A Need for Change! A Coding Framework for Improving Transparency in Decision Modeling

Fernando Alarid-Escudero[1], Eline M. Krijkamp[2], Petros Pechlivanoglou[3], Hawre J. Jalal[4], Szu-Yu Zoe Kao[5], Alan Yang[6], Eva A. Enns[5]

[1]Center for Research and Teaching in Economics (CIDE), Drug Policy Program, [2]Erasmus MC Rotterdam, Epidemiology department, [3]The Hospital for Sick Children and University of Toronto, [4]University of Pittsburgh, Graduate School of Public Health, [5]University of Minnesota School of Public Health, Division of Health Policy and Management, [6]The Hospital for Sick Children

Background

- The use of **open-source** programming languages in **health decision sciences** is growing and has the potential to facilitate model transparency, reproducibility, and shareability
- However, **guidance** as to how to structure the required components of model building and analysis **is lacking**

Aim

To create a **generalizable** coding **framework** for model-based decision and cost-effectiveness analyses
"DARTH coding framework"

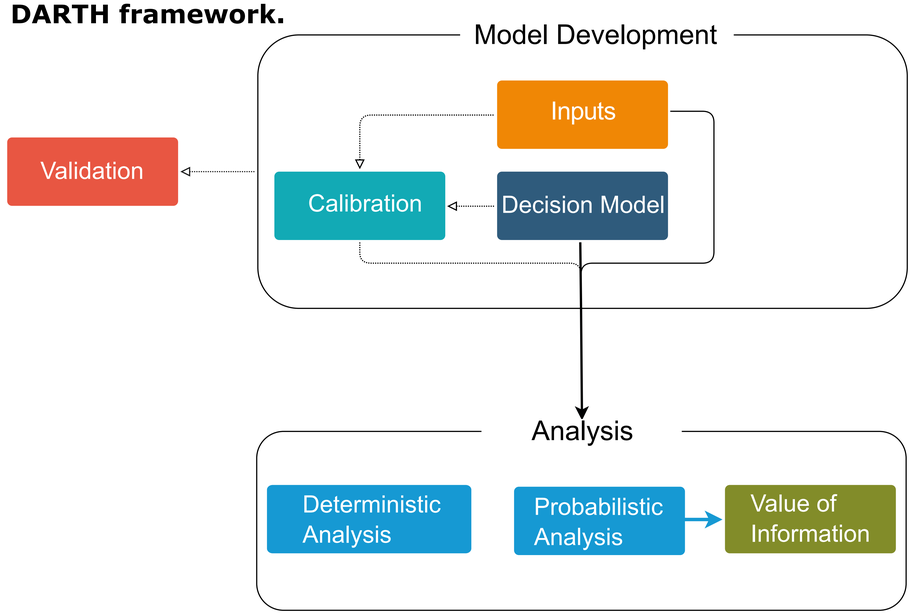
Components of a decision analysis

1) **Model inputs:** All model input variables x are declared and values are set
2) **Decision Model:** A function M that maps model inputs x to outputs y

$$x \rightarrow \boxed{\mathrm{M}(x)} \rightarrow y$$

3) **Calibration:** Unknown model parameters are estimated by calibrating model outputs to match specified calibration targets
4) **Validation:** Comparison of model outputs to other data sources not used in the model development
5) **Analysis**
   a. Probabilistic: Sets of input parameter values are randomly sampled from distributions
   b. Scenario and deterministic sensitivity analysis: The impact of individual or sets of parameters on model outcomes can be assessed systematically
   c. Value of information (VOI) analysis: To determine whether further potential research is needed

Schematic representation of the different components of the DARTH framework.



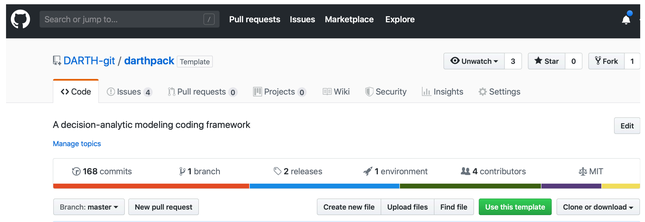
Naming convention

Prefix	Data type	Prefix	Variable type	Prefix	Variable type
<> (no prefix)	scalar	n	number	ly	life years
v	vector	p	probability	q	QALYs
m	matrix	r	rate	se	standard error
a	array	u	utility		
df	data frame	c	cost		
dtb	data table	hr	hazard ratio		
l	list	rr	relative risk		

Alarid-Escudero F, Krijkamp E, Pechlivanoglou P, Jalal H, Kao S-YZ, Yang A, Enns EA. A Need for Change! A Coding Framework for Improving Transparency in Decision Modeling. Pharmacoeconomics 2019. doi:10.1007/s40273-019-00837-x.

Key Attributes

- **A fully developed model-based cost-effectiveness analysis (CEA)** using a cohort state-transition model is provided
- A suggested **file folder structure and organization** that is easily customizable
- A consistent **naming convention** for variables and files that balances readability and brevity
- **Unit testing** with tests of units of code (often a function or a small process) to verify whether the code executes and generates outputs as intended
- **Version control** that manages changes to any components of the framework. Implemented on GitHub



- **Model transparency** through a detailed description of the model provided in RMarkdown
- **Graphical interface** through a Shiny app that allows users to modify the input parameters, rerun the model through the app's interface, and navigate through the updated results

DARTH coding framework as an R package!

- **`darthpack`** is hosted on GitHub
- To be used as a **template,** standalone **package**, or as modifiable **scripts**
- Website: https://darth-git.github.io/darthpack/

https://github.com/DARTH-git/darthpack

 No conflicts of interest

fernando.alarid@cide.edu @feralaes