Peer Models Network

Peer Models Network: Decision-Analytic Models on the Cloud

Mohsen Sadatsafavi
The University of British Columbia

R for HTA - 2021

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Disclosures & Acknowledgements

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- This is a team work!
  - **Stephanie Harvard**
  - **Amin Adibi**

Evaluation Platform In COPD (EPIC)

- A Discrete Event Simulation Model
- Interface in R
- Core engine in C/C++ (Rcpp)
- ~3,900 lines of R / ~3,900 lines of C/C+
- Our‘pledge’ was to make the model open-source and easily accessible

GLOBAL HEALTH | CEA REGISTRY http://ghcearegistry.com/orchard/about-the-clearinghouse

GitHub: https://github.com/resplab/epicR

Sadatsafavi M, et al. Development and Validation of the Evaluation Platform in COPD (EPIC): A Population-Based Outcomes Model of COPD for Canada. *Med Decis Making*. 2019

How feasible is to ‘review’ the code?

```
// -*- mode: C++; c-indent-level: 4; c-basic-offset: 4; indent-tabs-mode: nil; -*-

#include <RcppArmadillo.h>
// [[Rcpp::depends(RcppArmadillo)]]
using namespace Rcpp;

/*
Layout:
1. Basic
2. Settings
3. Random
4. Input
5. Output
6. Agent
7. Event
8. Model
*/


#define OUTPUT_EX_BIOMETRICS 1 //height, weight etc;
#define OUTPUT_EX_SMOKING 2
#define OUTPUT_EX_COMORBIDITY 4
#define OUTPUT_EX_LUNG_FUNCTION 8
#define OUTPUT_EX_COPD 16
#define OUTPUT_EX_EXACERBATION 32
#define OUTPUT_EX_GPSYMPTOMS 64
#define OUTPUT_EX_MORTALITY 128
#define OUTPUT_EX_MEDICATION 256
#define OUTPUT_EX_POPULATION 512

#define OUTPUT_EX 65535


#define MAX_AGE 111

#define MAX_AGE 111

```

EPIC: Accessibility

An R package:

remotes::install_github("RESPlab/epicR")

