tPRiors: Bayesian prevalence estimation with elicited priors

Konstantinos Pateras

1. University of Thessaly, Department of Public Health
2. University of Utrecht, Department of Biostatistics

kostas.pateras@gmail.com

September 22, 2021

Plans within and after training

1 www.menti.com, code: 7651 6327

Why?

1. Accessible to non-statisticians / field experts
2. Spread true prevalence estimation concept
3. Collection of methods + additional analyses

Why?

1. Accessible to non-statisticians / field experts
2. Spread true prevalence estimation concept
3. Collection of methods + additional analyses
4. Personal: Learn GUI, Shiny, Rshiny, tcl-tk
5. Rstudio shiny contest 2021 [Check if interested]

How?

1. Developed with R and Shiny
2. No heavy IT skills required
3. 1st draft in 2-3 months

How?

1. Developed with R and Shiny
2. No heavy IT skills required
3. 1st draft in 2-3 months
4. Increased learning curve on topic

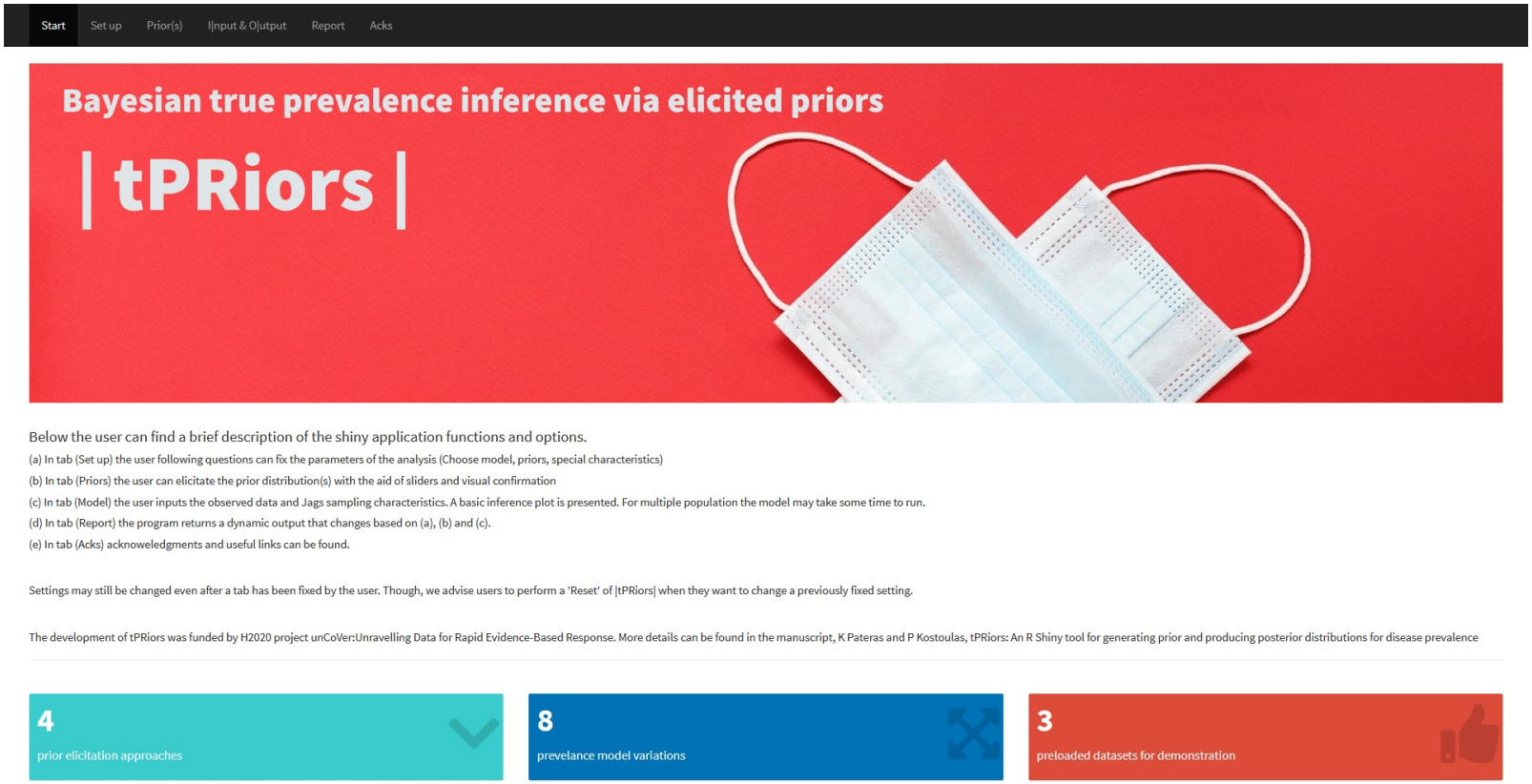
What's included?

- 8 distinct prevalence models included
- 5 ways to elicit priors (powered by priorGen [Kostoulas 2019])
- 20 modelling set-ups
- ∞ modelling strategies
- Single/Multiple populations - Apparent/True prevalence - No zero/Zero prior prevalence - Informative/ Non Informative

