

Supplementary File 2

**Mapping of Family Reported Outcome Measure (FROM-16) scores to EQ-5D:
Algorithm to calculate Utility Values**

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How to use the FROM-16 mapping algorithm

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Microsoft Excel spreadsheet[®] with pre-programmed formulae is available upon request

The mapping of the FROM-16 scores to utility values for use in economic appraisal should be based on aggregated group scores. The example provided is for illustrative purposes only and should not be replicated as such.

Step 1: Enter the respondent’s age, sex, and the responses to the 16 items of FROM-16, as shown below in the Excel sheet

Conversion of FROM-16 Item Score to EQ-5D utility values Using Multinomial Logistic Regression (Enter family member (FM) Age, Sex & FROM-16 scores below per subject)																			
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
2	Subject ID	FM Age (years)	FM Sex M= 0, F=1	Worry	Angry	Sad	Frustrated	Talking about thoughts	Difficulty caring	Time for self	Travel	Eating habits	Family activities	Holiday	Sex life	Work or study	Family relationships	Family expenses	Sleep
3																			
4	1	73	0	1	0	0	1	1	2	0	0	1	0	0	0	0	0	0	1
5																			
6																			
9	Step 2: Substitute the values of constant, regression coefficients and values of the independent variables from Table 5 in the manuscript in the two equations below (when using an Excel sheet, add values for each cell See the example on the next page: for example for “FM Age=73” we can simply write “B4”).																		
10																			
11																			
12	$\log\left(\frac{\pi_2}{\pi_1}\right) = \alpha_{mobility (Some\ problem)} + (\beta_{age} * Age) + (\beta_{sex} * Sex) + (\beta_{worry} * Worry) + (\beta_{angry} * Angry) + (\beta_{sad} * Sad) + (\beta_{frustrated} * Frustrated) + (\beta_{thoughts} * Talking\ about\ thoughts) + (\beta_{caring} * Difficulty\ caring) + (\beta_{time\ for\ self} * Time\ for\ self) + (\beta_{travel} * Travel) + (\beta_{eating\ habits} * Eating\ habits) + (\beta_{family\ activities} * Family\ activities) + (\beta_{holiday} * Holiday) + (\beta_{sex\ life} * Sex\ life) + (\beta_{work} * Work/study) + (\beta_{family\ relationship} * Family\ relationship) + (\beta_{family\ expenses} * Family\ expenses) + (\beta_{sleep} * Sleep)$ $\log\left(\frac{\pi_3}{\pi_1}\right) = \alpha_{mobility(Extrem\ problem)} + (\beta_{age} * Age) + (\beta_{sex} * Sex) + (\beta_{worry} * Worry) + (\beta_{angry} * Angry) + (\beta_{sad} * Sad) + (\beta_{frustrated} * Frustrated) + (\beta_{thoughts} * Talking\ about\ thoughts) + (\beta_{caring} * Difficulty\ caring) + (\beta_{time\ for\ self} * Time\ for\ self) + (\beta_{travel} * Travel) + (\beta_{eating\ habits} * Eating\ habits) + (\beta_{family\ activities} * Family\ activities) + (\beta_{holiday} * Holiday) + (\beta_{sex\ life} * Sex\ life) + (\beta_{work} * Work/study) + (\beta_{family\ relationship} * Family\ relationship) + (\beta_{family\ expenses} * Family\ expenses) + (\beta_{sleep} * Sleep)$ <p>α = the constant of the equation β = the coefficient of the predictor or independent variables(here age, gender and 16 items of FROM-16), β is the effect of the independent variable on the log-odds of being in category 2(some problem) and category 3 (Extreme problem) instead of category 1(no problem) in above equations.</p>																		

PAGE 2 of EXCEL Sheet -Mapping Algorithm using Multinomial logistic regression

Estimated probability of each score per EQ-5D domain per subject (copy formula* down each column up to the last subject)

	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS
3	MOBILITY					Selfcare					Usual activities					Pain/Discomfort					Anxiety/Depression				
4	log(n2/n1)	log(n3/n1)	P1	P2	P3	log(n2/n1)	log(n3/n1)	P1	P2	P3	log(n2/n1)	log(n3/n1)	P1	P2	P3	log(n2/n1)	log(n3/n1)	P1	P2	P3	log(n2/n1)	log(n3/n1)	P1	P2	P3
5	-0.449	-5.984	0.609	0.389	0.002	-1.8200	-5.8340	0.858	0.139	0.003	-0.5460	-3.5690	0.622	0.360	0.018	0.0500	-1.3480	0.433	0.455	0.112	-0.8190	-3.1780	0.675	0.297	0.028
6																									
7																									
9																									
10																									

