Mount Hood 2026 - Reference Simulations

Mt Hood Reference Simulation

Modelling groups are asked to run reference simulations for representative male and female patients with baseline characteristics specified in each Mt Hood Reference case population. This will enable model simulations to be compared across time—and will demonstrate the effect of model upgrades for those that have previously submitted type 2-diabetes reference case results. Latest submitted values will be used to update the Mount Hood Diabetes Network model registry available at: https://www.mthooddiabeteschallenge.com/registry.

New for 2026: The reference simulation differs from previous years in now offering two additional baseline populations for which to complete the reference simulation challenge. It is hoped that modelling groups with facility to complete simulations for more than one model baseline population will submit results for each individual population simulated in separate results files. The type 2 diabetes population modelled within prior reference simulations is captured in **Model population A**, and the submission of results for this population should be prioritized if time is limited, to maintain comparability of reference model results across time.

In addition, two further model baseline populations are specified. **Model population B** captures a population without type 1 or type 2 diabetes at baseline, but with obesity or prediabetes. It is intended simulations for this population use utility values common to the type 2 diabetes population, rather than type 1-specific utility values listed in Table 2. **Model population C** captures a population with type -1 diabetes previously specified in the 2022 Reference simulation, provided by An-Duy-Tran on behalf of the COSMO-T1D modelling group. Specific type 1 diabetes utility values are provided for this population simulation, and it is requested modelling groups submitting results for this population do not use type 2 diabetes utility values, even where type 1 utility values are missing, to maintain comparability across model results.

Model inputs for Challenge – Reference Simulation

Patient Baseline Characteristics

To allow for consistent comparisons across all models, baseline patient characteristics for the simulated population should follow the values listed in Table 1. Any other baseline patient characteristics which your model *requires* to run effectively can be sourced from publicly available literature. Please document any additional assumed parameters and their sources in "Baseline Characteristics" tab in the accompanying Excel spreadsheet

Table 1: Patient Baseline Characteristics

Model Population	**A**		**B**		**C**	
	Type 2 diabetes[a]		**Non-T2D (Obesity // Prediabetes)[b]**		**Type 1 diabetes[c]**	
Patient Characteristics	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*
Current age (years)	66	66	51	51	37	37
Duration of diabetes (years)	8	8	-	-	22	22
Current/former smoker	N	N	N	N	N	N
Ethnicity	White	White	White	White	White	White
HbA1c. %	7.5	7.5	5.9	5.9	8.1	8.1
FPG. mmol/L	8.5	8.5	5.9	5.9		
Systolic Blood Pressure, mmHg	145	145	124	124	127	127
Diastolic Blood Pressure, mmHg	80	80	78	78	73	73
Total Cholesterol, mmol/l	5.2	5.2	5.3	5.3	4.8	4.8
HDL Cholesterol, mmol/l	1.3	1.3	1.2	1.2	1.6	1.6

LDL Cholesterol, mmol/l	3.0	3.0	3.2	3.2	2.7	2.7
Triglycerides, mmol/L	2.0	2.0	1.8	1.8	1.2	1.2
BMI (kg/m^2)	28	28	34	34	25	25
Albumin: creatinine ratio (mg/g)	14.2	14.2	13.6	13.6		
PVD	N	N	N	N	N	N
Micro or macro albuminuria (albuminuria >50)	N	N	N	N	N	N
Atrial fibrillation	N	N	N	N	N	N
eGFR (ml/min/1.73 m2)	70	70	95	95	96	96
WBC (x10^9/l)	7	7	-	-		
Heart rate (bpm)	79	79	-	-		
Haemoglobin (g/dl)	14	14	14	14		
Prior history of macrovascular disease	N	N	N	N	N	N
Prior history of microvascular disease	N	N	N	N	N	N

Sources:

[a]ADVANCE—Action in Diabetes and Vascular Disease: patient recruitment and characteristics of the study population at baseline

[b]The Diabetes Prevention Program: Baseline characteristics of the randomized cohort

[c]A Patient-Level Model to Estimate Lifetime Health Outcomes of Patients With Type 1 Diabetes

Utility Values

The reference simulation uses the health utility values reported in Table 2 below. Two sets of distinct health utility values are available. The first set of utilities for **Model populations A and B** are based on values from the 2018 Mt Hood Quality of life Challenge, with newly added health utility values for prediabetes and normal glucose tolerance (NGT) health states. The second set of utilities for **Model population C** are based on values provided by An-Duy-Tran on behalf of the COSMO-T1D group for the 2022 Mt Hood reference simulation. The utility sets are distinct and should not be mixed (even where values are missing), to maintain comparability across model submissions. For all utility parameters, it will be adequate to use point estimates rather than making full use of parameter uncertainty estimates reported in Table 2.

