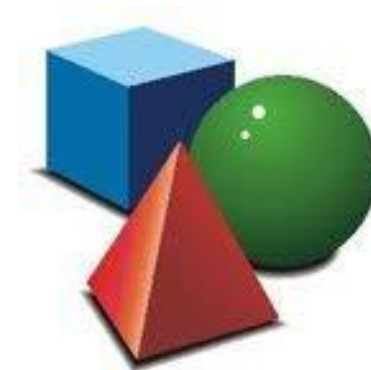


Health Economics in R: scoping workshop

Nathan Green

Imperial College London



Agenda: morning

Time	Item	Lead(s)
09.00	Arrival, registration, and refreshments	
09.30	Welcome and introduction	Nathan Green, Claire Thomson
10.00	Background and aims	Nathan Green
11.00	Break	
11.30	General overview of current tools for health economics <ul style="list-style-type: none">• Excel (20m)• TreeAge (20m)• R (and RStudio) (20m)	Mohamed Gad, Nathan Green, Lazaro Mwandigha
12.30	Lunch	

Agenda: afternoon

Time	Item	Lead(s)
12.30	Lunch	
13.30	Case studies using R for Health Technology Assessments (HTA)	Gianluca Baio
14.00	Identify health economic modelling needs & challenges	Nathan Green
14.30	Group needs and priorities	Nathan Green
15.00	Break	
15.30	Feedback, identify possible opportunities & solutions	Nathan Green
16.00	Effective development of research software: Communication, collaboration and iteration!	Jeremy Cohen
16.30	Next steps/roadmap/wrap-up	Nathan Green
17.00	Close	

Who are we?

- Department of Infectious Disease Epidemiology, School of Public Health, imperial College London
- We are one of the largest academic departments specialising in infectious disease epidemiology in Europe
- Highly interdisciplinary research focuses on the transmission, evolution and control of infectious diseases in human and animal populations
- Work spans a wide range of disease areas, including emerging infectious diseases, HIV, malaria, tuberculosis, polio, influenza, mosquito-borne viral infections, sexually transmitted infections, neglected tropical diseases (NTDs), and bacterial and fungal infections
- Close partnership e.g. Public Health England and the World Health Organisation (WHO)
- NIHR health Protection Research Unit for Modelling Methodology



Who are you?

Workshop background

- Health economics is concerned with efficiency, effectiveness, value and behaviour in health and healthcare
- Health economics, and more generally medical decision making, is an increasingly important and popular research field
- Those applying health economics range broadly, including governments (e.g. ACIP in the US, and JCVI in the UK), donors (e.g. BMGF) and international organizations (e.g. WHO)

New challenges

- Wider or more complex context than previously (e.g. precision medicine)
- “Big Data”
- Combining varied data types (e.g. administrative, survey, clinical trials)
- Making decisions under multiple uncertainties
- Infectious disease modelling
- Multiple stake-holders, e.g. patients, hospitals and governments
- ...

Aims for today

- Identify gaps and opportunities for R tools
- Kick start prototypes of functions, data and packages to be released publicly (e.g. CRAN), as well as training courses in using the new tools and papers
- To set-up new networks to promote the exchange of ideas, best practice, and other research goals
- To propose future collaboration and projects
- To feed into future hackathons

Clarify the modelling needs

Answer the following questions:

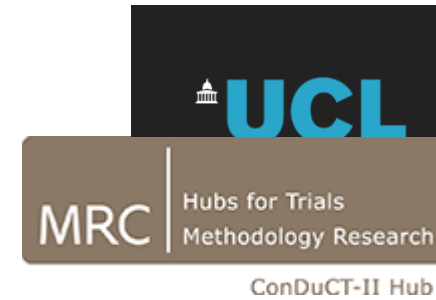
- What are the issues with current software?
- What can and should the new tools do better?
- What is the demand for these tools and by whom?
- Why do these need to be addressed? What will happen if they aren't?
- How wide spread is the issue? How long has it been a problem and what the impact?
- What evidence is there of this?

