

Mt Hood Diabetes Challenge Network

Mt Hood Challenge Conference 2026

Health Economics and Simulation Modelling

Padua, Italy | 2-4 October 2026



Mt Hood 2026

The Mt Hood Diabetes Challenge Network 2026 Challenges aimed to enhance transparency, comparability, and methodological innovation in diabetes & health economic simulation modelling.

The challenges included a comorbidity challenge, which integrated conditions such as dementia to examine their impact on outcomes like quality-adjusted life years, and a synthetic data challenge developed with the REDDIE project. Finally, a pre-symptomatic screening challenge in type 1 diabetes evaluated the long-term clinical and economic value of early detection strategies, reflecting increasing policy interest in prevention and early intervention.

The Mt Hood 2026 conference also accepted abstracts and organised sessions on a wide range of topics related to diabetes and health economic simulation modelling.

The meeting also featured a discussion on AI and diabetes simulation modelling, with a theme inspired by the 1968 film *2001: A Space Odyssey*.

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Venue Guide

Please note: Friday's short course and the main conference are at different venues.

Friday 2 October

Pre-conference Short Course

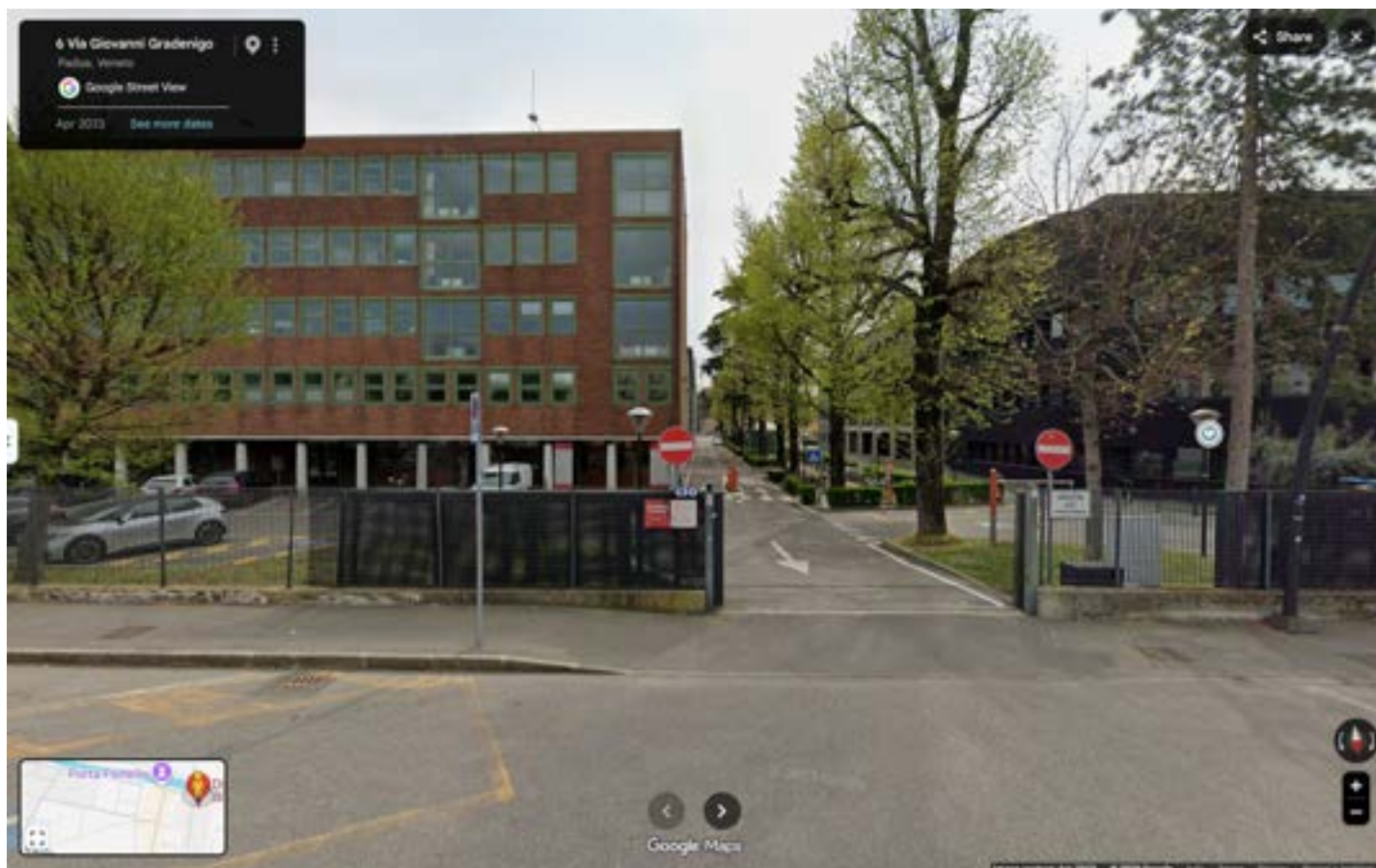
Aula Magna "A. Lepschy"
Department of Information Engineering
University of Padova
Via Giovanni Gradenigo 6/B, Padova

Finding the Aula Magna

Enter the university complex through the gate on Via Giovanni Gradenigo, shown in the photograph below.

Follow the road straight through the gate and into the university complex. Continue past the large building in the foreground. The Aula Magna is in the building behind it (a small part of this building can be seen in the distance in the photograph).

Once inside the building, go up the first flight of stairs on the right; the entrance to the Aula Magna is on the right.



Entrance from Via Giovanni Gradenigo. Continue straight through the gate and follow the road to the building behind the one in the foreground.

Saturday 3 & Sunday 4 October

Mt Hood Diabetes Challenge Conference

Palazzo della Salute
Via San Francesco 90, Padova

The entrance is directly from Via San Francesco, through the dark-framed glass doors shown in the photograph below.

The entrance is now marked “Palazzo della Salute”. Please note that the Google Street View image shown here was taken before the current signage was installed.

Once inside, follow the conference signs to:

Sala Elettra — main conference and plenary sessions

Sala Argo — parallel sessions



Main entrance to Palazzo della Salute, Via San Francesco 90.

Welcome to Mt Hood 2026

Welcome to the Mt Hood Challenge Conference 2026, being held in Padua, Italy, from 2-4 October 2026. The meeting brings together an international community of health economists, simulation modellers, clinicians, policy analysts and public-health researchers with a shared interest in the use of modelling to inform health policy and decision-making.

The Mt Hood Diabetes Challenge Network has a long tradition of scientific meetings designed to advance health economic simulation modelling in diabetes and its complications. Central to these meetings are the Mt Hood Challenges, in which modelling groups independently apply their models to common scenarios and then compare results. This provides a practical way of exploring differences in model structure, assumptions and predictions, while promoting transparency, comparability and methodological innovation.

Mt Hood 2026 builds on this tradition while broadening the scope of the network. Alongside diabetes, the programme considers modelling across related chronic diseases and, importantly, comorbidity and multimorbidity. This is reflected in the 2026 challenges, including work incorporating dementia into diabetes models, a synthetic data challenge developed in collaboration with REDDIE, and work examining pre-symptomatic screening in type 1 diabetes.

The conference will also showcase new research through submitted oral presentations covering health economic and simulation modelling methods and applications. A new pre-conference short course, Economic Evaluation and Simulation Modelling in Diabetes, will be held on Friday 2 October, providing an introduction to analysing costs, quality of life and survival data and to building diabetes simulation models.

We are particularly pleased to hold the 2026 meeting in Padua, home to one of the world's oldest universities and within easy reach of Venice. The scientific programme will be complemented by opportunities to meet colleagues informally, including the conference dinner at the historic Caffè Pedrocchi.

We hope that the combination of model challenges, new research, methodological discussion and collaboration will make Mt Hood 2026 a stimulating and enjoyable meeting - and continue the network's tradition of improving how simulation models are developed, compared and used to inform health-care decisions.

Acknowledgements

With thanks to our University of Padua colleagues: Enrico Longato, Erica Tavazzi, Sara Poletto, Sergio Gaiotti and Matteo Latino for their support in organising and hosting the 2026 conference.

The meeting also benefited from collaboration with REDDIE (Real-World Evidence for Decisions in Diabetes) and the International PharmacoEconomic Collaboration on Alzheimer's Disease (IPECAD).



Original conference artwork generated with OpenAI image-generation tools.

Participants

Name	Organisation
Amanda Adler	University of Oxford
Abdul Jabbar Omar Alsaleh	Sanofi
James Altunkaya	Oxford
Jay Bae	Eli Lilly and Company
Naga Chevala	Scientific Writer
Kah Suan Chong	National Cheng Kung University
Philip Clarke	University of Melbourne / Oxford
Yanrong Du	The Chinese University of Hong Kong
Ahmad Fasseeh	Alexandria University Faculty of Pharmacy
Logan Fenimore	Volo Health
Francesca Fiorentino	IQVIA
Volker Foos	Health Economics and Outcomes Research Ltd
Eskild Fredslund	Steno Diabetes Center Aarhus - Aarhus University Hospital
Sergio Gaiotti	University of Padova
John Giardina	Massachusetts General Hospital
Anoukh van Giessen	Twente University
Oliver Guenther	Sanofi
Jens Gundgaard	Novo Nordisk A/S
Ron Handels	Maastricht University
Maria Hanini	Imperial Business School
Souhayel Hedfi	School of Public Health - University of Queensland
Hanni Hille	GECKO Institute, Heilbronn University
Qi Huang	Peking University People's Hospital
Betina Højgaard	Steno Diabetes Center Copenhagen
Attila Imre	Semmelweis University
Mizuha Kobayashi	Sanofi
Line Kongstad	Associated Professor
Neda Laiteerapong	The University of Chicago
Mark Lamotte	Th(is) ² Modeling
Matteo Latino	University of Padua
Siu Him Lau	The Chinese University of Hong Kong
Donghyun (David) Lee	EVERSANA
Fleur Levrat-Guillen	Abbott
Jing Li	University of Michigan, Ann Arbor
Xinyu Li	University of Oxford
Enrico Longato	Department of Surgical, Oncological, and Gastroenterological Sciences - University of Padova
Aymeric Mahieu	Sanofi
Maja Marcus	Heidelberg Institute of Global Health, Heidelberg University
Luís Martins	Consultant This 2 Modeling
Philip McEwan	Health Economics and Outcomes Research Ltd
Dora Mezei	Syreon Research Institute
Mark Moses	Abbott Diabetes Care
Mariia Murasheva	CHEPI, Imperial College Business School and CERGAS, SDA Bocconi School of Management

Name	Organisation
Balázs Nagy	Semmelweis University, Center for Health Technology Assessment
Sharon Nicholls	Health Economics & Outcomes Research Ltd
Simone Parisotto	IQVIA
Luke Paterson	Nuffield Department of Primary Care Health Sciences, University of Oxford
Sara Poletto	Università degli Studi di Padova
Mafalda Ramos	Co-founder & Director Senior Health Economic Specialist This 2 Modeling
Geraint Roberts	Health Economic and Outcomes Research Ltd.
Gabriel Rogers	University of Manchester
Wendelin Schramm	GECKO Institute, Heilbronn University
Baiju Shah	University of Toronto
Harry J. Smolen	Medical Decision Modeling Inc.
Mubarak Ayodeji Sulola	Universitäts Heidelberg
Elise Chia-Hui Tan	Department of Health Service and Administration, College of Public Health, China Medical University (Taiwan)
Erica Tavazzi	University of Padova
Joshua Weinstein	Insulet Corporation
Michael Willis	The Swedish Institute for Health Economics
Aaron Winn	University of Illinois Chicago
Erin Wong	EVERSANA
Miaoqing Yang	University of Leeds
Wen Ye	University of Michigan
Xueting Yu	Medical Decision Modeling Inc.
Xiantong Zou	Peking University People's Hospital

Pre-conference Short Course

Economic Evaluation and Simulation Modelling in Diabetes

Friday 2 October 2026 | 9:30am-4:30pm

Aula Magna "A. Lepschy", Department of Information Engineering, University of Padua
Via Gradenigo 6/B, Padua

Please note: this is NOT the main conference venue at Palazzo della Salute.

Presenters: Professor Philip Clarke (University of Oxford / University of Melbourne) & Associate Professor Aaron Winn (University of Illinois Chicago)

Lunch will be provided at a local restaurant.

Time	Session
9:30-9:35	Welcome & introductions
9:35-10:30	Session 1 - Overview
10:30-11:00	Break
11:00-12:00	Session 2 - Regression modelling of cost
12:00-12:30	Session 3, Part 1 - Survival analysis: KM & life table methods
12:30-13:30	Lunch
13:30-14:00	Session 3, Part 2 - Survival analysis: parametric methods
14:00-15:00	Session 4 - Building diabetes models
15:00-15:30	Break
15:30-16:30	Session 5 - Health Economics in practice

Session 1 - Overview

Framing the cost-effectiveness problem in diabetes, and the kinds of data and evidence that feed it.

Session 2 - Regression modelling of cost

Modelling cost and quality-of-life data using regression methods.

Session 3 - Survival analysis (Parts 1 & 2)

Estimating and extrapolating survival, from Kaplan-Meier and life tables through to parametric methods.

Session 4 - Building diabetes models

What it takes to build an event-based simulation model, illustrated with the UKPDS Outcomes Model.

Session 5 - Health Economics in practice

An open, discussion-led session applying the day's methods to real examples - content shaped by participant interest.

Main Conference Programme

Palazzo della Salute, Via S. Francesco 90, Padua

Plenary sessions: Sala Elettra | Parallel sessions: Sala Elettra & Sala Argo

3-4 October 2026

Venue entrance: use the glass doors marked “Palazzo della Salute” at Via S. Francesco 90 (not the adjacent Medicine Museum, MusMe).

