

Change in capability-related quality of life resulting from hip or knee replacement: results from a cohort study using the ICECAP-O instrument

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Abstract:

Objectives: The health benefits of total hip or knee replacement are well established. However, health care reimbursement decisions in countries such as the UK are increasingly being influenced by those wider non-health benefits that are important to older people. The aim of this study was to quantify the one- and three-year changes in quality of life associated with total joint replacement (TJR) using the ICECAP-O capability instrument.

Methods: 107 patients in the Tayside Joint Replacement cohort were administered ICECAP-O pre-operatively.

Results: Mean improvements were 0.067 (n=58) after one year and 0.036 (n=55) after three years ($p < 0.05$). These figures were in line with cross-sectional data reported previously and suggest that TJR moves the median patient from the 38th percentile to the 69th (one year) and 58th percentile (three years) of the distribution in a typical British city. At baseline, women experienced greater reduction in capability than men; this explained larger mean treatment effects among women of 0.093 (0.043 for men) at one year and 0.046 (0.026 for men) at three years. Construct validity analyses were supportive of ICECAP-O, as was an analysis that split the sample according to whether patients achieved a Minimum Clinically Important Improvement on WOMAC.

Conclusions: This study provides the first longitudinal evidence of the strength of ICECAP-O in quantifying changes in quality of life. Researchers should consider administering it in future studies to enable the benefits of health interventions to be robustly quantified and put into context with social care and other interventions that may be administered.

Change in capability-related quality of life resulting from hip or knee replacement: results from a cohort study using the ICECAP-O instrument

Introduction

The health benefits and cost-effectiveness of hip or knee replacement are well-known and usually substantial.¹ As in many disease areas, there is interest in quantifying the associated changes in health-related quality of life (HrQoL). Preference-based health status classification instruments such as the EQ-5D (EuroQoL) are administered when cost-utility analysis is required.² The tickbox answers of the patient (which 'measure' his/her health) have an off-the-shelf numerical score applied to summarise ('value') that patient's overall health-related quality of life.³ The score reflects the trade-off that, on average, the relevant general population is willing to make between quality and length of life. When multiplied by life expectancy, the resulting number of quality-adjusted life years (QALYs) gained as a result of treatment can be compared with the additional cost, to calculate the cost-effectiveness of treatment and thereby help inform funding decisions.

There is growing interest in maintaining the measurement-valuation framework but in valuing quality of life which is defined more broadly.^{4,5} Older people, in particular, tend to require a mix of health and social care interventions; concentrating on health as the outcome of interest risks misallocating resources and failing to satisfy citizens' needs and wants. This was the main issue addressed in the UK MRC-funded Investigating Choice Experiments for the Preferences of Older People (ICEPOP) programme (2001-2009).⁶ The ICEpop CAPability instrument for Older people (ICECAP-O, previously called simply ICECAP)⁷ was developed to achieve this. There are four response categories to each of five attributes (dimensions): attachment (love and friendship), security (thinking about the future without concern), role (doing things that make you feel valued), enjoyment (enjoyment and pleasure) and control (independence). The wording of the response categories is influenced by the Capabilities Approach of Amartya Sen,⁸ in that the respondent is generally asked how able (s)he is to satisfy a desired level of each attribute. By applying the scoring from the UK valuation exercise to summarise a patient's five tickbox answers it fulfils the role of a common denominator of quality of life among older people,⁹ facilitating the evaluation of interventions across a variety of areas, not just in health care.

ICECAP-O has been administered in cross-sectional surveys^{10 11} and similar work is ongoing. However, to date there are no published data to inform its sensitivity to change in a longitudinal setting. This study administered it pre-operatively and both one and three years post-operatively to a subsample of participants in the Tayside Joint Replacement study: a cohort study of hip or knee replacement in Dundee, Scotland, UK. The broad aims were:

- (1) To provide further evidence of the construct validity of ICECAP-O, this time in older people experiencing impaired physical health. In particular, to test the associations between respondents' five tickbox answers and a number of survey questions about various factors including physical and mental health and restrictions on activities of daily living.
- (2) To apply the UK scoring to patients' responses to relate the ICECAP-O quality of life scores to differences in a number of sociodemographic and clinical factors. More specifically:
 - i. To calculate the mean change in quality of life resulting from hip/knee replacement and relate this to observed covariates.
 - ii. To examine any differences and attempt to gain an understanding of the situations or characteristics of the individual that tend to be associated with poor improvements in ICECAP-O score.

