

# Package ‘eq5d’

November 12, 2020

**Type** Package

**Title** Methods for Calculating 'EQ-5D' Utility Index Scores

**Version** 0.8.0

**Description** EQ-5D is a popular health related quality of life instrument used in the clinical and economic evaluation of health care. Developed by the EuroQol group <<https://euroqol.org/>>, the instrument consists of two components: health state description and evaluation. For the description component a subject self-rates their health in terms of five dimensions; mobility, self-care, usual activities, pain/discomfort, and anxiety/depression using either a three-level (EQ-5D-3L, <<https://euroqol.org/eq-5d-instruments/eq-5d-3l-about/>>) or a five-level (EQ-5D-5L, <<https://euroqol.org/eq-5d-instruments/eq-5d-5l-about/>>) scale. Frequently the scores on these five dimensions are converted to a single utility index using country specific value sets, which can be used in the clinical and economic evaluation of health care as well as in population health surveys. The eq5d package provides methods to calculate index scores from a subject's dimension scores. 26 TTO and 11 VAS EQ-5D-3L value sets including those for countries in Szende et al (2007) <[doi:10.1007/1-4020-5511-0](https://doi.org/10.1007/1-4020-5511-0)> and Szende et al (2014) <[doi:10.1007/978-94-007-7596-1](https://doi.org/10.1007/978-94-007-7596-1)>, 25 EQ-5D-5L EQ-VT value sets from the EuroQol website, and the EQ-5D-5L crosswalk value sets developed by van Hout et al. (2012) <[doi:10.1016/j.jval.2012.02.008](https://doi.org/10.1016/j.jval.2012.02.008)> are included. Additionally, a shiny web tool is included to enable the calculation, visualisation and automated statistical analysis of EQ-5D index values via a web browser using EQ-5D dimension scores stored in CSV or Excel files.

**License** MIT + file LICENSE

**Encoding** UTF-8

**LazyData** true

**Depends** R (>= 3.5.0)

**Suggests** testthat, shiny, DT, mime, readxl, ggplot2, ggiraph, ggiraphExtra, shinycssloaders, shinyWidgets, FSA, PMCMRplus, knitr, rmarkdown, covr

**URL** <https://github.com/fragla/eq5d>

**BugReports** <https://github.com/fragla/eq5d/issues>

**RoxygenNote** 7.1.1

**VignetteBuilder** knitr

**Language** en-GB

**NeedsCompilation** no

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CW

*EQ-5D-5L Crosswalk data*

---

### Description

Crosswalk index value calculation table to calculate EQ-5D-3L indices from EQ-5D-5L data for Denmark, France, Germany, Japan, Netherlands, Spain, Thailand, UK, USA and Zimbabwe.

### Usage

CW

**Format**

An object of class `data.frame` with 3125 rows and 10 columns.

**Source**

van Hout B, Janssen MF, et al. Interim scoring for the EQ-5D-5L: Mapping the EQ-5D-5L to EQ-5D-3L value sets. *Value in Health* 2012 Jul-Aug;15(5):708-15. doi: 10.1016/j.jval.2012.02.008. [PubMed](#)

[EQ-5D-5L Crosswalk Index Value Calculator](#)

---

eq5d	<i>Calculate EQ-5D index scores</i>
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**Description**

Wrapper for `eq5d3l` and `eq5d5l`. Calculate EQ-5D index scores for EQ-5D-3L and EQ-5D-5L. Available value sets can be viewed using the function `valuesets`.

**Usage**

```
eq5d(scores, version, type, country, ignore.invalid, ...)
```

**Arguments**

scores	numeric or <code>data.frame</code> with names/colnames MO, SC, UA, PD and AD representing Mobility, Self-care, Usual activities, Pain/discomfort and Anxiety/depression. Alternatively an EQ-5D score can be provided in five digit format e.g. 12321.
version	string of value "3L" or "5L" to indicate instrument version.
type	string specifying method type used in deriving value set scores. Options are TTO or VAS for EQ-5D-3L, VT for EQ-5D-5L or CW for EQ-5D-5L crosswalk conversion valuesets.
country	string of value set country name used.
ignore.invalid	logical to indicate whether to ignore dimension data with invalid, incomplete or missing data.
...	character vectors, specifying "dimensions" column names or "five.digit" column name. Defaults are "MO", "SC", "UA", "PD" and "AD" for dimensions and "State" for five.digit.