Using FROM -16 values from Table 1, Estimated probabilities can be calculated using probability equations derived from Multinomial logistic regression as below (Example of first row)

Eq-5D-3L dimensions	Formula*	P1	P2	P3
Mobility	U=log(n2/n1)	1/(1+EXP(U4)+EXP(V4)) = 0.609	EXP(U4)/(1+EXP(U4)+EXP(V4)) = 0.389	=EXP(V4)/(1+EXP(U4)+EXP(V4)) = 0.002
	V=log(n3/n1)			
Selfcare	Z=log(n2/n1)	1/(1+ EXP(Z4)+EXP(AA4)) = 0.858	=EXP(Z4)/(1+EXP(Z4)+EXP(AA4)) = 0.139	=EXP(AA4)/(1+EXP(Z4)+EXP(AA4)) = 0.003
	AA=log(n3/n1)			
Usual activities	AE=log(n2/n1)	1/(1+EXP(AE4)+EXP(AF4)) = 0.622	EXP(AE4)/(1+EXP(AE4)+EXP(AF4)) = 0.360	=EXP(AF4)/(1+EXP(AE4)+EXP(AF4)) = 0.018
	AF=log(n3/n1)			
Pain/Discomfort	AJ=log(n2/n1)	1/(1+EXP(AJ4)+EXP(AK4)) =0.433	=EXP(AJ4)/(1+EXP(AJ4)+EXP(AK4)) =0.455	=EXP(AK4)/(1+EXP(AJ4)+EXP(AK4)) =0.112
	AK=log(n3/n1)			
Anxiety/Depression	AO=log(n2/n1)	1/(1+EXP(AO4)+EXP(AP4)) = 0.675	EXP(AO4)/(1+EXP(AO4)+EXP(AP4)) = 0.297	EXP(AP4)/(1+EXP(AO4)+EXP(AP4)) = 0.028
	AP=log(n3/n1)			

Microsoft Excel spreadsheet® with pre-programmed formulae is available upon request

PAGE 3 of EXCEL Sheet -Mapping Algorithm Monte Carlo Simulation method

	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG
1	Random Number Generator* for each domain (formula* random number generator is given in the box below)					Monte Carlo Simulation	Predicted score for each EQ-5D domain# (formula for each dimension is given in the box below)					Conversion of EQ-5D-3L domain score to Utility value	RESULTS
2	Mobility Random	Selfcare Random	Usual activities Random	Pain/Discomfort Random	Anxiety/Depression Random		Mobility Score	Selfcare Score	Usual Activities Score	Pain/ Discomfort Score	Anxiety/ Depression Score		Utility value #
3													
4	0.4327	0.3375	0.4336	0.6160	0.7480		1	1	1	2	2	0.725	
5							<p><i>The predicted domain scores may be converted to utility scores using the relevant TTO value sets specific to your country. These value sets as well as the syntax for SPSS (incase of large datasets) may be obtained from http://www.euroqol.org</i></p>					<p>#The utility value is calculated here using the UK MVH tariff equation developed by Dolan et al. 1996.</p>	

Step 3: Generate random numbers between 0 and 1 using the formula*=RAND()

Step 4: Predict the EQ-5D-3L domain response score using the formula below (linked to predicted domain probabilities on page 2)

Mobility score = IF(AU4=<W4,1,0)+IF(AND(AU4>W4,AU4=<(W4+X4)),2,0)+IF(AU4>(1-Y4),3,0)
 Selfcare = IF(AV4=<AB4,1,0)+IF(AND(AV4>AB4,AV4=<(AB4+AC4)),2,0)+IF(AV4>(1-AD4),3,0)
 Usual activities = IF(AW4=<AG4,1,0)+IF(AND(AW4>AG4,AW4=<(AG4+AH4)),2,0)+IF(AW4>(1-AI4),3,0)
 Pain/Discomfort = IF(AX4=<AL4,1,0)+IF(AND(AX4=AL4,AX4=<(AL4+AM4)),2,0)+IF(AX4>(1-AN4),3,0)
 Anxiety/Depression = =IF(AY4=<AQ4,1,0)+IF(AND(AY4>AQ4,AY4=<(AQ4+AR4)),2,0)+IF(AY4>(1-AS4),3,0)

Step 5: Utility value can now be calculated using UK TTO tariff. In this example we have calculated a health state of 11122 using the respondent’s FROM-16 score, age and sex, which is equal to a utility value of 0.725. *Please note the algorithm is more accurate at the group level. The example shown here, with data from a single subject, is to inform readers how to use the mapping algorithm.