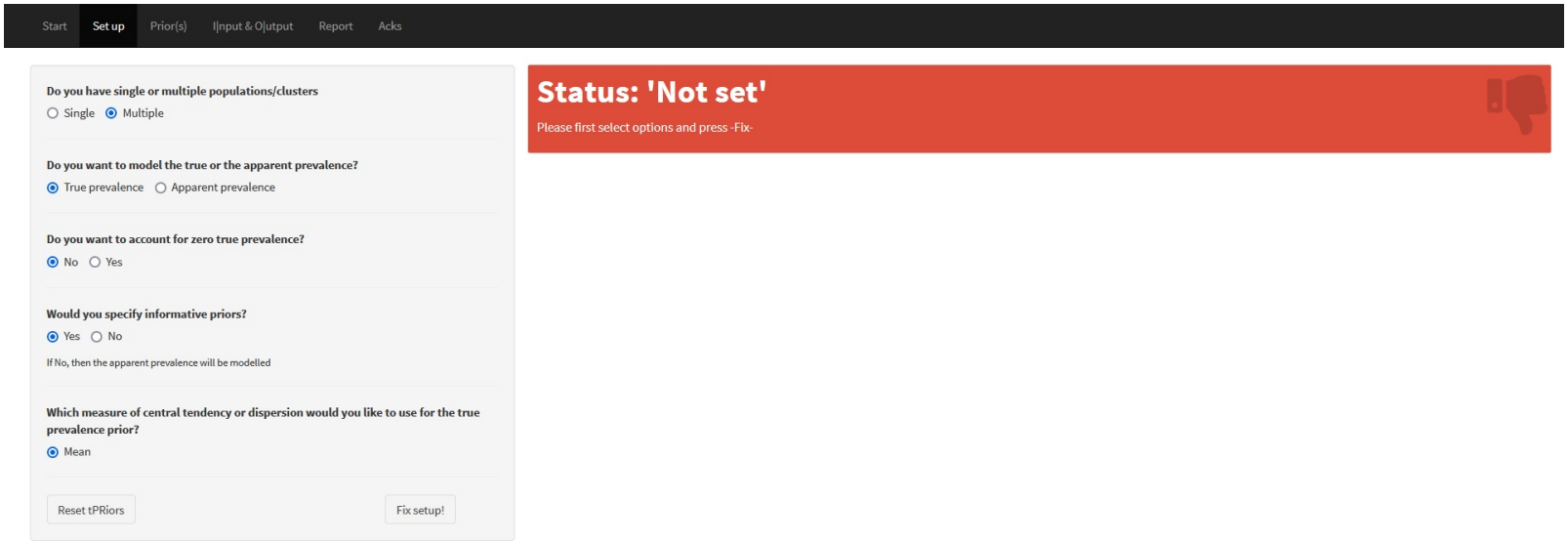
How to work with tPRiors?

- Install with devtools
- Download repository and click Run App through the global.R script [Fastest]
- Use https://publicintegratedhealth.shinyapps.io/tPRiors