If your model requires parameterisation of additional utility weights for health states not listed, please set these to zero where possible, and failing this – utilise and document the value and source for the additional utility parameterisation as a last resort. Please document your sources and assumptions in the "Utility values" tab in the accompanying Excel spreadsheet.

Restating the above for further clarity – this challenge requires participants to only apply disutility values for complication events described in the instructions wherever possible. If this is not possible and your model requires you to apply additional disutilities for certain health states (e.g. a raised BMI health state which is independent of BMI's effect on complication events) - please report the additional disutility value used.

Please keep baseline utilities constant across all ages. Do not allow baseline utilities to change as participants age unless this feature is absolutely essential for the functioning of your model. If your model requires this feature for adequate functioning – please report the utility changes applied from baseline in the Excel sheet.

Please ensure to avoid confusion with utility/disutility terminology in loading the models and in reporting results. The "Utility/Disutility Values" column in Table 1 reports a positive "utility" value only for initial baseline states, these being Normoglycaemia, Pre-T2D, or diabetes without complications. Where patients can move between glycaemic states within a model, glycaemic utilities can be substituted for a corresponding disutility value (for example, a disutility of-0.040 to move from Normoglycaemia [0.900] to Prediabetes [0.860]). The remaining items in the table are all disutilities and are incremental (and applied additively where possible if multiple events occur in a given model cycle or year, i.e. the total utility decrement is the sum of disutlity values of events occurring in a given cycle, see below).

Based on the 2018 Mt. Hood challenge conference call on September 5, 2018, two suggestions were made for the Quality of Life challenge, including:

1) The additive quality-of-life (QoL) model is recommended when populating the health utility values into the simulation model. As shown in Table 2 below, if a subject has experienced two different complications belonging to two different categories of disease (e.g., stroke [in the category of cerebrovascular disease] and myocardial infarction [in the category of coronary heart disease]), the health utility value will be reduced by 0.219 which is the sum of individual decrement for these two complications (i.e., 0.164+0.055). However, if a subject has experienced two or more complications within the same category of disease (e.g., myocardial infarction [in the category of coronary heart disease] and congestive heart failure [in the category of coronary heart disease]), the health utility value will be reduced by 0.108 (the decrement for heart failure) which is the largest decrement of these two complications. 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.

2) The utility decrement and its 95% confidence interval for renal transplant was assumed to be half of those for hemodialysis.

Important Note

This reference simulation differs from prior type 2 diabetes reference challenges in newly offering utilities for prediabetes and normoglycamia, and therefore the possibility to assess the quality of life impact of incorporating glycaemic reversion. To maintain comparability with prior challenge results, it is therefore important to show the impact of this change by providing two sets of results for **Model population B** if your model incorporates this possibility for glycaemic reversion (for example you have a multi-state model incorporating distinct glycaemic health states for NGT, prediabetes and Type 2 diabetes). One set of results should incorporate these additional glycaemic utility values, whilst the other submission should incorporate only a single glycaemic for type 2 diabetes – and thus not capturing the possibility for glycaemic reversion, as common with prior reference challenges.

For clarity, we therefore request two (labelled) sets of results for **Model population B** if your model is capable of incorporating glycaemic reversion:

1) Model results using all glycaemic utility values listed for distinct health states of Normoglycamia, Prediabetes, and type 2 diabetes without complications.
2) Model results setting all glycaemic utilities (e.g. prediabetes and NGT) to a single common utility value with type 2 diabetes of 0.785 (95%CI 0.681-0.889) to maintain comparability with previous years' reference simulations.

If your model does not incorporate the possibility for glycaemic reversion, the results will be the same and therefore it is only necessary to submit one set of results for **Model population B**.

If your model can incorporate reversion, but analyst time only allows submission one set of results, please note this in your submission whilst prioritising scenario 2 to maintain compatibility of results with historic reference submissions.

Do direct any questions on implementation to james.altunkaya@ndph.ox.ac.uk.

