

Mt Hood Diabetes Challenge Reference simulation

To enable model simulations to be compared across time the Mt Hood Diabetes Challenge network has developed a reference simulation that can be run each time there are any changes to the model to determine the impact on simulated outcomes of representative patient. These reference simulations will be reported on the Mt Hood Diabetes Simulation Model registry. Each time the model is changed the developers should re-run these simulations and update the information contained in the registry. We would strongly encourage those publishing papers that are using a registered simulation models to include the following in the methods section of any study:

“This simulation model has been registered on the Mt Hood Diabetes Challenge Network as [simulation model name]. The registry includes a set of reference simulations that are intended to enable comparisons of models across time. The simulation model used in this study produces identical results for this reference simulation to that report in the registry as being conducted on [date] (for further details see <https://www.mthooddiabeteschallenge.com>).”

Reference simulation defined

Model Description:

We acknowledge that different models incorporate utilities in different ways (e.g. some assume additive effect, while others assume a multiplicative effect). However, for the purpose of this reference case simulation, the **additive** quality-of-life (QoL) model is recommended when populating the health utility values into the simulation model. Suggestions on how utility values are applied are described in Appendix 1. If the additive QoL model is not feasible in your model, please document your assumptions how the health utility values are populated in your model.

For transparency it would be useful to describe how utilities are incorporated into different diabetes models. Please provide the following information in the accompanying Excel spreadsheet (in tab labelled “Model Description”). These will be used to form a table in the manuscript.

- (i) What health states have a utility in your model;
- (ii) What values are typically assumed for each health state (provide point estimates and/or ranges). If these have varied over time, what values were used in the most recent published economic evaluation that involved a QALY simulation of the model. Please provide references of the source of the utilities where available.
- (iii) In 150 words (or less) succinctly describe how quality of life is modelled (e.g. are changes in utilities assumed to have an additive or multiplicative effect on QALY outcomes).

Model Inputs:

Utility Values

To examine the effect of different assumptions regarding quality of life’s impact on outcomes, we will run the same simulation with a variety of different assumptions regarding the utility associated with health states (such as diabetes-related complications). These values have been chosen to reflect high/low and average values from the literature. Utility values (Figure 1) from a recent systematic review (Beaudet et al., 2014) should be used for this challenge. In this challenge, it would be adequate to use point estimates and not model 2nd order uncertainty.

If you require additional utility weights for health states not listed, please include these using values you currently use. Please document your sources and assumptions in the “Utility values” tab in the accompanying Excel spreadsheet.

Figure 1: Utility values used to populate model

Table 3 – Preferred utility values for modeling complications associated with T2DM.				
Parameter	Proposed reference	Proposed utility value	95% CI	Range of candidate values
T2DM without complication	Clarke et al. [21]	0.785	0.681–0.889	0.690–0.940
Myocardial infarction	Clarke et al. [21]	–0.055	–0.067 to –0.042	–0.059 to –0.007
Ischemic heart disease	Clarke et al. [21]	–0.090	–0.126 to –0.054	–0.090 to –0.027
Heart failure	Clarke et al. [21]	–0.108	–0.169 to –0.048	–0.108 to –0.051
Stroke	Clarke et al. [21]	–0.164	–0.222 to –0.105	–0.164 to –0.070
Severe vision loss	Clarke et al. [21]	–0.074	–0.124 to –0.025	–0.070 to –0.012
Amputation event	Clarke et al. [21]	–0.280	–0.389 to –0.170	–0.280 to –0.063
Peripheral vascular disease	Bagust and Beale [22]	–0.061	–0.090 to –0.032 [*]	–0.186 to –0.061
Proteinuria	Bagust and Beale [22]	–0.048	–0.091 to –0.005 [*]	One reference identified
Neuropathy	Bagust and Beale [22]	–0.084	–0.111 to –0.057 [*]	–0.247 to –0.050
Active ulcer	Bagust and Beale [22]	–0.170	–0.207 to –0.133 [*]	–0.206 to –0.016
Excess BMI (each unit above 25 kg/m ²)	Bagust and Beale [22]	–0.006	–0.008 to –0.004 [*]	–0.006 to –0.002
Hemodialysis	Wasserfallen et al. [23]	–0.164	–0.274 to –0.054 [*]	One reference identified
Peritoneal dialysis	Wasserfallen et al. [23]	–0.204	–0.342 to –0.066 [*]	One reference identified
Renal transplant	Kiberd and Jindal [26]	0.762	0.658–0.866	0.762–0.820
Cataract	Lee et al. [32]	–0.016	–0.031 to –0.001 [*]	One reference identified
Moderate nonproliferative background diabetic retinopathy	Fenwick et al. [24]	–0.040	–0.066 to –0.014 [†]	One reference identified
Moderate macular edema	Fenwick et al. [24]	–0.070	–0.099 to –0.041 [†]	–0.070 to –0.012
Vision-threatening diabetic retinopathy	Fenwick et al. [24]	–0.047	–0.012 [‡]	–0.020–0.005 [‡]
Major hypoglycemia event	Currie et al. [18]	–0.014	–0.004 [‡]	–0.031 to –0.001 [‡]
Minor hypoglycemia event	Currie et al. [18]			

