

R-shiny: A tool for data visualization

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Disclaimer



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Agenda

1. What is R-shiny
2. One FIR R-shiny example
3. Summary & discussion

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R, R studio and Shiny

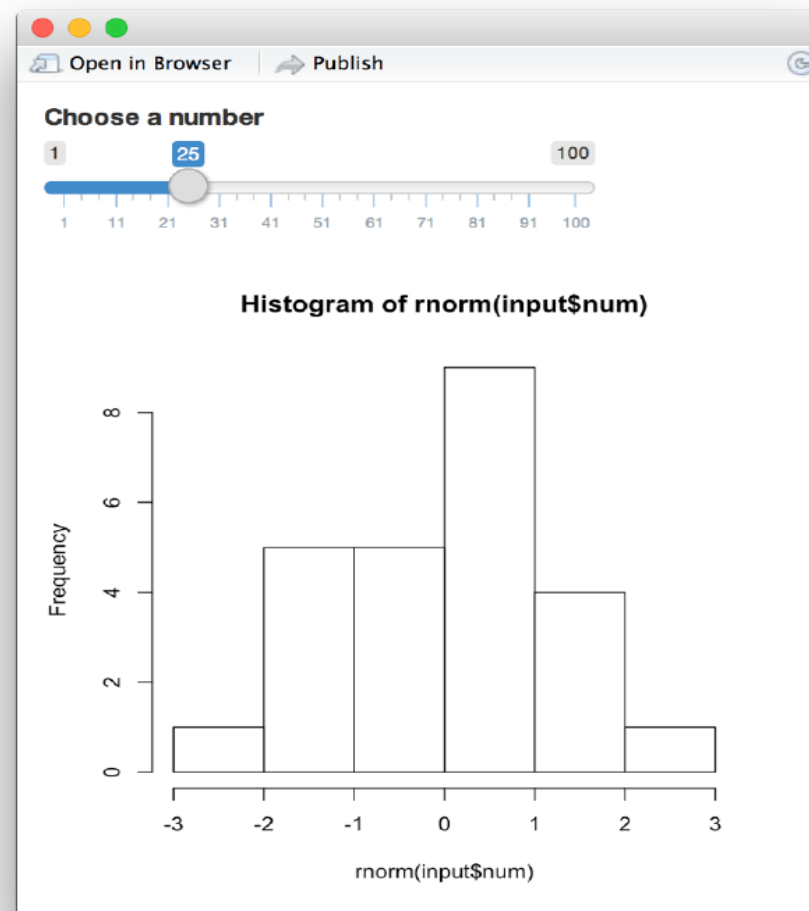
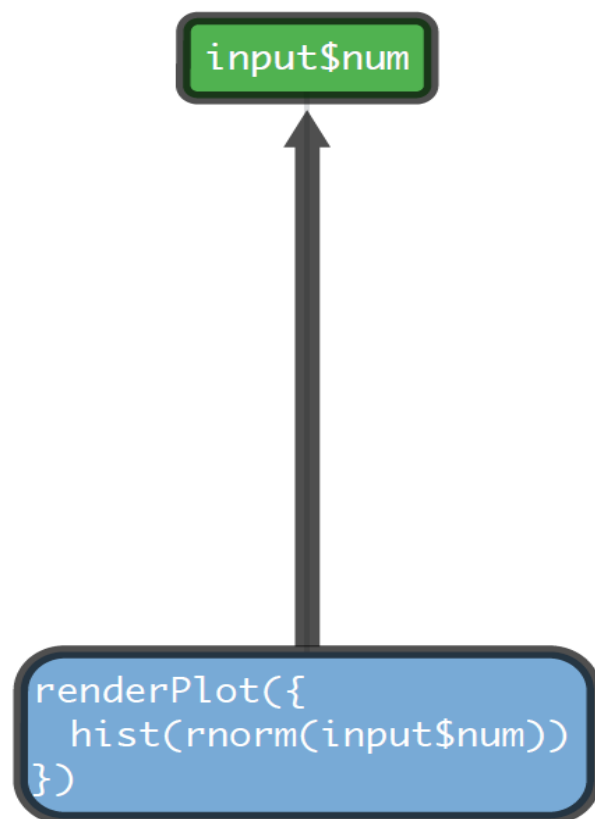


a
Programming
language

an integrated
development
environment
(IDE) for R

R package
created by
RStudio

One shiny example -Create interactions



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Shiny input

Buttons

Action

Submit

`actionButton()`
`submitButton()`

Single checkbox

☒ Choice A

`checkboxInput()`

Checkbox group

☒ Choice 1
☐ Choice 2
☐ Choice 3

`checkboxGroupInput()`

Date input

2014-01-01

`dateInput()`

Date range

2014-01-24 to 2014-01-24

`dateRangeInput()`

File input

Choose File No file chosen

`fileInput()`

Numeric input

1

`numericInput()`

Password Input

.....

