1
Valuing EQ-5D using Time Trade-Off in France

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1.1 INTRODUCTION

In cost-utility analysis consequences are often in term of QALY (Quality Adjusted Life Year). The time in a given health state is balanced by a coefficient (between 0 to 1) according to the quality given to the state. Using such an indicator supposes two things: knowing the health state of the patient and the utility level associated to this state. In this way, some preference-based indexes have been developed. Due to its simplicity, EQ-5D is one of the most used. This function gives a weight (or score) at each health state and takes in account the patient preference. The EQ-5D questionnaire has been developed and validated in many countries, included France. On the other hand, the utility function has not been elicited in France. In the absence of a set of national population-based utility weights, the EuroQoL group suggests to select a set of utility weights for a population that most closely approximates it. However it is not likely that preferences for different heath states are all-purpose. Utility values should be developed locally, on the basis of the judgments and priorities of local communities. Several studies have backed up this assumption pointing out that utilities function estimated in different countries could present some differences (Rosset et al. 1998; Buckingham et al. 2000). We then propose to compute the French value set for the EQ-5D.

1.2 METHOD

Sampling

A market research company recruited respondents for the French valuation study. Respondents aged over 18 were recruited to be representative of the French population with regard to age, gender and socio-professional group.

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Sample size calculations were based on the estimated number of respondents needed to obtain an estimation of the TTO mean score with a 95% probability that the true mean falls in the interval: [observed mean ± 0.05]. Three hundred respondents were then recruited to value each health state. Thirty interviewers trained by the researchers, conducted the face-to-face interview during the month of December 2008. Respondents received a gift voucher of 15 euros for participation.

Selection of health states

The present study is based on the MVH protocol. However some major modifications have been made. They mainly concerned the first part of the questionnaire (VAS in the MVH) and the number and the pool of states valued.

Unlike other valuation studies the health state "Unconscious" was not value in the French study.

Twenty four health states were selected to be directly valued. As respondents could not be expected to value all 24 health states using the TTO in a single interview (which was what the study was design for), only 17 health states were used with each respondents.

To allow the comparison with other valuation studies, we first chose to value the same 17 states than Macran and Kind (Macran and Kind 1999). These states were also valued in the Dutch study (Lamers et al. 2003; Lamers et al. 2006), in the Japanese one (Ikeda et al. 2000; Tsuchiya et al. 2002) and in the New Zealander study (Devlin et al. 2000) and are presented with a "*" in Table 1.1. They constituted a subset of the 42 health states valued in the MVH study (Dolan 1997). We completed with 7 health states randomly selected from these 42 health states.

The 24 health states were divided in three groups of 8. Three sets of health states were then constituted with 2 groups. One set of health states contains all the 17 sates of Macran and Kind. Table 1.1 also presents these sets. Hundred and fifty respondents were selected to value each sets of states.

Table 1.1. Health states set assignment.

Set 1		Set 2		Set 3	
21111*	Group 1	21111*	Group 1	11211*	Group 2
12111*		12111*		11121*	
13311*		13311*		32211*	
11113*		11113*		11112*	
11131*		11131*		11312*	
22222*		22222*		11133*	
23232*		23232*		32223*	
32313*		32313*		33323*	
11211*	Group 2	22121	Group 3	22121	Group 3
11121*		21323		21323	
32211*		22122		22122	
11112*		22233		22233	
11312*		33321		33321	
11133*		13332		13332	
32223*		23313		23313	
33323*		33232		33232	
33333*		33333*		33333*	
+ 11111*		+ 11111*		+ 11111*	
+ Death*		+ Death*		+ Death*	

* Health states forming a part of the 17 ones.
** The state unconscious was removed in the French study.

Structure of the interview

The face-to-face interview consisted of several stages:

- Self-reported health in the five-dimension descriptive system (EQ-5D).
- Self-reported health :
    - On a visual analogue scale (VAS) for half of the respondents.
    - Using the scoring method for the others.
- Evaluations of hypothetical health states :
    - Ranking + VAS of 19 health states (17 + dead + 11111) for half of the respondents.
    - Using the scoring method for the others (on 17 health states).
- TTO evaluations of 17 hypothetical health states.
- Socio-economic background questions.

The data were collected during the month of December 2008 by 30 face-to-face interviewers. The interview was conducted in the respondent's home using Computer Assisted Personal Interviewing. Respondents received a gift voucher of 15 euros for participation.

The whole questionnaire was replicated on the computer's screen.

Exclusion criteria

Exclusion criteria are defined as follows:
- Completely missing TTO data,
- Only 1 or 2 states valued,
- All states given the same value,
- All states valued as worse than dead.

Logical consistency

Hundred thirty six (136) health state pairs can be combined for each respondent (C_{17}^{2}) out of which 68 in set 1, 62 in set 2 and 69 in set 3 have a logically determined relationship. It means that a state with a less severe rating on a particular dimension, and no more severe ratings on all others can be judged better and have a superior or equal score. For example, 12111 is a better health state than 13111 or 13121.