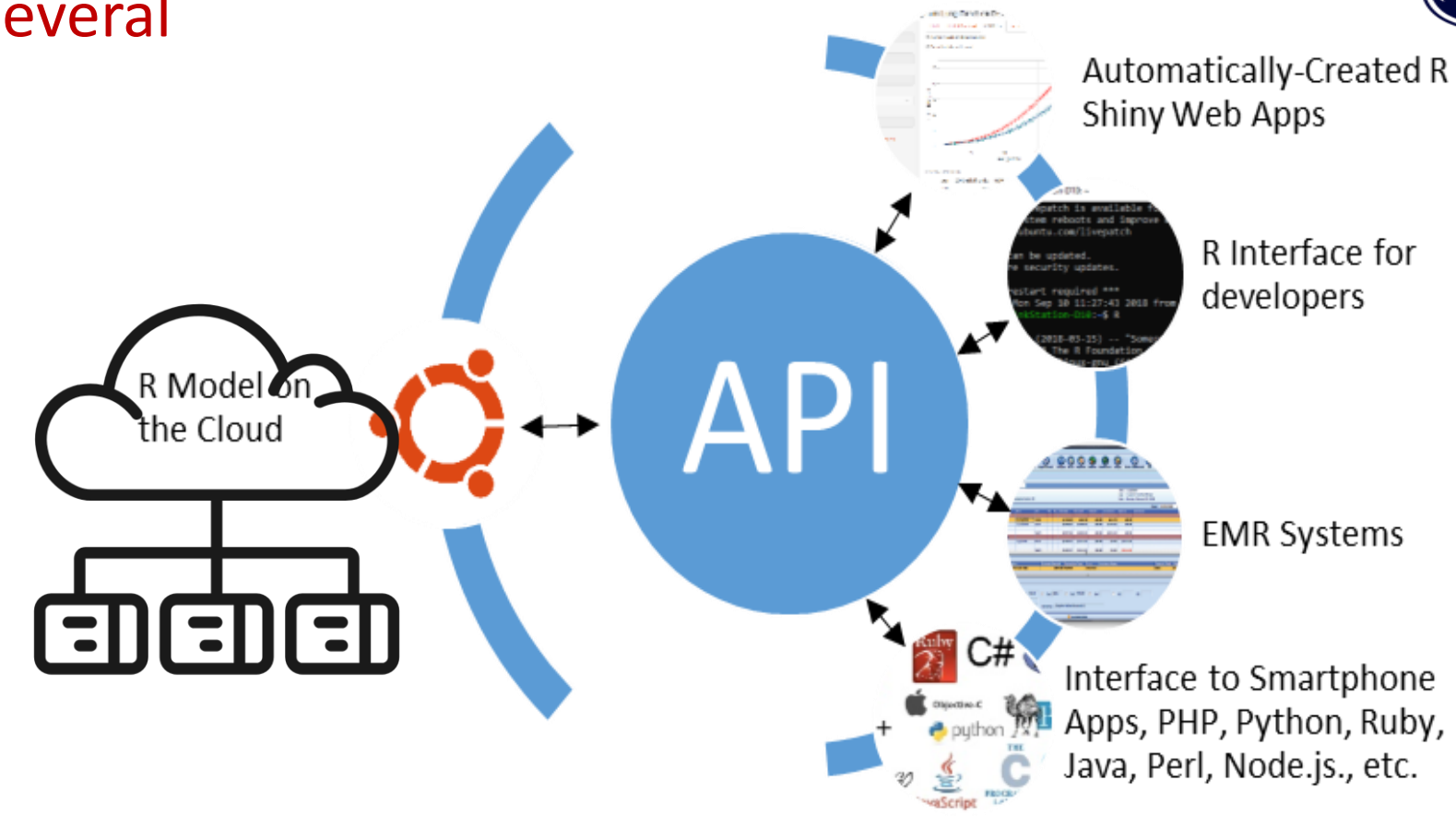
```
package 'vctrs' successfully unpacked and MD5 sums checked
package 'utf8' successfully unpacked and MD5 sums checked
package 'fansi' successfully unpacked and MD5 sums checked
package 'ellipsis' successfully unpacked and MD5 sums checked
package 'crayon' successfully unpacked and MD5 sums checked
package 'cli' successfully unpacked and MD5 sums checked
package 'magrittr' successfully unpacked and MD5 sums checked
package 'purrr' successfully unpacked and MD5 sums checked
package 'pkgconfig' successfully unpacked and MD5 sums checked
package 'pillar' successfully unpacked and MD5 sums checked
package 'tidyselect' successfully unpacked and MD5 sums checked
package 'tibble' successfully unpacked and MD5 sums checked
package 'generics' successfully unpacked and MD5 sums checked
package 'fastmap' successfully unpacked and MD5 sums checked
package 'cachem' successfully unpacked and MD5 sums checked
package 'bit' successfully unpacked and MD5 sums checked
package 'plogr' successfully unpacked and MD5 sums checked
package 'memoise' successfully unpacked and MD5 sums checked
package 'DBI' successfully unpacked and MD5 sums checked
package 'blob' successfully unpacked and MD5 sums checked
package 'bit64' successfully unpacked and MD5 sums checked
package 'proto' successfully unpacked and MD5 sums checked
package 'stringi' successfully unpacked and MD5 sums checked
package 'withr' successfully unpacked and MD5 sums checked
package 'isoband' successfully unpacked and MD5 sums checked
package 'digest' successfully unpacked and MD5 sums checked
package 'cpp11' successfully unpacked and MD5 sums checked
package 'dplyr' successfully unpacked and MD5 sums checked
package 'stringr' successfully unpacked and MD5 sums checked
package 'plyr' successfully unpacked and MD5 sums checked
package 'BH' successfully unpacked and MD5 sums checked
package 'hms' successfully unpacked and MD5 sums checked
package 'clipr' successfully unpacked and MD5 sums checked
