# eq5d: A command to calculate index values for the EQ-5D quality-of-life instrument

Juan Manuel Ramos-Goñi
Canary Islands Health Care Service
Canary Islands, Spain
jramos@sescs.es

Oliver Rivero-Arias
Health Economics Research Centre
University of Oxford
Oxford, UK
oliver.rivero@dphpc.ox.ac.uk

**Abstract.** The `eq5d` command computes an index value using the individual mobility, self care, usual activities, pain or discomfort, and anxiety or depression responses from the EuroQol EQ-5D quality-of-life instrument. The command calculates index values using value sets from eight countries: the United Kingdom, the United States, Spain, Germany, the Netherlands, Denmark, Japan, and Zimbabwe.

**Keywords:** st0220, eq5d, EQ-5D, index value

## 1 Description

The `eq5d` command computes an index value from individual responses to the EQ-5D quality-of-life instrument. The EQ-5D is a generic quality-of-life survey developed by the EuroQol Group and used widely by health economists and epidemiologists conducting applied work (EuroQol Group 1990). The EQ-5D survey includes five questions or domains covering mobility, self care, usual activities, pain or discomfort, and anxiety or depression. Each domain contains three possible responses indicating "no problem", "some problems", or "extreme problems". Therefore, the EQ-5D yields 243 (or $3^5$) possible health states that can be converted into an index value or a health-related quality-of-life score using a validated value set normally estimated using time trade-off methods and regression analysis. Initially only available in the United Kingdom, over the last decade, several country-specific value sets have been estimated and compiled by the EuroQol Group in Szende, Oppe, and Devlin (2007).

The EQ-5D index has an upper bound equal to 1 that indicates full health (indicated by "no problem" in all domains), whereas 0 represents death. Negative values are allowed, and the lower bound varies depending on the country-specific value set used.

`eq5d` provides users and programmers working with EQ-5D data in Stata with an easy implementation of the published country-specific value sets.

## 2 Syntax

eq5d *varname₁ varname₂ varname₃ varname₄ varname₅* $\left[\,if\,\right]$ $\left[\,in\,\right]$

   $\big[$ , <u>c</u>ountry(GB│US│ES│DE│NL│DK│JP│ZW) <u>sa</u>ving(*newvarname*) by(*groupvar*) $\big]$

   The variables must be introduced in the same order in which they appear in the EQ-5D questionnaire, for example, "mobility" (eqmob) for *varname₁*, "self-care" (eqcare) for *varname₂*, "usual activities" (equact) for *varname₃*, "pain/discomfort" (eqpain) for *varname₄*, and "anxiety or depression" (eqanx) for *varname₅*. In addition, the levels of each EQ-5D variable need to be coded as follows: 1 for "no problem", 2 for "some problem", and 3 for "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(GB│US│ES│DE│NL│DK│JP│ZW) specifies the country-specific value set to be used in the estimation of the EQ-5D index values. The country code should be specified in capital letters as follows: the United Kingdom (GB), the United States (US), Spain (ES), Germany (DE), the Netherlands (NL), Denmark (DK), Japan (JP), and Zimbabwe (ZW). The default is country(GB).

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

by(*groupvar*) specifies the group variable that contains the groups to be used by eq5d when reporting descriptive statistics.

## 4 Example

To illustrate how eq5d works, a hypothetical dataset of 20 individuals with information on the five domains of the EQ-5D, along with gender and age, has been simulated. The data have been stored in eq5d.dta.

```
. use eq5d
(Example data for eq5d)

. describe

Contains data from eq5d.dta
  obs:            20                          Example data for eq5d
 vars:             8                          18 Feb 2010 13:59
 size:           300 (99.9% of memory free)
```

| variable name | storage type | display format | value label | variable label |
|---|---|---|---|---|
| id | long | %12.0g | | Individual identifier |
| age | byte | %8.0g | | Age |
| gender | byte | %8.0g | gender | Gender |
| eqmob | byte | %15.0g | mobility | EQ-5D mobility |
| eqcare | byte | %13.0g | care | EQ-5D self-care |
| equact | byte | %13.0g | activity | EQ-5D usual activities |
| eqpain | byte | %13.0g | pain | EQ-5D pain |
| eqanx | byte | %18.0g | anxiety | EQ-5D anxiety |

```
Sorted by:  gender

. list, nolabel
```