Abstract presentation timing

Please keep strictly to the allocated time so that parallel sessions remain synchronised. Sessions with four abstracts: 15 minutes per abstract (12 minutes presentation + 3 minutes questions), with the remaining session time for introductions and changeover. Sessions with three abstracts: up to 20 minutes per abstract (approximately 15 minutes presentation + 5 minutes questions/changeover). Session chairs will give a warning as time approaches and will stop presentations that run over.

Saturday 3 October 2026

Day 1

Time	Session
09:00	Welcome & Overview Sala Elettra Chair: Philip Clarke / Enrico Longato Opening remarks - Mt Hood Network & Padua 2026.
09:15	Challenge 1 - Reference Simulation Update Sala Elettra Chair: James Altunkaya Updated reference case results across participating models.
10:45	Coffee Break Sala Elettra Refreshments provided.
11:15	Abstract Session A (Parallel) - Diabetes & Its Complications Sala Elettra Chair: Erica Tavazzi 1. Luke Paterson - Decomposing treatment effects for T2D models (Oxford) 2. Harry Smolen - Validation of Treatment Transition Model against real-world studies (MDM) 3. Xinyu Li - Integrating secular trends into diabetes health economic modelling (Oxford) 4. Wen Ye - Performance of the T1D Outcomes Model in a U.S. cohort (Michigan)
11:15	Abstract Session B (Parallel) - Applied Health Economics Sala Argo Chair: Sara Poletto 1. Ron Handels - IPECAD open-source model & cross-comparison workshop (Maastricht) 2. Maja-Emilia Marcus - Fasting blood glucose trajectories across age and time in 13 low- and middle-income countries and the United States (Heidelberg) 3. Hanni Hille - Cost-effectiveness of combination therapies in T2D nephropathy (Heilbronn) 4. Volker Foos - Verifying a C++ microsimulation model using double programming (HEOR Ltd)
12:30	Lunch Sala Elettra Refreshments provided.

Time	Session
13:00	Challenge 2 - Comorbidity & Multimorbidity: Mild Cognitive Impairment & Dementia in Diabetes Sala Elettra Chair: Michael Willis Challenge analysis and model comparison: James Lathe Presenting models include ECHO-T2DM, UKPDS-OM2, Medical Decision Modeling / TTM, Th(is)2Modeling / MRCDM, Michigan and DOMUS.
14:15	Abstract Session C (Parallel) - Diabetes & Its Complications II Sala Elettra Chair: Sergio Gaiotti 1. Yanrong Du - CKD risk model in Chinese T2D patients on RASi (CUHK) 2. Xinyu Li - Healthy participant effect in diabetes trials: SMRs over 44 years in UKPDS (Oxford) 3. Philip Clarke - Excess healthcare costs of T2D in Australia using linked administrative data (Oxford/Melbourne) 4. Anoukh van Giessen - Including workforce into HTA: illustration on the MICADO model (Twente)
14:15	Abstract Session D (Parallel) - Cost-Effectiveness and Diabetes Sala Argo Chair: Kah Suan Chong 1. Mark Lamotte - At what age should obesity be treated? A MRCDM modelling exercise (Th(is)2Modeling) 2. James Altunkaya - Multi-model inference: model averaging for structural uncertainty (Oxford) 3. Kah Suan Chong - Development and calibration of a health economic microsimulation model for Taiwanese patients with type 2 diabetes (National Cheng Kung University)
15:15	Refreshments Sala Elettra
15:45	Health Economic Modelling in the Age of AI Sala Elettra Chair: Phil McEwan Invited session on emerging applications of artificial intelligence in health economic modelling, including VAL-HE 10000.
16:45	Second Mt Hood Transparency Prize Sala Elettra Chair and award presentation: Harry J. Smolen Awarded to Katalina Chan, Kåre Hansen, Sergey Muratov, Shoghag Khoudigian and Mark Lamotte for their paper: <i>Smart connected insulin dose monitoring technologies versus standard of care: a Canadian cost-effectiveness analysis</i>
17:00	Mt Hood Network Business Meeting Sala Elettra Chair: Philip Clarke Mt Hood Network business and future meetings.
19:00 (TBC)	Conference Dinner - Caffè Pedrocchi Conference dinner at the historic Caffè Pedrocchi; included in conference registration.

Time	Session
09:15	Plenary - Clinical Perspectives on the Economics of Diabetes Sala Elettra Chair: Elise Chia-Hui Tan Keynote: Neda Laiteerapong, Professor of Medicine, University of Chicago A clinical perspective on the economics of diabetes: what are the key questions for the 2030s and beyond? Panel includes Amanda Adler.
10:15	Refreshments Sala Elettra
10:45	Abstract Session E (Parallel) - Health Services, Outcomes & Policy / Complications Sala Elettra Chair: Luke Paterson 1. Elise Chia-Hui Tan - Transition probabilities & cost per prediabetes remission, Taiwan (China Medical University) 2. Qi Huang - Dynamic ML model to identify treatment responders in T2D (Peking University) 3. Maja-Emilia Marcus - Trajectories in diabetes care: longitudinal cohort from China, England, South Africa and USA
10:45	Abstract Session F (Parallel) - Quantitative Methods & Theoretical Developments Sala Argo Chair: Mafalda Ramos 1. Abdul Jabbar Omar Alsaleh - Quantifying the value of delaying T1D progression: a new cost-effectiveness model for capturing value of delayed onset (Sanofi) 2. John Giardina - Estimating representative incidence and mortality rates for multimorbidity models from cross-sectional prevalence data (Massachusetts General Hospital) 3. Souhayel Hedfi - Modelling the impact of adherence variability on the cost-effectiveness analysis of an eHealth-enhanced chronic care model (University of Queensland)
11:45	Challenge 4 - Presymptomatic Screening in Type 1 Diabetes Sala Elettra Chair: Abdul Jabbar Omar Alsaleh Assess the long-term clinical and economic value of early-stage type 1 diabetes screening. Participating models: IHE-ASM and Th(is)2Modeling / MRCDM; developed with RTI/IHE.
12:30	Lunch Sala Elettra Refreshments provided.

Sunday 4 October 2026

Day 2 - Afternoon

Time	Session
13:15	Organised REDDIE Session - Synthetic Data for Diabetes Simulation Sala Elettra Chair: Amanda Adler Invited session: applications in trial, registry and risk-equation replication. Presenters: Gabriel Rogers; James Lathe; Sara Poletto (Manchester / Oxford / Padua).
13:15	Late-Breaking Abstract Session (Parallel) Sala Argo Chair: Xinyu Li 1. David Nathanson - Cost-effectiveness of isCGM in T2D using insulin in Sweden: a national real-world evidence perspective (Abbott/Sophiahemmet)* 2. Aymeric Mahieu - Autoantibody screening model for T1D, celiac disease and hypothyroidism (Sanofi/IHE) 3. Jay Bae - Do existing CV risk equations work in the incretin era? UKPDS OM2, BRAVO, RTI/CDC in SURPASS/REWIND (Lilly) <i>* Registration to be confirmed.</i>
14:15	Challenge 3 - Synthetic Data Challenge Sala Elettra Chair: Gabrielle Rodgers Participating models include Michigan, Canadian Diabetes Policy Model, Medical Decision Modeling / TTM, ECHO-T2DM, UKPDS-OM2, Abbott / DEDUCE, MICADO and the Cardiff T2D model.
15:15	Short Film - 2041: A Health Economics Odyssey Sala Elettra Introduced by Philip Clarke & Xinyu Li A Mt Hood closing film exploring the future of health economics, simulation modelling and AI.
15:30	Farewell Coffee Sala Elettra Refreshments provided.

Programme note: Session allocations and room assignments remain subject to final confirmation. TBC indicates a remaining programme gap.

Abstracts

The following abstracts are reproduced in full because the authors submitted them for publication in the conference programme.

IPECAD: Overview of Its Health-Economic Open Source Model and Workshop on Model Cross-Comparison

Ron Handels^{1,2}, Linus Jonsson², Bengt Winblad², Anders Wimo², Anders Skoldunger², Will Herring^{2,3}

¹ Maastricht University, Maastricht, Netherlands. ² Karolinska Institutet, Stockholm, Sweden. ³ RTI Health Solutions, Durham, NC, USA.

Introduction: The International Pharmacoeconomic Collaboration on Alzheimer's Disease (IPECAD) commits to advancing transparency and credibility of health-economic models via the development of open-source models and organisation of a series of workshops on model cross-comparison exercises. We aim to 1) provide an overview of the development and validation of the IPECAD open-source model framework for assessing the health-economic impact of amyloid-targeting treatment in Alzheimer's disease and 2) provide an overview of workshops for model cross comparison of various health-economic models in the field of Alzheimer's disease.

Methods: An open-source cohort state-transition model (IPECAD v2) was developed by replicating an established reference model and validating its implementation. The framework was used to cross-validate published models assessing lecanemab and to evaluate uncertainty related to treatment efficacy measures, disease progression, residual treatment effect, and stopping rules. For the latest model cross-comparison study, nine independent modelling groups participated in a workshop-based cross-comparison exercise using a standardised hypothetical scenario of mild cognitive impairment due to AD and synthetic treatment-effect estimates.

Results: The open-source model is continuously developed and has 2 main versions with several applications. In the latest development, results were highly sensitive to assumptions regarding residual treatment effect, stopping rules, and efficacy outcome selection. A total of 5 workshops have been held, with two cross-comparison and 3 discussion meetings. From the latest cross-comparison workshop challenge, predicted QALY gains and incremental non-treatment costs ranged, and variation was primarily driven by differences in treatment-effect implementation, outcome measures, and extrapolation methods.

Discussion: Substantial variability exists across AD cost-effectiveness models despite similar evidence inputs. Open-source modelling, systematic cross-validation, standardised reporting, and rigorous sensitivity analyses can enhance transparency and decision making while reducing uncertainty in HTA evaluations of emerging AD therapies.

Topic/s: Applied health economics

Quantifying the Value of Delaying T1D Progression: A New Cost-Effectiveness Model for Capturing Value of Delayed Onset

Abdul Jabbar Omar Alsaleh¹, Oliver Guenther², Hector Toro-Diaz³, Aymeric Mahieu², Shujun Li³, Helen Mitchell⁴, Mike McKenna⁵, Charlie Nicholls⁴

¹ Sanofi, Milan, Italy. ² Sanofi, Paris, France. ³ Thermo Fisher Scientific, Waltham, Massachusetts, USA. ⁴ Sanofi, Reading, UK. ⁵ Health Outcomes Solutions Ltd, London, UK.

Objectives: Advances in the treatment of type 1 diabetes (T1D) include early intervention with disease-modifying therapies (DMTs) like teplizumab an anti-CD3 antibody and the first approved DMT to delay progression from stage 2 T1D to stage 3 (clinical diabetes). The existing cost-effectiveness models (e.g. CORE, Sheffield) focus on disease management for individuals diagnosed with stage 3 T1D rather than the preceding stages. This study presents a de novo T1D model to evaluate the clinical and economic impact of delaying progression of stage 2 T1D to clinical diabetes.

Methods: Markov cohort model with a cycle length of 6 months and three health states (stage 2, stage 3 T1D, and death) was developed in Microsoft Excel® to estimate lifetime clinical and cost outcomes of DMTs. Individuals enter the model at stage 2, may transition to stage 3 or death, directly or after a period in stage 3. Time to stage 3 onset was modelled using treatment-specific time-to-event functions fitted to Kaplan-Meier curves using clinical trial data. Excess mortality was applied for individuals with stage 3 T1D. Long-term consequences of T1D were captured in an aggregated manner using average clinical and cost outcomes derived from published data.

Results: Model was populated using data from the placebo arm of the TN-10 study and estimated lifetime clinical outcomes. The projected undiscounted and discounted life expectancy was 66.98 and 26.24 years, respectively (Stage 2: 3.29 years, Stage 3: 22.95 years). The total discounted quality-adjusted life years (QALYs) were estimated to be 15.76.

Conclusions: This novel T1D model captures full patient journey and provides a robust framework for evaluating DMTs by quantifying the value of delaying clinical onset. It directly translates months of delay into measurable gains in life years and QALYs, offering a practical tool for assessing the cost-effectiveness of early intervention in T1D.

Topic/s: Quantitative Methods and Theoretical Developments

Development of an Autoantibody Screening Model for Type 1 Diabetes, Celiac Disease, and Hypothyroidism

Aymeric Mahieu¹, Adam Fridhammar², Kristian Nilsson², Hedda Carlsson², Abdul Jabbar Omar Alsaleh³, Kristian Mikkelsen⁴, Finn Kristensen⁵, Flemming Pociot⁶, Sofie Persson²

¹ Sanofi, Paris, France. ² IHE–The Swedish Institute for Health Economics, Lund, Sweden. ³ Sanofi, Milan, Italy. ⁴ Sanofi, Stockholm, Sweden. ⁵ DiaUnion, Hvidovre, Denmark. ⁶ Steno Diabetes Center, Copenhagen, Denmark.

Objective: Type 1 diabetes (T1D), celiac disease (CD), and hypothyroidism are chronic autoimmune diseases. They have a common genetic background and can occur during childhood. Combined screening for these conditions is efficient, as a single blood sample can be used to test for disease-specific autoantibodies simultaneously, which enables early detection and can improve clinical outcomes. The treatments which delay the onset of T1D is currently under development, before implementation, establishing the cost-effectiveness of screening is essential. Decision-analytic modelling offers a structured approach to assess the potential value of screening and informing decision makers. Thus, we developed a cost-effectiveness model for screening children for T1D, CD, and hypothyroidism.

Methods: A Markov model was developed for simulating children from early childhood through adulthood. The mode was constructed to include both short- and long-term consequences and disease milestones of T1D, CD, and hypothyroidism. For T1D, the model was linked to the Institute of Health Economics (IHE) Diabetes Cohort Model for T1D to simulate long-term complications and effects of screening on glycated haemoglobin level and disease onset. Movement between health states across all modules was governed by yearly transition probabilities.

