Internal Validation of the Metabo-Reno-Cardiovascular Disease Model: Mortality in Type 1 Diabetes

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Background

- The Metabo-Reno-Cardiovascular Disease Model (MRCDM) is a patient-level model with individuals with or without diabetes (type 1 or 2), obesity (defined by BMI), CVD or chronic kidney disease.
- It was developed to predict the risk of complications and mortality in these individuals.
- To predict the risk of mortality in type 1 diabetes (T1D) in Western countries, different approaches are available: Swedish National Diabetes Registry (SweNDR)[1], Scottish Registry Linkage (SRL)[2] and case fatality combined with non-specific mortality.

Objectives

- This study aims to validate the prediction of mortality and life expectancy in individuals with T1D using the MRCDM.

Methods

- The MRCDM is a microsimulation model, with specific disease submodules and complications represented within a structure of Markov Health states.
- Individuals that enter the model can be with or without diabetes (type 1 or 2), obesity, CVD and chronic kidney disease.
- To predict mortality in Western countries in type 1 diabetes, 3 approaches can be used: the SweNDR[1] mortality equation, Scottish SRL[2] mortality data, or disease specific mortality (case and long-term fatality) combined with non-specific general mortality (UK).
- To predict CVD SweNDR[5] and SRL[2] risk options were applied.
- The model was populated with country specific baseline characteristics of two studies[4,2] and assuming no history of CVD.
- The EDIC risk factors progression equations were used[3].
- With the different approaches, life-expectancy (LE) predictions were compared to the Swedish and Scottish study outcomes.

Table 1 – MRCDM Cohort inputs

Baseline characteristics	Sweden	Scotland
HbA1c (%)	7.90	8.56
Start age (years)	23	22
Duration of diabetes (years)	0	0
Proportion male (%)	58	56
SBP (mmHg)	124	125
DBP (mmHg)	75	76
Total cholesterol (mg/dL)	180	181
HDL (mg/dL)	56	54
LDL (mg/dL)	103	106
Triglycerides (mg/dL)	103	108
BMI (kg/m²)	25.4	25.9
eGFR (mL/min/1.73m²)	102	102

HbA1c: hemoglobin A1c, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, HDL: High-density lipoprotein cholesterol, LDL: Low-density lipoprotein cholesterol, BMI: Body mass index, eGFR: Estimated glomerular filtration rate

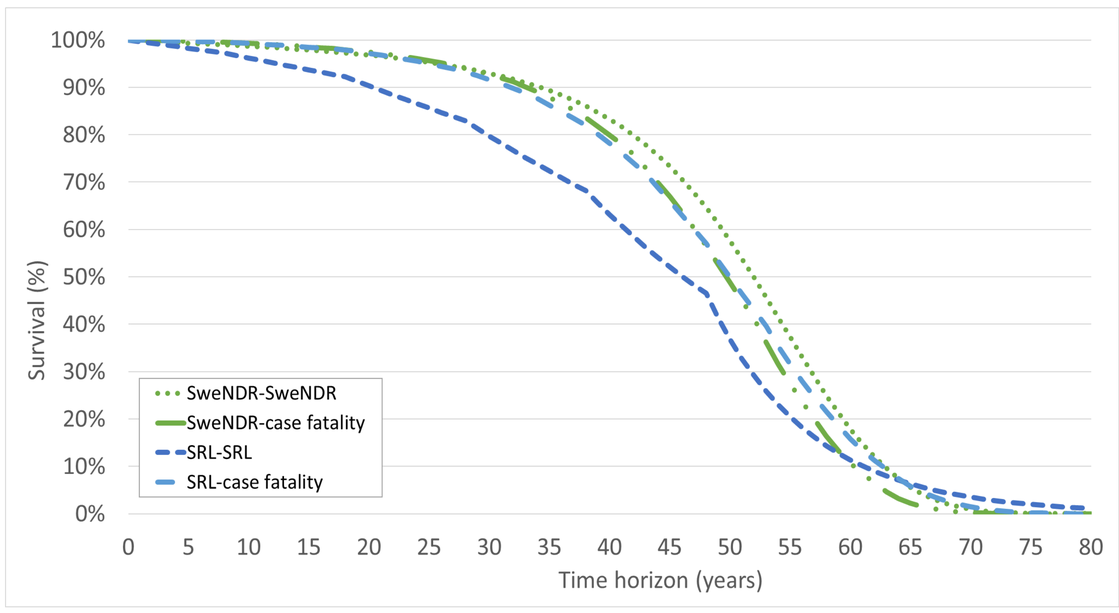
Table 2 – MRCDM predicted life expectancy

CVD equation options	Mortality approach	Predicted	Observed
SweNDR (Sweden)	SweNDR	75	74.6[4]
	Case fatality	73	
SRL (Scotland)	SRL	68	69.0[2]
	Case fatality	72	

Results

- In Table 2, the Swedish and Scottish observed life expectancy and the MRCDM predictions obtained with different cardiovascular and mortality risk options, covering different regions are shown.
- The MRCDM predictions are very similar to the clinical trial predicted life expectancies.
- Using the combination of case fatality combined with non-specific mortality, predictions show higher life expectancy for Scotland and lower for Sweden compared to the trial predicted outcomes.
- In Figure 1, the the MRCDM predicted survival curves are shown. The trials used as a source do not have this information available.
- The case fatality approach predicts similar survival for Sweden and Scotland despite the use of different CVD risk equations.

Figure 1 – MRCDM predicted long-term survival



Conclusions

- **For both Sweden and Scotland, the MRCDM predicts similar LE compared with the predictions of the source trials, with a variation of 2-4%.**

Want to know more about the MRCDM?
Contact: team@this2modeling.com

References

1. Tran-Duy A, Knight J, Palmer AJ, et al. A Patient-Level Model to Estimate Lifetime Health Outcomes of Patients With Type 1 Diabetes. Diabetes Care. 2020;43(8):1741-1749. doi:10.2337/dc19-2249
2. Livingstone SJ, Looker HC, Hothersall EJ, et al. Risk of Cardiovascular Disease and Total Mortality in Adults with Type 1 Diabetes: Scottish Registry Linkage Study. PLOS Med. 2012;9(10):e1001321. doi:10.1371/journal.pmed.1001321
3. Nathan DM. The Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications Study at 30 Years: Overview. Diabetes Care. 2014;37(1):9-16. doi:10.2337/dc13-2112
4. Rawshani A, Sattar N, Franzén SE, Rawshani A, Hattersley AT, Svensson AM, Eliasson B, Gudbjörnsdottir S. Excess mortality and cardiovascular disease in young adults with type 1 diabetes in relation to age at onset: a nationwide, register-based cohort study. The Lancet, Volume 392, Issue 10146, 477 - 486
5. Cederholm J, Eeg-Olofsson K, Eliasson B, Zethelius B, Gudbjörnsdottir S, Register on behalf of the SND. A new model for 5-year risk of cardiovascular disease in Type 1 diabetes; from the Swedish National Diabetes Register (NDR). Diabet Med. 2011;28(10):1213-1220. doi:10.1111/j.1464-5491.2011.03342.x