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Simulating the impact of changes in combined risk factor levels on life expectancy in older individuals with type 1 diabetes

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Abstract: Individuals with type 1 diabetes were shown to have life expectancies 10–12 years lower than the general population. However, most of the existing studies in type 1 diabetes did not quantify the relationship between combined values of risk factors for mortality and life expectancy. A recent study developed a risk-factor-based life expectancy table for individuals with type 1 diabetes, but it involved only individuals aged 50 years or younger (Tran-Duy et al. 2021). Life tables for the general population show that people who have survived to greater ages are expected to have longer lifespans. However, older patients with type 1 diabetes may have worse risk factors and are likely to have a history of diabetes-related complications which increase the risk of mortality. It is currently unclear how combined risk factor levels affect life expectancy in older people.

In this study a probabilistic discrete-time model was used to simulate the impact of changes in combined levels of important risk factors on life expectancy in older individuals with type 1 diabetes aged 60, 70 and 80 years. This patient-level model comprises an integrated system of 30 equations for predicting the occurrence of diabetes-related complications and death and progression of risk factors (Tran-Duy et al. 2020). Variables required as input for the simulations included 25 risk factors such as HbA1c, and 16 other auxiliary variables such as time since a complication. In addition to age, five other important risk factors were selected to examine the influence of the combinations of their levels on life expectancy. These factors (levels) included sex (male and female), current smoking status (smoker and non-smoker), BMI (20, 25, 30 and 35 kg/m^2), estimated glomerular filtration rate (eGFR; 30, 60, 90 and 120 ml min^{-1} 1.73 m^{-2}) and HbA1c (6, 8, 10 and 12 %). With these six risk factors, 768 synthetic cohorts were created, each representing a unique combination of the levels of the six risk factors. Values of other risk factors were sampled based on joint distribution of their values in the population of individuals with type 1 diabetes aged 60-80 years. For each synthetic cohort, the simulation was run until all individuals had died. The simulated results showed that life expectancies of older individuals with type 1 diabetes were strongly affected by combined levels of modifiable risk factors. There was a large difference in life expectancies within each age bracket. Patients with type 1 diabetes with optimal risk factor levels and who have survived to 80 years were expected to live as long as the general population. The simulated data suggest that the longer the patients have survived, the longer lifespans are expected.

In this presentation, the model structure and the simulation methods will be explained in greater detail. Application of the model and the simulated results in communications about the benefits of optimizing risk factors in patients with type 1diabetes will also be discussed.

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