A great number of inconsistencies could also be seen as an exclusion criterion. We had to arbitrary decide how many inconsistencies are acceptable to construct the value set (Ohinmaa and Sintonen 1998).

Transformation of health states

For states better than dead, TTO value is $v = \frac{t}{10}$ where *t* represents the number of years in full health. For states worse than dead, values are calculated by: $v = \frac{t}{10\ \ t}(-t\ \ (10-t))$. The lowest possible value is -39. This value occurs when the respondent prefers immediate death to six months in the targeted health state followed by 9.5 years in 11111. As in most valuation (ref. cf. Lamers) study we chose to bound negative value using a monotonic transformation: $v' = \frac{v}{1\ \ v}$.

Regression analysis

Variables

For each respondent and each health state, the dependent variable is 1 minus the TTO score given to that health states. It represents the loss of utility associated with the health state.

Following other valuation study, several sets of dummy variables were constructed. They were all considered as continuous variables. Table 1.2 presents these variables.

Table 1.2. Definition of independent variables used in regression analyses.

Variables	Definition
Constant	
Set 1: Dummies to represent the (assumed equal) move between all three levels	
MO	0 if mobility is level 1; 1 if level 2; 2 if level 3.
SC	0 if self-care is level 1; 1 if level 2; 2 if level 3.
UA	0 if usual activities is level 1; 1 if level 2; 2 if level 3.
PD	0 if pain/discomfort is level 1; 1 if level 2; 2 if level 3.
AD	0 if anxiety/depression is level 1; 1 if level 2; 2 if level 3.
Set 2: Dummies to represent the move from level 2 to 3. (This allows the effect of the move from level 1 to level 2 to be different from the effect of the move from level 2 to level 3).	
MO2	1 if mobility is level 2; 0 otherwise.
SC2	1 if self-care is level 2; 0 otherwise.
UA2	1 if usual activities is level 2; 0 otherwise.
PD2	1 if pain/discomfort is level 2; 0 otherwise.
AD2	1 if anxiety/depression is level 2; 0 otherwise.
Set 2: Dummies to represent the move from level 2 to 3. (This allows the effect of the move from level 1 to level 2 to be different from the effect of the move from level 2 to level 3).	
MO3	1 if mobility is level 3; 0 otherwise.
SC3	1 if self-care is level 3; 0 otherwise.
UA3	1 if usual activities is level 3; 0 otherwise.
PD3	1 if pain/discomfort is level 3; 0 otherwise.
AD3	1 if anxiety/depression is level 3; 0 otherwise.
I2	Number of dimensions at level 2 beyond the first.
I3	Number of dimensions at level 3 beyond the first.
D1	Number of dimensions at level 2 or level 3 beyond the first.
N2	1 if any dimension is at level 2; 0 otherwise.
N3	1 if any dimension is at level 3; 0 otherwise.

As the objective of the study is to estimate one preference-based EuroQol tariff for the whole French population, respondents' characteristics such as age, sex etc. were not included in the model. These variables will be tested in the selected model, results will be presented elsewhere.

Functional form

Figure 1.1. shows that the dependent variable, ie 1-TTO was not normally distributed[1]. It was skewed and bimodal with peaks at 0 and 1 (TTO=0 or 1). Usually used transformation, as power or logarithmic ones, were not feasible. Shaw et al. (Shaw et al. 2005) investigated several generalized linear models using various link functions and demonstrated that they consistently yielded poor predictions.

The assumption of normality is a convenience for the purpose of statistical inference. When this assumption is untrue, the estimates of the fixed and random parameters will still be consistent but the standard error estimates cannot be used to obtain confidence intervals or to test significance except in large sample (Goldstein 1999).

