Appendix

Ngene Pair Selection

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Pair selection for the 200 efficient pairs of the exploratory and confirmatory studies was conducted using Ngene. The premise for both designs was to have Ngene select the best design based on a candidate set of choice sets, with those candidate sets differing for the exploratory and confirmatory designs (as described in the EQ DCE Competition Description, Rules, and Procedures). The candidate set for the exploratory analysis was constructed based on 196 EQ-VT pairs (19600 pairs) and the set for the confirmatory analysis was based on all non-dominant pairs of Jaccard states (210586 pairs).

For the exploratory pair set, Ngene was programmed to select 600 pairs, even though only 200 were required. This was decided to increase the likelihood that each of the 196 pairs would appear at least once among the selected pairs. Using the 600 pairs that Ngene selected, the study team applied an ancillary algorithm that selected one pair for each of the 196 and imposed level balance across the 55 possible combinations of duration attributes (10 choose 2 + 10=55). This brute force method was implemented to best match the original EQ-VT design by including one pair of its 196 pairs with a duration attribute. The use of 200 pairs (instead of 196) was to facilitate pair assignment.

For the confirmatory pairs set, Ngene was programmed to select 200 pairs from the candidate set and all were included in the confirmatory design. Inherently the same Ngene program was run for both sets, except for differences in set size (600 and 200) and the candidate sets. The following section describe how we defined efficiency, priors and level balance in the pair selection process.

Efficiency: In terms of identifying the best design from the candidate set, we note that the estimation of utility decrements in DCEs involving duration is done through ratios of coefficients, specifically the coefficients on the interactions between duration and levels of the utility instrument divided by the coefficient on duration [1]. To use that in design construction, designs are contrasted in terms of the sum of the variances of the parameter ratios. We assume each ratio is equally important, so each of the 20 ratios (5 dimensions x 4 movements away from level one in each of the dimensions) are considered equally. In both designs, a modified Federov algorithm was used, as discussed in the Ngene manual.

Priors: Prior coefficients were derived from Model 1 of the pilot Australian study [2]. This model is a main effects model in the utility algorithm. To estimate main effects in the utility algorithm, it is necessary to estimate two-factor interactions involving life expectancy. Thus, there were 21 non-zero priors in the Ngene code representing duration as a linear term, and movements away from full health in each dimension interacted with duration. These are reproduced below. We assumed zero priors on the main effects of movements away from full health in each dimension. For, example, we included a non-zero prior for (Mobility 2 x life expectancy), but not for Mobility 2.

Table 1: Prior estimates

Dimension	Level	Prior value
Duration	Linear (range 1-10 years)	0.135
Duration x Mobility	2	-0.010
	3	-0.014
	4	-0.038
	5	-0.045
Duration x Self-Care	2	-0.009
	3	-0.011
	4	-0.030
	5	-0.044
Duration x Usual Activities	2	-0.017
	3	-0.017
	4	-0.042
	5	-0.041
Duration x Pain/Discomfort	2	-0.010
	3	-0.012
	4	-0.036
	5	-0.049
Duration x Anxiety/Depression	2	-0.019
	3	-0.034
	4	-0.058
	5	-0.055

Level Balance: A feature of the Ngene pair selection process used here is that it does not enforce level balance. When Ngene was initially tasked with designing the exploratory choice pairs, it tended towards a very high proportion of profiles with durations of either 1 or 10 years. While it is possible to constrain Ngene to ensure perfect level balance among the 10 duration attributes, this impacts negatively on efficiency. Thus, for both the explanatory and confirmatory designs, a midpoint solution was identified.

For the initial set of 600 choice pairs identified as the exploratory design, it was ensured that, across the 600 profiles presented as Option A, and also the 600 profiles presented in Option B, that each level of duration must be observed at least 50 times and no more than 70 times. A similar approach was taken for the confirmatory design. For the 200 pairs that constituted the confirmatory design, it was mandated that each duration level was seen between 15 and 25 times.

References
1. Bansback N, Brazier J, Tsuchiya A, Anis A. Using a discrete choice experiment to estimate societal health state utility values. J Health Econ. 2012;31:306-18. doi:10.1016/j.jhealeco.2011.11.004.
2. Norman R, Cronin P, Viney R. A pilot discrete choice experiment to explore preferences for EQ-5D-5L health states. Applied Health Economics and Health Policy. 2013;11(3):287-98**.**