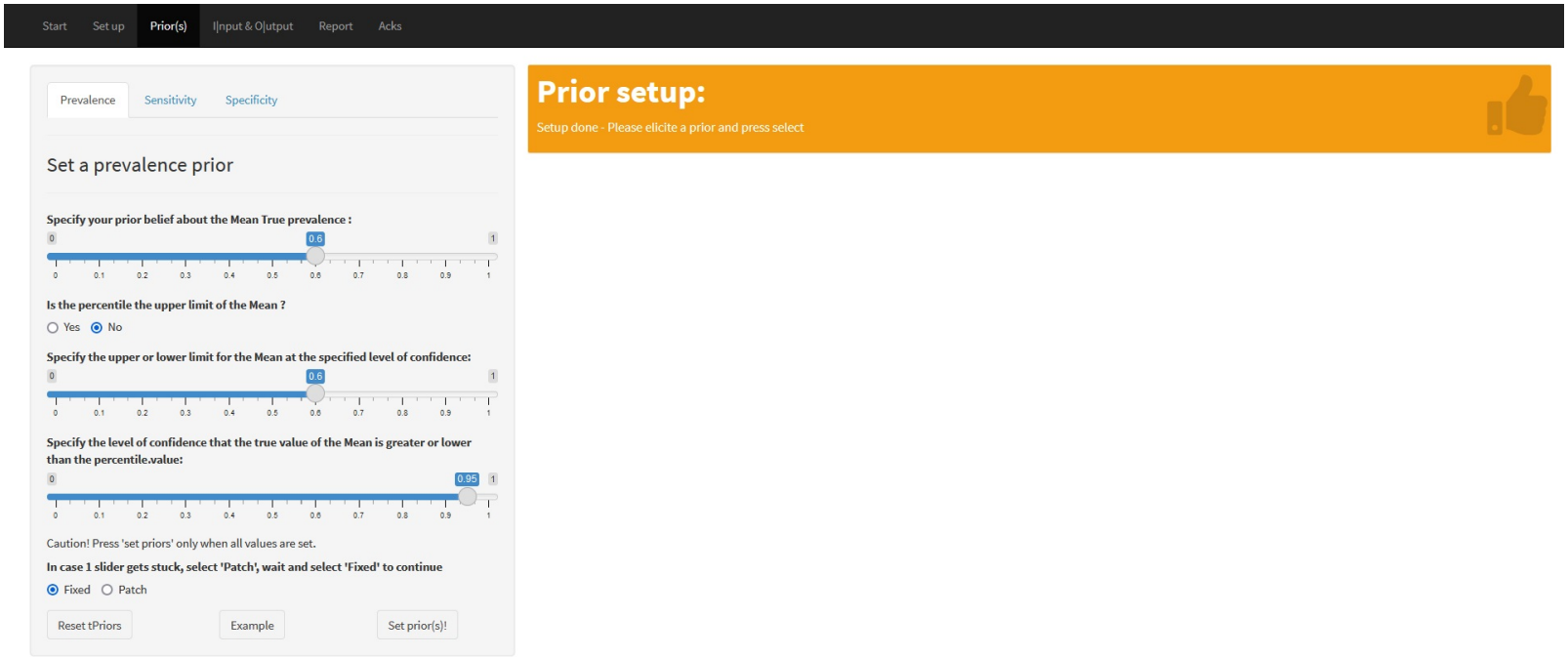
Starting page



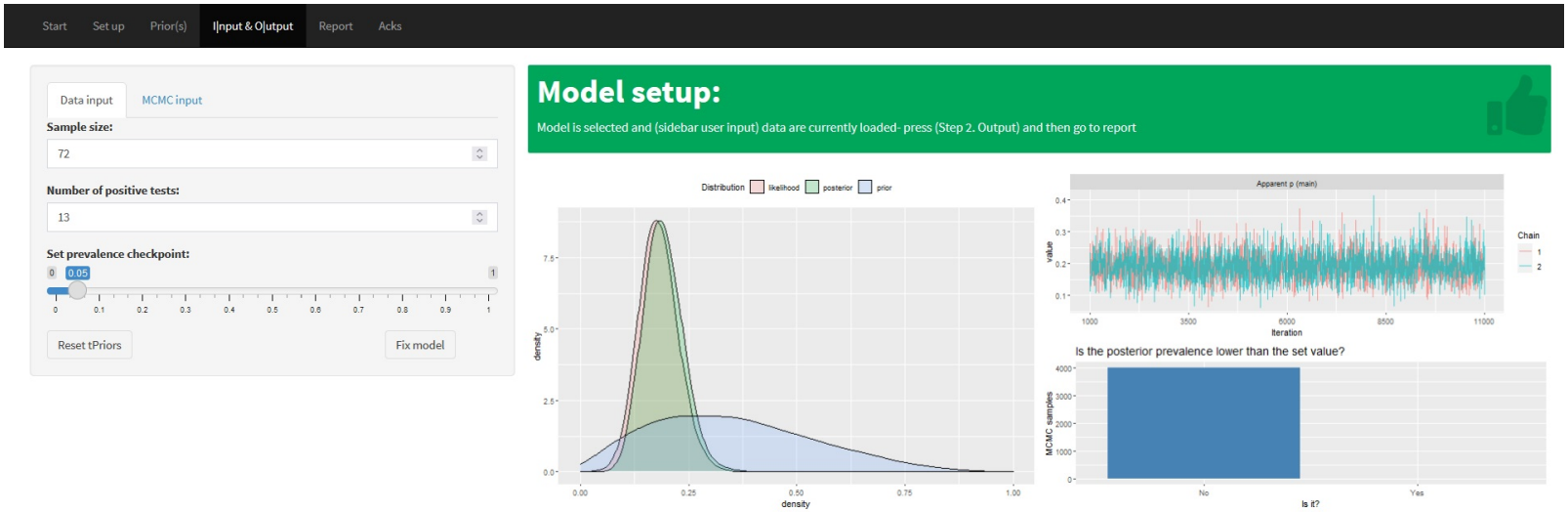
Set-up page



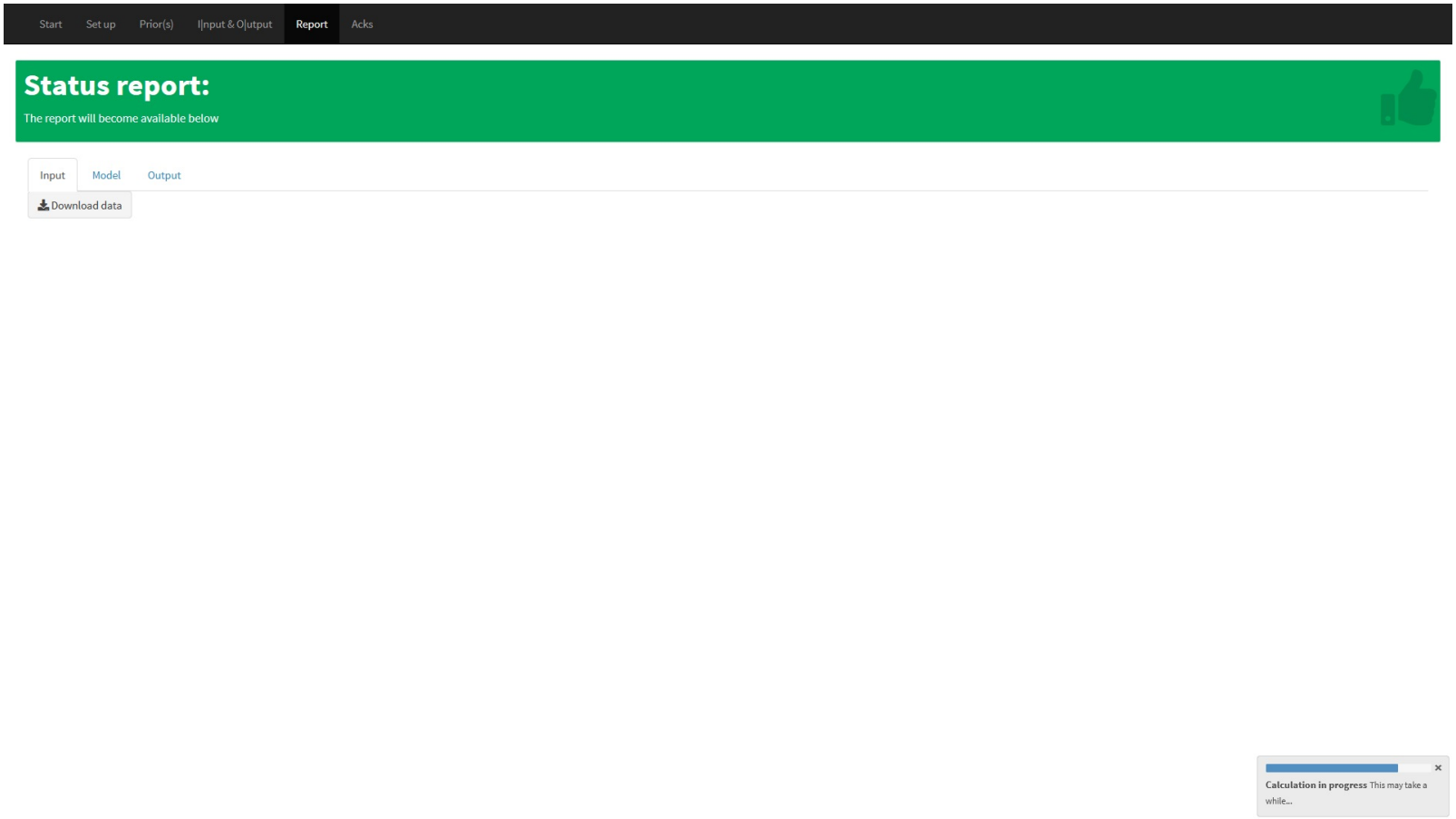
Prior page



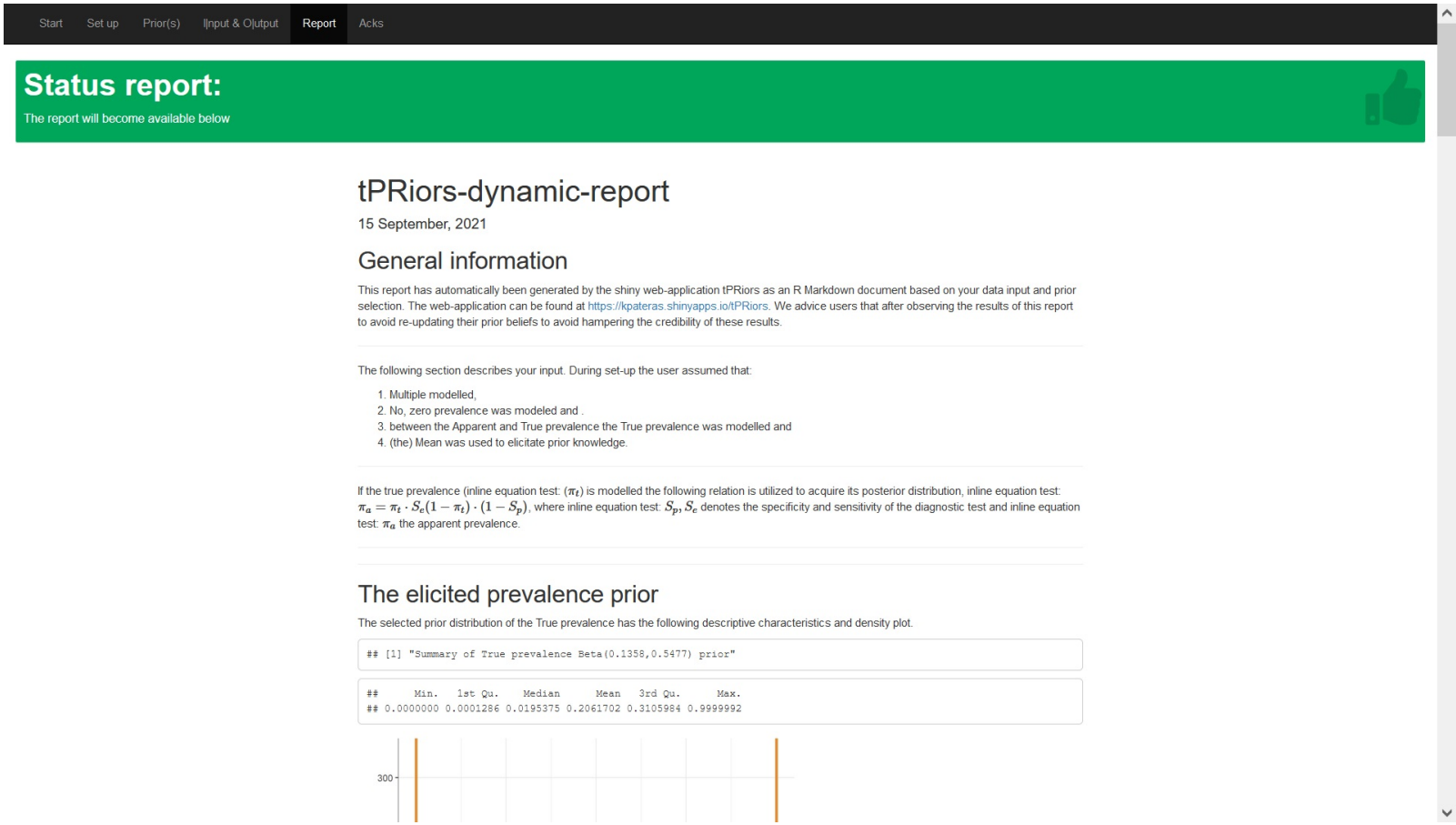
Input & Output page



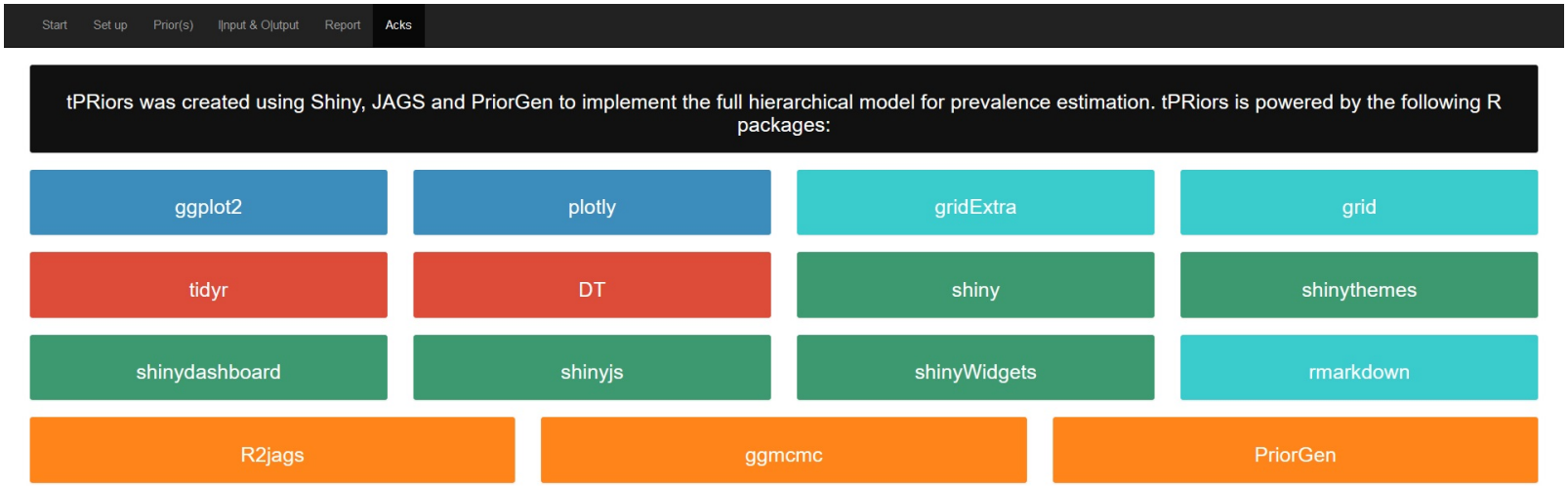
Report page



Report page



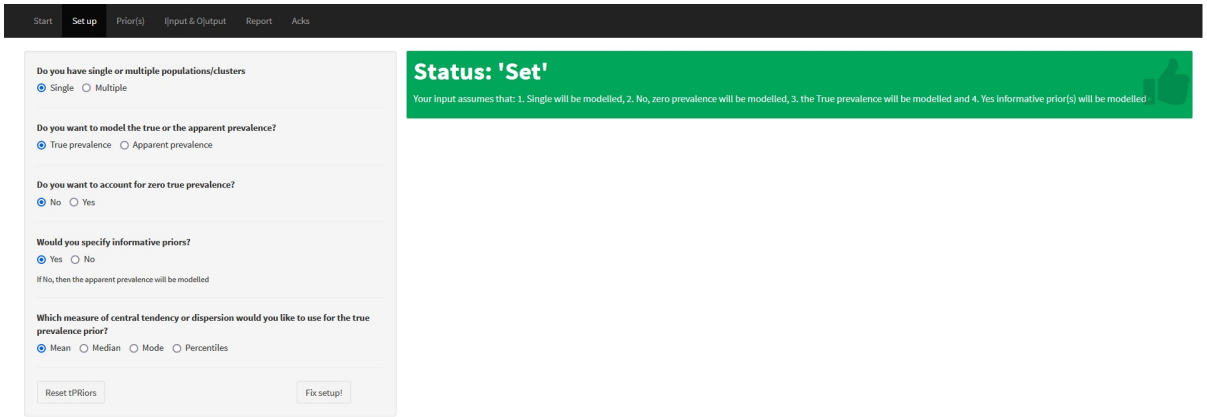
