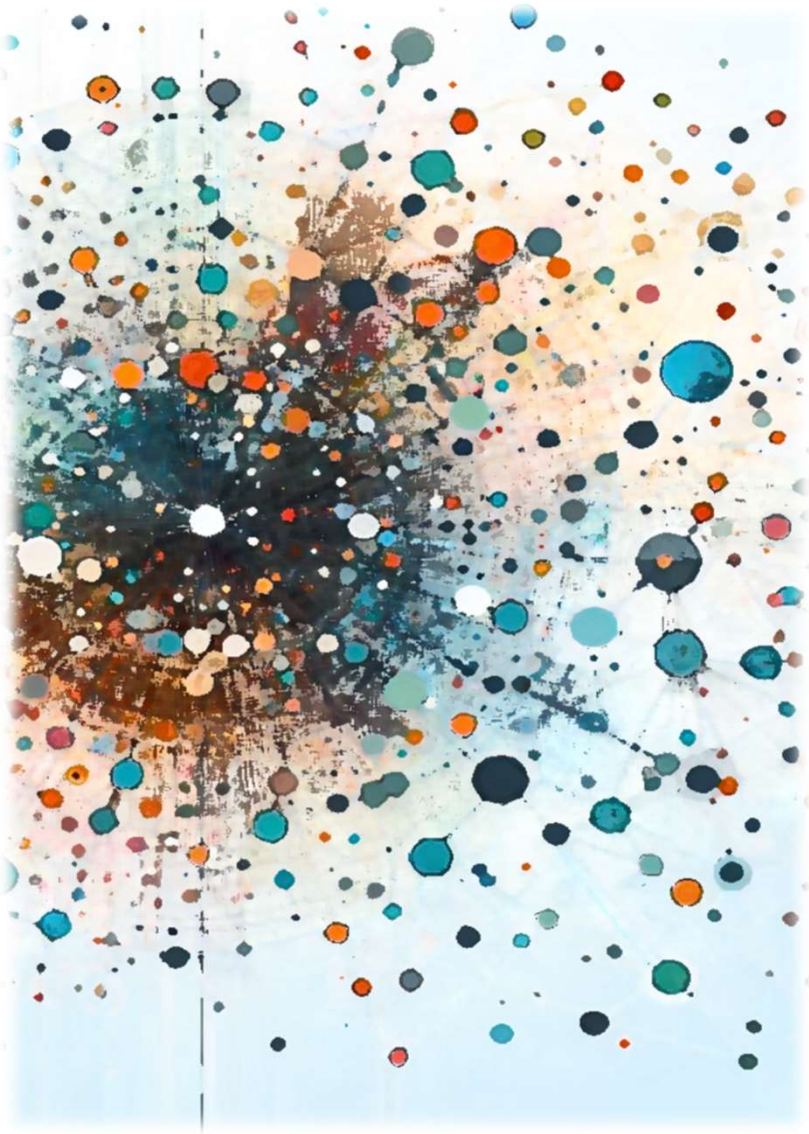


A User-Friendly R-Shiny Application for Indirect Treatment Comparisons in Health Technology Assessment

R for HTA workshop

Annachiara Rossi
Data Science Graduate, Biostatistics HTA, Novo Nordisk

Pepa Polavieja
Principal Statistician, Biostatistics HTA, Novo Nordisk

02-07-2024

Disclaimer

The views in this presentation are those of the authors, not of Novo Nordisk

This material has been readapted for external presentation

The use case presented is extracted from a real business case, data is anonimized