**Value**

a numeric vector of utility index scores.

**Examples**

```

eq5d(scores=c(MO=1,SC=2,UA=3,PD=4,AD=5), type="VT",
      country="Indonesia", version="5L")
eq5d(scores=c(MO=3,SC=2,UA=3,PD=2,AD=3),
      type="TTO", version="3L", country="Germany")

scores.df <- data.frame(
  MO=c(1,2,3,4,5), SC=c(1,5,4,3,2),
  UA=c(1,5,2,3,1), PD=c(1,3,4,3,4), AD=c(1,2,NA,2,1)
)
eq5d(scores.df, country="Canada", version="5L", type="VT", ignore.invalid=TRUE)

eq5d(scores=12321, type="TTO", version="3L", country="UK")

scores.df2 <- data.frame(
  state=c(11111,12121,23232,33333)
)

eq5d(scores=scores.df2, type="TTO", version="3L", country="UK", five.digit="state")

eq5d(scores=scores.df2$state, type="TTO", version="3L", country="UK")

```

---

eq5d3l

---

*Calculate EQ-5D-3L index scores*


---

**Description**

Calculate indices for EQ-5D-3L value sets. Available value sets can be viewed using the function `valuesets`.

**Usage**

```
eq5d3l(scores, type = "TTO", country = "UK")
```

**Arguments**

<code>scores</code>	numeric with names MO, SC, UA, PD and AD representing Mobility, Self-care, Usual activities, Pain/discomfort and Anxiety/depression.
<code>type</code>	3L values set type. Either TTO or VAS.
<code>country</code>	value set country.

**Value**

calculated utility index score.

**Examples**

```
eq5d3l(scores=c(MO=1,SC=2,UA=3,PD=1,AD=3), type="VAS", country="UK")
eq5d3l(scores=c(MO=3,SC=2,UA=3,PD=2,AD=3), type="TTO", country="Germany")
```

---

eq5d5l	<i>Calculate EQ-5D-5L index scores</i>
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---

**Description**

Calculate indices for EQ-5D-5L value sets. Available value sets can be viewed using the function `valuesets`.

**Usage**

```
eq5d5l(scores, country = "England")
```

**Arguments**

scores	numeric with names MO, SC, UA, PD and AD representing Mobility, Self-care, Usual activities, Pain/discomfort and Anxiety/depression.
country	value set country.

**Value**

calculated utility index score.

**Examples**

```
eq5d5l(scores=c(MO=1,SC=2,UA=3,PD=4,AD=5), country="England")
eq5d5l(scores=c(MO=3,SC=2,UA=5,PD=2,AD=3), country="Netherlands")
```

---

eq5dcf	<i>Calculate the cumulative frequency profile of an EQ-5D dataset</i>
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---

**Description**

Calculate the frequency, percentage, cumulative frequency and cumulative percentage for each profile in an EQ-5D dataset.

**Usage**

```
eq5dcf(data, version, ignore.invalid, ...)
```

**Arguments**

data	data.frame with names MO, SC, UA, PD and AD representing Mobility, Self-care, Usual activities, Pain/discomfort and Anxiety/depression.
version	string of value "3L" or "5L" to indicate instrument version.
ignore.invalid	whether to ignore invalid scores. TRUE returns NA, FALSE throws an error.
...	character vector, specifying "dimensions" column names. Defaults are "MO", "SC", "UA", "PD" and "AD".

**Value**

a data.frame or list of data.frames of counts/percentages. Columns contain dimensions names and rows the EQ-5D score.

---

eq5dcw	<i>Calculate EQ-5D-5L crosswalk index scores</i>
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---

**Description**

Calculate indices for EQ-5D-5L indices by mapping them onto EQ-5D-3L value sets. Available value sets can be viewed using the function `valuesets`.

**Usage**

```
eq5dcw(scores, country = "UK")
```

**Arguments**

scores	numeric with names MO, SC, UA, PD and AD representing Mobility, Self-care, Usual activities, Pain/discomfort and Anxiety/depression.
country	value set country.

**Value**

calculated utility index score.