Acks page



Single population toy-example

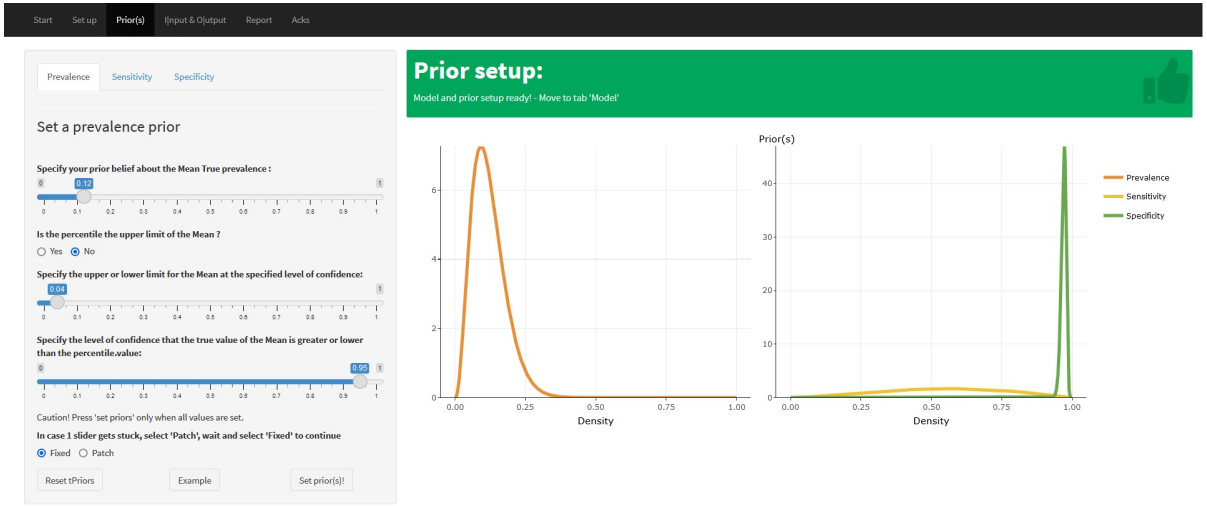
- Prevalence of a moderate adverse event (fatigue) of a vaccine.
2. Observed 50 events in a sample of 1000.
- Prior information:
    1. A publication stated that average risk for fatigue is low.