Methods

The participants in the Tayside Joint Replacement study were a geographical cohort of patients about to undergo hip or knee joint replacement at Ninewells Hospital, Dundee. Participants were assessed pre-operatively and post-operatively at one and three years. A questionnaire pack was sent to each patient's home approximately four weeks prior to surgery by the pre-operative assessment nurse at Ninewells hospital. The questionnaire pack consisted of an invitation to participate, patient information sheet, consent form, questionnaire and stamped return envelope. The patients completed the questionnaire at home and returned it by post to the research team at Ninewells Hospital, Dundee, Scotland prior to admission for surgery. All follow-up questionnaires were also completed by post. A written informed consent was obtained from all patients. Ethics approval was obtained from the Tayside Committee on Medical Research Ethics and was conducted in accordance with the Helsinki Declaration.

Given the length of the questionnaire administered in the study, ICECAP-O was administered to a subset of participants and therefore the study here may be considered a pilot for future studies involving the instrument. ICECAP-O was administered pre-operatively to the first 107 individuals recruited at the end of the main study questionnaire. An administrative error meant that of those individuals, the first 18 did not complete it post-operatively. Therefore distributions of participants across the categories of key covariates were compared across those who provided post-operative data and those who did not, to check the representativeness of the former.

Construct validity of ICECAP-O responses at pre-operative stage.

Construct validity was tested using patients' five pre-operative ICECAP-O responses in a similar manner to previous studies.¹¹ Associations between variables were investigated using chi-squared tests (for unordered categorical variables), Goodman and Kruskal gamma and Kendall's tau (for ordered variables) or one-way analysis of variance (for continuous variables) in Stata version 11. In forming a judgement about the strength or otherwise of relationships, patterns of percentages and means were considered as well as P-values, thus assessing magnitude and direction of relationships rather than just statistical significance. The predictions made as to which associations between ICECAP-O attributes and sociodemographic/health variables would be statistically significant are available from the first author on request. However, in summary: marital status and living status were predicted to be associated with attachment, with the former possibly being associated with security (being driven by widowed respondents); responses to questions from existing questionnaires dealing with joint pain and mobility were anticipated to be associated with ICECAP-O impairments in role, enjoyment and control, reflecting the loss of capability to be independent and to fully engage in meaningful or enjoyable activities of life. Responses to the questions that mentioned worry or distress were predicted to be associated with security, whilst those to any questions mentioning ability to engage in relationships were predicted to be associated with attachment.

Improvement in overall ICECAP-O capability associated with joint replacement.

The UK tariff (set of scores) reported in Coast et al⁹ was applied to each participant's ICECAP-O responses (pre- and both one- and three-year post-operatively). The three resulting outcomes were continuous and on a zero to one scale, where zero represents the state defined by the lowest level of

each of the five attributes ('no capability') and one represents that defined by the top level of each ('full capability'). The score for each of the five attributes individually was also a continuous variable, which was analysed to gain more insights into any differences between subgroups. The only attribute that was not expected to display any improvement was attachment (love and friendship). Descriptive statistics were calculated pre-operatively, one and three year post-operatively for those individuals that completed each, together with the change in ICECAP-O score.

Potential predictor variables were included (individually) in ordinary least squares regressions of ICECAP-O score at follow-up, adjusting for baseline. The small sample size precluded testing of a large number of clinical variables. Therefore only the key sociodemographic variables, and three key health / quality of life variables were investigated, namely: gender, marital status, living status, employment status, retirement status, education status, which joint (hip or knee) was replaced, overall pre-operative general health (5 categories) and overall pre-operative quality of life (5 categories). It was anticipated that neither of the last two variables would have any additional explanatory power beyond that of baseline ICECAP-O score. In the unlikely event of most/all variables being significant, methods which examine all possible combinations of variables were used to ascertain which were significant in a multivariable regression model.¹²

Sensitivity analysis to value improvement in overall ICECAP-O capability.

