MSR56

Evaluating the Impact of Using Different Risk Equations for Cost-Effectiveness Evaluation in the US Setting

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BACKGROUND

- Estimates from the Centers for Disease Control and Prevention National Diabetes Statistics Report in 2020 indicate that approximately 25.5 million adults are diagnosed with type 2 diabetes (T2D) in the US.[1] The ADA estimated that cost of diagnosed diabetes is in excess of USD 327.2 billion annually making the disease a significant healthcare challenge.[2]
- Health economic models of T2D are increasingly being used to guide formulary decision making in the US, as evidenced by the Academy of Managed Care Pharmacy (AMCP) Format for Formulary Submissions.[3]
- Choices around health economic modeling strategy can directly influence the outcomes reported in such analyses, particularly in chronic diseases such as T2D.[4] It is therefore important that the modeling approaches used to guide decision making are both clinically credible and valid for the populations of interest.

OBJECTIVE

- The aim of the present analysis was to evaluate the impact of using different risk equations to estimate the incidence of diabetes-related complications in a long-term, health economic modelling analysis in a US population with T2D.

Key Model Inputs

Table 1 – Baseline cohort characteristics

Characteristic (units)	Mean (SD)
Age (years)	63.7 (12.5)
Male (%)	52.6
Duration of diabetes (years)	12.3 (10.2)
HbA1c (%)	7.3 (1.7)
Systolic blood pressure (mmHg)	133.6 (20.2)
BMI (kg.m^{-2})	33.6 (8.0)

HbA1c, glycated hemoglobin; BMI, body mass index; SD, standard deviation

Table 2 – Risk factor changes associated with treatments A and B

Change from baseline in risk factors	Treatment A, mean (SD)	Treatment B, mean (SD)
HbA1c (%)	−2.3 (0.2)	−1.9 (0.2)
BMI (kg.m^{-2})	−4.1 (0.4)	−2.1 (0.2)

HbA1c, glycated hemoglobin; BMI, body mass index

Projected Outcomes

Table 3 – Mean projected life expectancy, quality-adjusted life expectancy and complication costs

	BRAVO Model risk equations			UKPDS OM2 risk equations		
	Treatment A	Treatment B	Difference	Treatment A	Treatment B	Difference
Life expectancy (years)	11.91	11.82	+0.09	12.56	12.53	+0.03
Quality-adjusted life expectancy (QALYs)	7.52	7.36	+0.16	7.36	7.28	+0.08
Complication costs (USD)	128,609	130,130	−1,520	84,910	85,233	−323

UKPDS OM2, United Kingdom Prospective Diabetes Study Outcomes Model 2; QALYs, quality-adjusted life years; USD, 2020 United States Dollars

Figure 1 – Cumulative incidence (%) of macrovascular complications common to both sets of risk equations

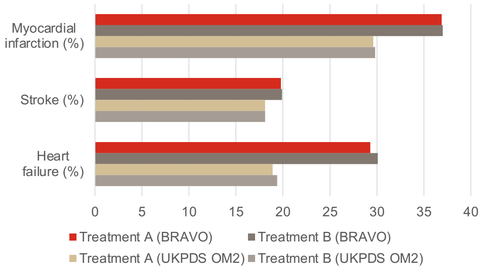
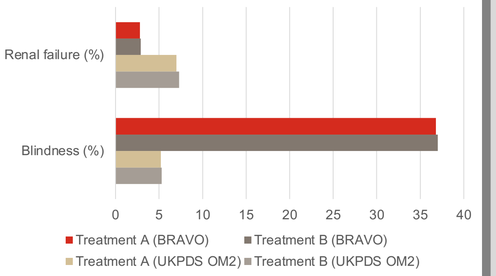


Figure 2 – Cumulative incidence (%) of microvascular complications common to both sets of risk equations



CONCLUSIONS

- The present analysis showed differing long-term health outcomes when different risk equations were used. When comparing two hypothetical treatments that improved HbA1c and BMI to different extents:
  - Incremental life expectancy was 3-fold higher with BRAVO (+0.09 years) than with UKPDS OM2 (+0.03 years) equations.
  - Incremental quality-adjusted life expectancy was 2-fold greater with risk equations from BRAVO (+0.16 QALYs) versus UKPDS OM2 (+0.08 QALYs).
- Relative to BRAVO Model risk equations, using equations from the UKPDS OM2 has the potential to underestimate the value of interventions capable of improving HbA1c and BMI when modeling long-term outcomes for a US cohort with T2D.

Limitations

- Only five complication endpoints were reported by both sets of risk equations, making comparison challenging, especially in terms of quality-adjusted life expectancy (angina, revascularization and severe pressure loss were only available from BRAVO risk equations / ischemic heart disease, foot ulcer and amputation were only available from UKPDS OM2)
- No costs associated with diabetes treatments were included in the analysis (as the interventions were hypothetical)

METHODS

- Long-term projections of clinical outcomes were made for a US cohort with T2D similar to the NHANES cohort described in the recent Institute for Clinical and Economic Review (ICER) review of tirzepatide for the management of T2D (Table 1).[5]
- The PRIME T2D Model framework was adapted to project long-term outcomes in two different scenarios.[6] In the first, the risk of complications and mortality was modeled using equations from the BRAVO model (derived from a US population) and in the second scenario United Kingdom Prospective Diabetes Study Outcomes Model 2 (UKPDS OM2, derived from a UK population) equations were used.[7,8] All other simulation settings and parameter inputs were identical across the two scenarios.
- Simulated patients received one of two hypothetical interventions to reduce HbA1c and BMI (treatment A was superior to treatment B in terms of HbA1c and BMI improvements, see Table 2).
- HbA1c gradually increased over time according to a published function.[9] Patients intensified to insulin therapy when HbA1c was above 8.5%, leading to a subsequent decrease of 0.8% in HbA1c and BMI levels returning to baseline.
- Quality-adjusted life expectancy was estimated using an additive approach in line with that described in the ICER review of tirzepatide.[5] The cost of diabetes-related complications was accounted in 2020 US dollar values (USD) based on published data. Simulations were run over a 50-year time horizon and future costs and clinical benefits were discounted at 3% annually.

RESULTS

- Life expectancy was generally lower using BRAVO Model risk equations than with UKPDS OM2 equations, with differences in incremental life expectancy observed (Table 3).
- Similarly, differences were observed in incremental quality adjusted life expectancy estimates with values of 0.16 QALYs projected using BRAVO equations versus 0.08 QALYs with UKPDS OM2 equations (Table 3).
- Cumulative incidence rates of most diabetes-related complications were higher with risk equations derived BRAVO than with UKPDS OM2 equations (Figure 1 and Figure 2), although in most cases only modest differences in incremental values (difference between treatments A and B) were observed.
- In contrast to macrovascular complications, the risk of renal failure was lower with using the BRAVO equations than UKPDS OM2 equations (Figure 2). Cumulative incidences were projected to be 2.8%/2.9% and 7.0%/7.3%, respectively, for treatments A/B.
- The risk of blindness was notably higher using the BRAVO risk equation than with UKPDS OM2. There is no obvious difference in endpoint definition that should lead to this disparity, but the estimates are in line with published validations for the BRAVO Model and the UKPDS OM2. Incremental values for blindness were comparable with both sets of equations (0.1% versus 0.2%).

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