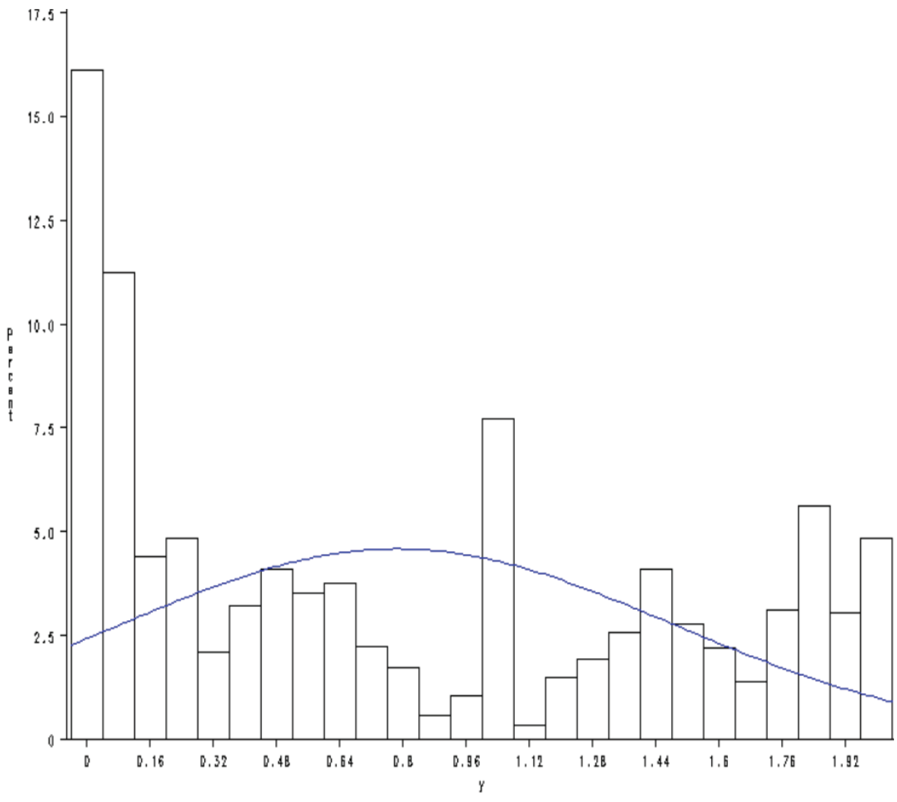

Figure 1.1. Functional form of the dependent variable.

1. The two peaks at 0 and 1 can be interpreted as an aversion to value health states worse than death (peak at 1, TTO=0) and a wish to have health states equivalent to full health (peak at 0, TTO=1).

Model specification

The analysis was conducted at an individual level to make the maximum use of the available data. Since each respondent valued several states, it was expected that a relation exists between its responses. For example, a respondent offering higher or lower value than the average for a particular health state is likely to do that persistently across health states. The variance of the error term in the model would be partially determined by each respondent, which violates one of the key assumptions of Ordinary Least Square (OLS) regression. A random effect (RE) model or a fixed effect (FE) model may then be used as estimation methods to address this problem.

The fixed effect model would be specified as follows:

$$y_{ij} = \beta_{1i} + \beta_2 x_{2,ij} + \quad + \beta_k x_{k,ij} + \varepsilon_{ij}$$

Where i=1,…,n represents the respondent, j=1,…17 represents the health states, and k=1,..K represents the independent variable. The random effect model assumes that the intercept β_{1i} varies across the respondents but not across the health states. There is no probability distribution on the effect inter respondents. The fixed effect model only permits conclusions on the studied population. Results can't be extrapolated to the whole population.

An alternative approach would be the random effect model. It would be specified as:

$$y_{ij} = \beta_1 + \beta_2 x_{2,ij} + \quad + \beta_k x_{k,ij} + \varepsilon_{ij}$$

$$\beta_1 = a_1 + u_{1i}$$

Where a_1 is an overall intercept, ε_{ij} is the traditional error term which represents the deviation between the observed value of the state j for the respondent i and the predicted one, and u_i is an error term representing the deviation between the intercept for the i^{th} respondent and the overall intercept.

A random term could be applied to any of the parameters by defining: $\beta_k = a_k + u_{ki}$

Following Dolan (Dolan 1997) and others, we estimated mixed model with random intercept. Fourteen different model specifications were compared (Table 1.3).

Table 1.3. Model tested.

TTO1=f(MO, SC, UA, PD, AD)
TTO2=f(MO, SC, UA, PD, AD, N2)
TTO3=f(MO, SC, UA, PD, AD, N3)
TTO4=f(MO, SC, UA, PD, AD, N2, N3)
TTO5=f(MO, SC, UA, PD, AD, MO3, SC3, UA3, PD3, AD3)
TTO6=f(MO, SC, UA, PD, AD, MO3, SC3, UA3, PD3, AD3, N2)
TTO7=f(MO, SC, UA, PD, AD, MO3, SC3, UA3, PD3, AD3, N3) ***(Dolan N3 model)****
TTO8=f(MO, SC, UA, PD, AD, MO3, SC3, UA3, PD3, AD3, N2, N3)
TTO9=f(MO2, SC2, UA2, PD2, AD2, MO3, SC3, UA3, PD3, AD3)
TTO10=f(MO2, SC2, UA2, PD2, AD2, MO3, SC3, UA3, PD3, AD3, N2)
TTO11=f(MO2, SC2, UA2, PD2, AD2, MO3, SC3, UA3, PD3, AD3, N3)
TTO12=f(MO2, SC2, UA2, PD2, AD2, MO3, SC3, UA3, PD3, AD3, N2, N3)
TTO13=f(MO2, SC2, UA2, PD2, AD2, MO3, SC3, UA3, PD3, AD3, D1us, I2, I2Sq, I3, I3Sq) ***(D1 model)*****
TTO14=f(MO2, SC2, UA2, PD2, AD2, MO3, SC3, UA3, PD3, AD3, D1us, I2, I3)

* (Dolan 1997)
** (Shaw, Johnson et al. 2005)

Model validation

Models were compared using different goodness of fit measures:
- The Akaike's information criterion (AIC).
- The Mean Absolute Error (MAE).
- The Pearson correlation between the observed and the predicted value.