Annachiara Rossi, Pepa Polavieja

Agenda

Background
Why Indirect Treatment Comparisons

Our Vision
Why do we need this tool

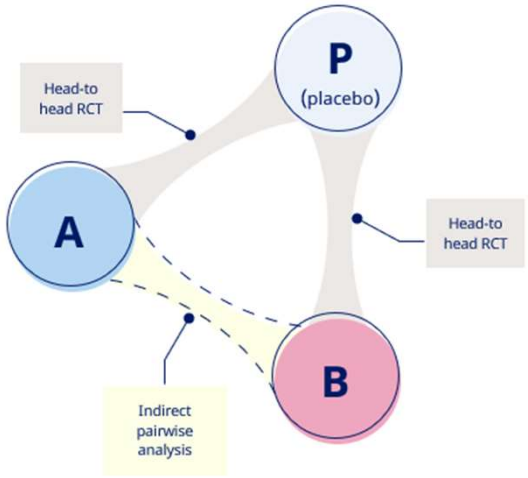
Our Code

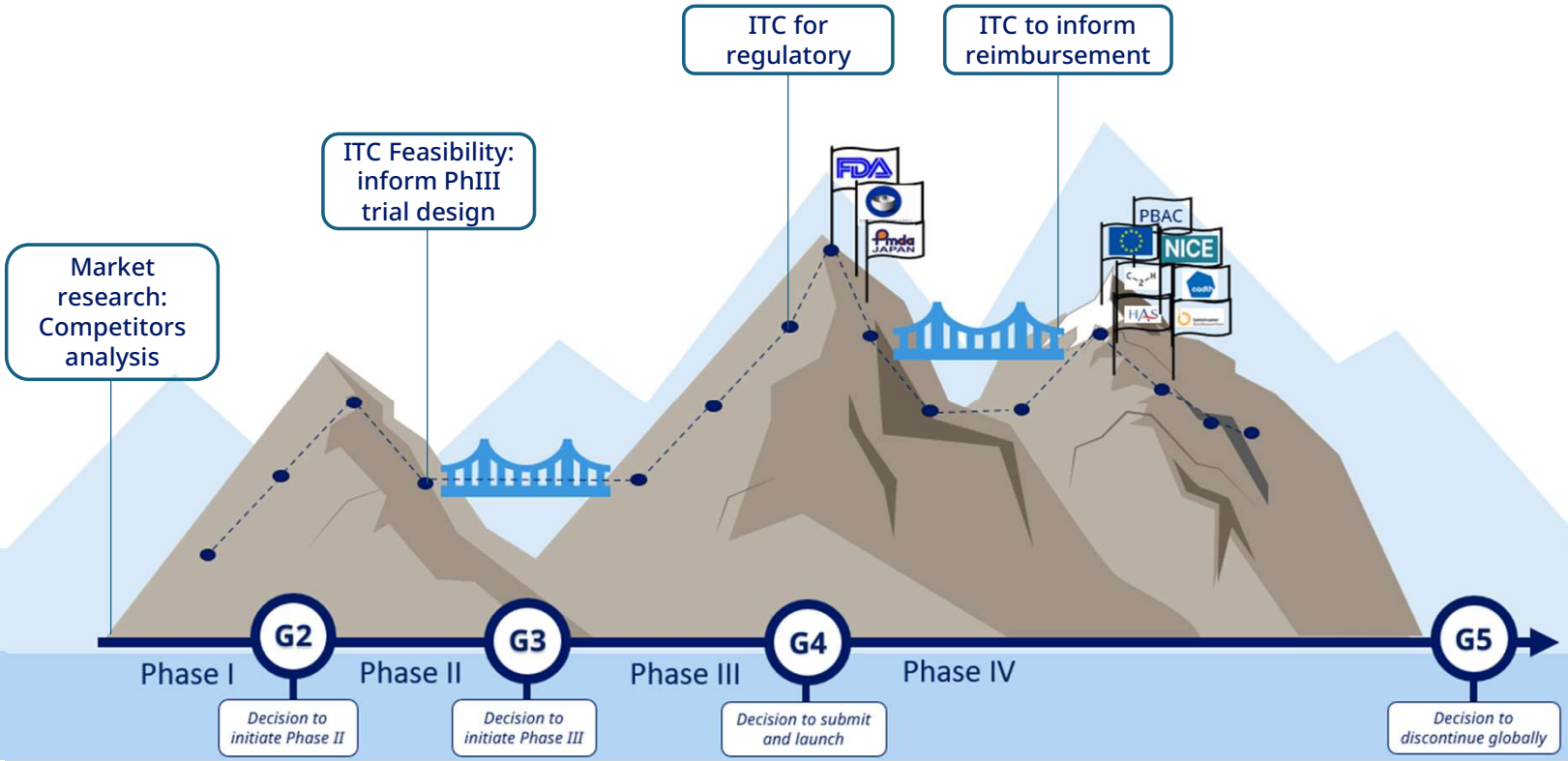
Our R-Shiny app

Improvements & Aspiration

Why Indirect Treatment Comparisons

ITC app to **standardize**, **scale** and **accelerate** delivery of results





ITC = Indirect Treatment Comparison
