Simulation model for lifetime prediction of complications in people with diabetes without previous cardiovascular disease using ASCEND risk equations

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Rationale

- Disease simulation models are used to synthesise clinical and economic data, and inform assessments of overall health effects and cost-effectiveness of interventions.
- Diabetes model recommended by NICE in the UK is the UKPDS Outcomes Model developed using patient data from 1977-2007, which over-predicts cardiovascular events and mortality in contemporary cohorts due to temporal changes in event rates[1].
- We propose a simulation model with new risk equations developed using a large contemporary well-curated dataset to predict outcomes in people with diabetes without cardiovascular disease.

Methods

- Simulation model uses parametric risk equations developed using data from 15480 participants in ASCEND[2] (people with diabetes without previous cardiovascular disease; study period 2005-2017; mean follow-up 7.4 years).
- Model predicts occurrence of complications each year over lifetime given one's baseline socio-demographic and clinical risk profile.
- We predict outcomes among ASCEND participants & 18250 UK Biobank (UKB) participants matching ASCEND eligibility criteria.

Baseline characteristics	ASCEND	UKB
Mean age (years)	63	59
Type 1 diabetes	6%	13%
Non-HDL cholesterol ≥3.5mmol/L	21%	37%
SBP ≥140mmHg	41%	51%
eGFR <90ml/min/1.73m^2	54%	61%
Microalbuminuria	13%	17%

Figure 1: Comparison of cumulative incidence observed (shaded region) vs predicted by the simulation model (line) over 10 years of follow-up

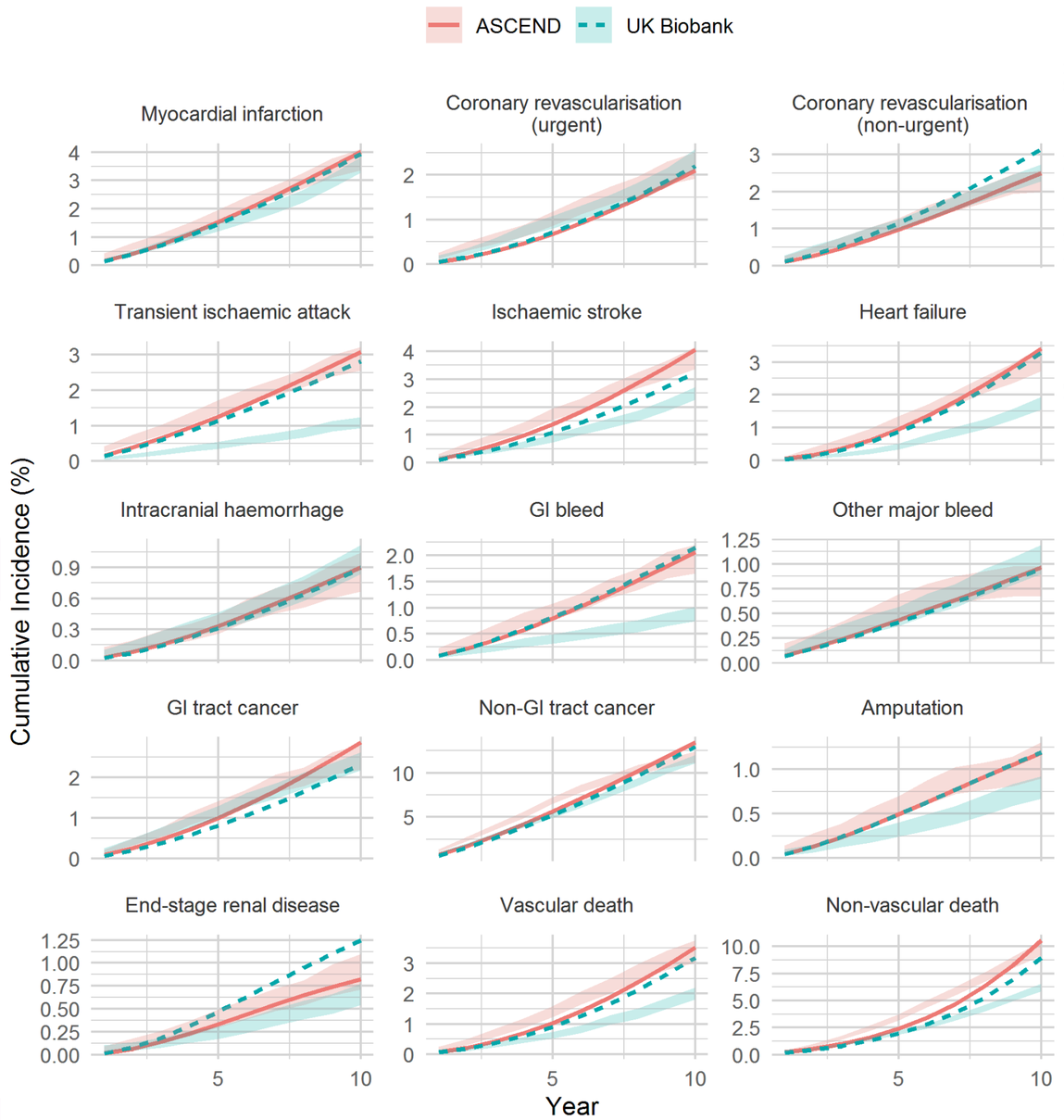
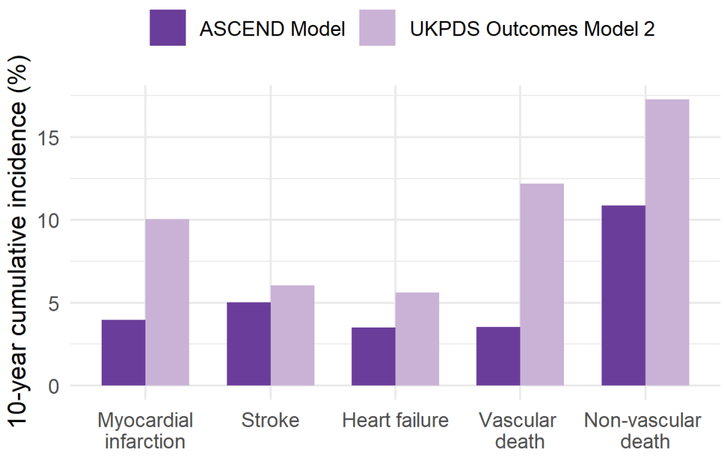


Figure 2: 10-year cumulative incidence among ASCEND participants with type 2 diabetes predicted by different simulation models



Results

- UKB cohort younger, but poorer lipid and blood pressure profile, and poorer renal function.
- Simulation model performed well for ASCEND and reasonably well for UKB.
- For UKB, discrepancies could be due to
  - mis-recordings or events not recorded in routine healthcare records which were used for identifying events;
  - differences in death rates not captured by ASCEND risk equations.
- Predicted life expectancies of participants with type 2 diabetes aged 60-70 was 17.7 years in ASCEND and 16.9 years in UKB, which is at least 5 years more than what would have been predicted by the UKPDS cohort[3], despite over-prediction of mortality.

References

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2. The ASCEND Study Collaborative Group. Effects of Aspirin for Primary Prevention in Persons with Diabetes Mellitus. *N Engl J Med*. 2018;379(16):1529-1539. doi:10.1056/NEJMoa1804988.
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Acknowledgements

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