Defining the health economic value of avoiding weight gain and hypoglycaemia in type 2 diabetes mellitus

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Introduction

- Treatment algorithms for the medical management of people with type 2 diabetes mellitus (T2DM) are based on a combination of glucose lowering efficacy and other important clinical effects such as the avoidance of weight gain and hypoglycaemia.
- Based on glucose lowering potential only, the addition of a sulphonylurea or basal insulin in those uncontrolled on metformin mono-therapy is considered the most effective and cost effective treatment strategy. From the patient perspective, weight gain and hypoglycaemia can negatively impact quality of life, treatment satisfaction and the attainment of glycaemic goals.
- The objective of this study was to assess the economic value associated the three key components of T2DM: changes in HbA1c, hypoglycemia and body mass index (BMI).

Methods

- This study used the IMS Core Diabetes Model (CDM) [1, 2], a validated and established diabetes model, to compare the quality adjusted life expectancy (QALE) benefits obtained from four treatment profiles associated with managing type 2 diabetes. A flow diagram of the CDM is presented in Figure 1.
- The CDM was run to project and compare the QALE benefits associated with the following treatment profiles:
  - Treatment 1: -0.5% HbA1c
  - Treatment 2: -0.5% HbA1c and BMI -1 kg/m^2
  - Treatment 3: -0.5% HbA1c, BMI -1 kg/m^2 and 2 NSHE avoided
  - Control: no effect from baseline
- Lifetime analyses were conducted using NHANES to populate the patient characteristics in the modeling (Table 1). Results were obtained from lifetime simulations for subjects with mean age 63.6 years, 53% male; 16% current smokers; duration of diabetes 9.5 years; HbA1c 7.4%; SBP 135mmHg; total cholesterol 195mg/dl and BMI 30.6kg/m2.
- Disutilities of -0.0052 [3] and -0.0038 [4] were applied to each NSHE and 1 unit increase in BMI above 25 Kg/m2, respectively.
- Future benefits were discounted at 3%.

Figure 1: Flow diagram of the IMS CORE Diabetes Model

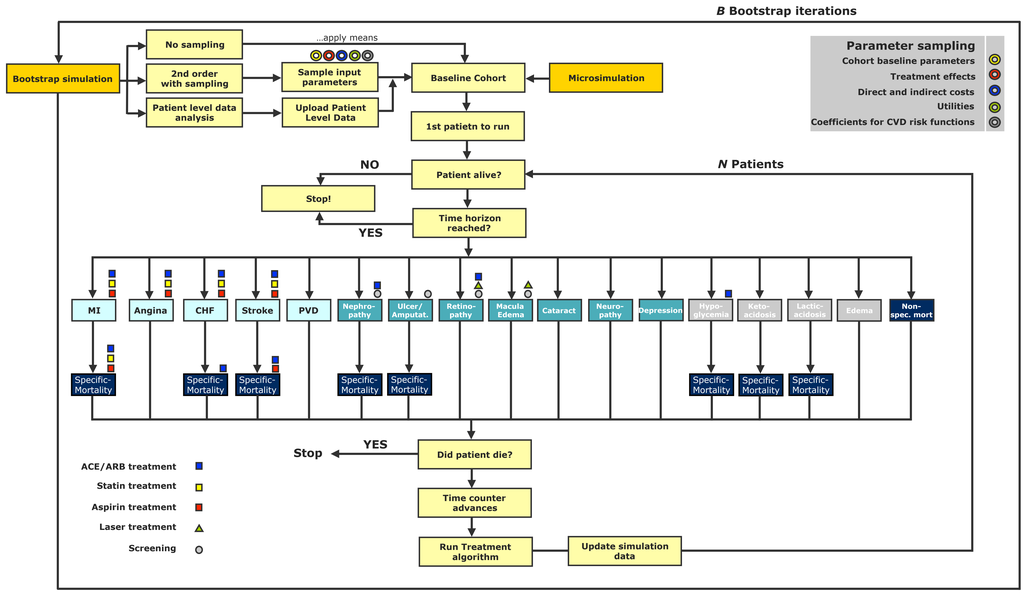
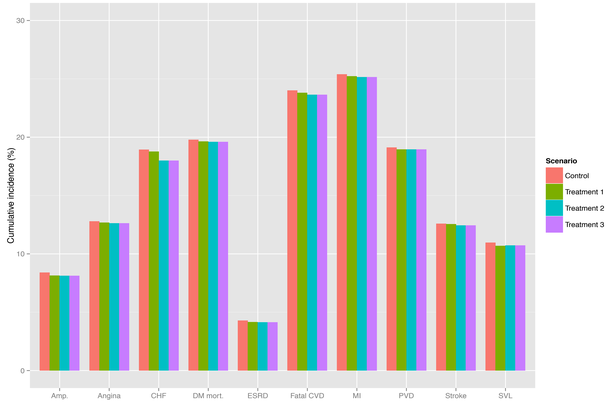


