Drivers of cost effectiveness in type 2 diabetes mellitus

PDB53

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Introduction

- Type 2 diabetes mellitus (T2DM) is a complex chronic disease; consequently, cost effectiveness models in T2DM are inevitably complex. Despite our efforts to validate these models and promote transparency it is often unclear to decision makers how these models map input values to output results and which factors are most influential. Due to complex run-time interactions simple one-way sensitivity analyses often fail to provide insight into how results are influenced by models settings and parameter values.

- Therefore, the objective of this study was to assess the relative impact of three key components of diabetes therapy on cost effectiveness: changes in HbA1c, non-severe hypoglycemia (NSHE) and body mass index (BMI). Furthermore, we illustrate how the benefits associated with these treatment components are differently affected by the attenuating effect of discounting.

Figure 1: Gains in QALE for treatment 1 to 3 vs. control over life time

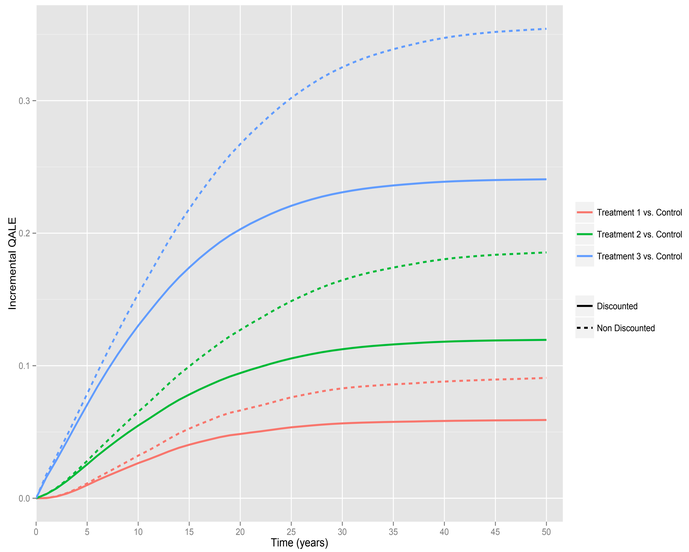


Figure 2: Incremental QALE over time for 0.5% HbA1c reduction vs. avoidance of 1 NSHE/year

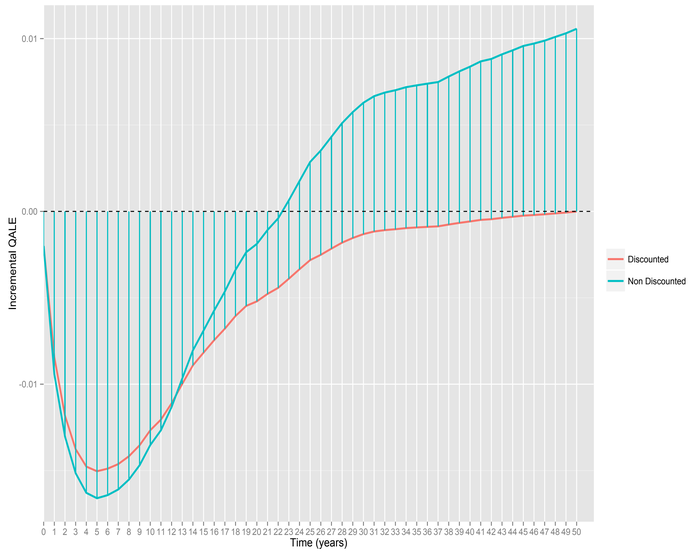
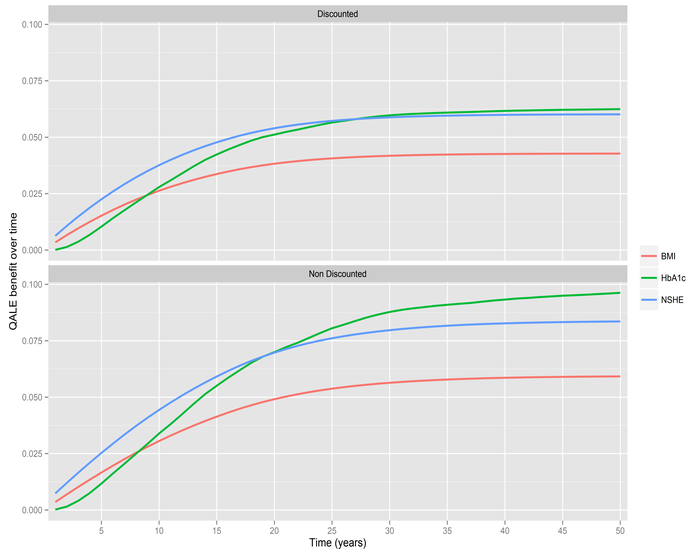


Figure 3: QALE gain over time for 0.5% HbA1c reduction, avoidance of 1 NSHE/year and 1 unit BMI reduction



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; these analyses were performed in two ways:

  1) The CDM was run to project and compare the QALE benefits associated with "combined therapy components":
     - 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
  2) "Individual therapy components" were projected to explore potential differences of the attenuating discounting effect on benefits achieved from each component:
     - Treatment 1: -0.5% HbA1c
     - Treatment 2: BMI -1 Kg/m2
     - Treatment 3: 1 NSHE avoided

- Lifetime analyses were conducted using NHANES to populate the patient characteristics in the modeling.
- 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%.

Results

- 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.

- Compared to Control (no effect), Treatments 1, 2 and 3 were associated with discounted gains in lifetime QALE of 0.059, 0.119 and 0.241 respectively (0.091, 0.185 and 0.354 undiscounted). Each unit decrease in NSHE and BMI was associated with similar gains in QALE associated with a 0.5% HbA1c reduction (Figure 1).

- When the individual treatment effect of 0.5% HbA1c lowering was compared to avoiding 1 NSHE/year, incremental discounted QALE converged to zero (equivalence) after 50 years of simulation. When no discounting was applied, the glucose reduction was associated with a 0.01 QALE benefit vs. avoiding 1 NSHE/ year (Figure 2).

- Lifetime discounted and undiscounted QALE benefits associated with 0.5% HbA1c reduction, 1 BMI reduction and avoidance of 1 NSHE per year were 0.06, 0.04 and 0.06 quality adjusted life years (discounted), respectively, and 0.10, 0.06 and 0.08 quality adjusted life years (undiscounted) (Figure 3).

Presented at the ISPOR 18th Annual International Meeting, New Orleans, LA, USA, May 18-22, 2013

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

- The CORE Diabetes Model is owned and maintained by IMS Health

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