Longer term aims

- Our goal is to develop novel, user-friendly analysis tools for widespread adoption to enable better-informed, rapid decision making by health economists, practitioners and others using widely available software
- Packages that will be published on the public code repository GitHub and CRAN
- Papers accompanying packages and their applications (Journal of Scientific Computing, Medical Decision Making,...)
- Established collaborations and further grant proposals

R for trial and model-based cost-effectiveness analysis

11 July 2018, University College London



- One-day workshop on the use of R for trial and model-based cost-effectiveness analysis (CEA)
- jointly organised by a consortium of researchers at various institutions (UCL, University of York, University of Oxford and Bangor University), led by the MRC Hubs for Trials and Methodology and Research Conduct-II.
- The Scientific Committee include: Howard Thom, Gianluca Baio, Anthony Hatzswell, Dyfrig Hughes, Chris Jackson, Marta Soares, Claire Williams, Nicky Welton, Padraig Dixon, Bobby Mihaylova and Iryna Schlackow.
- Funding for the workshop has been provided by the MRC Network of Hubs for Trials Methodology Research and the UCL Research Group Statistics for Health Economics.
- Aims
 - Explore the use of R for CEA as an alternative
 - Present a wide range of technical aspects, including a discussion of the many available add-on packages to help users get the most out of R for CEA.
 - Presentations and public discussions address the computational and transparency advantages of R over MS Excel for CEA and for easing collaboration.
- The speakers have diverse experience in government (including NICE), academia and industry.

Some relevant references

- Tosh J, Wailoo A, *Review of Software for Decision Modelling*, DSU Report, 2008
- Chase Hollman, Michael Paulden, Petros Pechlivanoglou, Christopher McCabe, *A comparison of four software programs for implementing decision analytic cost effectiveness models*, PACEOMICS Working Paper
- Menn P, Holle R. *Comparing Three Software Tools for Implementing Markov Models for Health Economic Evaluations*, *PharmacoEconomics* 2009;27:745–53.
- Jiaru Bai, Cristina del Campo, L. Robin Keller, *Markov chain models in practice: A review of low cost software options*, January 2017, *Investigacion Operacional* 38(1):56-62
- *Cost Effectiveness Modelling for Health Technology Assessment*, Edlin, Richard, McCabe, Christopher, Hulme, Claire, Hall, Peter, Wright, Judy

Software used for NICE Technology Appraisals

[from REVIEW OF SOFTWARE FOR DECISION MODELLING. DECISION SUPPORT UNIT,

Jon Tosh and Allan Wailoo]

Software	Respondents that used this software		Number of TAGs	Number of Manufacturers	Number of Consultancies
	n	%			
MS Excel	28	100%	6	14	8
TreeAge Pro	16	57%	6	7	3
WinBUGS	6	21%	1	2	3
R	5	18%	1	2	2
Arena	3	11%	0	2	1
SAS	3	11%	0	1	2
Crystal Ball	2	7%	1	0	1
Simu8	2	7%	1	0	1
STATA	1	4%	1	0	0
RevMAN	1	4%	1	0	0
Borland Delphi	1	4%	1	0	0
S-PLUS	1	4%	1	0	0
@risk	1	4%	0	0	1
STELLA	0	0%	0	0	0
Witness	0	0%	0	0	0

Important definitions

Transparency

- Eddy *et al.* state that
“transparency refers to the extent to which interested parties can review a model's structure, equations, parameter values, and assumptions.”. They identify two levels at which this is important; the first is to allow a general understanding of the model and the second a more technical understanding of the model.

Validation

- Validation complements transparency as a “... set of methods for judging a model's accuracy in making relevant predictions.”. They list five main types of validation: face validity, verification (“internal validity”), external validity and predictive validity. In this work validation refers primarily to verification which “... addresses whether the model's parts behave as intended and the model has been implemented correctly.”. [32]

Learning Curve

- Concerned with the ease with which a neophyte could acquire the skill necessary to implement cost-effectiveness model in the software.
- What is there to support the necessary skill acquisition, including worked examples, manuals, training videos and courses, but also whether any additional background knowledge such as basic programming concepts, are necessary.

Capability

- Scope of what is technically possible in the software
 - E.g. while TreeAge is competent across a diverse array of models they are not extensible; i.e. adding new types of analyses can only be done by the company. The growing literature on and interest in methods for approximating computationally burdensome VOI is a prime example, of an capability that users might wish to have access to, but which they must wait for the company to implement.

Computational speed

- Critical component of cost-effectiveness modelling software because it is one of the key determinants of
 - how long it will take to produce a given analysis
 - scope of analyses that are feasible within the time available for a project
- Complex models increase the computational burden and when performing multi-stage Monte-Carlo simulations, any inefficiency in model implementation is exacerbated
- Marked differences in the time it takes to run simulations has implications for the costs of undertaking research and for the ability to use decision analytic modelling as part of research and design processes and iterative evaluation processes

Summary

- This is an informal workshop
 - Attendee involvement is important
- We want to hear what you think
 - opinions, gripes
 - but also what works. If it aint broke don't fix it! What can we learn from success
- Enjoy the day

Questions?