The population tariff represents the set of average values that British older people ascribe to the various capability states. In particular, the average older person considers that impairments in attachment (love and friendship) and control (independence) are associated with greater loss of capability than impairments on the other three attributes.⁹ This valuation of life 'through the eyes of the average citizen' is consistent with the perspective taken in economic evaluation to inform priority-setting decisions and underpins principal analyses reported here. However, from a purely clinical perspective, it may be useful to value improvements in capabilities when an alternative tariff is applied: one that more closely represents the values of the individual patient (rather than the possibly non-existent 'average older person'). A 2010 re-analysis of the ICECAP-O valuation data suggested that women living alone have a very strong aversion to loss of independence, men living alone have a very strong aversion to loneliness and individuals living with a partner/spouse/others have moderate

aversion to loneliness (similar to that in the average population tariff).¹³ Since living status and sex are known for the Tayside JR cohort, the individual specific tariff was applied as a sensitivity analysis. Given that joint replacement was expected to affect the ICECAP-O control (independence) attribute most strongly this was anticipated to upweight the improvement in capability among women living alone (predominantly widows) compared to everyone else. Those analyses were exploratory and have normative implications: whilst they might potentially be used to prioritise treatment in the clinical setting, they are highly unlikely to prove acceptable in the wider health policy setting, since they might imply that joint replacement is more cost-effective among widows than all others.

Change in ICECAP-O scores associated with meaningful change in WOMAC score.

Previous work has established a minimum clinically important improvement (MCII) based on a subset of key WOMAC items and this classification was used here.¹⁴ After splitting the sample by joint (hip or knee) it was hypothesised that ICECAP-O improvement would be positive among those achieving at least a MCII and negative among those who did not. In the event that this hypothesis was rejected, the five individual attributes of ICECAP-O were examined to investigate whether the control attribute (independence) showed evidence of this relationship: a three-year follow-up increased the chances of confounding by non-health factors such as death of a spouse.

Results

Pre-operative ICECAP-O data were available from 107 patients, of whom all except one had complete ICECAP-O data. Information on the joint replaced (knee or hip) was missing for one further individual and this patient was also dropped from the dataset. Complete ICECAP-O post-operative data were available from 58 respondents after one year and 55 after three years. Of these, 44 provided data at both time points. Compared to respondents without post-operative ICECAP-O data, those with one-year follow-up data were (at the 5% level of significance) more likely to be employed (19% versus 4%) and less likely to be single (1.7% versus 6.4%) or widowed (15.5% vs 23.4%). Those with three-year follow-up data were similarly more likely to be employed (15.5% versus 10%) and married (69% versus 58%) and less likely to be single (1.8% versus 6%) and widowed (14.6% versus 24%).

Comparisons of ICECAP-O responses and scores to that from a general population sample

Table 1 reports the distributions of ICECAP-O responses among the pre-operative 105 participants, the 58 one-year and 55 three-year post-operative respondents, and the sample of 809 older members of the Bristol general population survey.¹⁰

Table 1: Distribution of ICECAP-O responses

	Pre-op N=105	1 Post N=58	3 Post N=55	Pop N=809
Attachment	%	%	%	%
4 I can have all of the love and friendship that I want	55.2	50	58.18	52.7
3 I can have a lot of the love and friendship that I want	34.3	32.76	34.55	35.1
2 I can have a little of the love and friendship that I want	8.6	17.24	7.27	10.5
1 I cannot have any of the love and friendship that I want	1.9	0	0	1.6
Security	%	%	%	%
4 I can think about the future without any concern	14.3	36.21	21.82	19.1
3 I can think about the future with only a little concern	47.6	39.66	40	39.5
2 I can only think about the future with some concern	26.7	13.79	29.09	33.2
1 I can only think about the future with a lot of concern	11.4	10.34	9.09	8.2
Role	%	%	%	%
4 I am able to do all of the things that make me feel valued	13.3	34.48	14.55	24
3 I am able to do many of the things that make me feel valued	44.8	46.55	43.64	48.6
2 I am able to do a few of the things that make me feel valued	35.2	18.97	40	24.8
1 I am unable to do any of the things that make me feel valued	6.7	0	1.82	2.7
Enjoyment	%	%	%	%
4 I can have all of the enjoyment and pleasure that I want	11.4	34.48	25.45	20.3
3 I can have a lot of the enjoyment and pleasure that I want	43.8	39.66	52.73	56.2
2 I can have a little of the enjoyment and pleasure that I want	36.2	25.86	20	22.6
1 I cannot have any of the enjoyment and pleasure that I want	8.6	0	1.82	0.9
Control	%	%	%	%
4 I am able to be completely independent	24.8	56.9	36.36	43.9
3 I am able to be independent in many things	44.7	34.48	43.64	43.8
2 I am able to be independent in a few things	24.8	6.9	18.18	10.4
1 I am unable to be at all independent	5.7	1.72	1.82	1.9