package 'chron' successfully unpacked and MD5 sums checked
package 'RSQLite' successfully unpacked and MD5 sums checked
package 'gsubfn' successfully unpacked and MD5 sums checked
package 'ggplot2' successfully unpacked and MD5 sums checked
package 'RcppArmadillo' successfully unpacked and MD5 sums checked
package 'tidyr' successfully unpacked and MD5 sums checked
package 'reshape2' successfully unpacked and MD5 sums checked
package 'readr' successfully unpacked and MD5 sums checked
package 'sqldf' successfully unpacked and MD5 sums checked
package 'ggthemes' successfully unpacked and MD5 sums checked

The downloaded binary packages are in
        C:\Users\msafavi\AppData\Local\Temp\Rtmpq8raJ4\downloaded_packages
Running `R CMD build`...
* checking for file 'C:\Users\msafavi\AppData\Local\Temp\Rtmpq8raJ4\remotes3d0c40896918\resplab-epicR-7ceee3e/DE
SCRIPTION' ... OK
* preparing 'epicR':
* checking DESCRIPTION meta-information ... OK
* cleaning src
* checking for LF line-endings in source and make files and shell scripts
* checking for empty or unneeded directories
Omitted 'LazyData' from DESCRIPTION
* building 'epicR_0.28.1.999.tar.gz'
Installing package into 'C:/Users/msafavi/Documents/R/win-library/4.1'
(as 'lib' is unspecified)
* installing *source* package 'epicR' ...
** using staged installation
** libs

*** arch - i386
Warning in system(cmd) : 'make' not found
ERROR: compilation failed for package 'epicR'
* removing 'C:/Users/msafavi/Documents/R/win-library/4.1/epicR'
Warning messages:
1: In missing_devel_warning(pkgdir) :
  Package epicR has compiled code, but no suitable compiler(s) were found. Installation will likely fail.
  Install Rtools (https://cran.r-project.org/bin/windows/Rtools/).Then use the pkgbuild package, or make sure th
at Rtools in the PATH.
2: In i.p(...) :
  installation of package 'C:/Users/msafavi/AppData/Local/Temp/Rtmpq8raJ4/file3d0c63065ce5/epicR_0.28.1.999.tar.
gz' had non-zero exit status
```

