

Models on the Peer Models Network

Amin Adibi, Stephanie Harvard, Mohsen Sadatsafavi

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Contents

| | | |
|-----------|-------------------------|-----------|
| 1 | Introduction | 5 |
| 2 | ACCEPT | 7 |
| 3 | BODE | 9 |
| 4 | CFMortality | 11 |
| 5 | CHDWilson | 13 |
| 6 | CODEXCOPD | 15 |
| 7 | COVIDSEIR | 17 |
| 8 | CVDAnderson | 19 |
| 9 | EPIC | 21 |
| 10 | FEV1 | 23 |
| 11 | QRISK3 | 25 |
| 12 | API Users' Guide | 27 |
| 12.1 | ACCEPT | 27 |
| 12.2 | BODE | 28 |
| 12.3 | EPIC | 29 |
| 12.4 | FEV1 | 29 |

| | |
|----------------------------|----|
| 12.5 CVDAnderson | 30 |
| 12.6 CHDWilson | 30 |
| 12.7 CFMortality | 31 |
| 12.8 QRISK3 | 31 |
| 12.9 CODEXCOPD | 32 |
| 12.10COVIDSEIR | 32 |

Chapter 1

Introduction

This user guide includes information about models hosted on the Peer Models Network.

Chapter 2

ACCEPT

| Field | Value |
|----------------|--|
| Model Name | Acute COPD Exacerbation Prediction Tool (ACCEPT) |
| Modelling Team | RESP |
| Publication | doi:10.1016/S2213-2600(19)30397-2 |
| Purpose | Predict probability, rate, and severity of COPD exacerbations |
| Video | The ACCEPT Model in 90 Seconds |
| Interviews | Amin Adibi on the ACCEPT Model for COPD: Why and How |
| Media | COPD exacerbations: finally, a more than ACCEPTable risk score |
| Web App | ACCEPT web App |
| R Package | accept |
| Excel Sheet | PC Version |
| API User Guide | Link |

Chapter 3

BODE

| Field | Value |
|----------------|--|
| Model Name | The Body-Mass Index, Airflow Obstruction, Dyspnea, and Exercise Capacity Index |
| Modelling Team | Celli et al. |
| Publication | 10.1056/NEJMoa021322 |
| Outcome | Mortality Risk |
| R Package | bode |
| API User Guide | Link |

Chapter 4

CFMortality

| Field | Value |
|----------------|--|
| Model Name | Mortality prediction models in cystic fibrosis |
| Modelling Team | Stanojevic et al. |
| Publication | 10.1183/13993003.00224-2019 |
| Outcome | Mortality Risk |
| Video | |
| R Package | cfmortality |
| API User Guide | Link |

Chapter 5

CHDWilson

| Field | Value |
|----------------|--|
| Model Name | Prediction of Coronary Heart Disease Using Risk Factor Categories |
| Modelling Team | Wilson et al. |
| Publication | 10.1161/01.CIR.97.18.1837 |
| Outcome | Coronary Heart Disease |
| Excel Sheet | PC Version |
| R Package | chdwilson |
| API User Guide | Link |

Chapter 6

CODEXCOPD

| Field | Value |
|----------------|---|
| Model Name | The CODEX (comorbidity, obstruction, dyspnea, and previous severe exacerbations) Index |
| Modelling Team | Almagro et al. |
| Publication | 10.1378/chest.13-1328 |
| Outcome | Survival and readmission at both 3 months and 1 year after hospital discharge for a COPD exacerbation |
| R Package | codexcpd |
| API User Guide | Link |

Chapter 7

COVIDSEIR

| Field | Value |
|----------------|---|
| Model Name | Bayesian SEIR model to estimate physical-distancing effects |
| Modelling Team | Anderson et al. |
| Publication | 10.1101/2020.04.17.20070086 |
| Outcome | COVID-19 Cases |
| R Package | covidseir |
| API User Guide | Link |

Chapter 8

CVDAnderson

| Field | Value |
|----------------|--|
| Model Name | Prediction of Coronary Heart Disease Using Risk Factor Categories |
| Modelling Team | Anderson et al. |
| Publication | 10.1016/0002-8703(91)90861-B |
| Outcome | CHD, MI, CHD Mortality, Stroke, CVD, CVD Mortalitye |
| R Package | cvdanderson |
| API User Guide | Link |