    2. Experts report that fatigue is observed with very high sensitivity but moderate specificity.

Set-up page



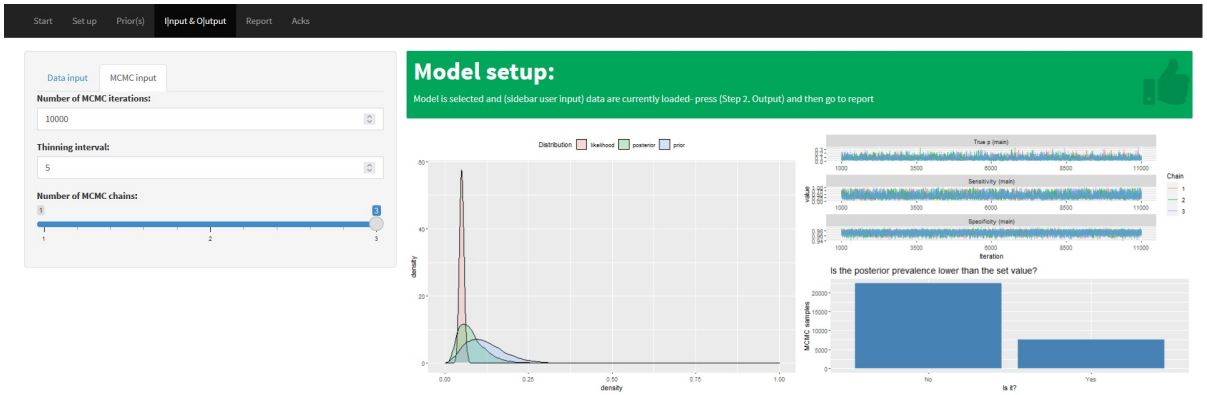
1. Single - True - No zero - Informative - Mean.
2. If Apparent (Se=Sp=1), if Non-informative, then 3 prior prevalence choices available.
3. Currently, selected measure applies to all priors.

