Mouth Hood Diabetes Challenge 2026 – Draft Model Challenge

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

Proposed Context and Positioning for Mount Hood Challenge 2026

As part of our interest in participating in the Mount Hood Challenge 2026, we aim to contribute with a rigorous and policy-relevant economic evaluation, addressing one of the most pressing topics in type 1 diabetes (T1D): the value of presymptomatic screening. Early identification of children at high risk—or already progressing through presymptomatic T1D stages—has become increasingly central to current clinical and research priorities, particularly with the emergence of disease-modifying therapies and the growing global emphasis on preventive strategies.

The proposed screening model is highly relevant to the Mount Hood Challenge for several reasons:

Alignment with Challenge Themes

The Mount Hood Challenge has historically focused on the advancement, comparison, and transparency of decision analytic models in diabetes. Our model directly contributes to this mission by presenting a comprehensive hybrid decision-analytic framework, combining a screening decision tree with a full pre- and post-symptomatic Markov model in T1D progression. This approach allows for assessment of upstream (screening) and downstream (long-term outcomes) interventions in a single, coherent structure.

Policy Significance for Emerging Screening Programs

Policymakers are actively evaluating pathways for population-level T1D screening in countries including the UK, the US, and Germany, as well as via global collaborations such as EDENT1FI. Our model provides an evidence-based mechanism for estimating the economic and clinical value of such programs—an issue of increasing international relevance and a strong fit for an objective of the Challenge in developing models that can inform real-world decision-making.

Flexibility and Transparency for Comparative Modelling Exercises

The model includes multiple modules, such as—Markov traces, HbA1c trajectories, rescreening strategies, and mortality assumptions, making it well-suited for the comparative modelling activities that characterise the Mount Hood Challenge. Its structure allows other teams to benchmark, critique, and explore alternative assumptions in a transparent way, supporting the collaborative learning objectives of the meeting.

Relevance to Current Clinical Innovations

With the introduction of therapies capable of delaying the progression to stage 3 (symptomatic) T1D, the economic implications of early detection have changed considerably. This model offers a timely framework for evaluating presymptomatic screening pathways, a topic expected to feature prominently in upcoming Mount Hood discussions.

Decision Problem

Whether presymptomatic screening is cost-effective in comparison with no screening in the identification and treatment of children with presymptomatic T1D.

Core country and Analysis Perspective

The reference country for the analysis was UK. Societal perspective (base case).

Interventions

Screening for T1D-associated autoantibodies, compared with “no screening”.

Analysis Timeframe

Lifetime.

Cost-Year

The cost-year for the analysis was 2025.

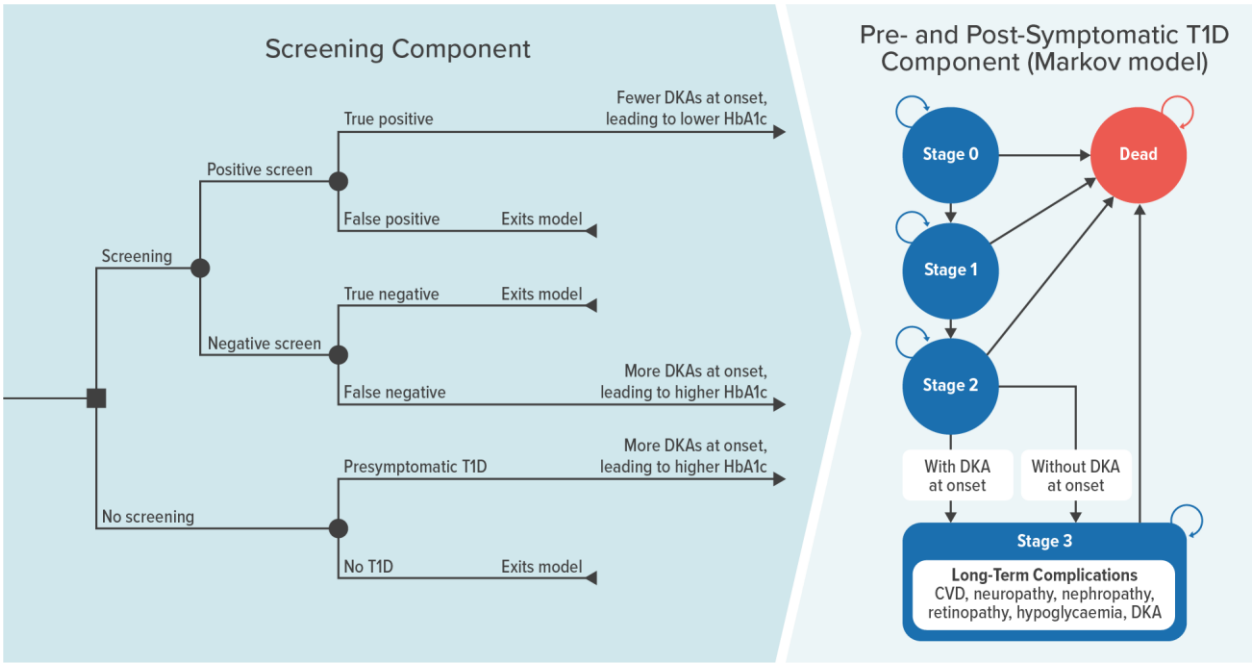
Discounting

The default discount rate for costs and health outcomes was 3.5%.