Whilst pre-operatively participants in the Tayside JR cohort experience a broadly similar distribution of responses across levels of attachment and security to the general population of Bristol, the adverse effects of their poor pre-operative physical health upon role, enjoyment and control are clear. The benefit of joint replacement on those attributes (and on security) at one-year follow-up is marked: the distribution of responses is more favourable than that in the general population sample. For security, at least, this may reflect an “overshooting” effect whereby pre-operative dread of surgery has been replaced by short-term confidence in the future due to regained mobility. Indeed, at the three-year

follow-up the distributions for security and enjoyment have moved closer to those among the general population. The improvements in enjoyment appear more sustained than those in control after three years.

Construct validity of ICECAP-O responses at pre-operative stage.

Table 2 presents a selection of results of the tests of construct validity (with the full set available on request).

Table 2: ICECAP-O tests of construct validity

variable	attachment	security	role	enjoyment	control
Gender	0.831	0.146	0.183	0.54	0.145
Marital status	0.043*	0.042*	0.55	0.082	0.709
Living status	0.017*	0.23	0.915	0.787	0.414
Retirement reason	0.714	<0.001**	0.105	0.167	0.752
Education	0.825	0.933	0.651	0.626	0.538
How would you describe the pain you usually have from your joint?	0.951	0.078	<0.001**	0.004**	0.003**
How often have you had severe pain from arthritis?	0.991^	0.079	0.046*	0.005**	0.004**
How often have you had pain in two or more joints at the same time?	0.551	0.011*	0.003**	0.003**	<0.001**
Does remaining standing for 30 minutes increase your pain?	0.431	0.019*	<0.001**	<0.001**	<0.001**
How active has your arthritis been?	0.865	0.032*	<0.001**	0.015*	0.002**
How does your joint problem restrict you getting on with people (friends and family)?	0.003**	0.001**	<0.001**	<0.001**	<0.001**
How does your joint problem restrict you visiting friends or relatives?	0.085	<0.001**	<0.001**	<0.001**	<0.001**
I feel tense or 'wound-up'	0.657	0.001**	0.058	<0.001**	0.009**
I still enjoy the things I used to enjoy	0.243	0.022*	<0.001**	<0.001**	<0.001**
I get a sort of frightened feeling as if something awful is about to happen	0.381	0.002**	0.014*	0.002**	<0.001**
I can laugh and see the funny side of things	0.004**	<0.001**	<0.001**	<0.001**	<0.001**
Worrying thoughts go through my mind	0.754	<0.001**	0.01*	<0.001**	0.002**

Joint-related variables report gamma test P-values; Tau values are similar.

Associations that were hypothesised a priori are highlighted in grey.

*significant (in the expected direction) at the 5% level.

** significant (in the expected direction) at the 1% level.

^ significant (in the unexpected direction) at the 1% level

In virtually all cases the predicted associations were observed, with most of these, particularly for security and control, at high levels of significance ($p < 0.01$). There were far more statistically significant associations with security than expected, and these were predominantly observed for questions related to joint pain and joint stiffness. This suggests that concern about the future is either

a substantial non-health problem associated with joint pain/stiffness or a “worry about upcoming surgery” effect.

Improvement in overall ICECAP-O capability associated with joint replacement.

The tariff for ICECAP-O allowed the pre-operative and post-operative sets of five responses to be differentially weighted, depending on how important each is to British older people. Among the 58 respondents with one-year post-operative ICECAP-O data, the pre-operative mean (median) ICECAP-O score was 0.795 (0.827), whilst the corresponding one-year post-operative figures were 0.862 (0.893). For the 55 respondents with three-year post-operative data, the figures are pre-operative 0.796 (0.827) and at three years post-operatively 0.832 (0.880). Examination of the scores in the Bristol survey allowed these values to be put into context with the wider population of older people in a British city where the mean was 0.832, median was 0.863 and the interquartile range was (0.777, 0.911). When examining the individual level Bristol data, joint replacement appears to move the median patient from around the 38th percentile of the distribution of ICECAP-O scores among the general population aged 65+ to the 69th at one-year follow-up and to around the 58th percentile at three-year follow-up.

