tPRiors:Bayesian prevalence estimation with elicited priors

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Harmony COST EU action
Co-presentors (Eleftherios Meletis, Polychronis Kostoulas)

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Larisa, October 25-27, 2023

Expectations

www.menti.com, code: 8722 4275

Why?

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

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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]
6. Manuscript : |tPRiors|

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

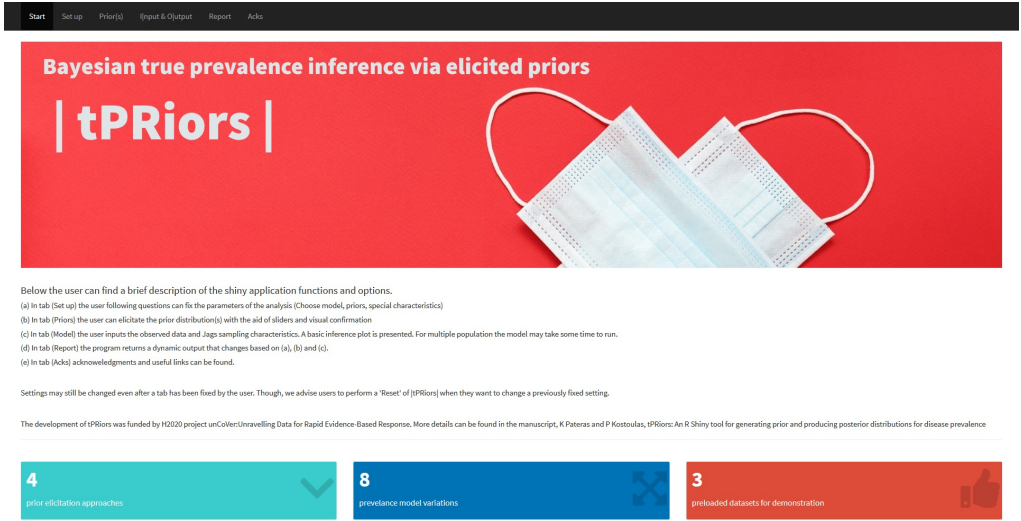
How?

Fast Clone/Download repository and click Run App through the global.R script
github.com/kpatera/tPRiors

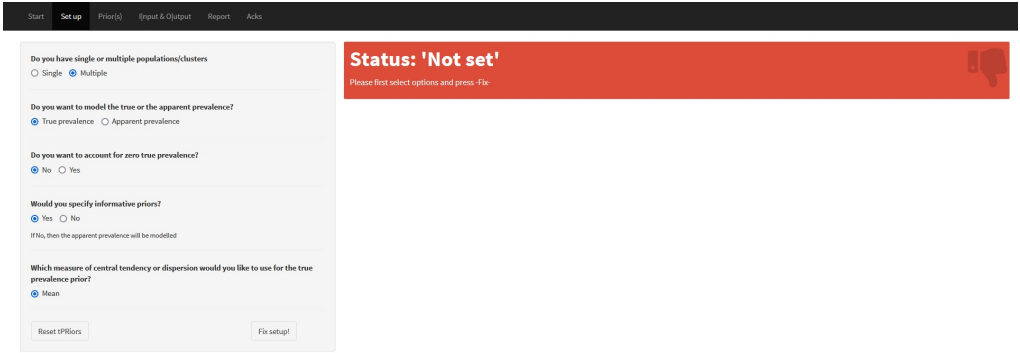
Easy Through the web - application

- `publicintegratedhealth.shinyapps.io/tPRiors`
- `publicandonehealth.shinyapps.io/tPRiors`
- `kpateras.shinyapps.io/tPRiors`