Mean Absolute Error and Pearson correlation need to be calculated on a sample different from the modelling one. Two approaches were chosen. First, models were calculated on the 17 health states of Macran and Kind (Macran and Kind 1999). Data on the other health states were used as the validation sample.

A second approach consists of bootstraping available data. If we want to conserve the 24 valued data, it is evident that our sample is not big enough for randomly splitted it into a modelling and a validation sample. Therefore, our sample served as a modelling sample and 500 validation samples were constructing through bootstrapping. It consists of a random selection with replacements of respondents from the modelling sample. The sample size for the validation samples was the same as the modelling sample one. For each of these validation samples, the MAE and the Pearson correlation were calculated. The smaller the AIC, the smaller the MAE and the higher this correlation, the better the goodness of fit of the model. The model with the best goodness of fit will determine the French EQ-5D tariff.

We also wanted the model parameter estimates to be statistically significant, with the expected sign, and the expected magnitude (for example, the coefficient for M2, representing the difference between 1 and 2, is expected to be smaller than the coefficient for M3, representing the difference between 1 and 3). Finally, the estimated values had to be logically consistent. As described elsewhere in the methods part, a state with a less severe rating on a particular dimension and no more severe ratings on all others can be judged better and must have a superior or equal score.

Statistical analyses were performed using SAS software.

1.3 RESULTS

Characteristics of the sample

452 respondents take part in the survey. 9 were excluding as they met at least one exclusion criteria, leaving: 8 due to giving all states the same value and 1 due to valuing all states worse than dead. We note that 6 respondents gave all states but one the same value and 9 respondents gave all states but 2 the same value …etc. These were not excluded from the analyses.

Table 1.4. Characteristics of the sample.

	French general population*		Sample (n=443)	
Women (%)	51.6		51.7	
Years (%)				
18-24	11.5	27.8	12.0	28.5
25-34	16.3		16.5	
35-44	18.1	35.5	19.2	36.1
45-54	17.4		16.9	
55-64	15.4		18.1	
65-74	10.2	36.7	12.6	35.4
>75	11.1		4.7	
Mean age (std dev)			46.1	

* Source: French National Institute for Statistics and Economic Studies. Situation in 2008.

Table 1.4. Characteristics of the sample. (Continued)

	French general population*		Sample (n=443)	
socio-professional group (SPG) (The unemployed having already worked are classified according to their last trade)				
Craftsman trading and heads of undertakings	5.8	SPG+ 35.6	5.9	SPG+ 35.5
Frameworks, higher professions intellectual	11.5		12.9	
Intermediate occupations	18.3		16.7	
Employed	26.1	SPG- 64.4	27.1	SPG- 64.6
Working	21.3		21.2	
Farmer owners	3.0		0.7	
People without community activity	14.0		15.6	
Educational level (%) For respondents aged 25-65 (n=309)				
Low	56.8		51.8	
Middle	28.4		29.8	
High	14.0		18.5	
In couple (%) For respondents aged up to 25 (n=389)	68.1		67.1	
Respondents (%)				
Considers himself religious (n=430)	Not available		53.9	
Believes in life after death (n=386)	Not available		38.6	
Perceived health (%)				
Excellent / (very) good	Not available		87	
Fair / Poor	Not available		13	

* Source: French National Institute for Statistics and Economic Studies. Situation in 2008.

Direct valuation of health states

Each respondent was asked to value 17 health states using the TTO procedure. Table 1.5 presents the number of states valued. On the 443 non-excluded respondents, 387 (87.4%) valued the whole health states.

Table 1.5. Number of health states valued.

		Number of respondents
Number of states valued:	7	1
	9	3
	11	1
	12	2
	13	5
	14	1
	15	13
	16	30
	17	387

The mean values for the 24 health states directly valued ranged from 0.88 for state 11121 to -0.50 for state 33333; the median values from 0.99 to -0.62 for states 11112 and 33333, respectively (see Table 1.6). Figure 1.2 presents a comparison between the French observed TTO values and the MVH ones.

Table 1.6. Mean, median and standard deviation for observed values (after exclusion) and percentage of negative values per state.