The mean one-year ICECAP-O improvement of 0.067 is statistically significant at conventional levels (95% confidence interval 0.036, 0.099), as is that at three years (0.036; 95% confidence interval 0.003,0.069). Again, these can be put into context, this time by comparing with results from a fully-adjusted model of the Bristol ICECAP-O scores: compared to those rating their health as “not good”, older people who rated their health as “good” (“fairly good”) on average experienced ICECAP-O scores that were 0.068 (0.039) higher.¹⁰ Table 3 presents summary statistics for the five attributes individually.

At one-year follow-up the 95% confidence interval only includes zero for attachment, in line with predictions. The large improvement in security (thinking about the future) is notable. This probably reflects the large increase in the number of patients with no concerns after surgery; security is the only attribute with a large (>3%) difference in values between the fourth (top) and third response categories.⁹ At three-year follow-up the overall treatment effect is still statistically significant, although

the only attribute to do individually is enjoyment. Indeed the improvement in enjoyment is remarkably sustained compared to that in the other attributes: it contributes half of the three-year treatment effect and is barely changed from that at one-year follow-up.

Table 3: Mean treatment effects, by ICECAP-O attribute

	One-year follow-up (n=58)				Three-year follow-up (n=55)			
	Coef.	SE	Lower	Upper	Coef.	SE	Lower	Upper
Overall	0.067	0.016	0.036	0.099	0.036	0.016	0.003	0.069
Attachment	-	0.006	-0.021	0.002	-	0.003	-0.009	0.005
Security	0.021	0.007	0.008	0.034	0.005	0.006	-0.007	0.017
Role	0.017	0.005	0.007	0.026	0.004	0.006	-0.008	0.016
Enjoyment	0.019	0.005	0.009	0.028	0.018	0.005	0.008	0.027
Control	0.021	0.005	0.011	0.030	0.012	0.006	-0.001	0.025

The mean improvements in overall ICECAP-O score associated with joint replacement conceal differences by gender. At baseline, women were experiencing far greater reductions in capability than men (ICECAP-O scores of 0.740 vs 0.806). Those differences at baseline were entirely responsible for the (unadjusted) difference in mean treatment effects at one year (0.093 for women, 0.043 for men) and at three years (0.046 for women, 0.026 for men): in a regression of the one-year change in ICECAP-O score on gender and baseline score the coefficient for women was 0.017 and non-significant at the 5% level. The gender- and baseline-adjusted 95% confidence interval for the one-year treatment effect of 0.068 was (0.040, 0.095). The confidence interval for the equivalent three-year figure of 0.036 was (0.006, 0.067).

None of the sociodemographic variables was significant at the 5% level as a predictor of ICECAP-O improvement except for retirement status: those who retired early due to sickness or disability (n=6) on average experienced a 0.071 deterioration in ICECAP-O score after adjustment for baseline. Own pre-operative health, quality of life and which joint (hip/knee) were not associated with change in ICECAP-O score.

Sensitivity analysis to value improvement in overall ICECAP-O capability.

One patient with follow-up data had missing data on the living with status variable. Therefore the three subgroup tariffs were applied to 57 of the 58 patients with follow-up ICECAP-O data. The mean effect of treatment was 0.069 (0.039, 0.099 95% confidence interval when adjusting for baseline). As expected, this was slightly higher than when using the mean population tariff, and again gender was non-significant when adjusting for baseline. Most of the 0.069-0.067=0.002 additional capability was explained by higher scores on role, enjoyment, control and security (no doubt driven by the ten women living alone). As expected, when moving to subgroup tariffs the mean ICECAP-O improvement among the ten women living alone increased more (from 0.122 to 0.125) than that among everyone else (from 0.069 to 0.067). Figures for three year follow-up are available on request.

Change in ICECAP-O scores associated with meaningful change in WOMAC score.

Of the 58 patients with ICECAP-O data at one-year follow-up, only 36 had sufficient WOMAC data to allow classification according to meaningful clinical improvement. At three-years 40 out of 55 had such data. Of these 40, there was a meaningful WOMAC improvement in 15 of 22 knee patients and 13 of 18 hip patients. On average WOMAC responders (non-responders) experienced an increase (decrease) in ICECAP-O score at three-year follow-up. Table 4 contains the average changes with confidence intervals.