Results: The IHE autoantibody screening model for T1D, CD, and hypothyroidism comprised 28 health states across three disease modules (T1D: 14; CD: 6; hypothyroidism: 8). The costs for screening, follow-up, treatment, complications, and production losses were included, enabling a societal perspective or the cost-effectiveness analysis. Health outcomes were expressed in life years and quality-adjusted life years. The model evaluated disease-specific and combined screening strategies, generating incremental cost-effectiveness ratios for comparison.

Conclusions: This model enables the evaluation of cost-effective screening strategies for T1D, CD, and hypothyroidism in children, supporting informed decisions on timing, frequency, and which autoimmune diseases to screen for. Future work will apply setting-specific data to assess different screening programmes.

Topic/s: Applied health economics

Participating Modelling Groups

The descriptions below are based on the modelling-group registration forms submitted for Mt Hood 2026. They provide brief background on the participating groups and models.

Abbott / DEDUCE

International

Diabetes economic microsimulation model used for long-term clinical and cost-effectiveness analyses; the group has also applied it to Swedish National Diabetes Register data.

Mt Hood 2026: Synthetic Data.

Canadian Diabetes Policy Model (CDPM)

Canada - University of Western Ontario / University of Toronto

Microsimulation using contemporary Canadian population data, following biomarkers, complications, comorbidities, mortality, healthcare costs and quality of life in monthly cycles.

Mt Hood 2026: Reference Simulation; Synthetic Data.

Chinese Diabetes Outcome Model (CDOM)

Hong Kong / China

Diabetes outcomes model developed for Chinese populations to project long-term complications, survival and health-economic outcomes.

Mt Hood 2026: Reference Simulation.

ECHO-T2DM

Sweden - IHE

Stochastic patient-level T2D microsimulation with parallel complication states and selectable risk engines, projecting long-term clinical and economic outcomes.

Mt Hood 2026: Reference Simulation; Dementia; Synthetic Data.

EDENT1FI Model

EU - Sanofi on behalf of the EDENT1FI consortium

Screening and cost-effectiveness model combining a decision-tree screening module with a Markov model of progression from presymptomatic to clinical T1D.

Mt Hood 2026: Presymptomatic T1D Screening.

IHE Diabetes Cohort Model (IHE-DCM)

Sweden - IHE

Annual-cycle cohort diabetes model with multiple complication states and risk engines, used to project long-term clinical outcomes, QALYs and costs.

Mt Hood 2026: Reference Simulation.

IHE Autoantibody Screening Model (IHE-ASM)

Sweden - IHE

Markov cohort model evaluating childhood screening for T1D, coeliac disease and autoimmune thyroid disease; linked to IHE-DCM-T1 for long-term T1D outcomes.

Mt Hood 2026: Presymptomatic T1D Screening.

Insulet / EVERSANA - SCOTT2

USA / Canada

Patient-level T2D model integrating established diabetes risk engines and designed to evaluate treatment pathways and diabetes technologies.

Mt Hood 2026: Reference Simulation.

Medical Decision Modeling / Treatment Transitions Model (TTM)

USA

Diabetes simulation model designed to evaluate long-term clinical and economic consequences of alternative treatment pathways and transitions.

Mt Hood 2026: Reference Simulation; Dementia; Synthetic Data.

MICADO

Netherlands - RIVM / University of Groningen / University of Twente

Population-level Markov-type multistate model linking risk factors to diabetes and major microvascular and macrovascular complications, life expectancy, QALYs and costs.

Mt Hood 2026: Reference Simulation; Synthetic Data.

Michigan Diabetes Modelling Group

USA - University of Michigan

Diabetes simulation modelling group projecting long-term complications, survival and economic outcomes.

Mt Hood 2026: Dementia; Synthetic Data.

Syreon Metabolic Model

Hungary / Egypt - Syreon Research Institute / Syreon Middle East

Cardiometabolic model extending diabetes modelling from obesity and prediabetes through T2D, cardiovascular risk, complications, treatment and prevention.

Mt Hood 2026: Reference Simulation; Synthetic Data.

Th(is)²Modeling - Metabo-Reno-Cardiovascular Disease Model (MRCDM)

Belgium / global

Agent-based C++ model for diabetes, obesity, cardiovascular and chronic kidney disease, modelling changing risk factors and a broad range of complications.

Mt Hood 2026: Reference Simulation; Dementia; Presymptomatic T1D Screening.

UKPDS Outcomes Model 2 (UKPDS-OM2)

United Kingdom - University of Oxford

Patient-level T2D simulation based on long-term UKPDS follow-up, predicting complications, mortality, life expectancy, quality-adjusted life expectancy and costs.

Mt Hood 2026: Reference Simulation; Dementia; Synthetic Data.

Participating Models and Challenge Participation

Mt Hood Diabetes Challenge 2026 - Padua

No.	Model / group	Country / region	1. Reference	2. Dementia	3. Synthetic	4. T1D screening
1	Abbott / DEDUCE	International			Yes	
2	Canadian Diabetes Policy Model	Canada	Yes		Yes	
3	Chinese Diabetes Outcome Model (CDOM)	Hong Kong / China	Yes			
4	ECHO-T2DM	Sweden	Yes	Yes	Yes	
5	IHE-DCM / IHE-ASM*	Sweden	Yes			Yes*
6	Insulet / EVERSANA - SCOTT2	USA / Canada	Yes			
7	IQVIA	International	Yes			
8	Medical Decision Modeling / TTM	USA	Yes	Yes	Yes	
9	Michigan Diabetes Modelling Group	USA		Yes	Yes	
10	Syreon Metabolic Model	Hungary / Egypt	Yes		Yes	
11	Th(is)*Modeling / MRCDM	Belgium / global	Yes	Yes		Yes
12	UKPDS Outcomes Model 2 (UKPDS-OM2)	United Kingdom	Yes	Yes	Yes	
13	MICADO	Netherlands	Yes		Yes	
14	EDENT1FI Model	European Union				Yes
15	Diabetes Outcomes Model for the U.S. (DOMUS)	USA		Yes		
16	Cardiff Type 2 Diabetes Model	United Kingdom			Yes	

* IHE: Challenge 4 uses IHE-ASM; the Reference Simulation entry refers to IHE-DCM. The table reflects final known participation and later challenge submissions, not only initial registrations.

Challenge Instructions

The following instructions are reproduced verbatim from the final challenge documents circulated for Mt Hood 2026, preserving the original wording, tables, references and pagination for future reference.

Challenge 1 - Reference Simulation Update

Original challenge instructions - reproduced verbatim

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	
<i>Patient Characteristics</i>	<i>Men</i>	<i>Women</i>	<i>Men</i>	<i>Women</i>	<i>Men</i>	<i>Women</i>
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 m ²)	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 disutility 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 normoglycemia, 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 Normoglycemia, 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 ^e	-0.077 ^e	-0.029 ^e
	Hemodialysis	-0.164	-0.274	-0.054	-0.082 ^f	-0.128 ^f	-0.036 ^f
	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 ^a	-0.475 ^a	-0.108 ^a
Coronary heart disease	Myocardial infarction	-0.055	-0.067	-0.042			
	Ischemic heart disease	-0.090	-0.126	-0.054	-0.181 ^a	-0.331 ^a	-0.031 ^a
	Heart failure	-0.108	-0.169	-0.048	-0.058 ^b	-0.101 ^b	-0.015 ^b
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 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.

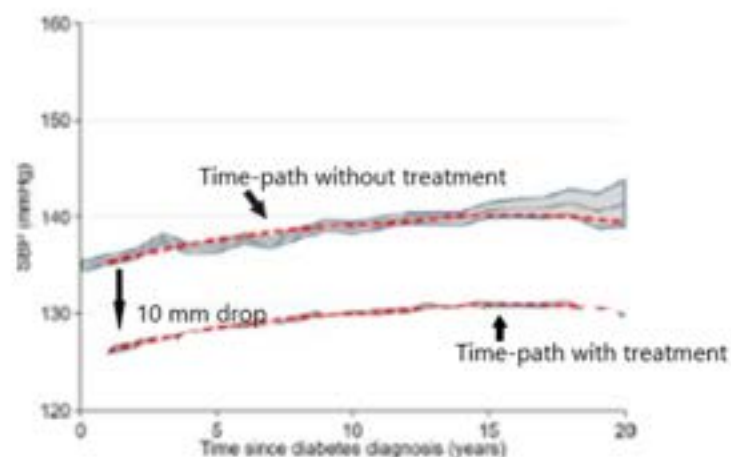
Run each of the four interventions listed in Step 2 to estimate the expected QALYs and calculate the incremental QALYs compared to the baseline (control). Extract the results and add to the accompanying Excel workbook (in tab labelled "Time paths & Outcomes").

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.

Challenge 2 - Diabetes, Aging, and Dementia

Original challenge instructions - reproduced verbatim

Mount Hood 2026 Diabetes, Aging, and Dementia Challenge: Challenge Instructions (Version 1.6; 31 July 2026)

1 INTRODUCTION

Background

Dementia is increasingly recognised as an important comorbidity in people with type 2 diabetes. Older adults with type 2 diabetes are at increased risk of cognitive decline and dementia, and the presence of dementia may substantially influence survival, quality of life, healthcare utilisation, and diabetes management. Consequently, dementia has the potential to affect both the occurrence and consequences of diabetes-related complications and is becoming increasingly relevant when evaluating the long-term clinical and economic consequences of diabetes.

Recent methodological developments, including the publication of diabetes-specific dementia risk equations, are making explicit modelling of dementia within diabetes simulation models increasingly feasible. The recently developed Diabetes Outcomes Model for the U.S. (DOMUS) includes published diabetes-specific risk equations for dementia (Winn et al., 2025). Other groups, including those developing future versions of the UKPDS Outcomes Model, are also working toward incorporating dementia outcomes.

Despite these advances, most currently available diabetes simulation models do not explicitly represent dementia. This challenge therefore seeks to understand both how participating models currently capture the consequences of dementia and how diabetes simulation models may incorporate explicit diabetes-specific dementia outcomes.

Many of the clinical and economic consequences of dementia develop over decades and cannot be directly observed within available clinical studies. Decision-analytic models therefore play a central role in synthesising available evidence and projecting long-term clinical and economic outcomes to inform healthcare decision-making. Previous work has similarly emphasised that the prolonged natural history of cognitive impairment necessitates long-term modelling, as many of the benefits, harms, and costs associated with dementia occur well beyond the duration of available clinical studies (Handels et al., 2025).

The Mount Hood Diabetes Challenge Network brings together developers and users of diabetes simulation models to address common decision problems using independently developed models. By systematically comparing model predictions, assumptions, and methods, the Mount Hood Network facilitates methodological learning and continuous model improvement, with the ultimate goal of strengthening the credibility of model-based evidence for healthcare decision-making.

Challenge aim

The aim of this challenge is to characterise current approaches to dementia representation within diabetes simulation models and to compare the implications of those representations for projected long-term survival, quality-adjusted survival, diabetes-related outcomes, and costs. More broadly, the challenge seeks to identify opportunities for methodological learning and future model development through systematic comparison of independently developed diabetes simulation models. Costing is intentionally simple and uses common UK inputs to support comparison rather than a full cost-effectiveness analysis.

2 CHALLENGE OVERVIEW

- **Decision Problem:** This challenge asks diabetes modelling groups to simulate two populations with type 2 diabetes: (1) an incident (at-risk) cohort free of dementia at baseline (Runs 1 and 2), and (2) a prevalent cohort aged 80 years with and without dementia at baseline (Run 3). Results will be used for cross-model learning, not ranking models.
- **Target populations:** Adults with type 2 diabetes

- **Incident (at-risk) cohort (Runs 1–2):** Adults with type 2 diabetes who are free of dementia at baseline and are followed to estimate the occurrence and consequences of incident dementia.
- **Prevalent cohort (Run 3):** Adults aged 80 years with type 2 diabetes, represented by eight profiles: the four prior-stroke-by-prevalent-dementia combinations in Table 3, run once for men and once for women.
- **Dementia definition:** The preferred outcome is all-cause dementia. If your model represents a different dementia concept, use the closest available state or event and document the mapping (see Table 4).
- **Simulation runs:** Run 1 (incident at-risk reference cohort), Run 2 (the same cohort with the dementia utility decrement and dementia care cost set to 0, if feasible), and Run 3 (prevalent age-80 cohort). Run each simulation separately for men and women.
- **Time horizon:** Simulate all runs for 40 years or until death, whichever occurs first. Report end-of-simulation cumulative totals. Label these as lifetime totals only when no simulated individuals remain alive at year 40; otherwise label them as 40-year cumulative totals and report the proportion still alive.
- **Outcomes:** End-of-simulation survival, life-years, dementia-free life-years, years lived with dementia, QALYs, major diabetes complications and health states, cumulative complication costs, cumulative dementia costs, and total costs, together with dementia incidence and prevalence where modelled.

3 CHALLENGE INSTRUCTIONS

Participants should implement the challenge specifications described in this section using their own independently developed diabetes simulation models. Unless otherwise specified, participants should implement the challenge as closely as possible while preserving their model's established structure and methods. Where exact implementation is not feasible, the model's standard approach should be retained and any material deviations documented in the reporting workbook.

Step 1. Load the model with baseline population characteristics

Implement the incident and prevalent cohorts separately for men and women using the baseline population characteristics specified below. If your model requires additional baseline inputs beyond those specified for either cohort, use your usual default values and document the values and sources in the reporting workbook.

Incident (at-risk) cohort (Runs 1 and 2): Populate the model using the common type 2 diabetes reference-case population specified in Table 1. All individuals should be free of dementia at baseline.