Prior page



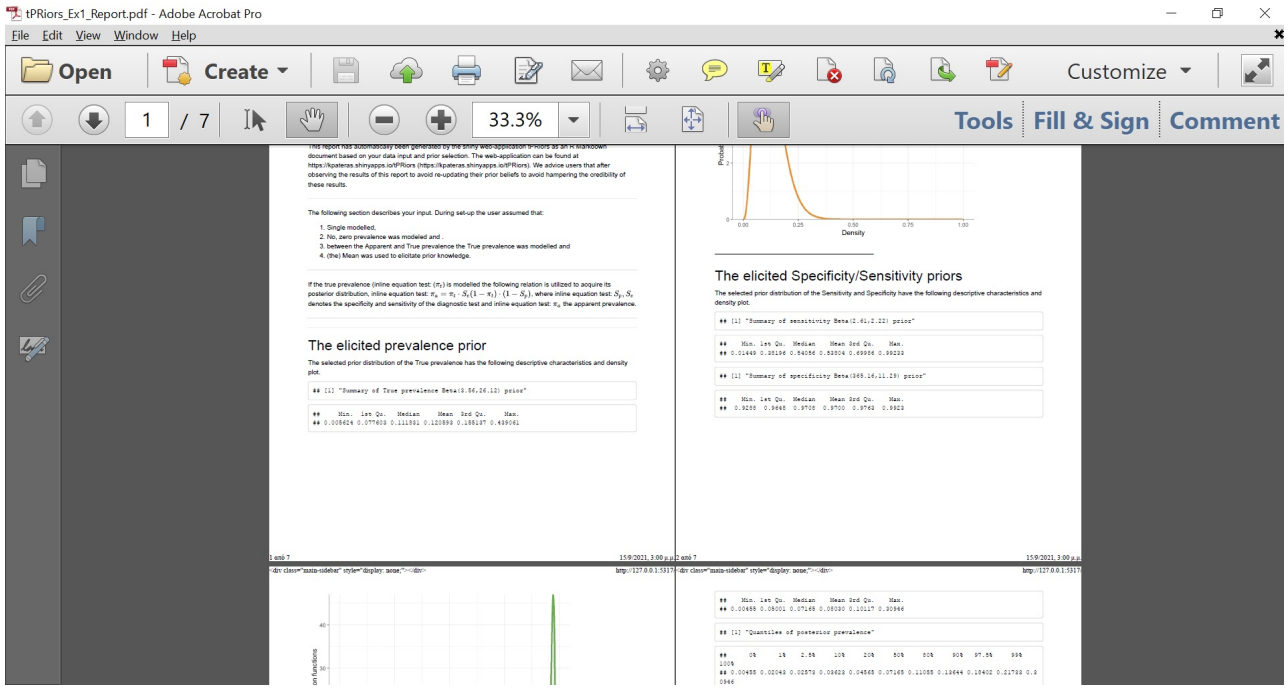
1. Does not currently support raw hyper-parameter values
2. Some prior specifications can be non-appropriate
3. Caution! If "Set" is selected, change values slowly to avoid technical errors.

Input & Output page



1. Meshing with MCMC input should not change inference.
2. Change input data to check the dynamics of posterior, prior, likelihood.

Report page



1 Open "tPRiors_Ex1_Report.pdf", discuss

Further analyses

1. Check ESS, diagnostics, extra plots,
2. Check models, input data, output data
3. Use ggmcmc for clearer diagnostic plots

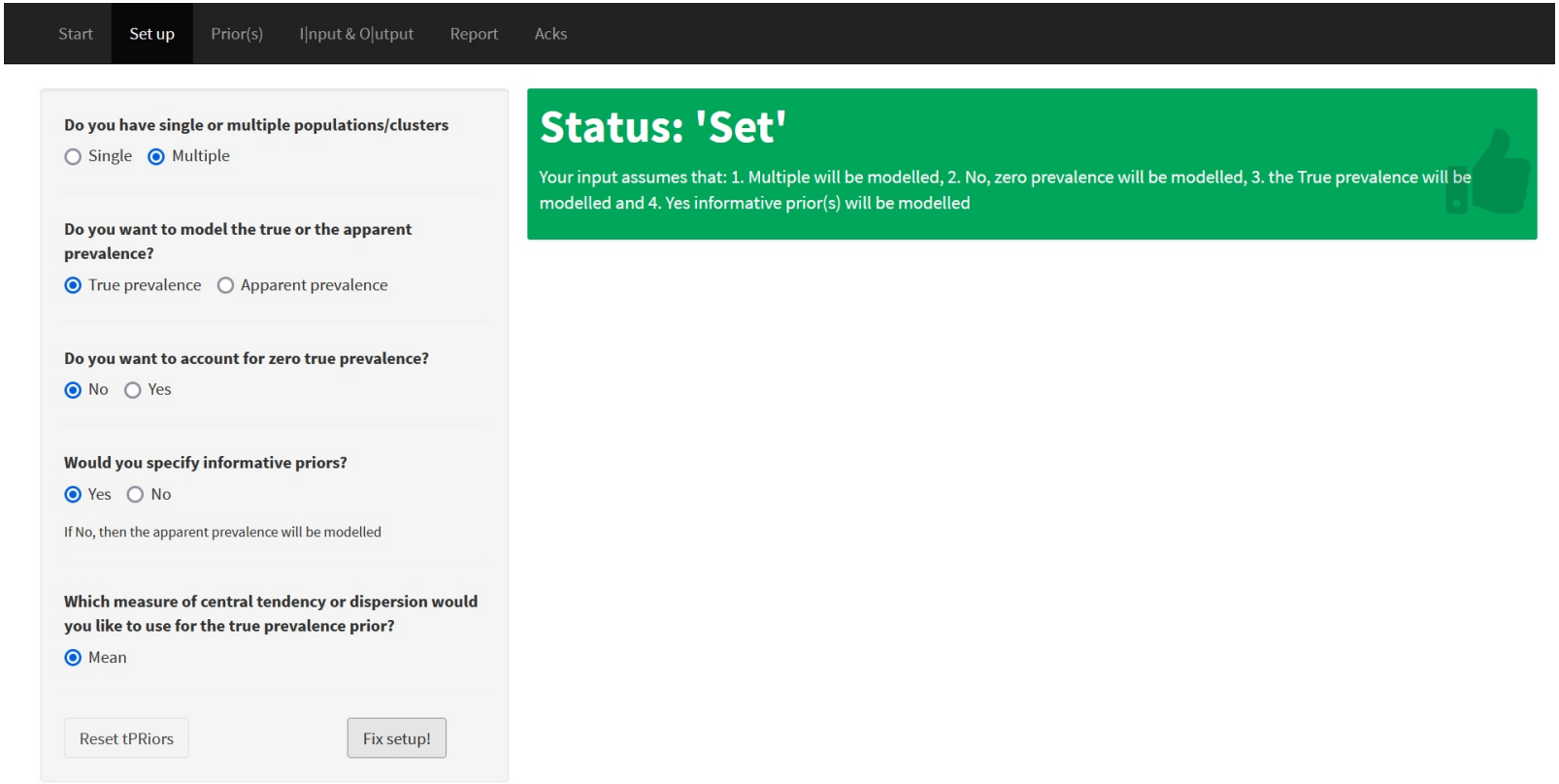
Exercise - Analysis and replication of results! (15-20')

- Check manuscript Perquin et al. 2008 GitHub/day3
- Calculate the posterior prevalence of dementia for 65+ participants
- Experts discuss that:
  1. the average risk for dementia is relatively low but depends on age range.
  2. Conducted test known to show high sensitivity and very high specificity.
  3. Work individually. Report posterior median and IQR of the true prevalence.