RCT = Randomized Control Trial

Our Vision

Improved communication

Facilitated Collaboration

Ideal state: Tool able to generate submission-ready reports

Streamlined HTA Submissions

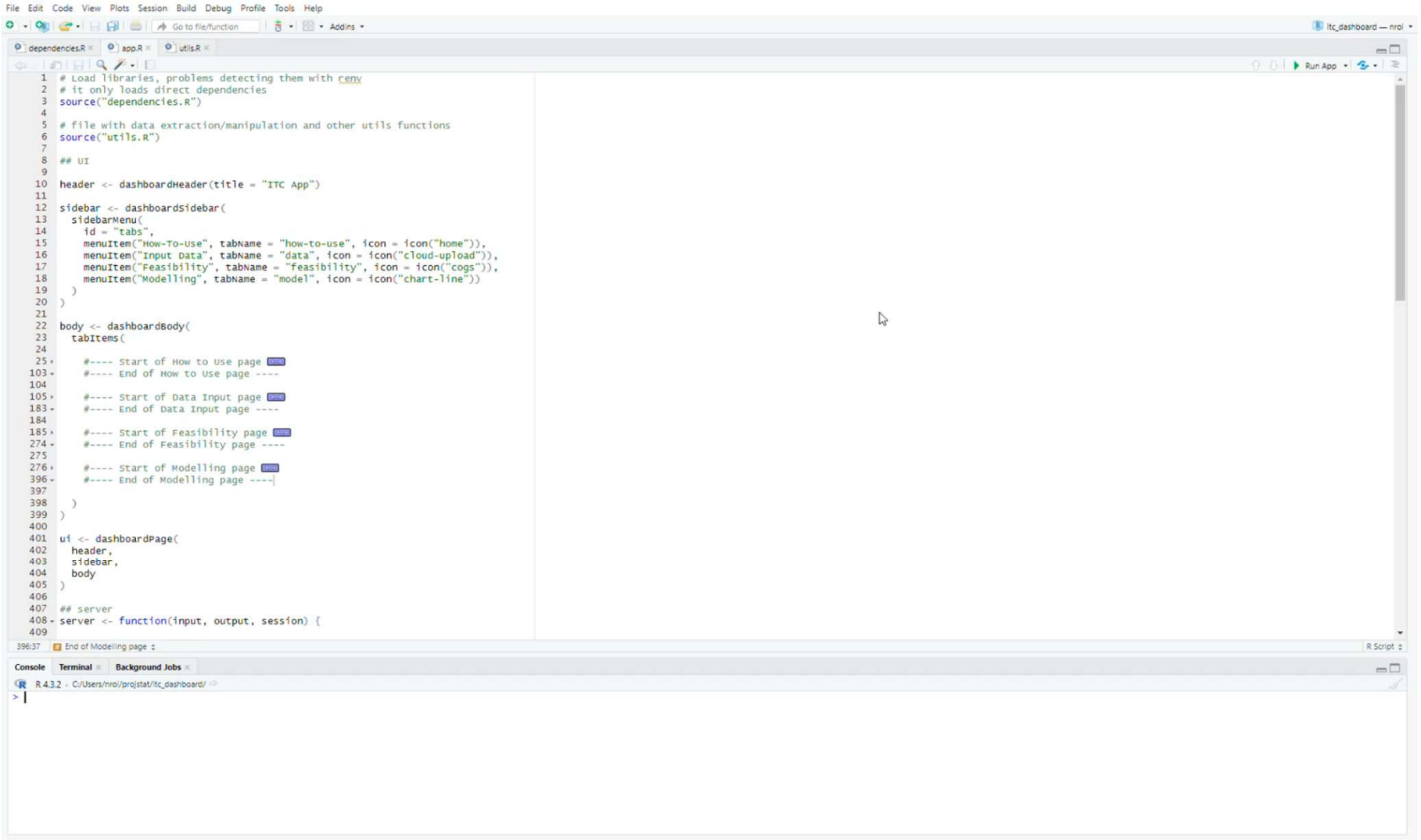
By consolidating data input, statistical analysis, and visualization, the ITC app enhances the efficiency of our processes, *minimizing errors* and *accelerating* the delivery of innovative solutions to patients.