Table 1. Baseline characteristics for the incident (at-risk) cohort (Runs 1 and 2)

Characteristic	Men	Women
Current age	66	66
Duration of diabetes	8 years	8 years
Current or former smoker	No	No
Ethnicity	White	White
HbA1c	7.5%	7.5%
Systolic blood pressure	145 mmHg	145 mmHg
Diastolic blood pressure	80 mmHg	80 mmHg
Total cholesterol	5.2 mmol/L	5.2 mmol/L
HDL cholesterol	1.3 mmol/L	1.3 mmol/L
LDL cholesterol	3.0 mmol/L	3.0 mmol/L
Triglycerides	2.0 mmol/L	2.0 mmol/L

Characteristic	Men	Women
BMI	28 kg/m ²	28 kg/m ²
Urinary albumin-to-creatinine ratio (uACR)	14.2 mg/g	14.2 mg/g
Peripheral vascular disease	No	No
Urine albumin concentration ≥50 mg/L	No	No
Atrial fibrillation	No	No
eGFR	70 mL/min/1.73 m ²	70 mL/min/1.73 m ²
White blood cell count	7 × 10 ⁹ /L	7 × 10 ⁹ /L
Heart rate	79 bpm	79 bpm
Haemoglobin	14 g/dL	14 g/dL
Prior macrovascular disease	No	No
Prior microvascular disease	No	No

Note: Use the Table 1 baseline values as specified for the common analysis. If a model requires additional inputs, use the model's standard values and document them in the reporting workbook.

Prevalent cohort (Run 3): First set the fixed age-80 diabetes characteristics in Table 2. Then, within each sex, simulate the four prior-stroke-by-prevalent-dementia combinations in Table 3. This gives four profiles for men and four for women (eight profiles in total). The profiles may be simulated separately or in one batch. Prevalent dementia means dementia is present at baseline; a history flag may be used only as a proxy when a current dementia state cannot be initialised, and the mapping must be documented.

Table 2. Fixed baseline characteristics for the prevalent age-80 cohort (Run 3)

Profile variable	Values	Instruction
Current age	80 years	Use age 80 for all Run 3 profiles.
Sex	Men and women	Run the four Table 3 profiles separately for men and women, giving eight profiles in total.
Diabetes profile	Table 1 values except age	Use the same diabetes risk-factor values as Run 1, with age changed to 80.
Prior stroke	No / Yes	Create profiles with and without prior stroke.
Prevalent dementia at baseline	No / Yes	Current dementia at baseline. If unavailable, use the closest history/state proxy and document it.
Smoking status	No	Use non-smoker status for all profiles.

Renal-profile note: Run 3 retains Table 1 uACR (14.2 mg/g) and eGFR (70 mL/min/1.73 m²). ESKD incidence may therefore be low or zero in some models and should be interpreted in light of each model's renal-progression approach.

Apply all four combinations below once for men and once for women. Sex is therefore a stratifier, not another column to vary inside this four-row table.

Table 3. Prior-stroke-by-dementia combinations within each sex for Run 3

Profile within each sex	Prior stroke	Prevalent dementia at baseline	Purpose
Neither condition	No	No	Age-80 comparator with neither condition present.
Prior stroke only	Yes	No	Shows the contribution of prior stroke without prevalent dementia.
Prevalent dementia only	No	Yes	Shows the contribution of prevalent dementia without prior stroke.

Profile within each sex	Prior stroke	Prevalent dementia at baseline	Purpose
Both conditions	Yes	Yes	Shows the combined implications of prior stroke and prevalent dementia.

Step 2. Specify dementia representation

For the purposes of this challenge, prevalent dementia refers to individuals who have dementia at baseline. If a model does not represent prevalent dementia as a separate health state, participants should use the closest available representation and document the representation used and how it was mapped to the challenge definition.

Table 4. Dementia representation instructions

Item	Instruction
Incident (at-risk) cohort (Runs 1 and 2)	Use no dementia at baseline. Report incident dementia during follow-up if the model can generate it.
Run 2 dementia-burden comparator	Use the same cohort and the same dementia incidence, progression, mortality, diabetes-management effects, and complication pathways as Run 1. Set only the dementia utility decrement and dementia care cost to 0. Retain all diabetes complication costs. This is a structural burden comparator, not a clinical intervention.
Preferred dementia outcome	All-cause dementia, if available.
Acceptable alternatives	Alzheimer's disease, vascular dementia, generic cognitive impairment, or dementia severity states may be used if those are the modelled concepts.
Prevalent cohort (Run 3)	Use the age-80 profiles with prior stroke and current prevalent dementia at baseline varied as shown in Table 3. If current dementia cannot be initialized, use the closest history/state proxy and document what the proxy captures and what it omits.

Step 3. Configure the simulation runs

Configure the simulation runs specified in Table 5 separately for men and women. No diabetes or dementia intervention arm is included in this challenge; Run 2 is a structural dementia-burden comparator, not an intervention.

Run 2 should be completed only if the model can set the dementia utility decrement and dementia care cost to 0 without changing clinical dementia effects, diabetes complications, or diabetes complication costs.

Table 5 specifies the three simulation runs to be completed, including the target cohort, baseline dementia status, dementia representation during follow-up, and the purpose of each run.

Table 5. Simulation runs

Run	Cohort	Dementia at baseline	Dementia during follow-up	Purpose
1	Incident (at-risk) cohort	No dementia at baseline	Use the model's usual incident dementia risk, dementia utility decrement, and downstream consequences.	Common type 2 diabetes reference case with incident dementia modelled.
2	Incident (at-risk) cohort	No dementia at baseline	Use the same clinical dementia representation as Run 1. Set the dementia utility decrement and dementia care cost to 0; retain all clinical effects and diabetes complication costs.	Comparator isolating the specified dementia utility decrement and dementia care cost while holding clinical pathways and diabetes complication costs fixed.

Run	Cohort	Dementia at baseline	Dementia during follow-up	Purpose
3	Prevalent cohort	No or yes, varied within each sex and prior-stroke stratum.	Use the model's usual dementia, stroke-history, mortality, utility, and diabetes-interaction assumptions.	Factorial profile set for older people with type 2 diabetes. Profiles may be run together if supported by the model.

Step 4. Load general simulation parameters

Apply the general simulation parameters specified in Table 6. Where exact implementation is not possible, retain the model's standard implementation and document any material deviations in the reporting workbook.

Table 6. General simulation parameters

Topic	Instruction
Time horizon	Simulate all runs for 40 years or until death, whichever occurs first. Report end-of-simulation totals as lifetime only if no individuals remain alive at year 40; otherwise report 40-year cumulative totals and the proportion still alive.
Risk factor paths	Hold the specified baseline risk factors constant over the simulation. Age and modelled events may change normally.
Discounting	Annual state traces, life-years, QALYs, and costs should be undiscounted. The challenge is descriptive and does not request an ICER.
Dementia equations	Use each model's standard dementia incidence equation, progression assumptions, mortality effects, and diabetes interactions. This challenge does not specify a common dementia-risk equation.
Replications	For microsimulation models, use enough replications for stable mean results. Report the number of simulated individuals or replications, random-seed policy, and whether common random numbers were used across paired runs.
Deviations	Document all departures from the specified inputs or scenarios in the reporting workbook.
Cost perspective	UK NHS and publicly funded social care. Exclude patient-paid care, unpaid care, productivity, and monetised quality-of-life losses.
Cost price year and currency	Report pounds sterling (£) in 2024/25 prices. This is the latest published NHS National Cost Collection year available when Version 1.6 was prepared.
Costing approach	Use the common values in Table 10. Apply each complication cost once, in the cycle of first occurrence. Apply the dementia cost for every person-year lived with dementia in Runs 1 and 3. In Run 2, set only the dementia care cost to 0 and retain all diabetes complication costs. Do not add other complication follow-up costs.

Step 5. Load health utility and cost parameters; calculate QALYs and costs

Use the diabetes utility values and utility decrements in Table 8, based on Beaudet et al. (2014), where feasible. Point estimates are sufficient; second-order uncertainty is not required. Report all QALYs undiscounted.

Table 7. Health utility specifications

Item	Instruction
Diabetes utility values and utility decrements	Use the common values shown in Table 8, based on Beaudet et al. (2014), where feasible. If the model cannot use them directly, retain the model's usual approach and document the difference.
Dementia utility decrement	Use the common general dementia utility decrement of -0.235. If the model cannot apply it directly, map the closest internal representation and document the mapping.
Baseline utility	Keep baseline utility constant across ages where the model permits. If age-specific baseline utility is unavoidable, report the implementation clearly.

Item	Instruction
Combining diabetes utility decrements	Where feasible, apply an additive quality-of-life approach across different disease categories and apply only the largest decrement when multiple complications fall within the same category. Document any alternative approach.
Combining dementia utility decrement	Apply the dementia utility decrement additively with diabetes complication decrements for the common challenge analysis. Document any unavoidable alternative.
Timing	For incident dementia, begin the dementia utility effect in the cycle of onset. For prevalent dementia in Run 3, apply it from baseline.
Run 2 dementia-burden comparator	In Run 2, set the dementia utility decrement to 0. Keep dementia incidence, mortality effects, diabetes-management effects, and diabetes complications the same as Run 1. The Run 2 dementia care cost setting is specified in Table 10.

Table 8. Diabetes utility values and utility decrements (Beaudet et al., 2014)

Disease category	Complication/state	Utility value or utility decrement
Baseline	Diabetes without complications	0.785
Acute metabolic disorder	Minor hypoglycaemia event	-0.014
Acute metabolic disorder	Major hypoglycaemia event	-0.047
Comorbidity	Excess BMI: each unit above 25 kg/m ²	-0.006
Retinopathy	Cataract	-0.016
Retinopathy	Moderate non-proliferative diabetic retinopathy	-0.040
Retinopathy	Moderate macular oedema	-0.040
Retinopathy	Vision-threatening diabetic retinopathy	-0.070
Retinopathy	Severe vision loss	-0.074
Nephropathy	Proteinuria	-0.048
Nephropathy	Renal transplant	-0.082
Nephropathy	Haemodialysis	-0.164
Nephropathy	Peritoneal dialysis	-0.204
Neuropathy	Peripheral vascular disease	-0.061
Neuropathy	Neuropathy	-0.084
Neuropathy	Active ulcer	-0.170
Neuropathy	Amputation event	-0.280
Cerebrovascular disease	Stroke	-0.164
Coronary heart disease	Myocardial infarction	-0.055
Coronary heart disease	Ischaemic heart disease	-0.090
Coronary heart disease	Heart failure	-0.108

Source: Beaudet et al. (2014). Table 8 specifies the common diabetes reference-case inputs. The general dementia utility decrement in Table 9 is the only additional common utility input for this challenge.

The only new common utility input introduced for this challenge is one general dementia utility decrement of -0.235. This is the moderate diagnosed-dementia utility decrement used in a recent UK health-economic model (Shore et al., 2023), selected as a pragmatic single value between its mild (-0.125) and severe (-0.305) values. Models do not need separate MCI or dementia-severity utility rows for the common challenge analysis.

Table 9. Dementia utility decrement reporting table

Utility item	Use in this challenge	Value used	Source	Application notes
No dementia	Baseline/comparator state	No additional dementia utility decrement	Challenge assumption	Use the diabetes baseline and complication utilities.
General dementia utility decrement	Apply while dementia is present in the model	-0.235	Shore et al. (2023), moderate diagnosed dementia	Apply additively while dementia is present: from baseline in prevalent profiles and from the cycle of onset for incident dementia.
Run 2 dementia utility decrement setting	Run 2 only	0	Challenge setting	Set the dementia utility decrement to 0 in Run 2; keep all clinical dementia effects unchanged.

Cost specifications

Use the common cost inputs below for the challenge analysis. Values are rounded to the nearest £100 to avoid false precision. The diabetes-event values are UK excess hospital costs uprated to 2024/25; the dementia value is an annual UK NHS plus publicly funded social-care estimate. These deliberately simple inputs are intended for cross-model comparison.

Table 10. Common UK cost inputs

Complication/state	Challenge cost (£, 2024/25)	Application	Source and derivation
Myocardial infarction	5,900	Once, at first occurrence	Keng et al. (2022): £4,913 in 2019/20, uprated with NHSCII
Ischaemic stroke	8,600	Once, at first occurrence	Keng et al. (2022): £7,170 in 2019/20, uprated with NHSCII
Heart failure	10,000	Once, at first occurrence	Keng et al. (2022): £8,319 in 2019/20, uprated with NHSCII
End-stage renal disease (renal failure)	25,200	Once, at first occurrence	Keng et al. (2022): £20,954 in 2019/20, uprated with NHSCII
Lower-limb amputation	21,500	Once, at first occurrence	Keng et al. (2022): £17,887 in 2019/20, uprated with NHSCII
Severe vision loss	5,300	Once, at first occurrence	Alva et al. (2015) blindness proxy; UK value converted to 2017/18 prices and uprated with NHSCII
Dementia	16,400 per person-year	Each year lived with dementia in Runs 1 and 3; set to £0 in Run 2	Derived from Carnall Farrar (2024) NHS and publicly funded social-care totals; uprated to 2024/25 with NHSCII

Note: NHSCII = NHS Cost Inflation Index. The 2019/20 diabetes complication costs were multiplied by 1.20265. The dementia input was derived from £7.1 billion NHS healthcare plus £8.4 billion publicly funded social care for 982,000 people in 2024, then uprated by the provisional 2024/25 NHSCII of 4.02%. For severe vision loss, blindness in one eye is used as the closest available UK proxy: the Alva et al. blindness proxy, converted to £4,247 in 2017/18 prices, was multiplied by 1.24804.

For the Run 2 dementia-burden comparator, calculate $\Delta QALY = QALY \text{ Run 1} - QALY \text{ Run 2}$ and $\Delta Cost = \text{total cost Run 1} - \text{total cost Run 2}$. A negative $\Delta QALY$ and positive $\Delta Cost$ are expected because Run 1

includes the dementia utility decrement and dementia care cost. Clinical outcomes and diabetes complication costs should be unchanged. Report the signed differences separately and do not calculate an ICER because Run 2 is not an intervention. For Run 3 paired comparisons, calculate outcome with prevalent dementia minus the otherwise identical outcome without prevalent dementia.

Step 6. Run the simulations

Run the simulations specified in Step 3 using the assumptions and parameter values described in Steps 4 and 5. Perform all feasible simulation runs separately for men and women. For microsimulation models, use sufficient replications to produce stable mean results. If one or more runs cannot be completed, perform all feasible runs and document the limitation in the reporting workbook.