|  | id | age | gender | eqmob | eqcare | equact | eqpain | eqanx |
|---|---|---|---|---|---|---|---|---|
| 1. | 1 | 49 | 1 | 1 | 1 | 1 | 2 | 1 |
| 2. | 2 | 68 | 1 | 1 | 2 | 1 | 2 | 1 |
| 3. | 3 | 75 | 1 | 2 | 1 | 3 | 2 | 3 |
| 4. | 4 | 66 | 1 | 1 | 1 | 1 | 2 | 1 |
| 5. | 5 | 66 | 1 | 1 | 2 | 2 | 2 | 2 |
| 6. | 6 | 29 | 1 | 1 | 1 | 1 | 1 | 1 |
| 7. | 7 | 35 | 1 | 1 | 1 | 1 | 2 | 1 |
| 8. | 8 | 40 | 1 | 1 | 1 | 1 | 1 | 1 |
| 9. | 9 | 30 | 1 | 1 | 1 | 1 | 1 | 1 |
| 10. | 10 | 49 | 1 | 2 | 1 | 2 | 1 | 3 |
| 11. | 11 | 23 | 2 | 1 | 1 | 1 | 1 | 1 |
| 12. | 12 | 44 | 2 | 2 | 1 | 1 | 2 | 2 |
| 13. | 13 | 85 | 2 | 2 | 2 | 2 | 2 | 2 |
| 14. | 14 | 30 | 2 | 1 | 3 | 1 | 1 | 1 |
| 15. | 15 | 20 | 2 | 1 | 1 | 1 | 1 | 1 |
| 16. | 16 | 46 | 2 | 1 | 1 | 1 | 2 | 1 |
| 17. | 17 | 50 | 2 | 1 | 1 | 1 | 1 | 1 |
| 18. | 18 | 82 | 2 | 2 | 2 | 2 | 2 | 1 |
| 19. | 19 | 49 | 2 | 1 | 1 | 1 | 1 | 1 |
| 20. | 20 | 21 | 2 | 1 | 1 | 1 | 1 | 1 |

The sample data have been sorted by **gender**, where 1 indicates male and 2 indicates female, with women on average enjoying a better quality of life compared with men. The lower quality of life of male individuals is driven by observations 3 and 10, which both feature a level-3 (extreme problems) response on at least one domain. The EQ-5D index value for the whole group using the United States value set is calculated and reported as follows:

```
. eq5d eqmob eqcare equact eqpain eqanx, country(US)
```

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| _index | 20 | .81365 | .1910834 | .4029999 | 1 |

eq5d 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 index for the gender variable as follows:

```
. eq5d eqmob eqcare equact eqpain eqanx, country(US) by(gender)
```

-> gender = Male

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| _index | 10 | .7875 | .2013876 | .4029999 | 1 |

-> gender = Female

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| _index | 10 | .8398 | .1870994 | .529 | 1 |

eq5d also displays summary statistics for a specific group of observations determined by the if and in conditions. For example, for a group of patients within a particular age interval, we could explore the summary statistics for the index values as follows:

```
. eq5d eqmob-eqanx if age>32 & age<70, country(US)
```

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| _index | 11 | .8236364 | .1432028 | .533 | 1 |

# 5   Saved results

eq5d 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

eq5d applies the additive linear equation $y = \beta \mathbf{X}$ to estimate index values, where $\beta$ is a vector of coefficients representing decrements from full health of the index value and $\mathbf{X}$ is a matrix indicating a set of covariates. 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 $\boldsymbol{\beta}$ and $\mathbf{X}$ varies, reflecting the type of model selected to fit the value sets in each particular country. A brief description of the items included in $\boldsymbol{\beta}$ and $\mathbf{X}$ in each country is given as follows:

Denmark, Japan, and Zimbabwe
> $\boldsymbol{\beta}$ represents decrements of the index value associated with the items in the $\mathbf{X}$ matrix. $\mathbf{X}$ is a matrix with the dummy variables for "some problems" and "extreme problems" in each domain of the EQ-5D. $\mathbf{X}$ also has a dummy variable indicating whether the individual is not in full health.

The United Kingdom, Spain, Germany, and the Netherlands
> $\boldsymbol{\beta}$ represents decrements of the index value associated with the items in the $\mathbf{X}$ matrix. $\mathbf{X}$ is a matrix with the dummy variables for "some problems" and "extreme problems" in each domain of the EQ-5D. $\mathbf{X}$ also has a dummy variable indicating whether the individual is not in full health and an additional dummy variable indicating whether "extreme problems" were reported in any of the domains.

The United States
> $\boldsymbol{\beta}$ represents decrements of the index value associated with the items in the $\mathbf{X}$ matrix. $\mathbf{X}$ is a matrix with the following: dummy variables for "some problems" and "extreme problems" in each domain of the EQ-5D, an ordinal variable that represents the number of deviations from full health beyond the first movement away, an ordinal variable that represents the number of domains with "extreme problems" beyond the first movement and its square, and the square of an ordinal variable that represents the number of domains with "some problems" beyond the first movement away.

For a full description of the models fit in each country, the reader is referred to the original research publications. References can be found in the monograph by the EuroQol Group (Szende, Oppe, and Devlin 2007).

Note: Death in the EQ-5D value sets is coded 0, but `eq5d` will report missing values for deceased patients because no EQ-5D responses are available. Hence, the user needs to recode these values manually if mortality is present in the dataset after implementing `eq5d`.

# 7 Acknowledgments

# 8 References

EuroQol Group. 1990. EuroQol—a new facility for the measurement of health-related quality of life. *Health Policy* 16: 199–208.

Szende, A., M. Oppe, and N. Devlin, ed. 2007. *EQ-5D Value Sets: Inventory, Comparative Review and User Guide.* Dordrecht: Springer.

**About the authors**

Juan Manuel Ramos-Goñi is a biostatistician at the Canary Islands Health Care Service, Spain.

Oliver Rivero-Arias is a senior researcher at the Health Economics Research Centre at the University of Oxford, United Kingdom.