**Examples**

```
eq5dcw(scores=c(MO=1,SC=2,UA=5,PD=1,AD=3), country="UK")
eq5dcw(scores=c(MO=3,SC=5,UA=5,PD=2,AD=3), country="Germany")
```

---

`eq5dds`*Analyse the descriptive system of an EQ-5D dataset*

---

## Description

Analyses the descriptive components of an EQ-5D dataset producing summary information either as counts or as percentages.

## Usage

```
eq5dds(data, version, counts = FALSE, by = NULL, ...)
```

## Arguments

<code>data</code>	data.frame with names MO, SC, UA, PD and AD representing Mobility, Self-care, Usual activities, Pain/discomfort and Anxiety/depression.
<code>version</code>	string of value "3L" or "5L" to indicate instrument version.
<code>counts</code>	logical show absolute counts in the summary table. Default is FALSE, which shows percentages for each EQ-5D dimension.
<code>by</code>	character specifying the column in the data.frame by which to group the results.
<code>...</code>	character vector, specifying "dimensions" column names. Defaults are "MO", "SC", "UA", "PD" and "AD".

## Value

a data.frame or list of data.frames of counts/percentages. Columns contain dimensions names and rows the EQ-5D score.

## Examples

```
dat <- data.frame(
  matrix(
    sample(1:3,5*12, replace=TRUE),12,5,
    dimnames=list(1:12,c("MO","SC","UA","PD","AD"))
  ),
  Sex=rep(c("Male", "Female"))
)

eq5dds(dat, version="3L")
eq5dds(dat, version="3L", counts=TRUE)

eq5dds(dat, version="3L", by="Sex")
```

---

`getDimensionsFromHealthStates`*Get individual dimension scores from their five digit health states*

---

**Description**

Get a data.frame of individual dimension scores from their five digit health states.

**Usage**

```
getDimensionsFromHealthStates(scores, ignore.invalid = TRUE, version = "5L")
```

**Arguments**

`scores` a vector of five digit scores  
`ignore.invalid` whether to ignore invalid scores. TRUE returns NA, FALSE throws an error.  
`version` 3L or 5L. Used for validating scores when `ignore.invalid` is FALSE.

**Value**

A data.frame of individual dimension scores.

**Examples**

```
getDimensionsFromHealthStates(c("12345", "54321"), version="5L")
```

---

`getHealthStates`*Get all five digit health state scores*

---

**Description**

Get all five digit health state scores for either EQ-5D-3L or EQ-5D-5L.

**Usage**

```
getHealthStates(version)
```

**Arguments**

`version` the EQ-5D version. Either 3L or 5L.

**Value**

A character vector of five digit health states.



**Examples**

```
getHealthStates("3L")
getHealthStates("5L")
```

---

```
getHealthStatesFromDimensions
```

*Get five digit health states from dimension scores*

---

**Description**

Merge MO, SC, UA, PD and AD dimension scores to get five digit health states.

**Usage**

```
getHealthStatesFromDimensions(
  scores,
  version = "5L",
  ignore.invalid = TRUE,
  dimensions = .getDimensionNames()
)
```

**Arguments**

scores	a data.frame containing each dimension in a column
version	3L or 5L. Used for validating scores when ignore.invalid is FALSE.
ignore.invalid	whether to ignore invalid scores. TRUE returns NA, FALSE throws an error.
dimensions	character vector specifying "dimensions" column names. Defaults are "MO", "SC", "UA", "PD" and "AD".

**Value**

A character vector of individual dimension scores.

**Examples**

```
scores <- data.frame(MO=c(1,1,1,1,1),SC=c(1,2,1,2,1),
                    UA=c(1,2,3,2,1),PD=c(3,2,1,2,3),AD=c(3,3,3,3,3))
getHealthStatesFromDimensions(scores, version="5L")
```

---

lfs	<i>Calculate the Level Frequency Score for an EQ-5D profile</i>
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---

**Description**

Calculate the Levels Frequency Score for a single or number of EQ-5D profiles

**Usage**

```
lfs(scores, version, ignore.invalid, ...)
```

**Arguments**

scores	data.frame with names MO, SC, UA, PD and AD representing Mobility, Self-care, Usual activities, Pain/discomfort and Anxiety/depression.
version	string of value "3L" or "5L" to indicate instrument version.
ignore.invalid	whether to ignore invalid scores. TRUE returns NA, FALSE throws an error.
...	character vector, specifying "dimensions" column names. Defaults are "MO", "SC", "UA", "PD" and "AD".

