States in Japan. Value Health. 2016 Jul-Aug;19(5):648-54.

12 Kim SH, Ahn J, Ock M, Shin S, Park J, Luo N, Jo MW. The EQ-5D-5L valuation study in Korea. Qual Life Res. 2016 Jul;25(7):1845-52.

13 Versteegh MM, Vermeulen KM, Evers SM, de Wit GA, Prenger R, Stolk EA. Dutch Tariff for the Five-Level Version of EQ-5D. Value Health. 2016;19(4):343-52.

14 Ramos-Goñi JM, Craig B, Oppe M, Ramallo-Fariña Y, Pinto-Prades JL, Luo N, Rivero-Arias O. Handling data quality issues to estimate the Spanish EQ-5D-5L Value Set using a hybrid interval regression approach. Value in Health 2017. In Press

15 Pattanaphesaj J, Thavorncharoensap M, Ramos-Goñi JM, Tongsiri S, Ingsrisawang L, Teerawattananon Y. The EQ-5D-5L Valuation study in Thailand. Expert Rev Pharmacoecon Outcomes Res. 2018 Jul 6:1-8.

16 Augustovski F, Rey-Ares L, Irazola V, Garay OU, Gianneo O, Fern?ndez G, Morales M, Gibbons L, Ramos-Goñi JM. An EQ-5D-5L value set based on Uruguayan population preferences. Qual Life Res. 2016;25(2):323-33. Erratum in: Qual Life Res. 2016 Feb;25(2):335.

About the authors

Juan Manuel Ramos-Goñi is senior consultant at Axentiva Solutions S.L.

Jesús Oramas Zárate is junior consultant at Axentiva Solutions S.L.

Oliver Rivero-Arias is Associate Professor at the National Perinatal Epidemiology Unit (NPEU), Nuffield Department of Population Health, University of Oxford.