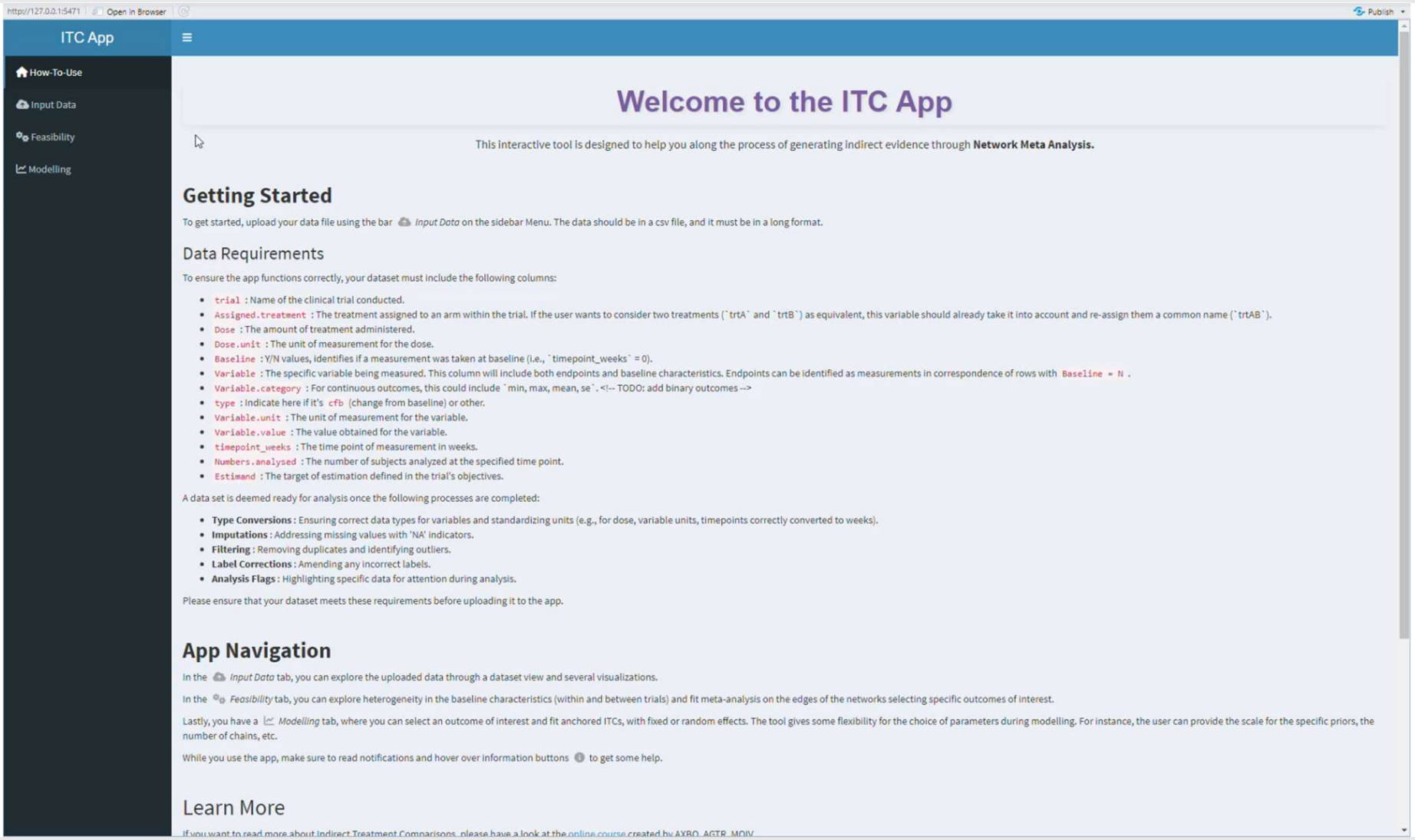
Customization

Reproducibility

Compliance

Our code


File Edit Code View Plots Session Build Debug Profile Tools Help
dependencies.R
app.R
utils.R
Run App
# Load libraries, problems detecting them with renv
# it only loads direct dependencies
source("dependencies.R")
# file with data extraction/manipulation and other utils functions
source("utils.R")
UI
header <- dashboardHeader(title = "ITC App")
sidebar <- dashboardSidebar(
sidebarMenu(
id = "tabs",
menuItem("How-To-Use", tabName = "how-to-use", icon = icon("home")),
menuItem("Input Data", tabName = "data", icon = icon("cloud-upload")),
menuItem("Feasibility", tabName = "feasibility", icon = icon("cogs")),
menuItem("Modelling", tabName = "model", icon = icon("chart-line"))
)
)
body <- dashboardBody(
tabItems(
#---- Start of How to Use page ----
#---- End of How to Use page ----
#---- Start of Data Input page ----
#---- End of Data Input page ----
#---- Start of Feasibility page ----
#---- End of Feasibility page ----
#---- Start of Modelling page ----
#---- End of Modelling page ----
)
)
ui <- dashboardPage(
header,
sidebar,
body
)
server
server <- function(input, output, session) {
396:37
End of Modelling page
R Script
Console
Terminal
Background Jobs
R 4.3.2 · C:/Users/nroi/projstat/itc_dashboard/
>


http://127.0.0.1:5471
Open in Browser
Publish
ITC App
How-To-Use
Input Data
Feasibility
Modelling
Welcome to the ITC App
This interactive tool is designed to help you along the process of generating indirect evidence through Network Meta Analysis.
Getting Started
To get started, upload your data file using the bar Input Data on the sidebar Menu. The data should be in a csv file, and it must be in a long format.
Data Requirements
To ensure the app functions correctly, your dataset must include the following columns:
trial : Name of the clinical trial conducted.
Assigned.treatment : The treatment assigned to an arm within the trial. If the user wants to consider two treatments (`trtA` and `trtB`) as equivalent, this variable should already take it into account and re-assign them a common name (`trtAB`).
Dose : The amount of treatment administered.
Dose.unit : The unit of measurement for the dose.
Baseline : Y/N values, identifies if a measurement was taken at baseline (i.e., `timepoint_weeks` = 0).
Variable : The specific variable being measured. This column will include both endpoints and baseline characteristics. Endpoints can be identified as measurements in correspondence of rows with Baseline = N .
