# Patient-level modelling of long-term cardiovascular and mortality outcomes in chronic kidney disease

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**Abstract:** Chronic kidney disease (CKD) places a significant burden on healthcare systems and society (AIHW, 2024). While mortality is high among patients with end-stage kidney disease, more individuals with CKD die from cardiovascular disease (CVD) than from kidney failure itself (Tonelli et al, 2006). In recognition of the significant and increasing health and economic impact of CKD, Kidney Health Australia has recently developed a National Strategic Action Plan to address the burden of CKD in the Australian society (Kidney Health Australia, 2020). This Action Plan provides a national vision for preventing kidney disease, emphasizing the effective use of research, evidence and data for the action. Quantifying the long-term health and economic impact of CVD prevention in CKD patients is therefore essential for informed healthcare planning and efficient resource allocation.

Despite the well-established relationship between CKD and CVD, there are currently no simulation models available to quantify the long-term impacts of early CVD intervention in patients with CKD on both health and economic outcomes. This study aims to develop an individual-level simulation model to estimate lifetime disease progression and project lifetime incidence CVD events, kidney replacement therapy and mortality in patients with CKD.

Model development was based on data from the Clinical Practice Research Datalink (CPRD), linked with hospital and death records. Established in 1987, CPRD contains de-identified electronic medical records from over 2,000 UK general practices, covering 60 million patients as of November 2024 (CPRD, 2024). The model focuses on predicting major CVD events, including fatal and non-fatal myocardial infarction, fatal and non-fatal ischemic and haemorrhagic stroke, heart failure, percutaneous coronary intervention (PCI), coronary artery bypass grafting (CABG), peripheral vascular disease, and angina-related hospitalisation, as well as dialysis, kidney transplant, and mortality. Predictors include demographic, clinical, biochemical, and treatment-related variables, such as age, sex, deprivation index, SARS-CoV-2 infection, diabetes, cardiovascular history, blood pressure, lipid profiles, kidney function markers, and use of therapies including SGLT-2 inhibitors.

This presentation will detail the model development process, including event, medications and risk factor identification, equation construction for risk factor progression and event prediction, and integration of the equations into a comprehensive framework for simulations and uncertainty analysis. Preliminary results will highlight key predictors of CVD and mortality outcomes, interdependencies among events, and findings from internal validation. We will conclude with a discussion of the model's strengths, limitations, and potential applications in healthcare decision-making and economic evaluation.

## REFERENCES

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