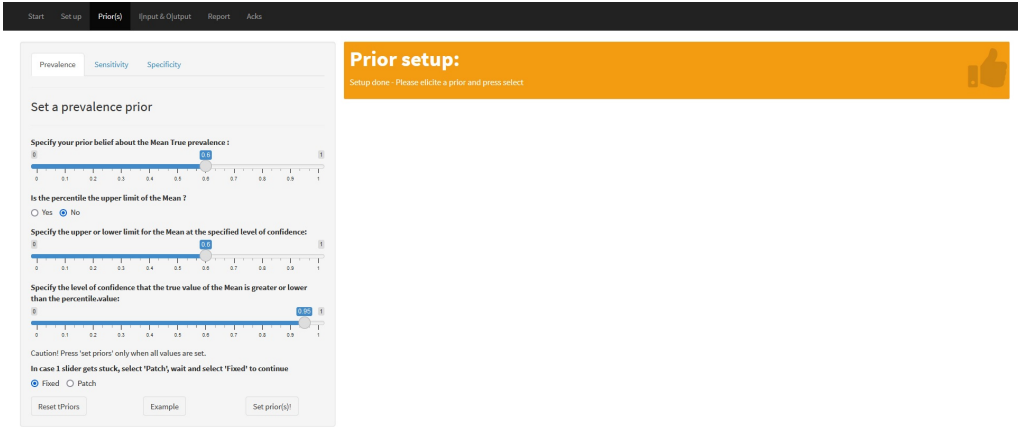
Starting page



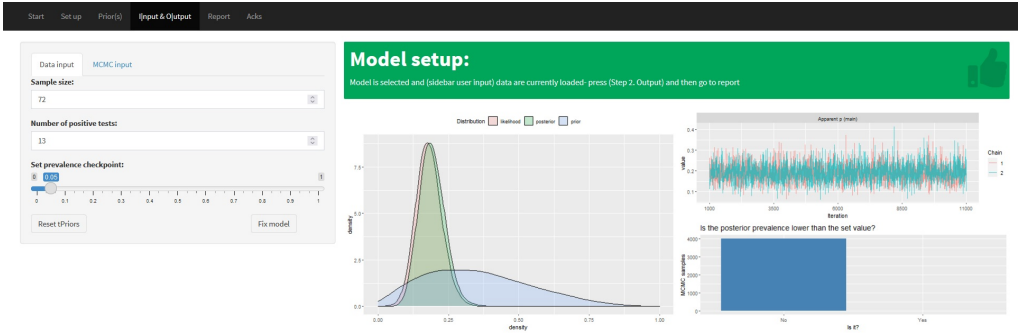
Set-up page



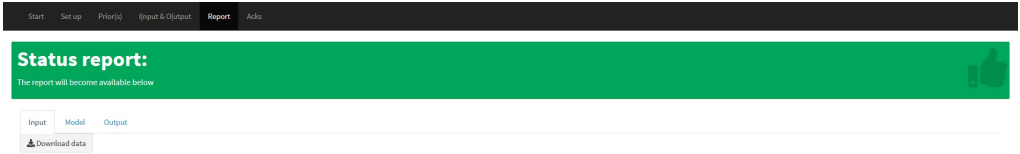
Prior page


Start
Set up
Prior(s)
I(nput & O)utput
Report
Acks
Prevalence
Sensitivity
Specificity
Set a prevalence prior
Specify your prior belief about the Mean True prevalence :
Is the percentile the upper limit of the Mean ?
Yes
No
Specify the upper or lower limit for the Mean at the specified level of confidence:
Specify the level of confidence that the true value of the Mean is greater or lower than the percentile.value:
Caution! Press 'set priors' only when all values are set.
In case 1 slider gets stuck, select 'Patch', wait and select 'Fixed' to continue
Fixed
Patch
Reset tPriors
Example
Set prior(s)!
Prior setup:
Setup done - Please elicite a prior and press select

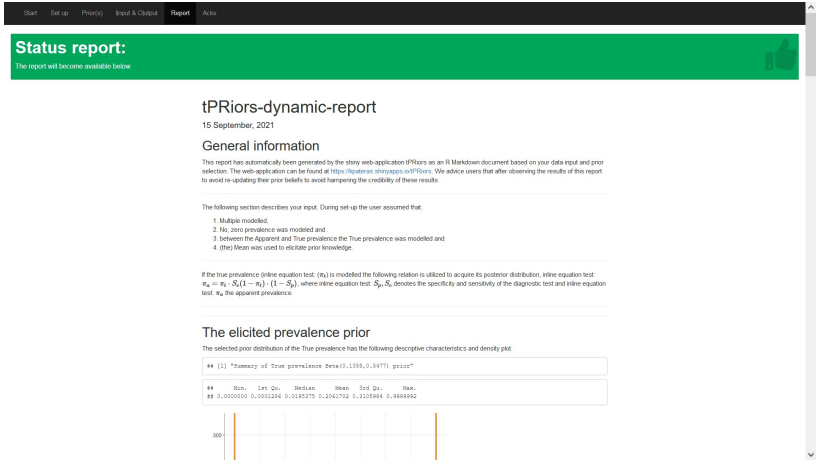
Input & Output page



Report page



Report page



Start Set up Prior(s) Input & Ouput Report Aces

Status report:

The report wil become available below

tPRiors-dynamic-report

15 September, 2021

General information

This report has automatically been generated by the shiny web-application tPRiors as an R Markdown document based on your data input and prior selection. The web-application can be found at https://kpateras.shinyapps.io/tPRiors. We advice users that after observing the results of this report to avoid re-updating their prior beliefs to avoid hampering the credibility of these results.