CI, confidence interval; T2DM, type 2 diabetes mellitus.
^{*} Estimated from the standard error values provided.
[†] Estimated from the interquartile range values provided.
[‡] Disutilities converted into annual values.

Source: Table 3 from Beaudet et al. "Review of utility values for economic modeling in type 2 diabetes." Value in Health 17.4 (2014): 462-470

[https://www.valueinhealthjournal.com/article/S1098-3015\(14\)00054-0/pdf](https://www.valueinhealthjournal.com/article/S1098-3015(14)00054-0/pdf)

Patient Baseline Characteristics

To allow for consistent comparisons across all models, baseline patient characteristics should follow the values as listed in Table 1. Any other baseline patient characteristics that your model may require can be sourced from publicly available literature (but please document this including sources in “Baseline Characteristics” tab in the accompanying Excel spreadsheet).

Table 1: Characteristics of a representative patient to be used in the simulations

Patient Characteristics	Men	Women
<i>Current age</i>	66	66
<i>Duration of diabetes</i>	8	8
<i>Current/former smoker</i>	N	N
<i>HbA1c %</i>	7.5	7.5
<i>Systolic Blood Pressure mmHg</i>	145	145
<i>Diastolic Blood Pressure mmHg</i>	80	80
<i>Total Cholesterol mmol/l</i>	5.2	5.2
<i>HDL Cholesterol mmol/l</i>	1.3	1.3
<i>LDL Cholesterol mmol/l</i>	3.0	3.0
<i>BMI</i>	28	28
<i>Albumin: creatinine ratio</i>	14.2	14.2
<i>PVD</i>	N	N
<i>Micro or macro albuminuria (albuminuria ≥ 50)</i>	N	N
<i>Atrial fibrillation</i>	N	N
<i>eGFR (ml/min/1.73 m²)</i>	70	70
<i>WBC (x10⁹/l)</i>	7	7
<i>Heart rate (bpm)</i>	79	79
<i>Haemoglobin (g/dl)</i>	14	14
<i>Prior history of macrovascular disease</i>	N	N
<i>Prior history of microvascular disease</i>	N	N

It is important in each simulation all other factors are kept constant between simulations. This includes assumptions around biomarker evolution; i.e. HbA1c and systolic blood pressure to be kept constant over time and not allow for evolution.

The main outputs required will be incremental **undiscounted** Quality Adjusted life expectancy (LE). As such, please set the discount rate to 0% for QALY prior to running the simulations.

Reference Simulations:

Step 1: Run a simulation using the baseline characteristics in Table 1 held constant over a 40-year period, separately for males and for females

For microsimulation models, please ensure that the number of replications is sufficient to generate stable results.

Step 2: Simulate four common interventions (plus all combined), separately for males and females

Re-run the simulation with four individual interventions (one-at-a-time and then all combined) that capture initial and permanent reductions in common risk factors from time paths modelled in Step 1. Reductions from these interventions should only be applied to post-baseline cycles and baseline values should remain unchanged.

- (i) 0.5%-point reduction in HbA1c;
- (ii) 10mm Hg reduction in Systolic Blood Pressure;
- (iii) 0.5 mmol/l (19.33 mg/dl) reduction in LDL Cholesterol
- (iv) 1-unit reduction in BMI (kg/m²)
- (v) All interventions combined

Extract the results put them in an Excel workbook (which can be downloaded from the Mt Hood website) and send them in the following format. Please include the date and if possible the version number of the model

Model	Sex	Control	0.5% red. HbA1c	10mmHg in SBP	0.5mmol/l red. LDL	1-unit red BMI	All combined	Date
Cardiff (UKPDS82)	Male	12.42	12.51	12.59	12.64	12.55	13.01	5/10/2018
Cardiff (UKPDS82)	Female	14	14.07	14.16	14.11	14.15	14.48	5/10/2018