Step 7. Extract model results and populate the reporting workbook

Modify the workbook as necessary to accommodate model-specific outputs while preserving the requested outcome definitions and overall workbook structure.

Table 11. Reporting workbook contents

Workbook area	What to include
Baseline characteristics	Specified reference values plus any additional model-required inputs, with values and sources.
Utility values and utility decrements	Diabetes utility values used, the general dementia utility decrement, source, value type, timing, and combination rule.
Time paths and outcomes	Input risk-factor time paths, dementia incidence/prevalence, survival, life-years, QALYs, major health-state traces or counts, and cumulative costs.
Simulation settings	Number of simulated individuals or replications, random-seed policy, use of common random numbers, and any stability checks.
Deviations	Any departures from these instructions, why they were needed, and the likely direction of impact if known.
Cost values and outputs	Common costs used, event/state mapping, cumulative complication costs, dementia costs, and total costs.

Please report end-of-simulation cumulative outcomes separately for each run and sex. Label them as lifetime totals only if no individuals remain alive at year 40; otherwise label them as 40-year cumulative totals and report the proportion still alive. Also report supporting checkpoints at 10, 20, and 40 years for Runs 1 and 2 and at 5, 10, and 20 years for Run 3, together with annual state traces where requested. If an output is unavailable, leave it blank and briefly explain why. Costs should be cumulative, undiscounted, and reported per starting individual in 2024/25 pounds sterling.

Table 12. Required outputs

Output	Required?	Notes
Input risk-factor time paths	Yes	Report specified baseline risk factors over time, even when they are held constant.
Alive and dead by year	Yes	Annual trace, preferably as proportions of the starting cohort.
Dementia prevalence by year	Yes, if modelled	Report no dementia, dementia, and death. Severity-state reporting is optional.
Cumulative incident dementia	Yes, if modelled	For runs starting without dementia.
Life-years	Yes	Mean per starting individual at the end of simulation, with supporting checkpoint values.
Dementia-free life-years	Yes, if modelled	Mean time alive without dementia.

Output	Required?	Notes
Years lived with dementia	Yes, if modelled	Mean time alive with dementia.
QALYs	Yes	Undiscounted total at the end of simulation, with supporting checkpoint values.
Run 1 minus Run 2 QALYs	Yes, if Run 2 feasible	Use QALY Run 1 – QALY Run 2 at the end of simulation. The value should be negative when the dementia utility decrement lowers QALYs; clinical outcomes should be unchanged.
Major diabetes complications and health states	Yes, if available	Report rates, counts, or cumulative incidence for usual diabetes model outcomes, such as MI, stroke, heart failure, renal failure, amputation, severe vision loss, and other major health states.
Event definitions	Yes	State whether event outputs represent first events, total events, people ever experiencing an event, or prevalent cases.
Survival-adjusted complications	If feasible	For the prevalent cohort, report events per person-year alive or another survival-adjusted measure to help interpret competing mortality.
Cumulative complication costs	Yes	Apply Table 10 costs once at first occurrence; report the total and, where feasible, the breakdown by complication.
Cumulative dementia costs	Yes, if dementia modelled	Apply £16,400 for each person-year lived with dementia in Runs 1 and 3. Set the dementia care cost to £0 in Run 2.
Total costs	Yes	End-of-simulation cumulative complication costs plus cumulative dementia costs, per starting individual.
Run 1 minus Run 2 total costs	Yes, if Run 2 feasible	Use total cost Run 1 – total cost Run 2 at the end of simulation. The value should be positive and should reflect dementia care costs only; diabetes complication costs should be unchanged.

Step 8. Document model implementation

Alongside the numerical results, please provide a short implementation note covering the items below. A concise response is sufficient.

Table 13. Model implementation documentation

Item	Documentation requested
Dementia representation	Whether the model includes dementia, what type of dementia is represented, and how this was mapped to the challenge definition.
Incident dementia risk	The data source, equation, variables, and transition assumptions used to generate incident dementia. If dementia incidence is not modelled, state this.
Prevalent cohort (Run 3)	How the age-80 factorial cohort was implemented, including the mapping used for prior stroke and prevalent dementia at baseline.
Mortality	Whether the model's standard implementation assumes dementia affects mortality directly, indirectly through severity, or not at all.
Utilities	The dementia utility decrement values used, their sources, value type, timing, and how they were combined with diabetes complication decrements.
Diabetes interactions	Whether dementia affects diabetes treatment, adherence, complications, hypoglycaemia, or other diabetes outcomes in the model.
Double counting	Whether dementia can occur after stroke or other vascular events and how double counting between dementia, stroke, and cognitive impairment is avoided.

Item	Documentation requested
Deviations	Any deviations from these instructions and the reason for them.
Costs	How each model event/state was mapped to Table 10, how partial cycles were handled, confirmation that only the dementia care cost was set to 0 in Run 2, and any deviations from the common cost method.
Renal progression and ESKD	How eGFR and uACR progress over time and how ESKD is generated (for example, risk equations, renal-state transitions, or another method).

Step 9. Prepare the headline interpretation summary

Provide a headline interpretation of approximately 300-450 words in total, organised under the three prompts below. Focus on end-of-simulation cumulative outcomes. State whether these are lifetime totals or 40-year cumulative totals. Use intermediate checkpoints only to explain when or why the final differences emerge. Report signed Run 1 minus Run 2 differences and paired Run 3 differences. Do not calculate an ICER because the challenge contains no intervention comparison.

- 1. Run 1 headline results:** What are the end-of-simulation totals for life-years, cumulative dementia incidence, years lived with dementia, QALYs, cumulative dementia costs, cumulative complication costs, and total costs? Identify the principal model mechanisms driving these results.
- 2. Run 2 dementia-burden comparison:** What are the end-of-simulation Run 1 minus Run 2 differences in QALYs and total costs? Confirm that survival, dementia incidence, diabetes complications, and diabetes complication costs are unchanged, and explain any unexpected difference.
- 3. Run 3 headline results:** At the end of the simulation, how does prevalent dementia change life-years, QALYs, cumulative dementia costs, cumulative complication costs, and total costs relative to no prevalent dementia within the same sex and prior-stroke stratum? Highlight material differences by sex or prior-stroke status.

4 RESULTS SUBMISSION

Please submit the completed results workbook, implementation note, and brief interpretation to the challenge organisers using the address and deadline in the participant invitation email. If one or more runs cannot be implemented, submit the feasible results and document the limitation. The goal is to understand current model capabilities and the potential importance of dementia, not to require every model to implement every feature.

Submission package

The submission package should include:

- Completed results workbook named MODEL_MtHood2026_Dementia_Results_v1.6.xlsx
- Implementation note named MODEL_MtHood2026_Dementia_Implementation_v1.6.docx
- Brief interpretation named MODEL_MtHood2026_Dementia_Interpretation_v1.6.docx
- Optional supporting files, prefixed with the same MODEL identifier

Questions, contact information, and deadline

Replace MODEL in each filename with a short, consistent model name. The submission deadline, email address, and named organiser contact will be those stated in the participant invitation email. Send clarification questions to that organiser contact. Material clarifications will be circulated to all participating groups, and the latest numbered challenge version will take precedence over earlier drafts.

5 REFERENCES

1. Alva ML, Gray A, Mihaylova B, Leal J, Holman RR. The impact of diabetes-related complications on healthcare costs: new results from the UKPDS (UKPDS 84). *Diabetic Medicine*. 2015;32(4):459–466. <https://doi.org/10.1111/dme.12647>.
2. Beaudet A, Clegg J, Thuresson PO, Lloyd A, McEwan P. Review of utility values for economic modeling in type 2 diabetes. *Value in Health*. 2014;17(4):462–470. <https://doi.org/10.1016/j.jval.2014.03.003>.
3. Carnall Farrar. The economic impact of dementia – Module 1: Annual costs of dementia. Report commissioned by Alzheimer's Society; May 2024. <https://www.alzheimers.org.uk/what-we-do/policy-and-influencing/dementia-scale-impact-numbers>.
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Challenge 3 - REDDIE Synthetic Data Challenge

Original challenge instructions - reproduced verbatim

MOUNT HOOD 2026

REDDIE #1 (CROSS-SECTIONAL) CHALLENGE

v1.3 (21 September 2026)

TYPE 2 DIABETES

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1. BACKGROUND

This document sets out the first of two challenges that have been devised by the REDDIE consortium for the 2026 Mount Hood meeting, in Padova, Italy.

REDDIE (Real-World Evidence for Decisions in Diabetes; www.reddie-diabetes.eu) is an EU-funded project exploring how real-world data can complement RCTs in diabetes. One of the project's aims is to generate synthetic data that mimic the statistical properties of a population with type 2 diabetes without disclosing any real patient-level data, and to test the use of these data in applications where real patient-level data might otherwise be used.

The originator dataset we have used is drawn from the Swedish National Diabetes Register (NDR; last seen at Mount Hood 6 in 2012). The NDR is a nationwide, prospective registry that captures detailed data on people with diabetes in Sweden, including risk factors, treatments, and complications, with near-complete population coverage. It is linkable to other national registers (e.g., hospitalisations, prescriptions, and mortality), enabling long-term observational and outcomes research at scale.

As it is not currently feasible to provide a synthetic version of the entire NDR population, we have focused on a subpopulation defined by Hallström *et al.*¹, comprising people with type 2 diabetes starting a new medicine (either DPP-4 inhibitor or GLP-1 receptor agonist) between 2012 and 2022 ($n = 29,057$). We have longitudinal data for this cohort that we will use in our second challenge, but this challenge focuses only on the baseline characteristics of the cohort.

As they depend on specifying heterogeneous populations, **these challenges are likely only to be possible for patient-level simulation models**. If your model functions at cohort level, please feel free to review the instructions below and let us know if there is anything further we can do to enable your participation.

2. CHALLENGE

Motivation

This challenge relies solely on cross-sectional data reflecting a snapshot of the target population. We are interested to know whether increasingly sophisticated representation of the baseline population produces different results.

The purpose of this challenge is not to determine which model is 'best'; rather, we are interested to explore the extent to which any or all of the participating models are sensitive to how realistically we define the baseline cohort.

As detailed below, we are asking participants to simulate cohorts starting from this snapshot multiple times, with increasingly detailed information to define their baseline populations:

- Round One:** repeatedly simulating a single person representing the mean characteristics of the target population;
- Round Two:** simulating a heterogeneous population based on the mean and variance of each baseline characteristic, but sampling these independently, **without** information on correlations between them;
- Round Three:** simulating a heterogeneous population based on the mean and variance of each baseline characteristic **with** information on correlations between them;
- Round Four:** directly using pseudo-patient-level data from a synthetic population derived in REDDIE.

Please do not use information from later rounds to enrich your approach to earlier rounds.

In principle, participants could, e.g., use the Round 4 dataset to arrive at more informed distributional assumptions for Round 2 or enhanced information about joint distributions for Round 3. However, this would contaminate results by augmenting the level of information each round is designed to represent. **For each round, please act as if the information explicitly provided for the round is all you have available.**

Using Li *et al.*'s review² as our guide, we have attempted to include as many baseline characteristics as we can that are likely to feature in your model, but we cannot cover everything. Therefore, we ask, below, for you to define additional baseline parameters as neutrally as possible and to provide details of any that you use.

There is one common variable that we have been unable to provide: the NDR does not collect data on ethnicity *per se*. Therefore, we request that you simulate a 100% white population throughout these challenges, as the Swedish diabetic population is very predominantly of Nordic origin.³

2.1. Round one: average participant simulated repeatedly

Table 1 provides the mean characteristics of the NDR cohort.

Table 1 Mean values of NDR cohort

Parameter	Category	N	n	Prob	Mean
Background					
Age		29,057	-	-	72.624
Sex (% male)		29,057	16,946	0.583	-
Smoker (current)		29,057	3,298	0.114	-
Duration of diabetes		29,057	-	-	11.538
Ethnicity (white)		assume		1.000	
Clinical measurements / biomarkers					
BMI (kg/m ²)		29,057	-	-	30.890
HbA1c (mmol/mol)		29,057	-	-	68.126
eGFR		29,057	-	-	65.602
Urinary ACR (mg/mmol)		29,057	-	-	21.713
Albuminuria	Normal	29,057	12,801	0.441	-
	Microalbuminuria	29,057	9,268	0.319	-
	Macroalbuminuria	29,057	6,988	0.240	-
Systolic BP (mmHg)		29,057	-	-	136.034
Diastolic BP (mmHg)		29,057	-	-	76.000
LDL cholesterol (mmol/l)		29,057	-	-	2.440
HDL cholesterol (mmol/l)		29,057	-	-	1.161
Triglycerides (mmol/l)		29,057	-	-	2.158
Total cholesterol (mmol/l)		29,057	-	-	4.377
Medical history					
Ischaemic heart disease		29,057	10,093	0.347	-
Heart failure		29,057	4,725	0.163	-
Stroke		29,057	4,107	0.141	-
Myocardial infarction		29,057	4,840	0.167	-
Angina		29,057	5,728	0.197	-
Coronary revascularisation		29,057	6,128	0.211	-
Peripheral arterial disease		29,057	1,972	0.068	-
Atrial fibrillation		29,057	5,958	0.205	-
Renal disease		29,057	1,853	0.064	-
Diabetic retinopathy		29,057	12,107	0.417	-
Medicines					
Insulin		29,057	9,018	0.310	-
Non-insulin antihyperglycaemics		29,057	29,057	1.000	-
Statins		29,057	21,279	0.732	-
Antihypertensives		29,057	24,371	0.839	-

We would like you to simulate the average person repeatedly, with as little variation as your model allows.