The following section describes your input. During set-up the user assumed that:

1. Multiple modelled,
2. No, zero prevalence was modeled and
3. between the Apparent and True prevalence the True prevalence was modelled and
4. (the) Mean was used to elicitate prior knowledge.

If the true prevalence (inline equation test: (π_t) is modelled the following relation is utilized to acquire its posterior distribution, inline equation test: $\pi_a = \pi_t \cdot S_e(1-\pi_t)\cdot(1-S_p)$, where inline equation test: S_p, S_e denotes the specificity and sensitivity of the diagnostic test and inline equation test: π_a the apparent prevalence.

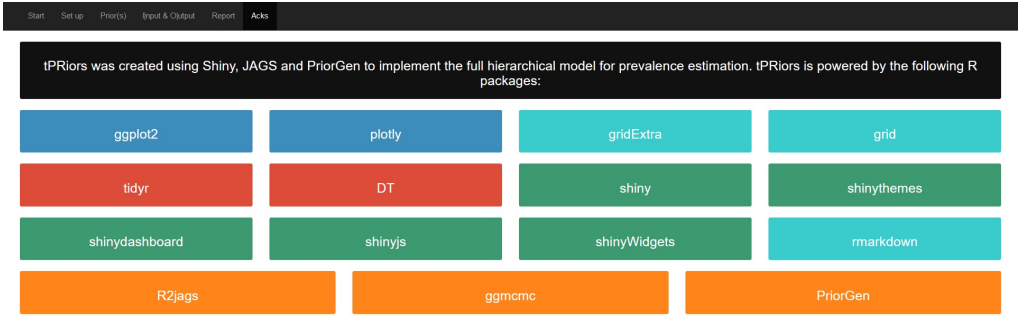
The elicited prevalence prior

The selected prior distribution of the True prevalence has the following descriptive characteristics and density plot.

```
## [1] "Summary of True prevalence Beta(0.1358,0.5477) prior"
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 0.0000000 0.0001284 0.0185375 0.2041702 0.2105864 0.9999992
```

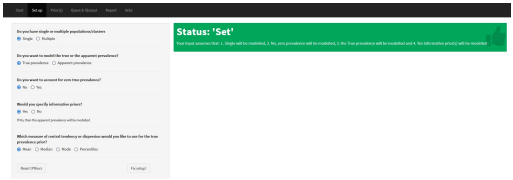
Acks page



Single population (30-60')

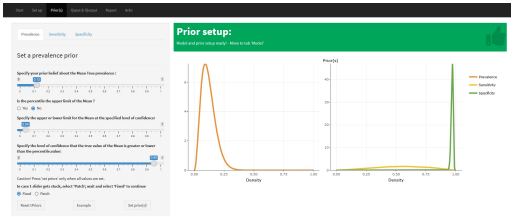
- Prevalence of a moderate adverse event (fatigue) of a vaccine.
- Observed 50 events in a sample of 1000.
- Prior information:
  1. A publication stated that average risk for fatigue is low.
  2. Experts report that fatigue is observed with very high sensitivity but moderate specificity.
- Fill $->$ www.menti.com 5163 1177

Set-up page



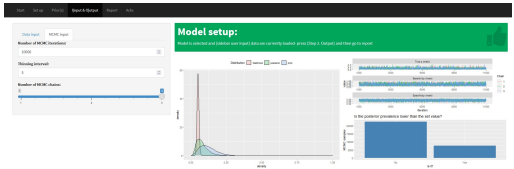
1. Single - True - No zero - Informative - Mean.
2. If Apparent (Se=Sp=1), if also Non-informative, then 3 prior prevalence choices available.
3. Currently, selected measure applies to all priors.

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. Use the fix if needed or reset.

Input & Output page



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

Further analyses

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

Multiple populations (30-60')

- Check manuscript Pateras & Kostoulas 2022 (|tPRiors|)
- Replicate the multiple population results via the Dementia_updated.xls dataset.

tPRiors

- Tips
  - Set-up: Multiple - True - NonZero - Informative
  - Priors: Conditions applied, caution how to set values
  - I&O : Necessary step to check 'Step 2. Output' before moving to report!
- Exercise goals
  - ... to produce the posterior study-level boxplot.
  - ... to save all information for reproducibility.
  - ... to re-produce the posterior study-level boxplot of your peer.

Bibliography

- Pateras, K. and Kostoulas, P. |tPRiors|: a tool for prior elicitation and obtaining posterior distributions of true disease prevalence. BMC Med Res Methodol 22, 91 (2022).
- Bagipulo et al. A Systematic Review and Meta-Analysis on the Prevalence of Dementia in Europe (2018)
- Pateras K & Kostoulas P. priorGen version 2.0, R package (2019-2023)