Chapter 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 |

Chapter 10

FEV1

| Field | Value |
|----------------|--|
| Model Name | Individualized prediction of lung-function decline in COPD |
| Modelling Team | RESP |
| Publication | doi:10.1503/cmaj.151483 |
| Outcome | Lung function over next 11 years |
| Web App | FEV1 web App |
| Excel Sheet | PC Version |
| R Package | fev1 |
| API User Guide | Link |

Chapter 11

QRISK3

| Field | Value |
|----------------|--|
| Model Name | 10-Year Cardiovascular Disease Risk Calculator |
| Modelling Team | Hippisley-Cox et al. |
| Publication | 10.1136/bmj.j2099 |
| Outcome | 10-yr risk of heart attack/stroke |
| R Package | QRISK3 |
| API User Guide | Link |

Chapter 12

API Users' Guide

Peer Models Network is an initiative to make models for healthcare decision-making accessible, transparent and interpretable to all British Columbians. With support from the Canada Foundation for Innovation, BC SUPPORT Unit and BC Academic Health Science Network, the Peer Models Network (PMN) aims to increase engagement between the modelling community and policymakers, interdisciplinary scholars, patients, journalists, and other members of the public.

The PMN centres around a software infrastructure called the Programmable Interface for Statistical and Simulation Models (PRISM). PRISM hosts models on the cloud and provides standard Application Programming Interfaces (APIs) that allows users of different levels of technical backgrounds to interact with models hosted on a cloud. Users can submit queries to cloud-hosted models through a multitude of software platforms, including Microsoft Excel, R, Python, bash scripts, Javascript and custom web apps. This enables direct access to users who lack either the software or hardware infrastructure or the technical expertise to set up models on their own devices. It also enables more technical users to integrate modes with other pieces of software.

In its current implementation, PRISM can hosts models that are developed in R, including those that use Cpp and STAN.

Synchronous APIs calls are currently implemented and support for asynchronous calls that are required by extra long processing times is under active development.

12.1 ACCEPT

Cloud Access through R

Users can access models on the Peer Models Network using the `peermodels` R package, available on GitHub. The following code snippet illustrates how you can run the model for example patients provided in the `accept` package:

```
remotes::install_github (resplab/peermodels)
library(peermodels)
connect_to_model("accept", api_key = YOUR_API_KEY)
input <- get_default_input()
results <- model_run(input)
```

Cloud Access through Python

```
import json
import requests
url = 'https://prism.peermodelsnetwork.com/route/accept/run'
headers = {'x-prism-auth-user': YOUR_API_KEY}
model_run = requests.post(url, headers=headers,
json = {"func":["prism_model_run"],"model_input":[{"ID": "10001","male": 1,"age": 57,"smo
print(model_run)
results = json.loads(model_run.text)
print(results)
```

Cloud Access through Linux Bash

In Ubuntu, you can call the API with `curl`:

```
curl \
-X POST \
-H "x-prism-auth-user: REPLACE_WITH_API_KEY" \
-H "Content-Type: application/json" \
-d '{"func":["prism_model_run"],"model_input":[{"ID": "10001","male": 1,"age": 57,"smo
https://prism.peermodelsnetwork.com/route/accept/run
```

12.2 BODE

Cloud Access through R

Users can access models on the Peer Models Network using the `peermodels` R package, available on GitHub. The following code snippet illustrates how you can run the model for example patient provided in the `bode` package:

```
remotes::install_github (resplab/peermodels)
library(peermodels)
connect_to_model("bode", api_key = YOUR_API_KEY)
input <- get_default_input()
results <- model_run(input)
```

Cloud Access through Linux Bash

In Ubuntu, you can call the API with curl:

```
curl \
-X POST \
-H "x-prism-auth-user: REPLACE_WITH_API_KEY" \
-H "Content-Type: application/json" \
-d '{"func":["prism_model_run"],"model_input":[{"FEV1": 40,"mMRC": 3,"BMI": 22,"walk": 100}]}' \
https://prism.peermodelsnetwork.com/route/bode/run
```