Modelling Approach

The type of analysis undertaken was a cost-utility analysis. The model approach is illustrated by the model diagram below. The model comprises 2 components: a screening component and a pre- and post-symptomatic T1D component (Markov model).

Model Diagram



CVD = cardiovascular disease; DKA = diabetic ketoacidosis; HbA1c = glycated haemoglobin; T1D = type 1 diabetes.

Screening Component

In the screening component, individuals were divided by screening outcome. Two screenings were included—an initial screening and a confirmatory screening for those that test positive at the initial screening. Individuals with AAs either have a single AA or multiple AAs.

Re-Screening

While almost all individuals with multiple AAs will eventually develop T1D, only a proportion of individuals with a single AA (stage 0) will eventually develop T1D. The model included an option to re-screen individuals for whom a single AA is detected at initial screening.

Pre- and Post-Symptomatic T1D Component (Markov Model)

Progression to Stage 3 T1D

Individuals who will go onto develop T1D enter a cohort Markov model with 5 health states: stage 0 T1D, stage 1 T1D, stage 2 T1D, stage 3 T1D, and death. The cycle length was 1 year. Individuals move progressively through each health state, with no transitions to previous stages, until they reach stage 3 T1D or death.

HbA1c

The model provides flexibility to consider the (changes in) surrogate endpoint HbA1c over time using several approaches:

- The “no long-term HbA1c benefit” option, in which the mean HbA1c (%) after onset (both with or without DKA) is constant.
- The “two periods of HbA1c” option, in which the mean HbA1c (%) can be specified for 2 separate periods
- The “annual HbA1c over time” option, in which an HbA1c (%) value can be entered by the user by age and by arm.
- The “mean HbA1c values over time, estimated using Duca et al. (2017)” option, in which annual HbA1c (%) values after experiencing a DKA event at onset of T1D (or not) reported by Duca et al. (2017) are weighted by percentage of individuals with DKA at onset.
- The “mean HbA1c values over time, estimated using Duca et al. (2017), with inclusion of HbA1c value for the year before onset in the mean HbA1c estimates” option, in which the “mean HbA1c values over time, estimated using Duca et al. (2017)” option is considered together with the year before onset.
- The “short-term HbA1c benefit with long-term impact on the risk of complications” option, in which a short-term HbA1c benefit is specified before and/or after the onset of stage 3 T1D.

Long-Term Complications

Individuals in the stage 3 T1D health state were at risk of developing T1D-associated complications. As per McQueen et al. (2020), the proportion who had a DKA at onset of T1D inform the HbA1c of the cohort, which in turn informed the incidence of long-term complications. The model also included flexibility for the user to manually set the HbA1c, by cycle, for the with-screening and without-screening arms.

HbA1c was linked to long-term complications using hazard ratios published by Wolowacz et al. (2015), which were used to estimate the costs and quality-adjusted life-years (QALYs) associated with long-term complications for different levels of HbA1c.

Mortality

Building a cohort-level model in which the cohort may experience multiple complications, some of which are associated with complication-specific mortality rates, requires an assumption to estimate the risk of cumulative mortality in each cycle. The model includes 4 options to estimate overall cohort-level mortality:

- The “sum of complication-specific mortality in the current cycle” option
- The “sum of complication-specific mortality in the previous cycle” option
- The “maximum complication-specific mortality in the current cycle” option
- The “no complication-specific mortality, general population mortality is applied” option

Model Outcomes

- (Incremental) Costs by arm
- (Incremental) QALYs by arm
- Incremental cost effectiveness ratio

References

Duca LM, Wang B, Rewers M, Rewers A. Diabetic Ketoacidosis at Diagnosis of Type 1 Diabetes Predicts Poor Long-term Glycemic Control. Diabetes Care. 2017 Sep;40(9):1249-55. doi:http://dx.doi.org/10.2337/dc17-0558.

McQueen RB, Rasmussen CG, Waugh K, Frohnert BI, Steck AK, Yu L, et al. Cost and cost-effectiveness of large-scale screening for type 1 diabetes in Colorado. Diabetes Care. 2020 Jul;43(7):1496-503. doi:http://dx.doi.org/10.2337/dc19-2003.

Wolowacz S, Pearson I, Shannon P, Chubb B, Gundgaard J, Davies M, et al. Development and validation of a cost-utility model for Type 1 diabetes mellitus. Diabet Med. 2015 Aug;32(8):1023-35. doi:http://dx.doi.org/10.1111/dme.12663.