Table 2. Utility values by categories of diseases/complications

Disease category	Utility value for use in Mt. Hood QoL challenge	Model populations A + B NGT/Prediabetes/Type 2 Diabetes [a]			Model population C Type 1 Diabetes [d]		
		Utility/Disutility Values	Lower 95% CI	Upper 95% CI	Utility/Disutility Values	Lower 95% CI	Upper 95% CI
Baseline utility value	Normoglycaemia	0.900 [b]	0.882 [b]	0.918 [b]	-	-	-
	Prediabetes	0.860 [b]	0.851 [b]	0.869 [b]	-	-	-
	Diabetes without complications	0.785	0.681	0.889	0.900 [e]	0.880 [e]	0.930 [e]
Acute metabolic disorder	Minor hypoglycemia event	-0.014	-0.004	-0.004			
	Major hypoglycemia event	-0.047	-0.012	-0.012	-0.002	-0.004	-0.000
	Major hyperglycemic event				-0.071 [f]	-0.116 [f]	-0.026 [f]
Comorbidity	Excess BMI (each unit above 25 kg/m^2)	-0.006	-0.008	-0.004	-0.005	-0.009	-0.001
Retinopathy	Cataract	-0.016	-0.031	-0.001			
	Moderate non-proliferative background diabetic retinopathy	-0.040	-0.066	-0.014	-0.027	-0.048	-0.005
	Moderate macular edema	-0.040	-0.066	-0.014			
	Vision-threatening diabetic retinopathy	-0.070	-0.099	-0.041			
	Severe vision loss	-0.074	-0.124	-0.025			

Nephropathy	Proteinuria	-0.048	-0.091	-0.005			
	Renal transplant	-0.082 [c]	-0.137 [c]	-0.027 [c]	-0.053 [g]	-0.077 [g]	-0.029 [g]
	Hemodialysis	-0.164	-0.274	-0.054	-0.082 [g]	-0.128 [g]	-0.036 [g]
	Peritoneal dialysis	-0.204	-0.342	-0.066			
Neuropathy	Peripheral vascular disease	-0.061	-0.090	-0.032			
	Neuropathy	-0.084	-0.111	-0.057	-0.236	-0.299	-0.173
	Active ulcer	-0.170	-0.207	-0.133	-0.125	-0.226	-0.023
	Amputation event	-0.280	-0.389	-0.170	-0.117	-0.225	-0.009
Cerebrovascular disease	Stroke	-0.164	-0.222	-0.105	-0.291 [e]	-0.475 [e]	-0.108 [e]
Coronary heart disease	Myocardial infarction	-0.055	-0.067	-0.042			
	Ischemic heart disease	-0.090	-0.126	-0.054	-0.181 [e]	-0.331 [e]	-0.031 [e]
	Heart failure	-0.108	-0.169	-0.048	-0.058 [h]	-0.101 [h]	-0.015 [h]
Cardiac Procedures	Percutaneous revascularization				+0.025	-0.051	+0.101
	Coronary revascularization				-0.079	-0.218	+0.060

Sources: [a] Utility values from Beaudet et al. 2014, except those otherwise highlighted. [b] Leal et al. 2022.[c] The utility decrement and its 95% confidence interval for renal transplant was assumed to be the half of those for haemodialysis. [d] Utility values from Peasgood et al 2016 based on EQ-5D-3L, except those otherwise highlighted. [e] Solli et al 2010 based on EQ-5D-3L. [f] Hart et al 2003 based on EQ-5D-3L. [g] Ahola et al 2010 based on 15D. [h] Coffey et al 2002 based on QWB-SA.

Abbreviations: QoL, quality of life; CI, confidence interval; BMI, body mass index.

Reference Simulation - Instructions

Step 1: Run a simulation using the patient baseline risk factors from Table 1 held constant over a 40-year period, separately for males and for females

This simulation should match both the 2018 Mt Hood challenge and the reference case simulations which are on the Mt Hood website: (https://www.mthooddiabeteschallenge.com/refsim).

Ensure QALYs are **not discounted** for this challenge.

Extract the results and enter input values in a transparent manner in the accompanying Excel workbook in tab labelled "Time paths & Outcomes" (modify the workbook to fit your outcomes if necessary, but please try to preserve the basic structure). Do not forget to include traces of risk factor time paths for input values of all risk factors utilised by the model; event rates (or counts) of all major health states predicted by the model (e.g. MI; stroke; renal failure, etc.), and life-expectancy.

For microsimulation models, please ensure that the number of replications is sufficient to generate stable results. Report how many replications were used.