12.3 EPIC

Cloud Access through R

Users can access models on the Peer Models Network using the `peermodels` R package, available on GitHub. The following code snippet illustrates how you can run the model for example patient provided in the `epicR` package:

```
remotes::install_github (resplab/peermodels)
library(peermodels)
connect_to_model("epic", api_key = YOUR_API_KEY)
input <- get_default_input()
results <- model_run(input)
```

12.4 FEV1

Cloud Access through R

Users can access models on the Peer Models Network using the `peermodels` R package, available on GitHub. The following code snippet illustrates how you can run the model for example patient provided in the `fev1` package:

```
remotes::install_github (resplab/peermodels)
library(peermodels)
connect_to_model("fev1", api_key = YOUR_API_KEY)
input <- get_default_input()
results <- model_run(input)
```

Cloud Access through Linux Bash

In Ubuntu, you can call the API with curl:

```
curl \
-X POST \
-H "x-prism-auth-user: REPLACE_WITH_API_KEY" \
-H "Content-Type: application/json" \
-d '{"func":["prism_model_run"],"model_input":[{"male":1,"age":70,"smoker":1,"FEV1":2.5}]}
https://prism.peermodelsnetwork.com/route/fev1/run
```

12.5 CVDAnderson

Cloud Access through R

Users can access models on the Peer Models Network using the `peermodels` R package, available on GitHub. The following code snippet illustrates how you can run the model for example patient provided in the `cvdanderson` package:

```
remotes::install_github (resplab/peermodels)
library(peermodels)
connect_to_model("cvdanderson", api_key = YOUR_API_KEY)
input <- get_default_input()
results <- model_run(input)
```

Cloud Access through Linux Bash

In Ubuntu, you can call the API with `curl`:

```
curl \
-X POST \
-H "x-prism-auth-user: REPLACE_WITH_API_KEY" \
-H "Content-Type: application/json" \
-d '{"func":["prism_model_run"],"model_input":[{"age": 33,"gender": 1,"Tchol": 230,"ECG": "Normal"}]}
https://prism.peermodelsnetwork.com/route/cvdanderson/run
```

12.6 CHDWilson

Cloud Access through R

Users can access models on the Peer Models Network using the `peermodels` R package, available on GitHub. The following code snippet illustrates how you can run the model for example patient provided in the `chdwilson` package:

```
remotes::install_github (resplab/peermodels)
library(peermodels)
connect_to_model("chdwilson", api_key = YOUR_API_KEY)
input <- get_default_input()
results <- model_run(input)
```

Cloud Access through Linux Bash

In Ubuntu, you can call the API with curl:

```
curl \
-X POST \
-H "x-prism-auth-user: REPLACE_WITH_API_KEY" \
-H "Content-Type: application/json" \
-d '{"func":["prism_model_run"],"model_input":{"age": 55,"gender": 1,"TChol": 250,"LDL": 120,"HDL": 100}}' \
https://prism.peermodelsnetwork.com/route/chdwilson/run
```

12.7 CFMortality**Cloud Access through R**

Users can access models on the Peer Models Network using the `peermodels` R package, available on GitHub. The following code snippet illustrates how you can run the model for example patient provided in the `chdwilson` package:

```
remotes::install_github (resplab/peermodels)
library(peermodels)
connect_to_model("cfmortality", api_key = YOUR_API_KEY)
input <- get_default_input()
results <- model_run(input)
```

Cloud Access through Linux Bash

In Ubuntu, you can call the API with curl:

```
curl \
-X POST \
-H "x-prism-auth-user: REPLACE_WITH_API_KEY" \
-H "Content-Type: application/json" \
-d '{"func":["prism_model_run"],"model_input":{"male": 0,"age": 57,"fvc": 66.7,"fev1": 47.4,"fev1_f": 47.4}}' \
https://prism.peermodelsnetwork.com/route/cfmortality/run
```

12.8 QRISK3**Cloud Access through R**

Users can access models on the Peer Models Network using the `peermodels` R package, available on GitHub. The following code snippet illustrates how you can run the model for example patient provided in the `QRISK3` package:

```
remotes::install_github (resplab/peermodels)
library(peermodels)
connect_to_model("qrisk3", api_key = YOUR_API_KEY)
input <- get_default_input()
results <- model_run(input)
```