**Value**

a data.frame or list of data.frames of counts/percentages. Columns contain dimensions names and rows the EQ-5D score.

---

lss	<i>Calculate the Level Sum Score for an EQ-5D profile</i>
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---

**Description**

Calculate the Levels Sum Score for a single or number of EQ-5D profiles

**Usage**

```
lss(scores, version, ignore.invalid, ...)
```

**Arguments**

scores	data.frame with names MO, SC, UA, PD and AD representing Mobility, Self-care, Usual activities, Pain/discomfort and Anxiety/depression.
version	string of value "3L" or "5L" to indicate instrument version.
ignore.invalid	whether to ignore invalid scores. TRUE returns NA, FALSE throws an error.
...	character vector, specifying "dimensions" column names. Defaults are "MO", "SC", "UA", "PD" and "AD".

**Value**

a data.frame or list of data.frames of counts/percentages. Columns contain dimensions names and rows the EQ-5D score.

---

pchc

*Calculate the Paretian Classification of Health Change*

---

**Description**

Calculate the Paretian Classification of Health Change (PCHC) for two EQ-5D datasets.

**Usage**

```
pchc(
  pre,
  post,
  version = "5L",
  no.problems = TRUE,
  totals = TRUE,
  by.dimension = FALSE,
  ignore.invalid = TRUE,
  dimensions = .getDimensionNames()
)
```

**Arguments**

pre	data.frame, numeric or character. For data.frame default column names should be MO, SC, UA, PD and AD representing Mobility, Self-care, Usual activities, Pain/discomfort and Anxiety/depression. Vector using five digit format can also be used.
post	data.frame, numeric or character. For data.frame default column names should be MO, SC, UA, PD and AD representing Mobility, Self-care, Usual activities, Pain/discomfort and Anxiety/depression. Vector using five digit format can also be used.
version	string of value "3L" or "5L" to indicate instrument version.
no.problems	boolean. Summarise 11111 "No change" subjects in a "No problems" group.
totals	boolean. Include a summary total.
by.dimension	boolean. Summarise results by each EQ-5D dimension rather than by the whole dataset.
ignore.invalid	boolean whether to ignore invalid scores. TRUE returns NA, FALSE throws an error.
dimensions	character vector, specifying "dimension" column names. Defaults are "MO", "SC", "UA", "PD" and "AD".

**Value**

a data.frame or list of data.frames of changes according to PCHC. contain dimensions names and rows the EQ-5D score.

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shiny_eq5d	<i>Launch shiny EQ-5D interface</i>
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**Description**

shiny\_eq5d launches a shiny interface for browser based EQ-5D calculations.

**Usage**

```
shiny_eq5d(display.mode = "normal")
```

**Arguments**

display.mode    The display mode to be passed to [runApp](#)

**Examples**

```
## Not run:
shiny_eq5d()
shiny_eq5d(display.mode="normal")

## End(Not run)
```

---

TTO	<i>EQ-5D-3L TTO value set data</i>
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**Description**

Coefficients for the estimation of the EQ-5D-3L index values based on TTO valuation studies for Argentina, Australia, Brazil, Canada, Chile, China, Denmark, France, Germany, Italy, Japan, Netherlands, Poland, Portugal, Singapore, South Korea, Spain, Sri Lanka, Sweden, Taiwan, Thailand, Trinidad and Tobago, UK, USA and Zimbabwe.

**Usage**

```
TTO
```

**Format**

An object of class data.frame with 63 rows and 26 columns.

## Source

Szende, A., Oppe, M., & de Charro, F. (2007), Comparative review of Time Trade-Off value sets. In Szende, A., Oppe, M., & Devlin, N. (Ed.), *EQ-5D Value Sets: Inventory, Comparative Review and User Guide* (pp. 27-28). Dordrecht, The Netherlands: Springer.

Janssen, B., Szende, A., & Ramos-Goñi JM. (2014), Data and Methods. Szende, A., Janssen, B., & Cabasés, J. (Ed.), In *Self-Reported Population Health: An International Perspective based on EQ-5D* (p 13). Dordrecht, The Netherlands: Springer.

