Internal Validation of the Metabo-Reno-Cardiovascular Disease Model: Mortality in Type 2 Diabetes

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th(is)² modeling DISEASE MODELING

Background

- Several generic disease models have been developed in cardiovascular disease (CVD), diabetes, obesity and kidney disease.
- These diseases have common comorbidities; thus, most of these models describe all of them to some extent, with some limitations.
- To the best of our knowledge, Metabo-Reno-Cardiovascular Disease Model (MRCDM) is the first model that fully integrates the impact of changes in a considerable amount of risk factors on the different diseases. Key drivers being the glycemic status and body weight.

Objectives

- This study aims to validate the prediction of mortality in individuals with type 2 diabetes 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, 2 approaches can be used: UKPDS82 mortality equations[1], or disease specific mortality (case and long-term fatality) combined with non-specific general mortality (UK).
- The model was populated with UKPDS specific baseline characteristics[1] and assuming no history of CVD.
- The UKPDS90 progression of risk factors equations were used[2].
- UKPDS82[1], Framingham[3-5] and the Swedish National Diabetes Registry (SweNDR)[6] CVD risk equations were applied.
- With the different approaches, Life-expectancy (LE) predictions were compared to the UKPDS study outcomes.

Table 1 – MRCDM Cohort inputs

Baseline characteristics	Value
HbA1c (%)	7.08
Start age (years)	53.3
Duration of diabetes (years)	0
Proportion male	61%
SBP (mmHg)	135
DBP (mmHg)	82
Total cholesterol (mg/dL)	209
HDL (mg/dL)	41
LDL (mg/dL)	135
Triglycerides (mg/dL)	208
BMI (kg/m²)	27.5
eGFR (mL/min/1.73m²)	82

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

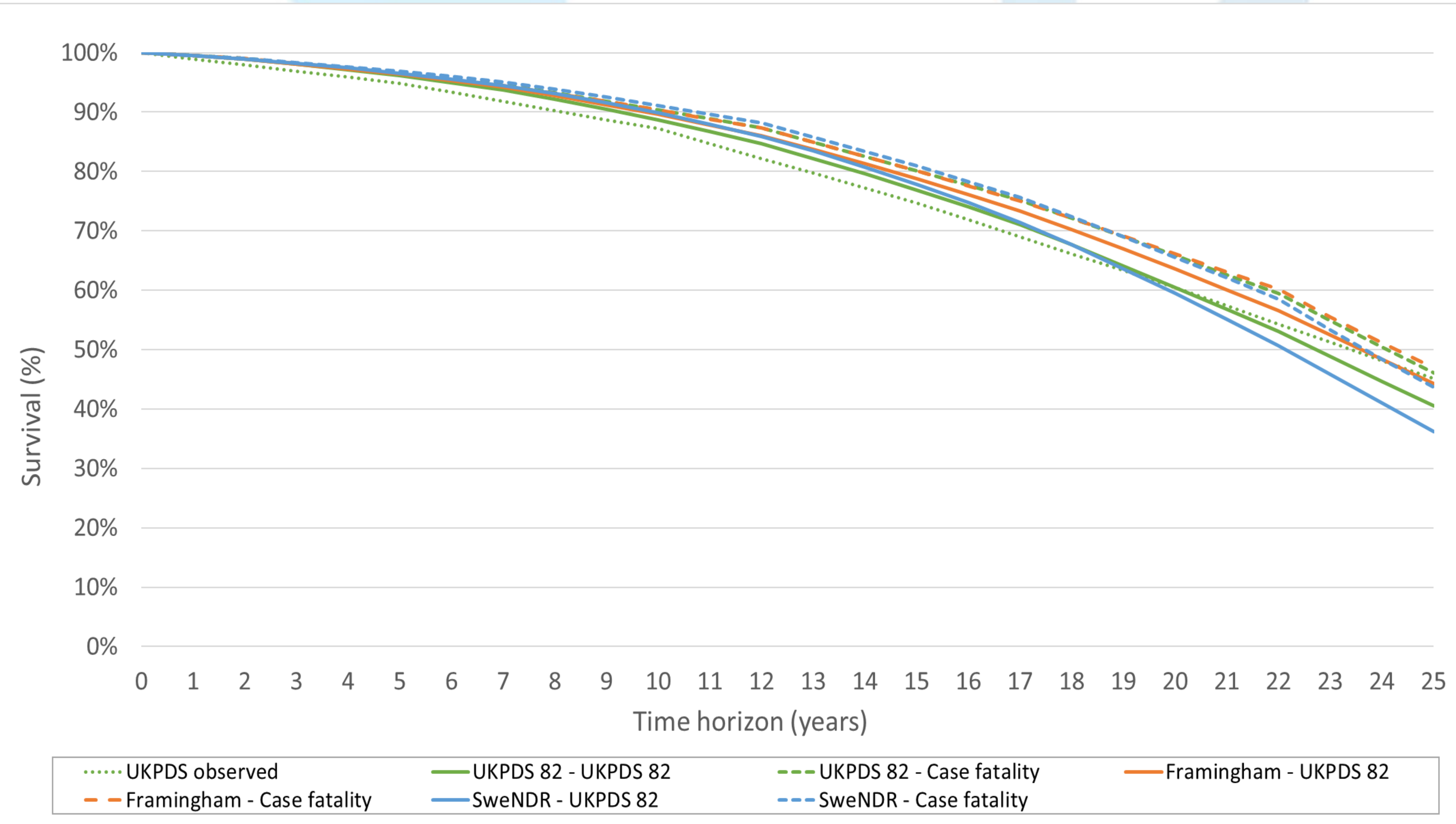
Table 2 – MRCDM predicted life expectancy

Equation / study		Predicted LE (in years)
UKPDS observed outcomes[1]		23.0
CVD equation	**Mortality approach**	
UKPDS 82	UKPDS 82	22.3
UKPDS 82	Case fatality	23.5
Framingham	UKPDS 82	23.0
Framingham	Case fatality	23.6
SweNDR	UKPDS 82	21.5
SweNDR	Case fatality	22.9

Results

- In Table 2, the UKPDS 82 observed life expectancy and the predictions obtained with three sets of MRCDM risk equations covering different regions are shown.
- Using the combination of short and long-term case fatality and non-specific mortality, results in slightly higher life expectancy compared to the UKPDS combined mortality approach. Nevertheless, the MRCDM predictions are similar to the observed data.
- In Figure 1, the UKPDS 82 observed survival and the MRCDM predicted survival are shown.
- Compared to the UKPDS 82 observed data, the MRCDM predicts lower annual mortality at younger ages and higher annual mortality at more advanced ages.
- This is the case, for both UKPDS 82 combined mortality approach and for the case fatality approach, independent of the CVD risk equations used.

Figure 1 – MRCDM predicted long-term survival



Conclusions

- **Independent of the mortality approach and the CVD risk equations selected, the MRCDM provides similar LE predictions to what is observed in the UKPDS 82 study.**
- **When comparing annual mortalities, the evolution over time is slightly different.**

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

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