12.9 CODEXCOPD

Cloud Access through R

Users can access models on the Peer Models Network using the `peermodels` R package, available on GitHub. The following code snippet illustrates how you can run the model for example patient provided in the `codexcopd` package:

```
remotes::install_github (resplab/peermodels)
library(peermodels)
connect_to_model("codexcopd", api_key = YOUR_API_KEY)
input <- get_default_input()
results <- model_run(input)
```

Cloud Access through Linux Bash

In Ubuntu, you can call the API with `curl`:

```
curl \
-X POST \
-H "x-prism-auth-user: REPLACE_WITH_API_KEY" \
-H "Content-Type: application/json" \
-d '{"func":["prism_model_run"],"model_input":[{"age":40,"charlson":8,"FEV1":40,"mMRC"}]}' \
https://prism.peermodelsnetwork.com/route/codexcopd/run
```

12.10 COVIDSEIR

We have recently deployed the Bayesian SEIR model to estimate physical-distancing effects developed by Anderson et al to our cloud infrastructure. The current version of the R package deployed to the PRISM server is `covidseir` v0.0.0.9006.

The current implementation of the `covidseir` package is experimental and has some limitations, given the computational intensity of the model. Depending on the number of `chains` and `iterations`, the `html` connection might be dropped for calls that more than a dozen minutes. Currently, fitting the model with default parameters takes about 5 minutes. We are actively working to implement

asynchronous support which would email the results back to the user when hours long model runs are requested.

Cloud Access through R

Users can access models on the Peer Models Network using the `peermodels` R package, available on GitHub. The following code snippet illustrates how you can run the model for example patient provided in the `covidseir` package:

```
library(peermodels)
connect_to_model("covidseir", api_key = YOUR_API_KEY, bypass_router = T)
input <- get_default_input()
names(input)
input$daily_cases
results <- model_run(input)
names(results)
draw_plots()
```

The same workflow can be used to fit and run the model based on custom data. For example, the code snippet below, automatically downloads latest COVID-19 case numbers for British Columbia, and reruns the simulation using different assumptions.

```
library(stringr)
library(dplyr)
library(tidyr)
library(readr)
library(lubridate)
library(peermodels)

url <- "https://docs.google.com/spreadsheets/d/1ad7-09_Jn6AxsdKvPE33T-iLfGpPRmd3piXQqFiVeas/export?format=xlsx"

CanadaCases <- read_csv(url)

covidCases <- CanadaCases %>% rename (name = "prname") %>% rename (Cases = "numconf") %>% mutate(
  filter (name!="Canada") %>% filter (date!=today())

bcCases <- covidCases %>% filter (name == "British Columbia")

connect_to_model("covidseir", api_key = "YDbxcnNHmf4XoteSmCFHKx", bypass_router = T)

input <- get_default_input()
first <- length(bcCases$numtoday)-42+1
last <- length(bcCases$numtoday)
input$daily_cases <- bcCases$numtoday[first:last]
```

Cloud Access through Python

```
import json
import requests
url = 'http://model-covidseir.cp.prism-ubc.linaralabs.com/ocpu/library/covidseirPrism/1.0.0/'
headers = {'x-prism-auth-user': 'YOUR_API_KEY'}
default_input = requests.post(url, headers=headers, json = {"func":["get_default_input"]})
# json_default_input = json.loads(default_input.json()[0]) # OR:
json_default_input = json.loads(json.loads(default_input.text)[0])
response = requests.post(url, headers=headers, json = {"func":["prism_model_run"], "model": "prism_model", "input": json_default_input})
results = json.loads(response.text)
```

In Ubuntu, you can call the API with `curl`:

```
curl \
-X POST \
-H "x-prism-auth-user: YOUR_API_KEY" \
-H "Content-Type: application/json" \
-d '{"func":["prism_model_run"],"model_input":{"daily_cases": [0,0,1,3,1,8,0,6,5,0,7,7,
]}' \
http://model-covidseir.cp.prism-ubc.linaralabs.com/ocpu/library/covidseirPrism/R/gatewa
```