Table 4: Mean three-year ICECAP-O treatment effects, by joint and MCII

	Knee				Hip			
	n	Coef.	Lower	Upper	n	Coef	Lower	Upper
>=MCII	15	0.040	-0.035	0.115	13	0.052	-0.008	0.111
<MCII	7	-0.022	-0.076	0.032	5	-0.058	-0.152	0.035

The confidence intervals all crossed zero, probably due to small numbers. Additional inferences are available from examining individual patients' attribute scores (available on request from the first author). As before, the one-year follow-up data demonstrated larger effects of treatment: there were statistically significant improvements in the majority of ICECAP-O attributes individually (as well as in the overall score) among WOMAC responders; the number of non-responders was too small for meaningful statistical analysis.

Conclusions

This was the first study to administer ICECAP-O as part of a study of joint replacement and has produced several interesting findings. In addition to the predicted associations between the WOMAC items and the role, enjoyment and control attributes, the construct validity results suggested that security (worry about the future) is associated with various aspects of joint pain and stiffness. Qualitative work among older people suggested that this, at least in part, reflected dread about upcoming surgery. Indeed, the large improvement in this attribute at one-year follow-up was largely absent after three years, suggesting short-term “relief” following surgery.

The regression results demonstrated that joint replacement is highly effective in improving older people’s lives. It led to statistically significant improvement in not only overall capability, but in four of the five attributes comprising it in the short term, and in one (enjoyment) in the longer term. Comparing mean ICECAP-O scores with the distribution of those from the general population in a typical British city suggested that joint replacement moves the median patient from around the bottom of the second quartile to above the median, or equivalently from “not good” to “good” self-rated health after one year and back to “fairly good” health after three years. This improvement conceals differences by gender: however those differences are almost entirely explained by poorer pre-operative capability among women, suggesting gender-related inequities in current British treatment patterns relative to need, as has been found before.¹⁵ It is possible that deteriorations in general health associated with ageing may explain the attenuation in the improvement in control (independence) but it is interesting that improvement in the enjoyment attribute appears to be sustained over time: total joint replacement helps older people to derive enjoyment and pleasure from life for a number of years.

Splitting patients according to minimum clinically important improvement (MCII) showed ICECAP-O’s ability to discriminate. Patients with at least a MCII experienced improvements in ICECAP-O scores on average whilst those who did not experience a MCII experienced deteriorations. Although the confidence intervals around the estimates included zero this almost certainly was due to sample size limitations caused by missing data on WOMAC and ICECAP-O. Furthermore using three-year follow-up increased the probability that other factors in life (such as bereavement) led to confounding of the

ICECAP-O responses: the results for the control (independence) and enjoyment attributes were more supportive of an association with MCII than the other attributes.

Sensitivity analysis allowed improvements in capability to be valued 'through the eyes of the average person of one's own gender and relationship status' rather than 'through the eyes of the average person'. This slightly increased the estimated gender-related differences in the effectiveness of joint replacement: since women living alone (primarily widows) are the group who are most adversely affected by impaired independence their capacity to benefit from an intervention like joint replacement is necessarily greatest. Although this use of subgroup (or individual level) values is now being investigated by health economists,^{16 17} its use in priority-setting at a national level remains controversial: joint replacement is highly cost-effective but it is possible, were the cost-effectiveness threshold used by bodies such as NICE to be reduced, that it could be judged cost-effective among widows but nobody else.

The main limitation of this study was the small sample size. Although the sample of patients with complete post-operative ICECAP-O data was not materially different from those with only pre-operative data, undetected sample selection effects may be present. Eleven patients experienced a reduction in capability score one year after joint replacement and whilst attachment and security were the attributes that typically contributed most to this, no firm insights can be drawn due to small numbers.