- Step one: define the modelled population:

- If your model allows you to simulate an individual person with hybrid characteristics (i.e. an observation that is 58% male) then please take advantage of this to simulate a single person who represents the average characteristics of the cohort.
- If this is not possible in your model, then please simulate a small population where all observations have the same value for all continuous variables (equal to the mean for the NDR population), and the binary characteristics are correctly (but independently) distributed. E.g. 100 people, all aged 72.6, a random 58 of whom are male, a random 11 of whom are current smokers, and so on. **We have provided an example in the Excel workbook (sheet 'Baseline_Round1a').**
- If your model requires baseline patient characteristics other than those specified here, please make the most neutral assumptions possible and document the values and sources you use in the 'Baseline_Round1' tab in the Excel workbook.
- If possible, please also record simuland-level baseline data for the population you simulated in the Excel workbook ('Baseline_Round1_popn' tab).
- Step two: Run the model to produce 29,057,000 realisations, e.g. **1 person × 29,057,000 internal loops** or **100 people × 290,570 internal loops**. By 'internal loops', we mean the number of times the same patient is simulated through the risk equations to reduce first-order uncertainty.
 - If this is insufficient to generate stable results, increase the number of internal loops for this and other rounds accordingly, and document in the Excel workbook.
- Step three: report results over a **30-year time horizon** discounting costs, LYs, and QALYs at **3.5% per year**.
- Step four: repeat steps 1–3, but include **all** of the following at 1 year:
 - 5.5 mmol/mol (0.5%-point) reduction in HbA1c;
 - 10 mmHg reduction in systolic blood pressure;
 - 0.5 mmol/l (19.33 mg/dl) reduction in LDL cholesterol
 - 1-unit reduction in BMI (kg/m²)

Allow the difference to persist unattenuated for the remainder of the model time horizon. Report results in the Excel workbook.

2.2. Round two: independently sampled characteristics

Table 2 supplements information on the mean characteristics of the NDR cohort with information on dispersion of continuous measures.

Table 2 Mean values of NDR cohort with dispersion

Parameter	Category	N	n	Prob	Mean	SD
Background						
Age		29,057	-	-	72.624	9.224
Sex (% male)		29,057	16,946	0.583	-	-
Smoker (current)		29,057	3,298	0.114	-	-
Duration of diabetes		29,057	-	-	11.538	8.125
Ethnicity (white)		assume		1.000		
Clinical measurements / biomarkers						
BMI (kg/m ²)		29,057	-	-	30.890	6.926
HbA1c (mmol/mol)		29,057	-	-	68.126	13.970
eGFR		29,057	-	-	65.602	25.392
Urinary ACR (mg/mmol)		29,057	-	-	21.713	57.473
Albuminuria	Normal	29,057	12,801	0.441	-	-
	Microalbuminuria	29,057	9,268	0.319	-	-
	Macroalbuminuria	29,057	6,988	0.240	-	-
Systolic BP (mmHg)		29,057	-	-	136.034	16.844
Diastolic BP (mmHg)		29,057	-	-	76.000	10.206
LDL cholesterol (mmol/l)		29,057	-	-	2.440	0.960
HDL cholesterol (mmol/l)		29,057	-	-	1.161	0.345
Triglycerides (mmol/l)		29,057	-	-	2.158	1.494
Total cholesterol (mmol/l)		29,057	-	-	4.377	1.142
Medical history						
Ischaemic heart disease		29,057	10,093	0.347	-	-
Heart failure		29,057	4,725	0.163	-	-
Stroke		29,057	4,107	0.141	-	-
Myocardial infarction		29,057	4,840	0.167	-	-
Angina		29,057	5,728	0.197	-	-
Coronary revascularisation		29,057	6,128	0.211	-	-
Peripheral arterial disease		29,057	1,972	0.068	-	-
Atrial fibrillation		29,057	5,958	0.205	-	-
Renal disease		29,057	1,853	0.064	-	-
Diabetic retinopathy		29,057	12,107	0.417	-	-
Medicines						
Insulin		29,057	9,018	0.310	-	-
Non-insulin antihyperglycaemics		29,057	29,057	1.000	-	-
Statins		29,057	21,279	0.732	-	-
Antihypertensives		29,057	24,371	0.839	-	-

We would like you to simulate this population, allowing for variation in continuous variables, but with no information as to how all variables are correlated with each other.

- Step one: generate a population of size **29,057** using the means, SDs, and proportions provided

- Your model may already be configured to simulate a population based on such inputs; if not, please generate one externally and use it to populate your model
 - Note that, for some variables, simply sampling from an untruncated normal distribution may result in impossible values (e.g. negative duration of diabetes). To preserve realism of the task (i.e. to reflect what it's really like to try to simulate a population based on publicly available data), we leave this as a problem for participants to solve.
 - If your model requires baseline patient characteristics other than those specified here, please make the most neutral assumptions possible and document the values and sources you use in the 'Baseline_Round2' tab in the Excel workbook.
 - If possible, please also record simuland-level baseline data for the population you simulated in the Excel workbook ('Baseline_Round2_popn' tab).
 - Step two: run the model to produce **29,057 people × 1,000 internal loops** (or more if necessary to generate stable results; please document in the Excel workbook).
 - Step three: report results over a **30-year time horizon** discounting costs, LYs, and QALYs at **3.5% per year**.
 - Step four: repeat steps 1–3, but include **all** of the following at 1 year:
 - 5.5 mmol/mol (0.5%-point) reduction in HbA1c;
 - 10 mmHg reduction in systolic blood pressure;
 - 0.5 mmol/l (19.33 mg/dl) reduction in LDL cholesterol
 - 1-unit reduction in BMI (kg/m²)
- Allow the difference to persist unattenuated for the remainder of the model time horizon. Report results in the Excel workbook.

2.3. Round three: characteristics sampled with correlations

We appreciate that this round asks participants to take steps that go beyond simply running a diabetes disease model. In particular, we are very interested to know how you go about using correlational data to generate a population to be simulated. This is a realistic scenario that occurs in practice, representing the greatest level of detail that could ever plausibly be available without direct access to patient-level data – see, for example, the 2015 version of [NICE's Type 2 Diabetes Guideline \(Appendix F; section 3.3.3\)](#).

If you do not have the time or expertise to generate a population using this information, you may omit this round, though we would encourage all participants to do what they can. In any event, please proceed with Round 4, which should be possible for everyone.

Table 3 shows correlations between variables which, combined with the information already provided in Table 2, will enable joint sampling of all parameters.

Steps are similar to before.

- Step one: generate a population of size **29,057** using the means, SDs, proportions, and correlation coefficients provided
 - You are likely to have to generate a population externally and use it to populate your model.
 - Correlation coefficients are:
 - [Pearson](#) for continuous–continuous pairs
 - [Polyserial](#) for categorical–continuous pairs
 - [Polychoric](#) for categorical–categorical pairs
 - As before, be aware that nothing in the information provided actively precludes the sampling of impossible values (e.g. negative duration of diabetes). Again, we are not providing any additional information, as we want to test how well a model can be populated using data that might plausibly be in the public domain, so we leave this as a problem for participants to solve.
 - If your model requires baseline patient characteristics other than those specified here, please make the most neutral assumptions possible and document the values and sources you use in the ‘Baseline_Round3’ tab in the Excel workbook.
 - If possible, please also record simuland-level baseline data for the population you simulated in the Excel workbook (‘Baseline_Round3_popn’ tab).
- Step two: run the model to produce **29,057 people × 1,000 internal loops** (or more if necessary to generate stable results; please document in the Excel workbook).
- Step three: report results over a **30-year time horizon** discounting costs, LYs, and QALYs at **3.5% per year**.
- Step four: repeat steps 1–3, but include **all** of the following at 1 year:
 - 5.5 mmol/mol (0.5%-point) reduction in HbA1c;
 - 10 mmHg reduction in systolic blood pressure;
 - 0.5 mmol/l (19.33 mg/dl) reduction in LDL cholesterol
 - 1-unit reduction in BMI (kg/m²)

Allow the difference to persist unattenuated for the remainder of the model time horizon. Report results in the Excel workbook.

Table 3 Correlation matrix for NDR cohort

	Age	Sex (% male)	Smoker (current)	Duration of diabetes	BM (kg/m ²)	HbA1c (mmol/mol)	eGFR	Urinary ACR (mg/mmol)	Albuminuria	Systolic BP (mmHg)	Diastolic BP (mmHg)	LDL cholesterol (mmol/L)	HDL cholesterol (mmol/L)	Triglycerides (mmol/L)	Total cholesterol (mmol/L)	Ischaemic heart disease	Heart failure	Peripheral arterial disease	Atrial fibrillation	Myocardial infarction	Angina	Coronary revascularisation	Renal disease	Stroke	Diabetic retinopathy	Ischaemic	Stroke	Walking performance
Age	1.00	-0.18	0.00	0.23	-0.26	-0.03	-0.35	-0.33	0.03	0.03	-0.28	0.03	0.16	-0.15	0.01	-0.07	0.15	-0.02	-0.12	-0.05	-0.21	0.06	0.24	-0.01	0.08	-0.02	-0.14	-0.03
Sex (% male)	-0.18	1.00	-0.01	-0.06	-0.07	0.02	0.32	0.04	0.07	-0.02	0.06	-0.15	-0.38	0.01	-0.23	0.20	0.01	0.01	0.16	0.10	0.28	0.01	0.02	0.03	0.01	0.00	0.13	0.04
Smoker (current)	0.00	-0.01	1.00	-0.01	-0.13	0.03	0.11	0.10	0.11	0.02	-0.05	0.02	0.01	0.02	0.02	0.00	0.02	0.00	0.01	-0.01	0.01	0.21	-0.02	0.04	0.02	-0.02	-0.01	-0.04
Duration of diabetes	0.23	-0.06	-0.01	1.00	-0.12	0.10	-0.16	0.03	0.02	0.04	-0.15	-0.06	0.07	-0.08	-0.05	-0.01	0.00	-0.02	-0.06	0.03	-0.06	0.11	0.01	0.11	0.46	0.43	0.04	0.07
BM (kg/m ²)	-0.26	-0.07	-0.13	-0.12	1.00	0.05	0.05	0.01	0.02	0.00	0.10	0.00	-0.12	0.13	0.02	-0.02	0.02	-0.02	0.01	-0.02	0.00	-0.15	0.00	0.05	-0.08	0.10	0.02	0.09
HbA1c (mmol/mol)	-0.03	0.02	0.03	0.10	0.05	1.00	0.06	0.06	0.11	0.01	0.03	0.04	-0.08	0.11	0.06	0.04	0.08	0.01	0.06	0.02	0.02	0.03	0.02	0.02	0.08	0.31	-0.02	-0.06
eGFR	-0.35	0.22	0.11	-0.16	0.05	0.06	1.00	-0.12	-0.03	0.02	0.11	-0.02	-0.03	0.00	-0.04	0.16	-0.08	0.19	0.17	0.12	0.23	0.06	-0.10	-0.08	-0.09	-0.12	0.06	-0.06
Urinary ACR (mg/mmol)	-0.33	0.04	0.10	0.03	0.01	0.06	-0.12	1.00	0.06	0.11	0.05	0.06	0.03	0.09	0.09	-0.03	0.02	0.00	-0.03	-0.02	-0.04	0.04	0.01	0.28	0.03	0.08	-0.03	0.01
Albuminuria	0.03	0.07	0.11	0.02	0.02	0.11	-0.03	0.06	1.00	0.11	0.05	0.06	-0.02	0.08	0.10	-0.08	0.02	-0.06	-0.09	-0.06	-0.12	-0.04	0.02	0.30	0.00	0.08	-0.06	-0.02
Systolic BP (mmHg)	0.03	-0.02	0.02	0.04	0.00	0.01	0.02	0.11	0.11	1.00	0.46	0.12	0.06	0.02	0.12	-0.10	-0.21	-0.02	-0.08	-0.07	-0.06	0.03	-0.13	0.03	0.04	0.02	-0.11	0.07
Diastolic BP (mmHg)	-0.24	0.06	-0.01	-0.15	0.10	0.03	0.11	0.05	0.05	0.46	1.00	0.10	-0.01	0.06	0.11	-0.08	-0.16	-0.01	-0.03	-0.08	-0.04	-0.09	-0.09	0.00	-0.07	-0.06	-0.07	0.01
LDL cholesterol (mmol/L)	0.03	-0.15	0.02	-0.06	0.00	0.04	-0.02	0.06	0.06	0.12	0.10	1.00	0.13	0.07	0.04	-0.16	-0.02	-0.06	-0.13	-0.13	-0.16	-0.02	-0.05	-0.01	-0.06	-0.05	-0.06	-0.12
HDL cholesterol (mmol/L)	0.16	-0.38	0.01	0.07	-0.12	-0.08	-0.03	0.03	-0.02	0.06	-0.01	0.13	1.00	-0.25	0.26	-0.15	-0.04	0.04	-0.14	-0.10	-0.18	0.00	-0.06	-0.04	0.02	-0.08	-0.10	-0.06
Triglycerides (mmol/L)	-0.15	0.01	-0.02	-0.08	0.13	0.11	0.00	0.08	0.08	0.02	0.06	0.07	-0.25	1.00	0.36	-0.01	0.01	-0.03	0.00	-0.01	-0.01	0.03	0.00	0.05	-0.05	0.03	-0.02	0.01
Total cholesterol (mmol/L)	0.01	-0.23	0.02	-0.05	0.02	0.00	-0.04	0.08	0.10	0.12	0.11	0.04	0.28	0.36	1.00	-0.19	-0.02	-0.06	-0.18	-0.15	-0.18	-0.01	-0.06	0.00	-0.06	-0.06	-0.02	-0.11
Ischaemic heart disease	-0.07	0.20	0.00	-0.01	-0.02	0.04	0.18	-0.03	-0.09	-0.10	-0.08	-0.16	-0.18	-0.01	-0.19	1.00	0.33	-0.11	0.08	0.07	0.06	0.09	0.20	-0.02	0.00	0.02	0.34	0.05
Heart failure	0.13	0.01	0.02	0.00	0.02	0.08	-0.08	0.02	0.02	-0.21	-0.16	-0.02	-0.04	0.01	-0.02	0.33	1.00	-0.07	0.26	0.21	0.16	0.01	0.60	0.11	-0.03	0.05	0.00	-0.01
Peripheral arterial disease	-0.02	0.01	0.00	-0.02	-0.02	0.01	0.19	0.00	-0.06	-0.02	-0.01	-0.06	0.04	-0.03	-0.06	-0.11	-0.07	1.00	-0.13	-0.10	-0.18	-0.07	0.04	-0.07	0.00	-0.01	0.10	-0.05
Atrial fibrillation	-0.12	0.16	0.01	-0.06	0.01	0.06	0.17	-0.03	-0.09	-0.06	-0.03	-0.13	-0.14	0.00	-0.16	0.08	0.26	-0.13	1.00	0.54	0.09	0.00	0.10	-0.05	-0.02	0.01	0.31	0.05
Myocardial infarction	-0.05	0.15	-0.01	0.03	-0.02	0.02	0.12	-0.02	-0.06	-0.07	-0.08	-0.13	-0.10	-0.01	-0.10	0.07	0.21	-0.10	0.54	1.00	0.01	0.11	0.15	0.00	0.01	0.02	0.28	0.04
Angina	-0.21	0.28	0.01	-0.06	0.00	0.02	0.23	-0.04	-0.12	-0.08	-0.04	-0.16	-0.18	-0.01	-0.19	0.06	0.16	-0.18	0.09	0.01	1.00	0.04	0.07	-0.06	-0.01	-0.02	0.38	0.06
Coronary revascularisation	0.08	0.01	0.21	0.11	-0.15	0.03	0.08	0.04	-0.04	0.03	-0.09	-0.02	0.00	0.03	-0.01	0.09	0.01	-0.07	0.00	0.11	0.04	1.00	0.01	0.02	0.08	0.05	0.03	-0.02
Renal disease	0.24	0.02	-0.02	0.01	0.00	0.02	-0.19	0.01	0.02	-0.13	-0.09	-0.05	-0.06	0.00	-0.06	0.20	0.60	0.04	0.10	0.15	0.07	0.01	1.00	0.05	0.01	0.02	0.01	-0.02
Stroke	-0.01	0.03	0.04	0.11	0.05	0.02	-0.06	0.26	0.30	0.03	0.00	-0.01	-0.04	0.05	0.00	-0.02	0.11	-0.07	-0.05	0.00	-0.06	0.02	0.05	1.00	0.10	0.21	0.04	0.04
Diabetic retinopathy	0.06	0.01	0.02	0.46	-0.08	0.08	-0.09	0.03	0.00	0.04	-0.07	-0.06	0.02	-0.05	-0.06	0.05	-0.03	0.00	-0.02	0.01	-0.01	0.05	0.01	0.10	1.00	0.37	0.05	0.05
Ischaemic	-0.02	0.00	-0.02	0.43	0.10	0.31	-0.12	0.08	0.09	0.02	-0.06	-0.05	-0.08	0.03	-0.05	0.02	0.05	-0.01	0.01	-0.02	-0.02	0.05	0.02	0.21	0.37	1.00	0.06	0.06
Stroke	-0.14	0.13	-0.01	0.04	0.02	-0.02	0.06	-0.03	-0.08	-0.11	-0.07	-0.06	-0.10	-0.02	-0.42	0.34	0.00	0.10	0.31	0.28	0.38	0.03	0.01	0.04	0.05	0.06	1.00	0.30
Antihypertensives	-0.03	0.04	-0.04	0.07	0.08	-0.08	-0.08	0.01	-0.02	0.07	-0.01	-0.12	-0.06	0.01	-0.11	0.05	-0.01	-0.05	0.05	0.04	0.06	-0.02	-0.02	0.04	0.05	0.06	0.30	1.00