Exercise - Analysis and replication of results! (15-20')

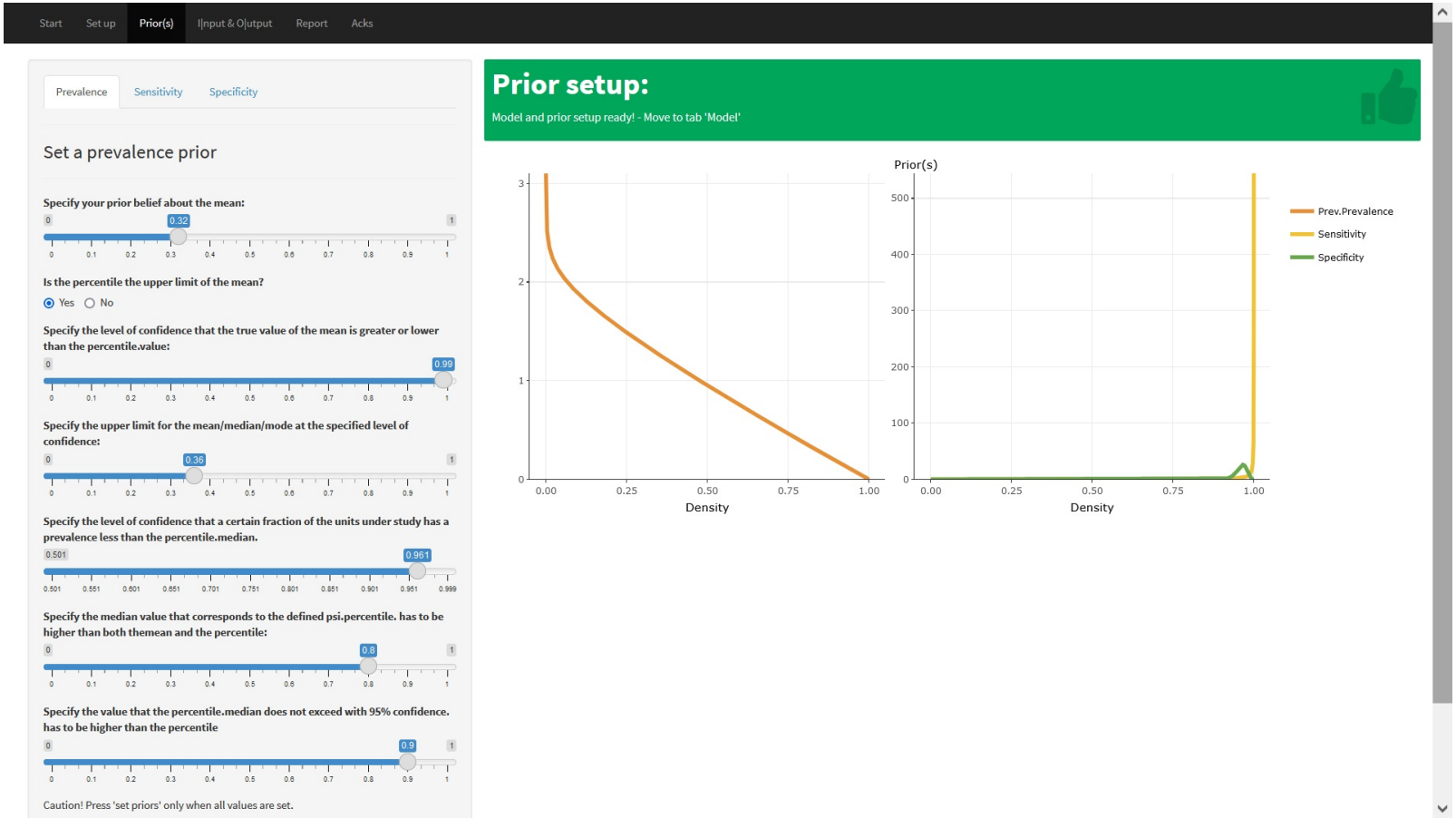
- Check manuscript Perquin et al. 2008 GitHub/day3
- Calculate the posterior prevalence of dementia for 65+ participants
- Experts discuss that:
  1. the average risk for dementia is relatively low but depends on age range.
  2. Conducted test known to show high sensitivity and very high specificity.
  3. Work individually. Report posterior median and IQR of the true prevalence.
  4. www.menti.com (1588 8807)