Variable.category : For continuous outcomes, this could include `min, max, mean, se`. <!-- TODO: add binary outcomes -->
type : Indicate here if it's cfb (change from baseline) or other.
Variable.unit : The unit of measurement for the variable.
Variable.value : The value obtained for the variable.
timepoint_weeks : The time point of measurement in weeks.
Numbers.analysed : The number of subjects analyzed at the specified time point.
Estimand : The target of estimation defined in the trial's objectives.
A data set is deemed ready for analysis once the following processes are completed:
Type Conversions : Ensuring correct data types for variables and standardizing units (e.g., for dose, variable units, timepoints correctly converted to weeks).
Imputations : Addressing missing values with 'NA' indicators.
Filtering : Removing duplicates and identifying outliers.
Label Corrections : Amending any incorrect labels.
Analysis Flags : Highlighting specific data for attention during analysis.
Please ensure that your dataset meets these requirements before uploading it to the app.
App Navigation
In the Input Data tab, you can explore the uploaded data through a dataset view and several visualizations.
In the Feasibility tab, you can explore heterogeneity in the baseline characteristics (within and between trials) and fit meta-analysis on the edges of the networks selecting specific outcomes of interest.
Lastly, you have a Modelling tab, where you can select an outcome of interest and fit anchored ITCs, with fixed or random effects. The tool gives some flexibility for the choice of parameters during modelling. For instance, the user can provide the scale for the specific priors, the number of chains, etc.
While you use the app, make sure to read notifications and hover over information buttons to get some help.
Learn More
If you want to read more about Indirect Treatment Comparisons, please have a look at the online course created by AXBO, AGTR, MOIV

Model Output

Column visibility | CSV | Search:

nterceptScale	TreatmentScale	HetDist	HetScale	RegressOn	InteractionWithTreatment	RegressionScale	NumChains	Iter	Warmup	AdaptDelta	Tau	NumDataPoints	ResidualDeviance	DIC
10000	10000						4	10000	5000	0.950	0	8	16.470	22.438
10000	10000	half_normal	1000				4	10000	5000	0.990	8.238 [0.491, 49.222]	8	7.813	15.528