Table 1: Baseline characteristics applied to the IMS CORE Diabetes Model

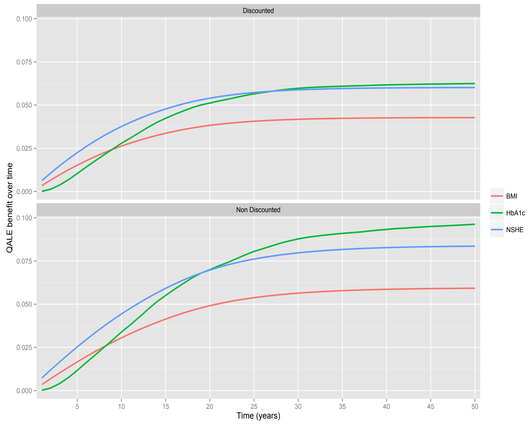
Patient Demographics	Cohort input	Baseline CVD complications	Cohort input
Start age	63.6 years	Prop. MI	0.13
Duration of diabetes	10 years	Prop. angina	0.10
Proportion male	0.53	Prop. stroke	0.11
Modifiable risk factors		Prop. HF	0.12
HbA1c	7.39%	Prop. atrial filbrillation	0.00
Systolic blood pressure	134.9 mmHg	**Baseline renal complications**	
Total cholesterol	195.0 mg/dl	Prop. MA	0.00
High density lipoprotein	47.9 mg/dl	Prop. GRP	0.00
BMI	30.6 Kg/m^2	Prop. ESRD	0.00
Proportion smokers	0.16	**Baseline retinopathy**	
Ethnicity		Prop. BDR	0.23
Prop. White	0.41	Prop. PDR	0.00
Prop. Black	0.26	Prop. SVL	0.00
Prop. Hispanic	0.30	**Baseline neuropathy**	
Prop. Native American	0.00	Prop. history of amputation	0.00
Prop. Asian/Pacific Islander	0.03	Prop. neuropathy	0.00

Figure 2: Predicted cumulative event rates over a lifetime simulation associated with the four treatment profiles



Amp = amputation; CHF = congestive heart failure; DM mort. = diabetes specific mortality; ESRD = end stage renal disease; CVD = cardiovascular disease; MI = myocardial infarction; PVD = peripheral vascular disease; SVL = severe vision loss

Figure 3: QALE gain over time for 0.5% HbA1c reduction, avoidance of 1 NSHE/year and 1 unit BMI reduction



Results

- Figure 2 shows the predicted cumulative event rates over a lifetime simulation associated with the four treatment profiles analysed. Reductions in complication rates were observed in Treatment 1 and Treatment 2 profiles compared to the Control (no effect) scenario.
- Compared to Control, Treatments 1, 2 and 3 were associated with discounted gains in lifetime QALE of 0.05, 0.11 and 0.23 respectively (0.091, 0.185 and 0.354 undiscounted).
- Over a lifetime simulation, each unit decrease in NSHE was associated with similar gains in QALE associated with a 0.5% HbA1c reduction (Figure 3).
- The maximum annual therapy specific costs (to remain cost effective at a willingness to pay threshold of GBP 20,000) for treatments 1, 2 and 3 were GBP 109.4, GBP 205.4 and GBP 428.6 respectively.

Conclusion

- Within models of T2DM, the health utility gains associated with weight reduction and avoidance of NSHE can exert considerable influence because they are applied to all patients in a treatment arm in contrast to changes in HbA1c that only impacts the probability of a future event (cardiovascular and/ or micro-vascular).
- Furthermore, the attenuating effect of compound discounting is more noticeable for the benefits associated with glucose lowering versus those obtained from avoiding NSHE or weight control because changes to weight and hypoglycaemia rates occur immediately within these models (because they are therapy dependent).
- Consequently, therapies associated with the avoidance of weight gain and hypoglycaemia invariably exhibit more favourable cost effectiveness profiles compared to those offering improvements in glucose lowering only.

References

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Acknowledgments

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