All correlation coefficients given to greater precision in accompanying Excel workbook

2.4. Round four: using synthetic population

Please repeat the task using the pseudo-patient-level synthetic dataset ($n = 29,057$) the REDDIE team has generated.

To request a copy of the synthetic dataset, please email gabriel.rogers@manchester.ac.uk.

Although the synthetic data are artificial, and contain no personal data, the Swedish custodians of the underlying NDR dataset have asked us to treat them as confidential research data, so we cannot post them on the Mount Hood website or otherwise make them publicly available. Therefore, we will provide the file directly to each participating group.

Before releasing the synthetic data, we will ask you to agree to terms and conditions restricting use of the data to the Mount Hood challenges. It is sufficient for participating researchers to agree to these terms and conditions; we do not need sign-off from legal departments.

Once you have received the synthetic pseudo-patient-level dataset, please take the following steps:

- Step one: It will not be necessary to generate your own population; simply plug the provided data into your model.
 - If your model requires baseline patient characteristics other than those provided, please make the most neutral assumptions possible and document the values and sources you use in the 'Baseline_Round4' tab in the Excel workbook.
 - If possible, please also record simuland-level baseline data **for any additional characteristics only** in the Excel workbook ('Baseline_Round1_popn' tab).
- Step two: run the model to produce **29,057 people × 1,000 internal loops** (or more if necessary to generate stable results; please document in the Excel workbook).
- Step three: report results over a **30-year time horizon** discounting costs, LYs, and QALYs at **3.5% per year**.
- Step four: repeat steps 1–3, but include **all** of the following at 1 year:
 - 5.5 mmol/mol (0.5%-point) reduction in HbA1c;
 - 10 mmHg reduction in systolic blood pressure;
 - 0.5 mmol/l (19.33 mg/dl) reduction in LDL cholesterol
 - 1-unit reduction in BMI (kg/m^2)

Allow the difference to persist unattenuated for the remainder of the model time horizon.

Report results in the Excel workbook.

3. OTHER DATA AND ASSUMPTIONS FOR MODELLING

For all inputs and assumptions other than baseline characteristics, please follow the Mount Hood Reference Simulation (see <https://www.mthooddiabeteschallenge.com/refsim>).

3.1. Risk factor progression

Hold all time-varying risk factors (e.g. HbA1c, systolic blood pressure, etc.) constant at their starting values. Do not apply progression equations or drift parameters. If any such functions are hardwired in your simulation in a way you cannot change, please give details in the Excel workbook.

3.2. Costs

Table 4 gives cost inputs. If your model has other endpoints for which costs are needed, please report these in the 'Costs' tab in the Excel workbook.

Table 4 Cost inputs for Mount Hood reference simulation

Parameter	Fatal cost	Non-fatal cost	Cost in subsequent years
Ischemic heart disease/Angina	£6,070	£14,001	£3,550
Myocardial infarction	£3,318	£9,518	£3,424
Heart failure	£2,825	£5,650	£4,277
Coronary revascularisation	–	£8,302	£3,550
Stroke	£6,463	£10,755	£3,534
Amputation	£9,825	£15,153	£5,328
Blindness	–	£4,247	£2,206
Haemodialysis	–	£43,359	£43,359
Renal failure / transplant	£10,289	£20,578	£20,578
Ulcer	–	£7,076	£1,072
Peripheral vascular disease	–	£4,698	£1,010
Cataract operation	–	£2,636	£178
Neuropathy	–	£29	£29
Gangrene treatment	–	£3,694	–
Retinopathy laser treatment	–	£1,176	–
Peritoneal Dialysis	–	£32,556	£32,556
Severe hypoglycaemia (req. med. assistance)	–	£1,470	–
Severe hypoglycaemia (req. non med. assistance)	–	£433	–
Non-severe hypoglycaemia	–	£4	–
Cost in the absence of complications		£1,990	

3.3. Utilities

Table 5 gives utility inputs. If your model has other endpoints for which utility values are needed, please report these in the 'Utilities' tab in the Excel workbook.

Table 5 Utility inputs for Mount Hood reference simulation

Category	Parameter	Utility / disutility	Lower 95% CI	Upper 95% CI
Baseline utility value	Diabetes without complications	0.7850	0.6810	0.8890
Acute metabolic disorder	Minor hypoglycaemia event	-0.0140	-0.0040	-0.0040
	Major hypoglycaemia event	-0.0470	-0.0120	-0.0120
Comorbidity	Excess BMI (each unit above 25 kg/m ²)	-0.0060	-0.0080	-0.0040
Oculopathy	Cataract*	-0.0160	-0.0310	-0.0010
	Moderate non-proliferative diabetic retinopathy*	-0.0400	-0.0660	-0.0140
	Moderate macular oedema*	-0.0400	-0.0660	-0.0140
	Vision-threatening diabetic retinopathy*	-0.0700	-0.0990	-0.0410
	Severe vision loss*	-0.0740	-0.1240	-0.0250
Nephropathy	Proteinuria*	-0.0480	-0.0910	-0.0050
	Renal transplant	-0.0820	-0.1370	-0.0270
	Haemodialysis*	-0.1640	-0.2740	-0.0540
	Peritoneal dialysis*	-0.2040	-0.3420	-0.0660
Neuropathy	Peripheral vascular disease*	-0.0610	-0.0900	-0.0320
	Neuropathy*	-0.0840	-0.1110	-0.0570
	Active ulcer*	-0.1700	-0.2070	-0.1330
	Amputation event	-0.2800	-0.3890	-0.1700
Cerebrovascular disease	Stroke*	-0.1640	-0.2220	-0.1050
Coronary heart disease	Myocardial infarction	-0.0550	-0.0670	-0.0420
	Ischemic heart disease*	-0.0900	-0.1260	-0.0540
	Heart failure*	-0.1080	-0.1690	-0.0480

* disutility applies for incident state and every subsequent cycle

4. FORTHCOMING LONGITUDINAL CHALLENGE

We still intend to provide a second challenge, to be documented separately, in which we ask participants to simulate populations over time, starting from the baseline cohorts developed here. However, for this challenge, we will also provide time-varying covariates (e.g. changes in HbA1c and lipids over time) for 2 cohorts undergoing different treatments (GLP-1RA -v- DPP-4i). Endpoint data from the synthetic dataset(s) created in REDDIE will provide a reference standard to which we will compare the modellers' predicted outcomes.

5. SUBMISSION

Please submit your completed Excel workbook by email using the address given in the participation invitation by **25 September 2026**.

6. REFERENCES

1. Hallström S, Michelsen J, Imberg H, et al. Cardiovascular outcomes of GLP-1 receptor agonists versus DPP-4 inhibitors in the Swedish National Diabetes Register: a LEADER-inspired target trial emulation. Manuscript in preparation.
2. Li X, Li F, Wang J, van Giessen A, Feenstra TL. Prediction of complications in health economic models of type 2 diabetes: a review of methods used. *Acta Diabetol*. 2023;60(7):861-879. doi:10.1007/s00592-023-02045-8
3. Rawshani A, Svensson AM, Rosengren A, Zethelius B, Eliasson B, Gudbjörnsdóttir S. Impact of ethnicity on progress of glycaemic control in 131 935 newly diagnosed patients with type 2 diabetes: a nationwide observational study from the Swedish National Diabetes Register. Published online June 1, 2015. doi:10.1136/bmjopen-2015-007599

Challenge 4 - Presymptomatic Screening in Type 1 Diabetes

Original challenge instructions - reproduced verbatim

Draft Challenge Instructions

(Updated - 2 Sept 2026)

2026 Mount Hood T1DM Diabetes Challenge:

Evaluation of the Economic Value of Presymptomatic Screening in Type 1 Diabetes

1 INTRODUCTION

Background:

Presymptomatic screening for type 1 diabetes (T1D) has become increasingly relevant following advances in the understanding of T1D as a progressive disease and the development of therapies capable of delaying progression to clinical disease. Together, these developments have shifted attention toward earlier identification and intervention, and several countries—including the UK, the US, and Germany, as well as via global collaborations such as EDENTIFI—are now evaluating screening strategies for individuals at risk of T1D, creating a need to evaluate the long-term clinical and economic consequences of presymptomatic screening.

Many of the potential benefits and costs of presymptomatic screening extend over decades and cannot be directly observed within available clinical studies. Decision-analytic models therefore play a central role in synthesizing available evidence and projecting long-term clinical and economic outcomes to inform healthcare decision-making.

The Mount Hood Diabetes Challenge Network brings together developers and users of diabetes simulation models to address common decision problems using independently developed models. By systematically comparing model predictions, assumptions, and methods, the Mount Hood Network promotes methodological learning and continuous model improvement, with the ultimate goal of strengthening the credibility of model-based evidence for healthcare decision-making.

Challenge Objectives:

- Collaboratively evaluate the long-term clinical and economic consequences of presymptomatic screening for T1D by addressing a common decision problem using independently developed diabetes simulation models
- Compare predictions from independently developed diabetes simulation models addressing a common decision problem to better understand the influence of model structure, assumptions, and implementation on predicted outcomes
- Identify opportunities to improve diabetes simulation models and strengthen the credibility of model-based evidence for healthcare decision-making through systematic comparison and methodological learning, including improving our understanding of different T1D screening models and how the implementation of costs, health utilities, choice of risk equations, and model assumptions impact model outcomes

Research Questions:

- What are the predicted long-term clinical and economic consequences of presymptomatic screening for T1D compared with no screening?
- To what extent do independently developed diabetes simulation models produce consistent estimates when addressing the same decision problem?

- What insights from systematic comparison of independently developed models can be used to improve diabetes simulation models and strengthen the credibility of model-based evidence for healthcare decision-making?

2 CHALLENGE OVERVIEW

- Decision Problem: Evaluate the long-term clinical and economic consequences of presymptomatic screening for T1D compared with no screening
- Target Population: 8-year old children in the general population
- Comparison
 - Intervention: Screening for T1D-associated autoantibodies, including confirmatory testing for individuals with a positive initial screening result (96%/98% Sensitivity and specificity of initial screening and 100%/100% Sensitivity and specificity of confirmatory screening)
 - Comparator: No screening
- Reference Country: France
- Analytic Perspective: Healthcare and Societal
- Time Horizon: Lifetime
- Outcomes: Number of avoided diabetes-related complications, life years, QALYs, direct costs, indirect costs, and cost-effectiveness of T1D screening.
- Cost Year: 2025
- Discount Rate: 2.5% annually for both costs and health outcomes

3 CHALLENGE INSTRUCTIONS

Participants should implement the challenge specifications described in this section using their own independently developed T1D screening models. Unless otherwise specified, participants should implement the challenge as closely as possible while preserving their model's established methods. Where exact implementation is not feasible, participants should use the closest available implementation and document any material assumptions, adaptations, or deviations in the reporting documents.