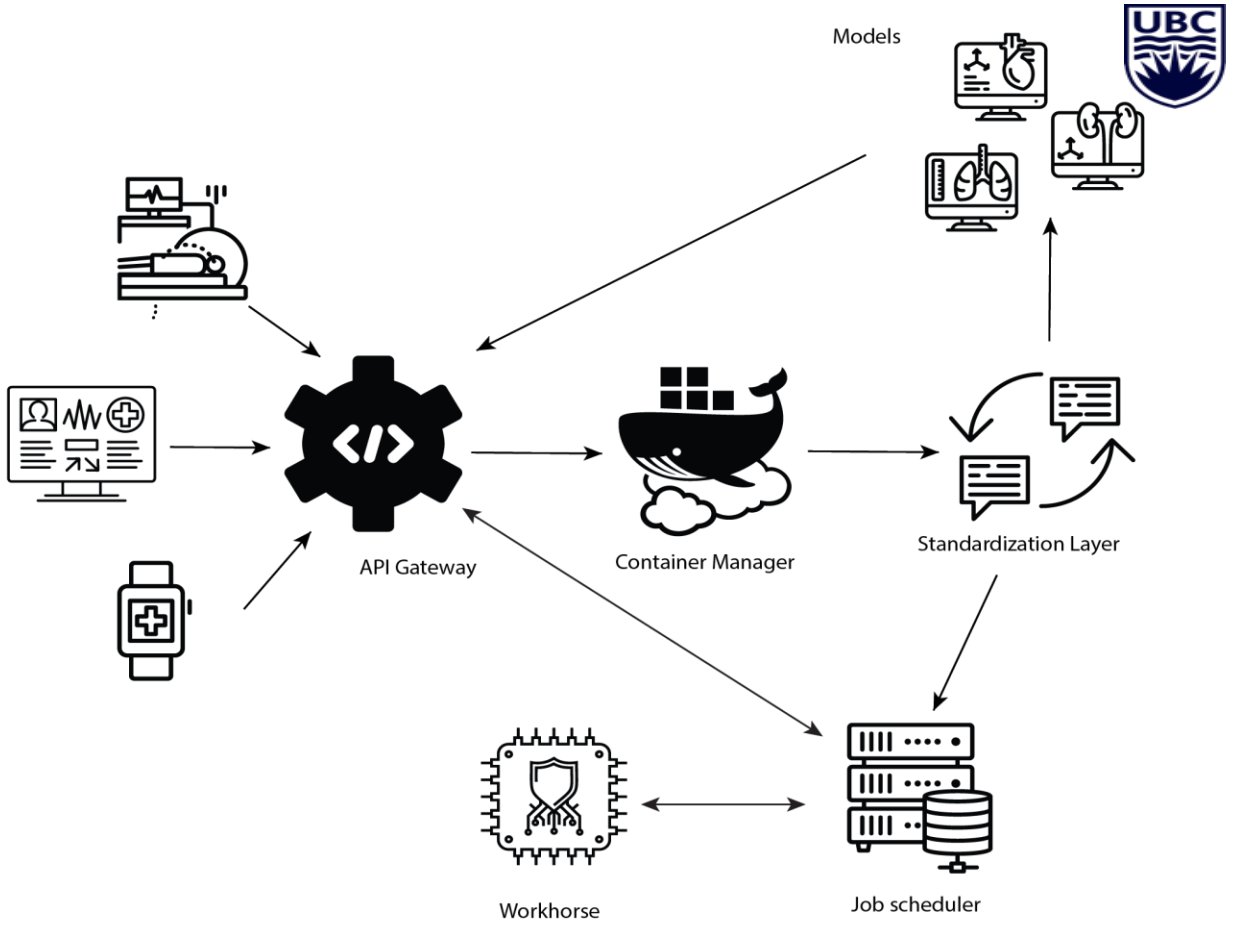
Shiny is good, but …

A proper Application Programming Interface (API) can have several benefits



Programmable Interface For Statistical & Simulation Models (PRISM)

- Stateless server instance contained within Docker
- (Selected) functions are exposed via Restful API
- Data are communicated in JSON
- Customized management via API key
- Sync and Async* runs



*Under development

http://resp.core.ubc.ca/research/Specific_Projects/PRISM

Documentation

9 EPIC

Field	Value
Model Name	Evaluation Platform in COPD (EPIC)
Modelling Team	RESP
Publication	doi:10.1177%2F0272989X18824098
Outcome	Patient-level outcomes, as well as mortality, prevalence, QALYs, costs, etc.
Video	The EPIC Model in 2 Minutes
Interviews	Mohsen Sadatsafavi on the EPIC Model
R Package	epicR
Excel Sheet	PC Version
API User Guide	Link

https://resplab.github.io/prismguide/epic.html

How does it look on the client side?

```
library(peermodels)

model_input <- get_default_input("epic",api_key="MY_API_KEY")

summary(model_input)

model_input$global_parameters.time_horizon <- 10

res <- model_run(input=model_input, model_name="epic")

res$status

summary(res)

draw_plots(1)
```

Disclaimer: peermodels is still under development and until version 1.0 is released server status will be unstable