**Australia:** Viney R, Norman R, King MT, Cronin P, Street DJ, Knox S, Ratcliffe J. Time trade-off derived EQ-5D weights for Australia. *Value Health*. 2011 Sep-Oct;14(6):928-36. doi: 10.1016/j.jval.2011.04.009. [PubMed](#)

**Brazil:** Viegas Andrade M, Noronha K, Kind P, Maia AC, Miranda de Menezes R, De Barros Reis C, Nepomuceno Souza M, Martins D, Gomes L, Nichele D, Calazans J, Mascarenhas T, Carvalho L, Lins C. Societal Preferences for EQ-5D Health States from a Brazilian Population Survey. *Value in Health Regional Issues* 2013;2(3):405–412. [PubMed](#)

**Canada:** Bansback N, Tsuchiya A, Brazier J, Anis A. Canadian valuation of EQ-5D health states: preliminary value set and considerations for future valuation studies. *PLoS One*. 2012;7(2):e31115. [PubMed](#)

**Chile:** Zarate V, Kind P, Valenzuela P, Vignau A, Olivares-Tirado P, Munoz A. Social valuation of EQ-5D health states: the Chilean case. *Value in Health*. 2011 Dec;14(8):1135-41. [PubMed](#)

**China:** Liu GG, Wu H, Li M, Gao C, Luo N. Chinese time trade-off values for EQ-5D health states. *Value Health*. 2014 Jul;17(5):597-604. doi: 10.1016/j.jval.2014.05.007. Epub 2014 Jul 23. [PubMed](#)

**Hungary:** Rencz F, Brodzsky V, Gulácsi L, Golicki D, Ruzsa G, Pickard AS, Law EH, Péntek M. Parallel Valuation of the EQ-5D-3L and EQ-5D-5L by Time Trade-Off in Hungary. *Value Health*. 2020 Sep;23(9):1235-1245. doi: 10.1016/j.jval.2020.03.019. Epub 2020 Aug 12. [PubMed](#)

**Poland:** Golicki D, Jakubczyk M, Niewada M, Wrona W, Busschbach JJ. Valuation of EQ-5D health states in Poland: first TTO-based social value set in Central and Eastern Europe. *Value in Health*. 2010;13(2):289-97. [PubMed](#)

**Portugal:** Ferreira LN, Ferreira PL, Pereira LN, Oppe M. The valuation of the EQ-5D in Portugal. *Qual Life Res*. 2014 Mar;23(2):413-23. doi: 10.1007/s11136-013-0448-z. Epub 2013 Jun 8. [PubMed](#)

**Singapore:** Luo N, Wang P, Thumboo J, Lim YW, Vrijhoef HJ. Valuation of EQ-5D-3L health states in Singapore: modeling of time trade-off values for 80 empirically observed health states. *Pharmacoeconomics*. 2014 May;32(5):495-507. doi: 10.1007/s40273-014-0142-1. [PubMed](#)

**Sri Lanka:** Kularatna S, Whitty JA, Johnson NW, Jayasinghe R, Scuffham PA. Valuing EQ-5D health states for Sri Lanka. *Qual Life Res*. 2015 Jul;24(7):1785-93. doi:10.1007/s11136-014-0906-2. Epub 2014 Dec 28. [PubMed](#) PMID: [PubMed](#)

**Sweden:** Burström K, Sun S, Gerdtham UG, Henriksson M, Johannesson M, Levin LÅ, Zethraeus N. Swedish experience-based value sets for EQ-5D health states. *Qual Life Res*. 2014 Mar;23(2):431-42. doi: 10.1007/s11136-013-0496-4. [PubMed](#)

**Taiwan:** Lee HY, Hung MC, Hu FC, Chang YY, Hsieh CL, Wang JD. Estimating quality weights for EQ-5D (EuroQol-5 dimensions) health states with the time trade-off method in Taiwan. *J Formos Med Assoc*. 2013;112(11):699-706. [PubMed](#)

**Thailand:** Tongsiri S, Cairns J. Estimating population-based values for EQ-5D health states in Thailand. Value Health. 2011 Dec;14(8):1142-5. doi: 10.1016/j.jval.2011.06.005. [PubMed](#)

**Trinidad and Tobago:** Bailey H, Stolk E, Kind P. Toward Explicit Prioritization for the Caribbean: An EQ-5D Value Set for Trinidad and Tobago. Value Health Reg Issues. 2016 Dec;11:60-67. doi: 10.1016/j.vhri.2016.07.010. [PubMed](#)

---

valuesets

*Get the available EQ-5D value sets.*

---

### Description

valuesets returns a data.frame of the available EQ-5D value sets in the eq5d package.