CarteEQ5D	N	Mean	Median	STD	Negative values (%)
11121	296	0.88	0.95	0.26	1.3
11112	296	0.88	0.99	0.26	1.3
11211	295	0.86	0.93	0.23	0.3
21111	293	0.82	0.93	0.35	3.7
12111	292	0.78	0.93	0.39	3.4
11312	295	0.63	0.80	0.43	7.8
11113	289	0.58	0.83	0.54	11.1
22121	291	0.56	0.70	0.50	12.0
11131	289	0.47	0.70	0.59	19.0
22122	291	0.45	0.63	0.54	16.1
11133	294	0.38	0.53	0.58	20.7
13311	291	0.36	0.50	0.57	19.6
21323	292	0.19	0.34	0.61	31.5
22222	286	0.18	0.38	0.65	32.5
32211	292	0.08	0.20	0.64	40.1
13332	288	-0.10	-0.18	0.63	52.1
23313	286	-0.11	-0.03	0.61	50.3
32223	293	-0.17	-0.30	0.60	57.7
23232	286	-0.19	-0.31	0.60	57.3
22233	284	-0.19	-0.30	0.61	57.4
32313	290	-0.23	-0.38	0.63	61.7
33321	283	-0.25	-0.38	0.58	62.2
33232	290	-0.35	-0.50	0.55	72.8
33323	290	-0.39	-0.50	0.54	75.9
33333	430	-0.50	-0.63	0.50	81.9

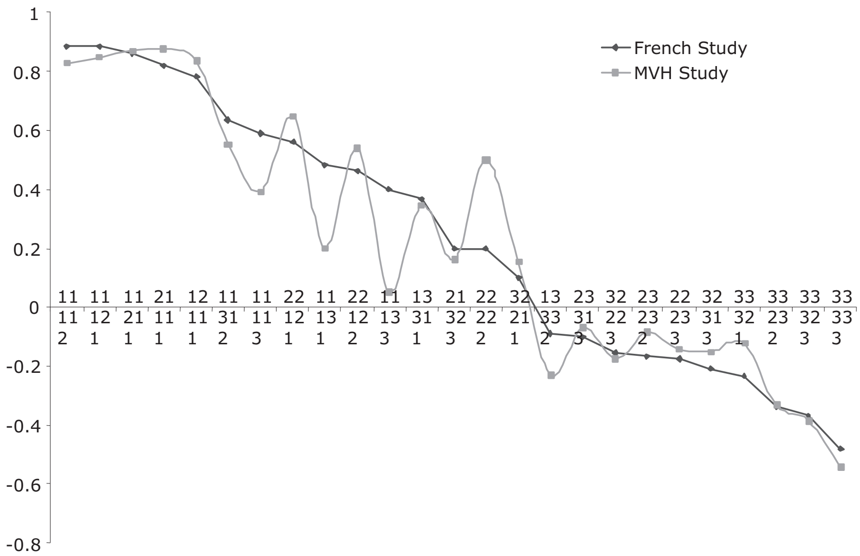

Figure 1.2. Mean French and MVH TTO observed values for 24 health states.

The mean number of inconsistencies among the full sample is 5.2 (SD: 4.9). There is no statistical difference in this number according to the set of states valued. Ninety percent of the sample exhibit logical inconsistencies (Table 1.7). Table 1.8 reports the mean values for respondents grouped according to their number of inconsistencies. For the whole health states, means for the respondents with only one inconsistency are not statistically different from the ones for respondents with no inconsistency. Before 5 inconsistencies per respondent, means, except one, are still not differents.

Regression analysis

Parameter estimates of the 14 model tested are presented in Table 1.9. The models presenting the best fist statistics, with all parameters being statistically significant are TTO8, TTO11, TTO12. TTO11 is an alternative specification to the N3-model. This model was selected to compute the French societal tariff for the EQ-5D. Estimates for dummies representing the difference between level 1 and level 2 (MO2, SC2, UA2, PD2, AD2) are lower than ones representing the difference between level 1 and level 3 which is the expected magnitude of that coefficient.

The same analysis on the 17 health states of Macran and Kind results in the selection of the same model. Details of this analysis (particularly MAE and Pearson coefficient on the 7 remaining states) will be presented elsewhere.

Final valuation model

Table 1.10 presents the mean TTO observed and predicted values. For 7 health states the residual error exceeds 0.05.

Table 1.11 presents the full set of French population-based preference weights for the 243 health states defined by the EQ-5D.

Table 1.7. Inconsistencies among the full sample (n=443).

Number of inconsistencies	Number of responses	Cumulative sum of responses	Cumulative percentage
0	42	42	9.5
1	54	96	21.7
2	56	152	34.3
3	51	203	45.8
4	34	237	53.5
5	40	277	62.5
6	30	307	69.3
7	25	332	74.9
8	27	359	81.0
9	19	378	85.3
10	12	390	88.0
11	12	402	90.7
12	6	408	92.1
13	9	417	94.1
14	7	424	95.7
15	4	428	96.6
16	2	430	97.1
17	2	432	97.5
18	4	436	98.4
19	2	438	98.9
22	1	439	99.1
23	1	440	99.3
25	1	441	99.5
33	1	442	99.8
39	1	443	100.0

Table 1.8. Mean TTO values according to the number of inconsistencies in the individual responses.

