Estimating the impact of different methods of utility assessment on the value of interventions in Type 2 diabetes

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BACKGROUND

- Methodological approaches to estimating utility in the presence of multiple co-morbidities include the 'minimum' and the 'multiplicative' approaches.
  - The minimum approach employs the value of the condition with the lowest individual utility score.
  - The multiplicative approach employs the arithmetic product of utility scores as a proportion of full health.
- Health Technology Appraisal (HTA) guidelines do not clearly recommend which method is preferred.
- A recent paper found that – when using a cardiovascular disease model - using different baseline utility profiles in conjunction with the minimum and multiplicative models yielded similar results (1).
- However, there are other examples where the results produced are different depending on which method is used (2-5).
- This is potentially important in the estimation of outcomes in diabetes as patients often experience multiple simultaneous complications.

AIMS

- The aim of this study was to explore whether the estimated benefit of an intervention is sensitive to whether we use a multiplicative or minimum approach to calculate patient utility.
- We also wish to understand whether the impact of using different methods varied between patients with advanced compared to newly diagnosed diabetes.

METHODS

- Patients considered were the entry cohorts from two well known studies in type 2 diabetes:
  - The UKPDS (6) compared intensive glucose lowering therapy to conventional therapy in newly diagnosed patients (UKPDS Cohort).
  - The ACCORD study (7) compared intensive glucose lowering therapy to conventional therapy in patients with more advanced type 2 diabetes (ACCORD Cohort).
- Baseline patient characteristics from the studies are shown in Table 1.

Table 1. Baseline characteristics of patients

	UKPDS Cohort	ACCORD cohort
Age at baseline (years)	**52**	**62**
Duration of diabetes (years)	**0**	**10**
HbA1c (%)	**7.1**	**8.3**
SBP (mmHg)	**135**	**136**
Total cholesterol (mg/dl)	**209**	**183**
HDL (mg/dl)	**40**	**42**
LDL (mg/dl)	**134**	**105**
Triglycerides (mg/dl)	**207**	**155**
BMI	**27.8**	**32.2**

METHODS (cont.)

- A published and validated computer simulation model (the CORE Diabetes Model) was used to project long-term outcomes.
- The model utilizes transition and risk probabilities of complications derived from landmark clinical and epidemiological studies.
- The CDM model was run using UK standard assumptions for treatment progression, management of risk factors and complications and epidemiology.
- Impact of intensive therapy on risk factors was taken from the underlying trials.
- Health state utilities for individual complications were derived from the UKPDS, supplemented with data from other published sources as necessary (Table 2).
- Expected quality adjusted life years (QALYs) in each arm and the benefit of therapy were calculated separately using the minimum and multiplicative utility calculation.
- To explore the possible impact on HTA we hypothesised an intervention that increased treatment costs by an arbitrary €5,000 over the patient's lifetime, and tested how much the incremental Cost Per QALY gained (CPQ) would be affected by the choice of utility calculation method.
- The model was run over a lifelong time horizon without discounting.

Table 2. Utility values used for individual complications

Utilities for individual complications	Mean	Utility loss associated with acute events	Mean
No complications	0.814	Myocardial infarction	-0.129
Post MI	0.736	Stroke	-0.181
Angina	0.682	Amputation	-0.538
Heart failure	0.633	Major hypoglycaemic event	-0.0118
Post stroke	0.545	Minor hypoglycaemic event	-0.0035
Peripheral vascular disease	0.570		
Haemodialysis	0,604		
Peritoneal dialysis	0.612		
Retinopathy	0.790		

RESULTS

- Compared with the ACCORD cohort, the UKPDS Cohort:
  - Was younger.
  - Had better glucose control.
  - Had lower total cholesterol.
  - Had lower body mass index.
- The model predicted higher life expectancy and more Quality Adjusted Life Years (QALYs) in the UKPDS cohort compared to the ACCORD cohort (Table 3).
- The model also predicted higher life expectancy and quality adjusted life expectancy in the intensive compared to conventional therapy arms.

RESULTS (cont.)

Table 3. Estimated outcomes in QALYs per patient treated

	Therapy	QALYs per patient: MINIMUM approach	QALYs per patient: MULTIPLICATIVE approach	Difference (MULTIPLICATIVE/ MINIMUM; %)
UKPDS cohort	Intensive	15.55	14.11	- 3.6%
	Conventional	14.13	13.62	- 3.0%
	Benefit	0.42	0.49	**+ 16.7%**
ACCORD cohort	Intensive	8.34	7.68	- 7.8%
	Conventional	8.09	7.35	- 9.1%
	Benefit	0.25	0.33	**+33.0%**

- Compared with the minimum approach, the multiplicative approach generated lower estimates of total lifetime QALYs.
- The multiplicative approach was however associated with higher estimate of benefit than the minimum approach.
- The change in benefit when moving form the minimum to multiplicative method was larger in the ACCORD cohort than the UKPDS cohort.
- The estimated CPQ for the hypothetical intervention in the UKPDS cohort was €11,900 using the minimum approach and €10,200 using the multiplicative approach.
- The estimated CPQ for the hypothetical intervention in the ACCORD cohort was €20,000 for the minimum approach and €15,150 for the multiplicative approach.

DISCUSSION

- Compared with the minimum approach, the multiplicative approach generated higher estimated benefits from therapy.
- This effect was most pronounced in patients with more advanced disease at baseline and is large enough to alter cost-effectiveness ratios appreciably.
- The current research literature does not clearly indicate which method is to be preferred and further methodological research and guidelines would be helpful.
- Until further methodological clarity is achieved the results of economic evaluations of interventions in late stage diabetes will be sensitive to the method of utility assessment chosen.

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