

Facilitating external use with user-friendly interfaces: **a health policy model case study**

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Motivation:

what is a health policy model?

A health policy model is a tool to inform policy decisions by projecting people's life courses. Predictions include

- disease events
- life expectancy
- quality of life
- healthcare costs
- effects of treatments

positive (disease risk reduction) and negative (adverse effects)

Projections made over long time periods (eg lifetime)



Motivation:

why are health policy models needed?

Healthcare budgets are limited and not all treatments can be recommended even if effective

- Models show whether treatments are good value for money
- Health policy models are increasingly used by policy makers and clinicians
- In UK, cost-effectiveness analyses are required by NICE
 - Good-value-for-money: £20-30K per extra quality-adjusted life-year (QALY)
- Flexible models can help answer many policy questions
- Aim for transparency, reliability, reproducibility and **usability**



Motivation: how to facilitate usability?

	Transparency	Reliability	Usability
Release the code	yes	yes	no useRs only code mis-use
Publish equations and methods	yes (sort of)	yes (sort of)	no analysts only
Provide user-friendly interface	no black box	no	yes NB: user vs useR
Publish equations and methods and provide user-friendly interface	yes (sort of)	yes (sort of)	yes



SHARP CKD-CVD model: Shiny interface

← → ↻ ⓘ dismod.ndph.ox.ac.uk/kidneymodel/app/ 🔍 ☆

SHARP CKD-CVD outcomes model

Introduction

Model overview

Glossary

File specifications

Model parameters

Type of analysis

Patient characteristics

Treatment parameters

Annual healthcare costs

Introduction

The SHARP CKD-CVD outcomes model simulates long-term cardiovascular event rates, kidney disease progression, (quality-of-life adjusted) survival and healthcare costs associated with individual patient profiles and treatments. It can be applied to patient populations with moderate-to-severe chronic kidney disease who are over 40 years of age, and can be used with individual patients as well as groups of patients.

The model reports long-term projections as well as cost-effectiveness results comparing against the 'no treatment' strategy. The evaluated health outcomes and costs are reported separately for each treatment arm. The user can vary parameters to assess sensitivity of the results.

To perform the analysis, specify the required parameters using the 'Model parameter' tabs and click on the 'Run analyses' button on the [Results](#) tab. Please refer to the [User guide](#) and the [published manuscript](#) for further information.

The [Glossary](#) tab contains a list of commonly used definitions.

Citation

When referring to this program in publications, please cite the following references:



Case study: SHARP CKD-CVD model

Background

- Chronic kidney disease (CKD) increases cardiovascular (CV) risk
- Want to project long-term outcomes in CKD
 - cardiovascular events, CKD progression, life expectancy, quality of life, healthcare costs;
 - enable implementation of treatments to reduce cardiovascular risk
 - assess long-term effects and cost-effectiveness.
- Patient-level data from a trial
 - baseline characteristics, within-trial events
- Risk equations derived from the data
- Combined into a Markov model to do lifelong projections
 - validated internally and externally



SHARP CKD-CVD model: need for a user-friendly interface

- The model to be useful for NICE, other analysts, clinicians...
- User-friendly interface accessible from anywhere
- No need for knowledge / installation of R
- Adaptation to other scenarios/countries
 - national mortality rates
 - national healthcare costs
- Customising parameters in the current setting
 - treatment to be assessed
 - population characteristics
 - duration of treatment / time horizon
 - discount rate



SHARP CKD-CVD model: Shiny interface



<http://one-elevenbooks.com/shiny-or-the-truth/>

- Application accessed via a link
- The user only sees the front end
- All programs/data stored externally
- The front end can be modified using CSS themes, htmlwidgets, and JavaScript actions
 - fancy fonts, links, email addresses etc
 - error checking on data entry

<http://dismod.ndph.ox.ac.uk/kidneymodel/app/>



User-friendly interface: help with debugging and transparency

- Face validity debugging
 - Easier to do on a user-friendly interface (even for the developers!)
- Feedback from external users
- Running several models against a reference simulation
 - Mount Hood diabetes challenge: models predicting long-term outcomes in diabetes patients
 - everyone gets the same tasks (eg change in life expectancy after statin initiation)
 - core assumptions same for everyone
 - additional assumptions must be documented in a pre-defined template
 - the results are presented, compared and (usually) published
 - user-friendly interface enables replication



SHARP CKD-CVD model: conclusions

- SHARP CKD-CVD model is a novel resource for evaluating health outcomes and cost-effectiveness of interventions in CKD
- User-friendly web-based freely available interface aids model use
- Together with the published equations / methods helps ensure reliability of the underlying code and methods transparency
- The user can enter with their own parameter values and perform calculations in different settings
- User's perspective taken into account:
 - simple menus, straightforward navigation, pretty looks
 - detailed user-guide
 - example input/output files, file descriptions and default values
 - error checking at data entry could (partially) prevent inappropriate use
 - which parameters should be modifiable?



SHARP CKD-CVD model: challenges and discussion points

- Day-to-day support
 - Replying to queries, fixing bugs
 - R/package updates may break everything!
 - Not updating is not an option (according to our IT team)
- Is R the best option for such an interface?
 - Might Python be faster and/or have better visualisation capabilities?
 - C++?
- Do the benefits of releasing the code outweigh the risks?



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SHARP CKD-CVD model



essentially,
all models are wrong,
but some are useful

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