		Mean values of health states according to the number of inconsistencies in the individual responses							
		0	1	2	3	4	5	6	7
11112	N	30	40	32	35	22	32	20	19
	Mean	0.89	0.96	0.97	0.87	0.88	0.85	0.90	0.79
11113	N	25	32	41	29	24	22	18	17
	Mean	0.66	0.67	0.63	0.58	0.64	0.70	0.58	0.59
11121	N	30	40	31	35	22	32	21	19
	Mean	0.95	0.95	0.95	0.91	0.95	0.94	0.81	0.90
11131	N	25	33	41	28	24	23	18	17
	Mean	0.69	0.60	0.47	0.56	0.51	0.29	0.39	0.51
11133	N	30	39	31	35	21	32	21	19
	Mean	0.28	0.42	0.39	0.43	0.51	0.32	0.40	0.24
11211	N	30	40	32	35	22	32	19	19
	Mean	0.91	0.91	0.92	0.86	0.94	0.81	0.73	0.86
11312	N	30	39	32	35	22	32	21	19
	Mean	0.71	0.73	0.76	0.55	0.68	0.53	0.70	0.58
12111	N	25	34	41	29	24	23	18	17
	Mean	0.81	0.94	0.91	0.86	0.82	0.72	0.84	0.78
13311	N	25	33	43	29	24	23	18	17
	Mean	0.38	0.50	0.42	0.40	0.42	0.18	0.19	0.50
13332	N	29	32	37	37	21	23	20	14
	Mean	-0.22	-0.24	0.06	0	-0.19	-0.04	-0.16	-0.07
21111	N	25	34	42	29	24	23	18	17
	Mean	0.92	0.87	0.91	0.85	0.91	0.79	0.85	0.86
21323	N	29	33	36	38	22	25	21	14
	Mean	0.12	0.18	0.38	0.22	0.28	0.25	0.13	0.20
22121	N	29	34	36	38	22	25	19	14
	Mean	0.69	0.71	0.64	0.64	0.69	0.42	0.34	0.54
22122	N	28	33	37	37	22	25	20	14
	Mean	0.57	0.56	0.55	0.52	0.57	0.41	0.37	0.35
22222	N	24	30	41	29	24	23	18	17
	Mean	0.21	0.31	0.34	0.25	0.31	0.01	0.19	0.55
22233	N	27	29	36	38	22	25	20	14
	Mean	-0.38	-0.18	-0.18	-0.14	-0.27	-0.01	-0.27	-0.11
23232	N	25	33	41	28	23	22	18	17
	Mean	-0.16	-0.16	-0.10	-0.13	-0.16	-0.26	-0.37	0.22
23313	N	29	31	34	37	22	24	21	14
	Mean	-0.25	-0.16	0.03	-0.08	-0.09	-0.06	-0.14	0
32211	N	30	37	31	35	22	32	20	19
	Mean	0.35	0.12	0.15	-0.08	0.11	-0.02	-0.05	0.22
32223	N	30	38	32	35	22	32	20	19
	Mean	-0.08	-0.26	-0.18	-0.33	-0.06	-0.21	-0.28	0
32313	N	25	32	42	29	24	23	18	17
	Mean	-0.28	-0.25	-0.17	-0.27	-0.30	-0.33	-0.27	0.24
33232	N	29	33	34	38	22	25	20	14
	Mean	-0.45	-0.42	-0.38	-0.42	-0.31	-0.27	-0.38	-0.22
33321	N	29	32	34	38	22	23	19	13
	Mean	-0.22	-0.41	-0.13	-0.29	-0.30	-0.16	-0.27	0.01
33323	N	30	38	30	35	22	31	20	19
	Mean	-0.48	-0.55	-0.48	-0.52	-0.35	-0.37	-0.47	-0.12
33333	N	41	50	55	49	34	37	29	25
	Mean	-0.62	-0.64	-0.61	-0.69	-0.56	-0.48	-0.59	-0.36

Notes: Figures in bold denotes that the difference in the mean value, compared to the group with no inconsistencies, is statistically significant at the 5% level.