In future studies researchers should consider including ICECAP-O among the instruments administered. Now that typical scores among various population subgroups are available they can put both baseline values and improvements into the wider context, as was done here. Ongoing work in Australia suggests that respondent attitudes, particularly those concerning social empowerment, may help explain differences in capability both as main effects, and as interactions with health variables. Such work is hypothesis generating at this stage but, if confirmed, may ultimately help clinicians better identify patients who are unlikely to benefit from joint replacement, or who are at significant risk of experiencing catastrophic decline following treatment. Clinicians may also wish to consider obtaining the patient's *own* values to score their ICECAP-O responses.^{13 18} the valuation exercise requires only

16 choice tasks and the use of patient-specific scoring represents the ultimate manifestation of individualised patient care. However, this raises normative issues already discussed: whilst individual patient values may quantify capacity to benefit (need), their use in informing national cost-effectiveness analyses is controversial. In any case, the work here is highly supportive of the ICECAP-O instrument and offers clinicians and policy-makers an additional tool to evaluate clinical, and other, interventions.

References

1. Higashi H, Barendregt JJ. Cost-Effectiveness of Total Hip and Knee Replacements for the Australian Population with Osteoarthritis: Discrete-Event Simulation Model. *PLoS ONE* 2011;6(9):e25403.
2. Kind P, Dolan P, Gudex C, Williams A. Variations in population health status: results from a United Kingdom national questionnaire survey. *British Medical Journal* 1998;316:736-41.
3. Dolan P, Gudex C, Kind P, Williams A. The time trade-off method: Results from a general population study. *Health Economics* 1996;5(2):141-54.
4. Cookson R. QALYs and the capability approach. *Health Economics* 2005;14:817-29.
5. Potoglou D, Burge P, Flynn TN, Netten A, Malley J, Forder J, et al. Best-worst Scaling vs. Discrete Choice Experiments: An Empirical Comparison using Social Care Data. *Social Science & Medicine* 2011;72(10):1717-27.
6. Coast J, Flynn TN, Sutton E, Al-Janabi H, Vosper J, Lavender S, et al. Investigating choice experiments for preferences for older people (ICEPOP): evaluative spaces in health economics. *Journal of Health Services Research and Policy* 2008;13(suppl. 3):31-37.
7. Grewal I, Lewis J, Flynn TN, Brown J, Bond J, Coast J. Developing attributes for a generic quality of life measure for older people: Preferences or capabilities? *Social Science & Medicine* 2006;62:1891-901.
8. Sen A. *Choice, welfare and measurement*. Cambridge, MA: Harvard University Press, 1982.
9. Coast J, Flynn TN, Natarajan L, Sproston K, Lewis J, Louviere JJ, et al. Valuing the ICECAP capability index for older people. *Social Science & Medicine* 2008;67:874-82.
10. Flynn TN, Chan P, Coast J, Peters TJ. Assessing quality of life among British older people using the ICECAP-O capability measure. *Applied Health Economics and Health Policy* 2011;9(5):317-29.
11. Coast J, Peters TJ, Natarajan L, Sproston K, Flynn TN. An assessment of the construct validity of the descriptive system for the ICECAP capability measure for older people. *Quality of Life Research* 2008;17:967-76.
12. Peters TJ, Somerset M, Campbell R, Sharp DJ. Variables associated with attendance at, and the perceived helpfulness of, meetings for people with multiple sclerosis. *Health and Social Care in the Community* 2003;11(1):19-26.
13. Flynn TN, Louviere JJ, Peters TJ, Coast J. Using discrete choice experiments to understand preferences for quality of life. Variance scale heterogeneity matters. *Social Science & Medicine* 2010;70:1957-65.
14. Tubach F, Ravaud P, Baron G, Falissard B, Logeart I, Bellamy N, et al. Evaluation of clinically relevant changes in patient reported outcomes in knee and hip

- osteoarthritis: the minimal clinically important improvement. *Annals of the Rheumatic Diseases* 2005;64:29-33.
15. Judge A, Welton NJ, Sandhu J, Ben-Shlomo Y. Equity in access to total joint replacement of the hip and knee in England: cross sectional study. *British Medical Journal* 2010;341:c4092.
 16. Basu A, Meltzer D. Value of information on preference heterogeneity and individualized care. *Medical Decision Making* 2007;27:112-27.
 17. Basu A. Individualization at the heart of comparative effectiveness research: The time for i-CER has come. *Medical Decision Making* 2009;29:N9-N11.
 18. Louviere JJ, Street DJ, Burgess L, Wasi N, Islam T, Marley AAJ. Modelling the choices of single individuals by combining efficient choice experiment designs with extra preference information. *Journal of Choice Modelling* 2008;1(1):128-63.