### Usage

```
valuesets(type = NULL, version = NULL, country = NULL)
```

### Arguments

type	string EQ-5D value set type. TTO or VAS for EQ-5D-3L, VT for EQ-5D-5L or CW for EQ-5D-5L crosswalk conversion dataset.
version	string either 3L or 5L.
country	string one of the countries for which there is a value set.

### Value

A data.frame containing the EQ-5D version, value set type and country

### Examples

```
valuesets()  
valuesets(type="TTO")  
valuesets(version="5L")  
valuesets(country="UK")
```

---

VAS

*EQ-5D-3L VAS value set data*

---

### Description

Coefficients for the estimation of the EQ-5D-3L index values based on VAS valuation studies for Belgium, Denmark, Europe, Finland, Germany, Iran, Malaysia, New Zealand, Slovenia, Spain and UK.

### Usage

VAS

### Format

An object of class `data.frame` with 21 rows and 11 columns.

### Source

Oppe, M., Szende, A., & de Charro, F. (2007), Comparative review of Visual Analogue Scale value sets. In Szende, A., Oppe, M., & Devlin, N. (Ed.), *EQ-5D Value Sets: Inventory, Comparative Review and User Guide* (pp. 37-38). Dordrecht, The Netherlands: Springer.

**Iran:** Goudarzi R, Zeraati H, Akbari Sari A, Rashidian A, Mohammad K. Population-Based Preference Weights for the EQ-5D Health States Using the Visual Analogue Scale (VAS) in Iran. *Iran Red Crescent Med J.* 2016 Feb 13;18(2):e21584. doi: 10.5812/ircmj.21584. [PubMed](#)

**Malaysia:** Yusof FA, Goh A, Azmi S. Estimating an EQ-5D value set for Malaysia using time trade-off and visual analogue scale methods. *Value Health.* 2012 Jan-Feb;15(1 Suppl):S85-90. doi: 10.1016/j.jval.2011.11.024. [PubMed](#)

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VT

*EQ-5D-5L VT value set data*

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### Description

EQ-5D-5L VT value set calculation data for Canada, China, England, France, Germany, Hong Kong, Indonesia, Ireland, Japan, Malaysia, Netherlands, Poland, Portugal, South Korea, Spain, Taiwan, Thailand, Uruguay and USA.

### Usage

VT

### Format

An object of class `data.frame` with 35 rows and 25 columns.

## Source

1. **Canada:** 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. [PubMed](#)
2. **China:** Luo N, Liu G, Li M, Guan H, Jin X, Rand-Hendriksen K. Estimating an EQ-5D-5L Value Set for China. *Value in Health*. 2017 Apr;20(4):662-669. doi: 10.1016/j.jval.2016.11.016. Epub 2017 Feb 9. [PubMed](#)
3. **England:** 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*. 2018 Jan;27(1):1-22 [PubMed](#)
4. **Ethiopia:** Welie AG, Gebretekla GB, Stolk E, Mukuria C, Krahn MD, Enquoselassie F, Fenta TG. Valuing Health State: An EQ-5D-5L Value Set for Ethiopians. *Value Health Reg Issues*. 2019 Nov 1;22:7-14. doi: 10.1016/j.vhri.2019.08.475. [PubMed](#)
5. **France:** Andrade LF, Ludwig K, Goni JMR, Oppe M, de Pouvourville G. A French Value Set for the EQ-5D-5L. *Pharmacoeconomics*. 2020 Jan 8. doi: 10.1007/s40273-019-00876-4. [PubMed](#)
6. **Germany:** Ludwig K, Graf von der Schulenburg JM, Greiner W. German Value Set for the EQ-5D-5L. *Pharmacoeconomics*. 2018 Feb;36(6):663-674. doi: 10.1007/s40273-018-0615-8. [PubMed](#)
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