Table 1.9. Parameter estimates, fit statistics

Effect	TTO1	TTO2	TTO3	TTO4	TTO5	TTO6	TTO7 N3-model	TTO8	TTO9	TTO10	TTO11	TTO12	TTO13 D1-model	TTO14
Intercep	0.047	0.042	0.218	0.245	0.069	0.070	0.187	0.210	0.069	0.070	0.187	0.210		
MO	0.205	0.212	0.206	0.198	0.131	0.130	0.154	0.143	.	.	.	.		
MO2	.	.	.	.	.	.	.	.	0.131	0.130	0.154	0.143	0.202	0.174
MO3	.	.	.	.	0.126	0.128	0.066	0.079	0.388	0.387	0.373	0.364	0.571	0.532
SC	0.161	0.160	0.165	0.167	0.196	0.195	0.210	0.209	.	.	.	.		
SC2	.	.	.	.	.	.	.	.	0.196	0.195	0.210	0.209	0.247	0.240
SC3	.	.	.	.	-0.070	-0.069	-0.094	-0.087	0.321	0.322	0.325	0.331	0.530	0.499
UA	0.133	0.134	0.076	0.068	0.207	0.206	0.156	0.142	.	.	.	.		
UA2	.	.	.	.	.	.	.	.	0.207	0.206	0.156	0.142	0.155	0.173
UA3	.	.	.	.	-0.145	-0.143	-0.124	-0.108	0.270	0.269	0.188	0.176	0.309	0.344
PD	0.154	0.149	0.125	0.127	0.096	0.096	0.109	0.108						
PD2	.	.	.	.	.	.	.	.	0.096	0.096	0.110	0.108	0.144	0.140
PD3	.	.	.	.	0.126	0.128	0.045	0.058	0.318	0.320	0.264	0.275	0.483	0.443
AD	0.123	0.119	0.095	0.096	0.082	0.081	0.088	0.078	.	.	.	.		
AD2	.	.	.	.	.	.	.	.	0.082	0.081	0.088	0.078	0.083	0.110
AD3	.	.	.	.	0.091	0.093	0.029**	0.052	0.255	0.256	0.204	0.209	0.389	0.378
N2	.	0.039	.	-0.046	.	-0.004**	.	-0.041	.	-0.004**	.	-0.041		
N3	.	.	-0.194	-0.218	.	.	-0.169	-0.178	.	.	-0.169	-0.178		
I2	.	.	.	.	.	.	.	.	.	.	.	.	-0.215	-0.041
I2Sq	.	.	.	.	.	.	.	.	.	.	.	.	0.036	
I3	.	.	.	.	.	.	.	.	.	.	.	.	-0.261	-0.178
I3Sq	.	.	.	.	.	.	.	.	.	.	.	.	0.0006**	
D1us	.	.	.	.	.	.	.	.	.	.	.	.	0.063	0.009**
AIC (smaller is better)	9657	9655	9512	9509	9556	9563	9484	**9485**	9556	9563	**9484**	**9485**	9463	9485
MAE	0.071	0.071	0.052	0.050	0.055	0.055	0.043	**0.042**	0.055	0.055	**0.043**	**0.042**		
Pearson correlation	0.980	0.982	0.990	0.991	0.989	0.988	0.993	**0.993**	0.989	0.988	**0.993**	**0.993**		

** ns

Table 1.10. Observed and predicted values for 24 health states.

CarteEQ5D	Observed	Predicted	Mean error
11112	0.879	0.894	-0.01
11113	0.581	0.609	-0.03
11121	0.880	0.873	0.01
11131	0.470	0.548	-0.08
11133	0.384	0.344	0.04
11211	0.856	0.826	0.03
11312	0.626	0.538	0.09
12111	0.777	0.772	0.004
13311	0.355	0.300	0.05
13332	-0.104	-0.052	-0.05
21111	0.819	0.828	-0.01
21323	0.190	0.158	0.03
22121	0.555	0.509	0.05
22122	0.454	0.422	0.03
22222	0.182	0.266	-0.08
22233	-0.191	-0.175	-0.02
23232	-0.186	-0.174	-0.01
23313	-0.114	-0.057	-0.06
32211	0.081	0.075	0.01
32223	-0.172	-0.239	0.07
32313	-0.228	-0.161	-0.07
33232	-0.348	-0.393	0.05
33321	-0.246	-0.182	-0.06
33323	-0.388	-0.386	-0.002
33333	-0.502	-0.541	0.04
MAE			0.039

Table 1.11. French Population-based predicted preference weights for 243 health states.