Step 1. Load model with general population characteristics

Populate the model using the average baseline characteristics of the general population undergoing screening specified in Table 1. Use cohort-level values if possible, rather than applying patient heterogeneity. Where a baseline characteristic cannot be represented directly within a model, participants should use the closest available representation and document any assumptions or deviations.

Table 1 Baseline characteristics of the population at screening

Parameter	Value	Source
Proportion female	50.3%	McQueen et al. (2020)
Starting age (years)	8	EDENT1FI data on file
Prevalence of multiple IABs	0.473%	EDENT1FI data on file

Parameter	Value	Source
T1D stage at baseline for individuals with multiple IABs	Stage 1: 80% Stage 2: 20%	EDENT1FI data on file

Step 2. Configure the screening strategy

Implement the screening strategy according to the specifications provided in Table 2. The screening strategy should include all components specified in the challenge, including the initial screening strategy, confirmatory testing, and monitoring of stage 1/2 T1D. Where the model cannot represent the screening pathway exactly, participants should implement the closest feasible representation and document any deviations.

The screening strategy is applied once to the entire general population cohort at age 8, with the exclusion of individuals with diagnosed stage 3 T1D, who are assumed to have been clinically diagnosed. No repeat population screening is modelled. The prevalence inputs in Table 1 determine the proportion of individuals with islet autoantibodies at the time of the age-8 screen. Individuals who do not have screen-detectable presymptomatic T1D at age 8 do not subsequently enter the screening-detected monitoring pathway, even if they develop islet autoimmunity later.

Table 2 Screening and monitoring parameters

Parameter	Value	Source
Sensitivity and specificity of initial screening	96% / 98%	Marzinotto et al. (2026)
Sensitivity and specificity of confirmatory screening	100%/100%	Assumption
Stage 1/2 monitoring duration	Until Stage 3 onset or age 18, whichever occurs first	Assumption

Step 3. Configure T1D progression and Stage 3 characteristics

Progression between Stage 1, Stage 2, and Stage 3 T1D should be simulated using the transition probabilities specified in Table 3. Screening and subsequent monitoring are assumed not to alter the natural history or timing of progression from Stage 1 or Stage 2 to Stage 3 T1D.

Table 3 T1D Progression and DKA at Stage 3 onset

Parameter	Value	Source
Annual transition probability from Stage 1 to Stage 2	0.123	Fr1da data on file
Annual transition probability from Stage 2 to Stage 3	0.200	Fr1da data on file
Proportion with DKA at stage 3 onset without monitoring	46%	McQueen et al. (2020)
Proportion with DKA at stage 3 onset during monitoring	3.22%	Schneider et al. (2023) and Hummel et al. (2023)

At Stage 3 T1D onset, populate the model using the Stage 3 T1D characteristics specified in Table 4. These parameters are based on the 2022 Mount Hood Diabetes Challenge and should be held constant

throughout the remainder of the simulation, except for the HbA1c effects specified in Step 4. Where possible, cohort-level means should be used rather than patient-level heterogeneity. Where a Stage 3 characteristic cannot be represented directly within a model, participants should use the closest available representation and document any assumptions or deviations.

Following Stage 3 T1D onset, the clinical management pathway is not modelled explicitly. Risk factors are assumed to remain constant, except for the effects associated with early detection, monitoring, and DKA at Stage 3 onset, as specified in Step 4.

For individuals who never develop Stage 3 T1D during the simulation, the development of T2D and other diseases is outside the scope of this challenge and should not be modelled explicitly. These events are assumed to be independent of the T1D screening strategy and therefore to occur equally in the screening and no-screening arms.

Table 4 Stage 3 T1D characteristics

Parameter	Value	Source
Current/former smoker, %	0/0	Assumption
HbA1c, %	8.1	Tran-Duy et al 2020
Systolic Blood Pressure, mmHg	127	Tran-Duy et al 2020
Diastolic Blood Pressure, mmHg	73	Tran-Duy et al 2020
Total Cholesterol, mmol/l	4.8	Tran-Duy et al 2020
HDL Cholesterol, mmol/l	1.6	Tran-Duy et al 2020
LDL Cholesterol, mmol/l	2.7	Tran-Duy et al 2020
Triglycerides, mmol/L	1.2	Tran-Duy et al 2020
BMI	25	Tran-Duy et al 2020
Estimated glomerular filtration rate, mL/min/1.73 m ²	96	Tran-Duy et al 2020

Step 4. Load consequences of monitoring screening-detected Stage 1 or Stage 2 T1D (e.g., HbA1c effect, AEs) according to Table 5. Two HbA1c effects are modelled, one associated with monitoring during onset of stage 3, and one associated with DKA at onset. Monitoring of stage 3 onset is also assumed to affect the risk of DKA at onset.

The modelling groups are asked to implement the effects in separate simulations representing three distinct scenarios (A, B and C):

- A. 0.4% reduction in HbA1c for 5 years after stage 3 onset during monitoring after screening detection (Lundgren et al, 2019). After 5 years, the effect is reverted back to baseline. Applied to all patients with monitored onset of stage 3.
- B. 0.45% increase in HbA1c for 17 years after stage 3 onset with DKA (Duca et al, 2017). After 17 years, the effect is reverted back to baseline. Applied to all patients with DKA at onset of stage 3.
- C. The 2 effects above applied simultaneously.
 - i. For a monitored onset of stage 3 with DKA, this means an initial effect of +0.05% [-0.4%+0.45%], followed by + 0.40% after 5 years, followed by reversion to baseline after another 12 years. The resulting HbA1c trajectory is: 8.15% during 5 years, 8.55% during the next 12 years, and then 8.1% during the remainder of the simulation.

No other intensifications or changes to other risk factors are modelled.

Table 5 Consequences of monitoring screening-detected T1D

Parameter	Value	Source
HbA1c effect associated with monitoring stage 3 onset (Applied in Scenario A and C)	-0.4%	Lundgren et al, 2019 (Average difference during follow up)
Duration of HbA1c effect associated with monitoring stage 3 onset	5 years	Length of follow up in Lundgren et al, 2019
HbA1c effect associated with DKA at onset of stage 3 (Applied in Scenario B and C)	+0.45%	Duca et al, 2017
Duration of HbA1c effect associated with DKA at onset of stage 3	17 years	Length of follow up in Duca et al, 2017
Proportion with DKA at stage 3 onset without monitoring	46%	McQueen et al. (2020)
Proportion with DKA at stage 3 onset during monitoring	3.22%	Schneider et al. (2023) and Hummel et al. (2023)

Step 5. Load QALYs

Load the model with your utility parameters specified in Table 6. Unless otherwise specified, participants should apply the challenge specifications while retaining their model's established methods for simulating clinical outcomes. If you require utility weights for additional health states not listed, please add utility values you currently use. Please document your sources and assumptions. Please also keep baseline utilities constant across all ages. Where possible, please do not change baseline utilities by age. However, if your model requires you to do so – please document your sources and assumptions. The additive quality-of-life (QoL) model is recommended. 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.

Table 6 Baseline utilities and disutility values associated with T1D complications

Category	Health state/event	Utility/disutility value	Source
Baseline utility value	No T1D	0.825	Assumption
	T1D without complications	0.825	HAS (2024)
CVD	MI event	-0.081	HAS (2024)
	Post-MI health state	-0.081	HAS (2024)
	Revascularisation event	-0.099	HAS (2024)
	Post-revascularisation health state	-0.081	HAS (2024)
	Angina health state	-0.080	HAS (2024)
	Heart failure health state	-0.099	HAS (2024)
	Stroke event	-0.132	HAS (2024)
	Post-stroke health state	-0.132	HAS (2024)
Cataracts	Cataract surgery event	-0.022	HAS (2024)
	Cataracts, partially sighted health state	-0.022	HAS (2024)
Neuropathy	Peripheral neuropathy health state	-0.283	HAS (2024)
	Peripheral vascular disease health state	-0.081	HAS (2024)
	Lower-extremity amputation event	-0.095	HAS (2024)

Category	Health state/event	Utility/disutility value	Source
Nephropathy	Amputee health state	-0.004	HAS (2024)
	Foot ulcer health state	-0.075	HAS (2024)
	Microalbuminuria health state	-0.084	HAS (2024)
	Proteinuria health state	-0.084	HAS (2024)
	ESRD health state	-0.115	HAS (2024)
Retinopathy	PDR health state	-0.022	HAS (2024)
	Macular oedema health state	-0.022	HAS (2024)
	Blindness / SVL health state	-0.076	HAS (2024)
Hypoglycaemia	Hypoglycaemia	-0.006	HAS (2024)
DKA	DKA	-0.0165	Peasgood et al. (2016)

Step 6. Load unit costs for direct medical costs and lost labor market productivity

Load the model with your cost parameters specified in Table 7 and Table 8. If you require additional cost inputs for health states or complications not listed, please add the costs you currently use and report any additional costs separately. Please document your sources and assumptions. For cost of DKA at onset, please add the event cost of DKA in Table 8.

Table 7 Costs of screening, monitored stage 1/2, and stage 3 onset

Item	Unit cost (EUR 2025)	Source
Screening	€27.84	Karl et al. (2022)
Confirmatory screening test	€10.48	Karl et al. (2022)
Monitoring stage 1 (state cost)	€60.75	Average annual cost of monitoring for screening-detected stage 1, with random plasma glucose and HbA1c assessment in clinic (Gillet et al. 2015, assuming 1 per year) and dysglycaemia assessment (Farrar et al. 2016, based on cost of OGTT, assuming 1 per year)
Monitoring stage 2 (state cost)	€133.9	Average annual cost of monitoring for screening-detected stage 2, with random plasma glucose and HbA1c assessment in clinic (Gillet et al. 2015, assuming 4 per year) and home glucose assessment (Farrar et al. 2016, assuming 6 per year)
Stage 3 onset without complications (event cost)	€5,433	EDENT1FI data on file
Reduction in cost of Stage 3 onset without complications due to monitoring	75%	Assumption
Labor market productivity loss for parents/caregivers following a stage 3 diagnosis without monitoring	1% (applied for 1 year)	Kennedy et al. (2025)

Item	Unit cost (EUR 2025)	Source
Annual income of parents/caregivers	€55,000	Kennedy et al. (2025)

Table 8 Costs of T1D complications

Category	Health state/event	Unit cost (EUR 2025)	Source
CVD	MI event	€17,107.48	HAS (2024)
	Post-MI health state	€1,330.69	HAS (2024)
	Revascularisation event	€4,212.95	HAS (2024)
	Post-revascularisation health state	€357.97	HAS (2024)
	Angina (year 1) health state	€7,864.46	HAS (2024)
	Angina (year 2+) health state	€611.49	HAS (2024)
	Heart failure (year 1) health state	€4,212.74	HAS (2024)
	Heart failure (year 2+) health state	€2,061.76	HAS (2024)
	Stroke event	€1,822.49	HAS (2024)
	Post-stroke health state	€884.59	HAS (2024)
	Stroke death event	€7,700.16	HAS (2024)
Cataracts	Cataract surgery event	€1,566.80	HAS (2024)
	Cataracts, partially sighted health state	€43.52	HAS (2024)
Neuropathy	Peripheral neuropathy health state	€208.91	NHS (2010)
	Peripheral vascular disease health state	€357.95	HAS (2024)
	Lower-extremity amputation event	€13,176.34	HAS (2024)
	Amputee health state	€1,830.11	HAS (2024)
	Foot ulcer health state	€1,330.69	HAS (2024)
Nephropathy	ESRD (year 1) health state	€91,815.47	HAS (2024)
	ESRD (year 2+) health state	€21,591.35	HAS (2024)
Retinopathy	PDR (year 1) health state	€208.91	HAS (2024)
	PDR (year 2+) health state	€208.91	HAS (2024)
	Blindness / SVL health state	€14,361.23	HAS (2024)
Severe hypoglycaemia event		€240.07	HAS (2024)
DKA event		€2,550.00	CHU Orleans (2025)
T1D without complications		€5,433.29	Clarke et al. (2003), cited in Heller et al. (2014)

Step 7. Load auxiliary model parameters

Set simulation duration to lifetime, or some arbitrarily high number of years depending on what your model supports and note in the documentation. Apply a 2.5% discount rate for both costs, QALYs and life-years.

Step 8. Double-check everything

Step 9. Run simulation

The sample sizes for probabilistic models should be large enough for convergence

- Challenge 1
 - Run three separate simulations representing the three distinct scenarios A, B and C described in step 4, using the healthcare payer perspective.
- Challenge 2
 - Run scenario C described in step 4, applying a societal perspective by assuming an income loss of 1% for caregivers for 1 year following a stage 3 diagnosis without monitoring.
 - For microsimulation models, please ensure that the number of replications is sufficient to generate stable results.

Step 10. Extract model results

Extract the results and enter values in a transparent manner in the accompanying Excel Reporting Workbook

Step 11. Document the model and necessary deviations in the Excel Reporting Workbook

4 RESULTS SUBMISSION

4.1 Reported Outcomes

Participants should report the required clinical and economic outcomes using the standardized submission workbook.

4.2 Model Documentation

Participants should submit documentation describing their implementation of the challenge. The documentation should include:

- Model name and version
- Model type
- Description of implementation
- Any material deviations from the challenge specifications
- Justification for those deviations
- Participants are encouraged to describe any implementation challenges or observations that may assist interpretation of differences between models.

4.3 Submission

Participants should submit all required files by the specified submission deadline.

The submission package should include:

- Completed Excel Reporting Workbook
- Any additional materials requested by the organizers



Prato della Valle, Padua