Set-up page



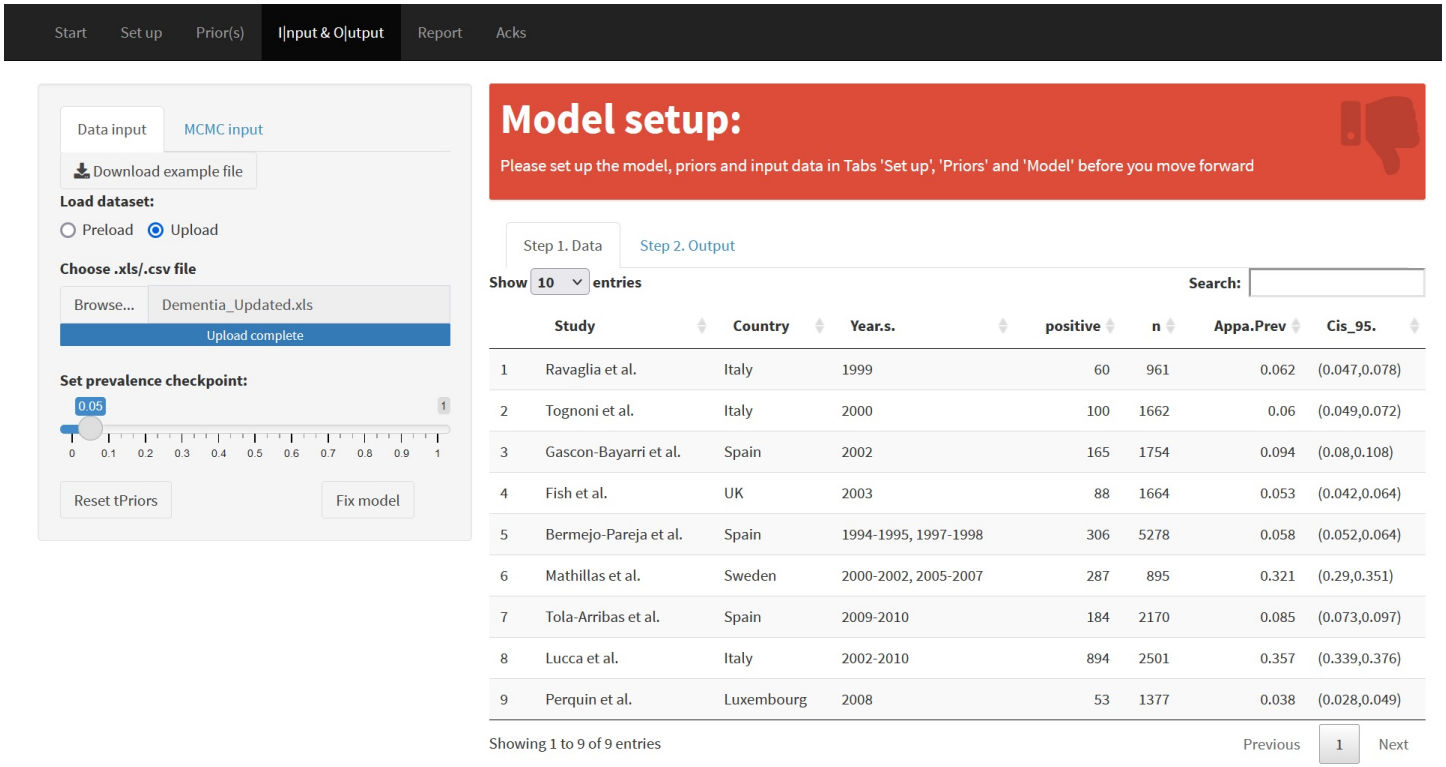
1. Multiple - True - NonZero - Informative
2. One elicitation measure, if non-informative is selected, $\psi \sim IG(0.1, 0.1)$.

Prior page



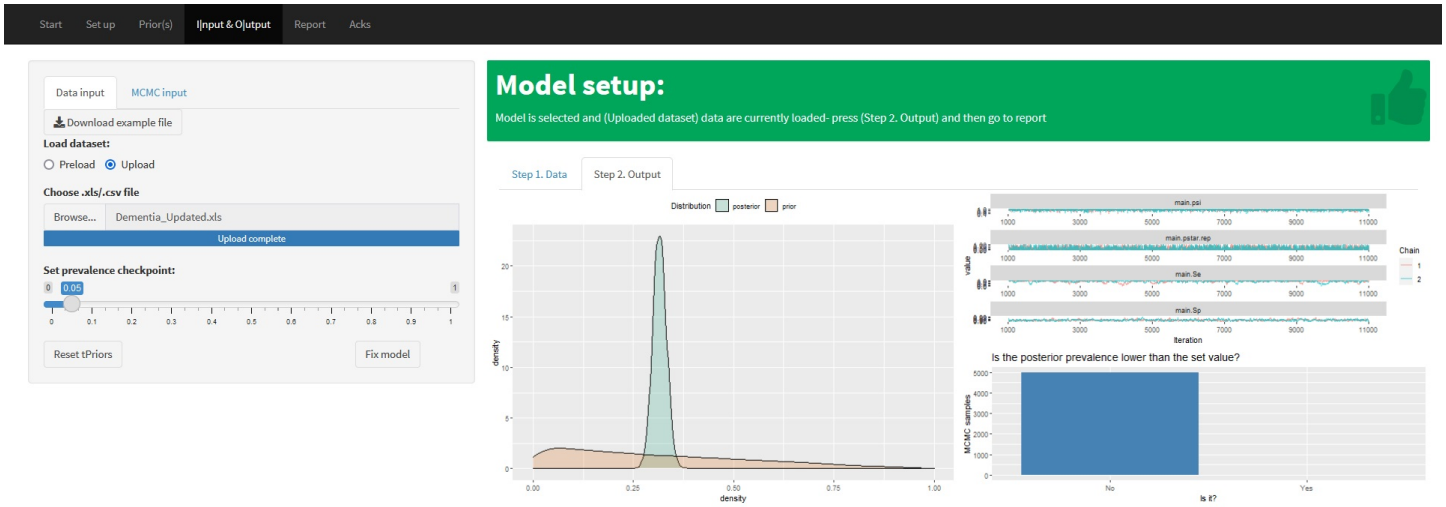
1. Conditions applied, caution how to set values
2. If plotted, change one at a time, observe change (not suggested)

Input & Output page



1. Load preselected data or upload .csv or .xls file. Must contain two columns named 1. positive and 2. n.
2. Download example file for a template.

Input & Output page



1. Necessary step to check Step 2. Output before moving to report!
2. Diagnostics look cramped...

Exercise - Analysis and replication of results! (15-20')

Download article Bacigalupo et al. 2018. Produce posterior box-plots for the study-specific prevalences of dementia using tPRiors and the multiple population models. Use similar SE and SP priors to previous example. 3 goals! Work in pairs but individually.

- Goal 1 is to produce the posterior study-level boxplot.
- Goal 2 is to save all information for reproducibility.
- Goal 3 is to re-produce the posterior study-level boxplot of your peer.

Bibliography [1 more slide]

- Konstantinos Pateras, Polychronis Kostoulas. tPRiors: Bayesian prevalence estimation with elicited priors, Submitted
- Bagipulo et al. A Systematic Review and Meta-Analysis on the Prevalence of Dementia in Europe 2018
- Perquin et al and cognitive complaints in the context of high cognitive reserve: A population-based study. 2015
- Polychronis Kostoulas priorGen, R packages, 2019

Final thoughts

www.menti.com
Code: 2118 8043