Showing 1 to 2 of 2 entries | Previous | 1 | Next

Diagnostics Report | Results Report

Annualized Height Velocity at 52 weeks
Fixed Effects model
Annualized Height Velocity at 52 weeks

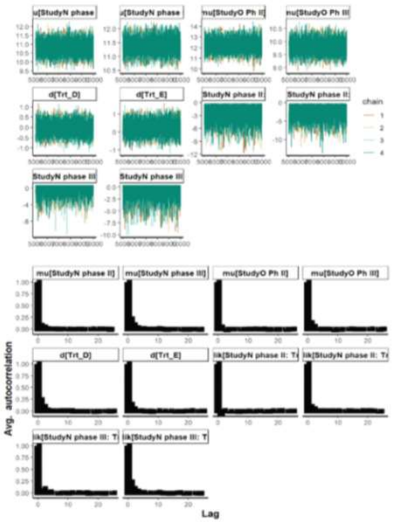
Model Diagnostics Report

Annualized Height Velocity at 52 weeks

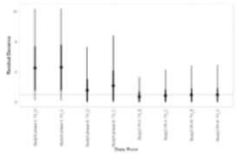
Fixed Effects model

Number of datapoints	Between study variability	Residual Deviance	Scale for treatment prior
8	0	16.47	22.438

Diagnostics: model convergence



Diagnostics: model fit



Consistency not explored as per user's choice.

Annualized Height Velocity at 52 weeks
Fixed Effects model
Annualized Height Velocity at 52 weeks

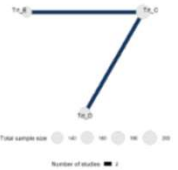
Model Output Report

Annualized Height Velocity at 52 weeks

Fixed Effects model

Parameters used for fitting

Trials included	StudyN phase II, StudyN phase III, StudyO Ph II, StudyO Ph III
Scale for intercept prior	10000
Scale for treatment prior	10000
NumChains	4
Iter	10000
Warmup	5000
AdaptDelta	0.95

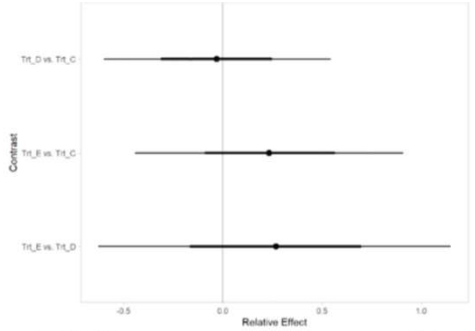


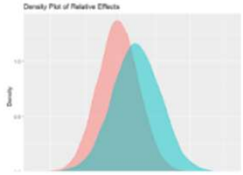
Model fit statistics

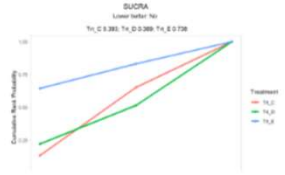
Number of datapoints	Between study variability	Residual Deviance	Scale for treatment prior
8	0	16.47	22.438

Pairwise Relative Effects

	Trt_C	Trt_D	Trt_E
Trt_C		0.03 [-0.544, 0.599]	-0.235 [-0.909, 0.442]
Trt_D	-0.03 [-0.599, 0.544]		-0.266 [-1.149, 0.627]
Trt_E	0.235 [-0.442, 0.909]	0.266 [-0.627, 1.149]	



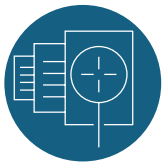




novo nordisk®

Current Improvements

Led by use cases & stakeholder engagement



- Additional endpoints types (binary, survival)
- Standardization of Targeted/Systematic Literature Review
- Development of customized outputs tailored to HTA bodies
- Standalone code generation
- Open sharing with stakeholders, training programs

Technical Development

- Develop the app as an R package

Future Aspirations

Collaborative Growth

- Gathering feedback through conference presentations
- Exploring opportunities for collaboration to enhance tool capabilities and reach

Open-Source Initiatives

- Explore open-source possibilities

Q
A