Step 2: Reference simulation of common treatment effects, holding risk factors constant

Re-run the 40-year simulation with each of the four individual interventions separately, and then all interventions combined, separately for males and females. These interventions represent a permanent reduction to ongoing risk factor trajectories, and are to be applied immediately after baseline. Intervention effects should be simulated in all post-baseline cycles, with baseline values remaining unchanged.

Please simulate each of:

(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 4 of the interventions above applied in combination simultaneously

Extract the results and add to the accompanying Excel workbook (in tab labelled "Time paths & Outcomes". Report outcomes and inputs in a transparent manner. Do not forget to include traces (numerical preferable, failing this curves) for input values of all model utilised risk factors; cumulative rates (or counts) of all major health states in the model (e.g. MI; stroke; renal failure, etc.) and life expectancy.

Step 3: Estimate incremental QALYs holding risk factors constant, separately for males and females

Using the "Utility/disutility" values in Table 2 run the baseline simulation and estimate expected QALYs over 40 years, assuming that decrements apply to the year of the of the event and are similarly applied to each subsequent year. However, if temporary events/states such as hypoglycaemia are modelled, it is likely that these decrements only apply to the year of the event. If so, please document this.

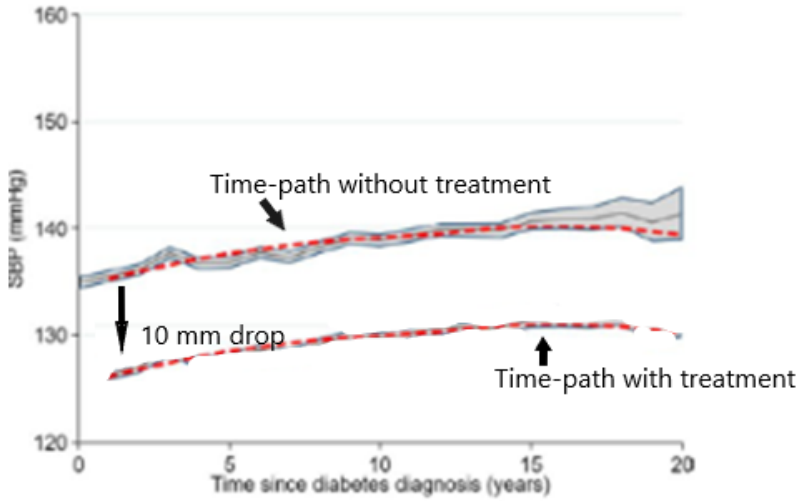
Run each of the four interventions listed in Step 2 to estimate the expected QALYs and calculate the incremental QALYs compared to the baseline (control). Extract the results and add to the accompanying Excel workbook (in tab labelled "Time paths & Outcomes").

Be sure to report incremental QALYs so that a negative value indicates worse QALYs (not inverting to account for a positive value indicating more disutility)

Step 4: Reference simulation of common treatment effects over 40 years, when risk-factor time-paths are NOT held constant

The simulations in step 1-3 does not capture the drift that can occur in many risk factors over time eg. the gradual increase in HbA1c. To understand what impact change in risk factors may have on incremental benefits the second component of this challenge is to redo the four simulations outlined in step 2 using the actual risk factor time paths or assumptions regularly used in your model. Please assume that treatment effects to be assumed still represent permanent vertical displacements from the trajectories without intervention time-paths.

As an example, consider the blood pressure treatment simulation – the treatment will permanently reduce SBP 10 mm Hg below the projected trajectory of SPB without treatment. Similarly, please allow all risk factors that are normally projected in your model to vary. So, when simulating the blood pressure lowering intervention allow HbA1c, LDL, BMI and other risk factors to follow the time-path predicted by your model without any treatment effect.



Extract the results and add to the accompanying Excel workbook (in tab labelled "Time paths & Outcomes". Report outcomes and inputs in a transparent manner. Do not forget to include traces (numerical or curves) for input values of all the above risk factors; cumulative rates (or counts) of all major health states in the model (e.g. MI; stroke; renal failure, etc.), QALYs and life expectancy.

Submission:

Prior to the meeting, please submit individual Excel spreadsheets for each modelled population ("MH Padua Reference Simulation_POPULATION_GROUP") to Mount Hood at: mthood2016@gmail.com **by 18 September 2026.** Please replace POPULATION with the population modelled, and GROUP with your modelling group name before submission, and note in the email text any requisite information about the results files submitted (for example whether you are submitting two sets of results for Model Population B – and which file is which). Please direct any outstanding questions regarding the challenge instructions to james.altunkaya@ndph.ox.ac.uk.