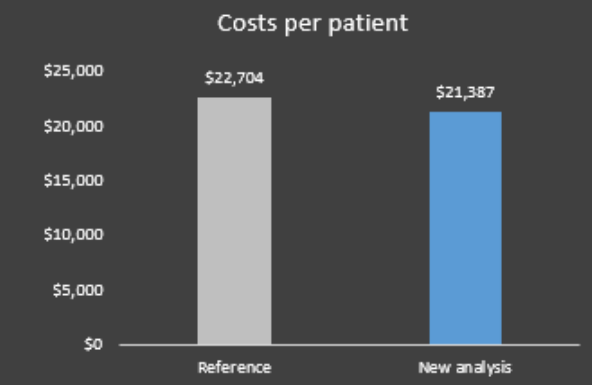
How does it look on the client side?

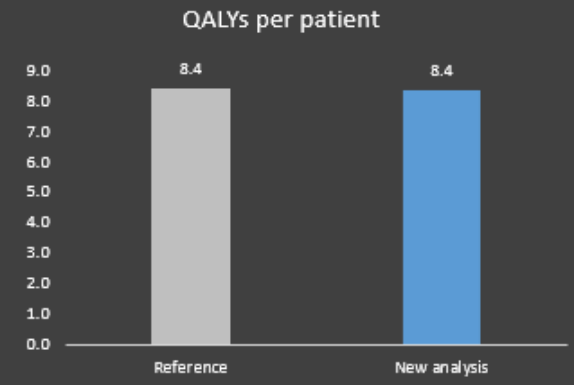
Connect to Model | Run

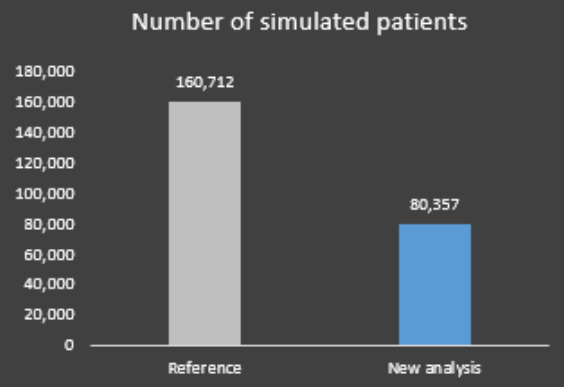
Summary of Outcome	
Total number of agents simulated	80357
Total person-years simulated	1095846.213
Total number of deaths during the simulation	18451
Total number of COPD patients	11968
Total pack years	976572.7903
Total costs (2015$)	255961437.3
Total QALYs	674427.7212

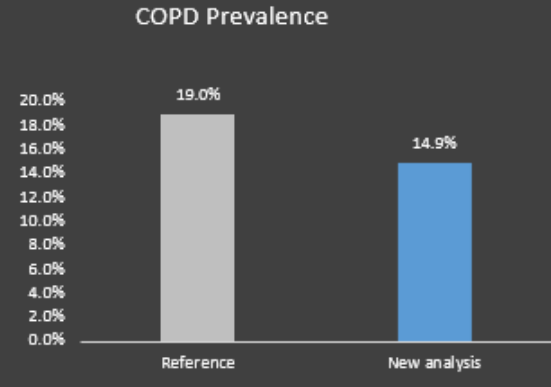
Cost and Utility	Reference	New Analysis
Cost per patient	$22,704	$21,387
QALYs per patient	8.4	8.4

Number of Simulated Patients Plot		
	Reference	New analysis
Reference N	160,712	80,357
Proportion died	0.220388023	0.229612853
COPD prevalence	19.0%	14.9%









Future Directions

- The entire pipeline should be transferrable

- Naming and formatting conventions for API functions for standard tasks
  - Model run, getting default inputs, updating inputs, CEA, PA, …

- Documentation

- Parallel processing

- Log and tracking

Thank you

Email: msafavi@mail.ubc.ca

Peer Models Network: https://www.peermodelsnetwork.com/

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