State	Value	State	Value	State	Value	State	Value	State	Value
11111	0.982	22212	0.375	22131	0.185	13331	0.036	23133	-0.134
11112	0.894	21321	0.362	12231	0.183	21233	0.035	23223	-0.135
11121	0.873	11331	0.361	23211	0.179	32122	0.033	13233	-0.136
21111	0.828	22221	0.354	31131	0.176	22231	0.030	33131	-0.150
11211	0.826	31112	0.352	31221	0.175	33112	0.027	33221	-0.150
11122	0.785	21123	0.346	22312	0.174	32113	0.026	32322	-0.155
12111	0.772	11133	0.344	13123	0.174	23123	0.021	33312	-0.160
21112	0.741	11223	0.344	31312	0.165	31231	0.020	32313	-0.161
11212	0.739	12131	0.339	21323	0.158	13133	0.019	23323	-0.167
21121	0.719	23111	0.334	11333	0.157	13223	0.019	13333	-0.168
11221	0.717	13211	0.332	22321	0.153	33121	0.005	23232	-0.174
12112	0.685	31121	0.330	21232	0.152	21333	0.003	22233	-0.175
21211	0.673	12312	0.328	12331	0.151	22331	-0.002	33321	-0.182
12121	0.663	11323	0.312	23311	0.147	31331	-0.012	31233	-0.184
21122	0.631	21132	0.307	31321	0.143	32212	-0.013	32231	-0.190
11222	0.629	12321	0.306	32112	0.143	13323	-0.013	33123	-0.199
11311	0.625	11232	0.305	23122	0.137	23132	-0.018	23332	-0.206
22111	0.619	13311	0.300	22123	0.136	23222	-0.019	22333	-0.206
12211	0.617	21213	0.300	13132	0.136	22133	-0.019	31333	-0.216
11113	0.609	13122	0.291	13222	0.135	22223	-0.020	32331	-0.222
21212	0.585	12123	0.290	12133	0.135	13232	-0.020	33132	-0.237
12122	0.575	31211	0.284	12223	0.134	12233	-0.021	33222	-0.238
21221	0.563	13113	0.284	23113	0.130	23213	-0.026	32133	-0.238
11131	0.548	21322	0.275	13213	0.128	31133	-0.029	32223	-0.239
11312	0.538	11332	0.273	31123	0.126	31223	-0.029	33213	-0.245
22112	0.531	21313	0.268	32121	0.121	32131	-0.034	33322	-0.270
12212	0.529	22222	0.266	21332	0.120	32221	-0.035	32323	-0.271
11321	0.516	22311	0.262	33111	0.115	33211	-0.041	33313	-0.277
22121	0.509	31311	0.252	13322	0.103	32312	-0.045	32232	-0.278
12221	0.507	12132	0.251	12323	0.102	23322	-0.051	23233	-0.290
11123	0.499	23112	0.246	22132	0.097	22323	-0.052	33231	-0.305
13111	0.488	22113	0.246	13313	0.096	13332	-0.052	32332	-0.309
21222	0.476	13212	0.244	12232	0.095	12333	-0.053	23333	-0.322
21311	0.472	12213	0.244	23212	0.091	23313	-0.057	33331	-0.337
22211	0.463	31122	0.243	22213	0.090	22232	-0.058	33133	-0.354
11132	0.461	21231	0.239	31132	0.088	31323	-0.061	33223	-0.354
21113	0.455	31113	0.236	31222	0.087	32321	-0.067	33323	-0.386
11213	0.453	32111	0.230	31213	0.080	31232	-0.068	33232	-0.393
31111	0.440	23121	0.225	32211	0.075	33311	-0.073	32233	-0.394
11322	0.428	13131	0.223	23131	0.070	33122	-0.082	33332	-0.425
22122	0.422	13221	0.223	23221	0.069	32123	-0.083	32333	-0.426
11313	0.421	12322	0.218	13231	0.068	23231	-0.086	33233	-0.509
12222	0.420	13312	0.213	22322	0.065	33113	-0.089	33333	-0.541
12311	0.416	12313	0.212	12332	0.064	22332	-0.090		
13112	0.400	21331	0.207	23312	0.059	31332	-0.100		
12113	0.399	31212	0.197	22313	0.058	23331	-0.118		
21131	0.395	21133	0.191	31322	0.055	32132	-0.122		
11231	0.393	13321	0.191	31313	0.048	32222	-0.123		
21312	0.384	21223	0.190	32311	0.043	33212	-0.129		
13121	0.378	11233	0.189	23321	0.037	32213	-0.129		

1.4 DISCUSSION

Based on representative sample of the general French population aged over 18, we tested several model specified to generate a preference weighting system for the EQ-5D in France. The direct valuation of 24 health states was obtained by TTO. We chose not to modify the initial TTO procedure to generate comparative measures. The utility function which will be calculated will thus be an important tool to generate QALYs and CUAs in France and in multinational studies.

However this study is the first to assess an EQ-5D utility function in France, some limitations have to be mentioned. First, a monotonic transformation was applied to the values for states worse than death. Although Lamers (Lamers 2007) showed that the smallest MAE occurred when negative values were linear transformed (i.e. $v' = \frac{v}{39}$ instead of $v' = \frac{v}{1 \quad v}$, see Transformation of health states in the Method part), we chose to conserve the non linear transformation in a comparative way. Actually, she also underlined the fact that modifying the bounding method for negative values at -1 results in different social tariff for EQ-5D. Using the linear transformation as in the US study, should result in smaller numbers of QALYs and probably in smaller QALY gains, especially for more severe diseases.

Second, data presented logical inconsistencies were not excluded from the study. More investigations could be made to determine the impact of these data on the tariff. Actually, in the New Zealander study, Devlin et al. (Devlin, Hansen et al. 2000) showed that computing a tariff admitting all inconsistencies or admitting none or just one results in different function.

Several models were tested in the study and the best according to the fit statistics will be chosen to assess the French tariff for the EQ-5D. We are confident that the model chosen will be the best between all the models tested but we will never know if a better model including other independent variables exists.

Further researches are still in process on the D1 model.

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