`passwordInput()`

Radio buttons

☒ Choice 1
☐ Choice 2
☐ Choice 3

`radioButtons()`

Select box

Choice 1

`selectInput()`

Sliders

0 50 100
0 25 75 100

`sliderInput()`

Text input

Enter text...

`textInput()`

Shiny output

Function	Inserts
<code>dataTableOutput()</code>	an interactive table
<code>htmlOutput()</code>	raw HTML
<code>imageOutput()</code>	image
<code>plotOutput()</code>	plot
<code>tableOutput()</code>	table
<code>textOutput()</code>	text
<code>uiOutput()</code>	a Shiny UI element
<code>verbatimTextOutput()</code>	text

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R Shiny

Shiny is an R package

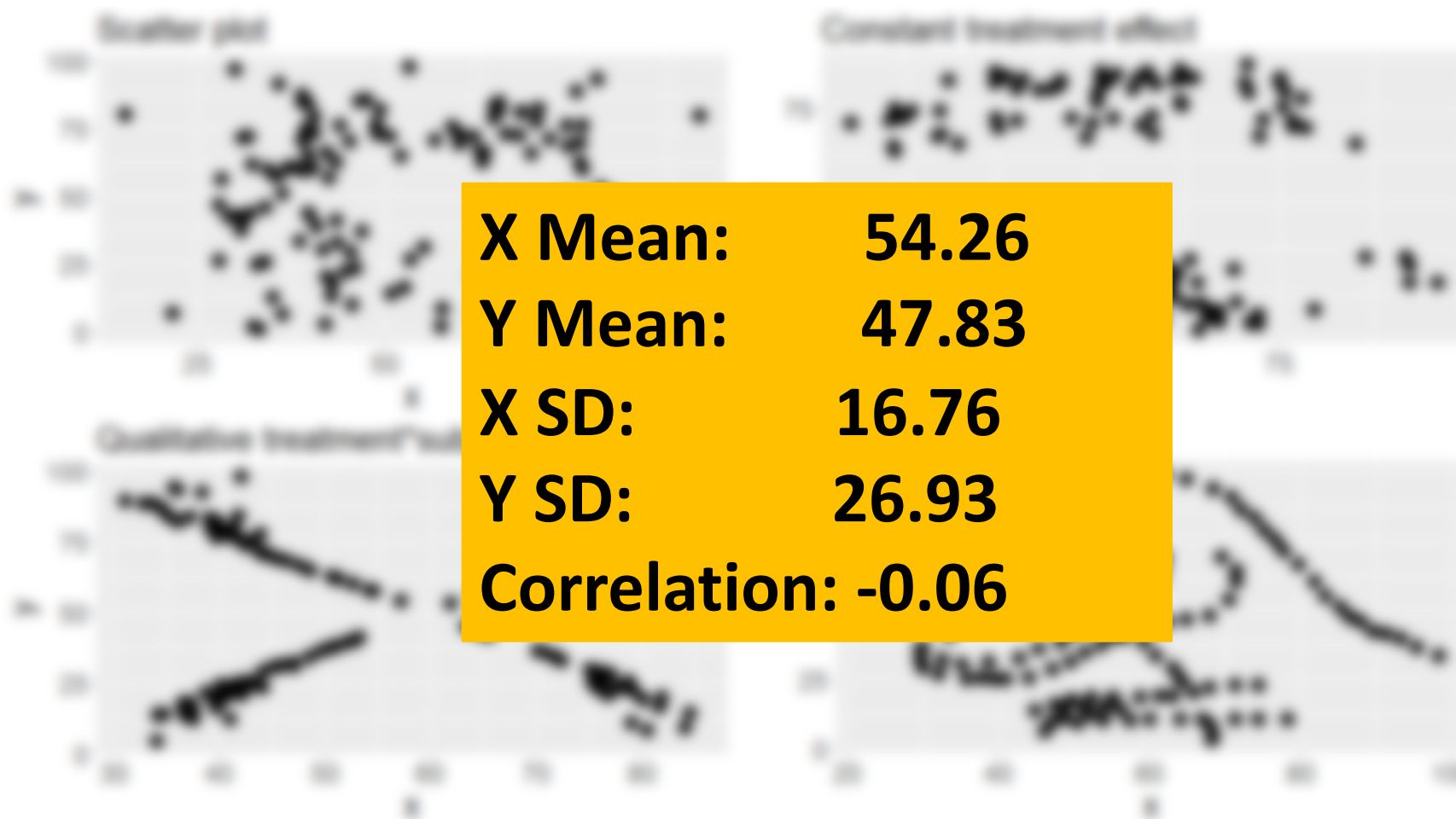
Interactive web application

- Reactive
- Flexible display of results/data (e.g. plot, table)

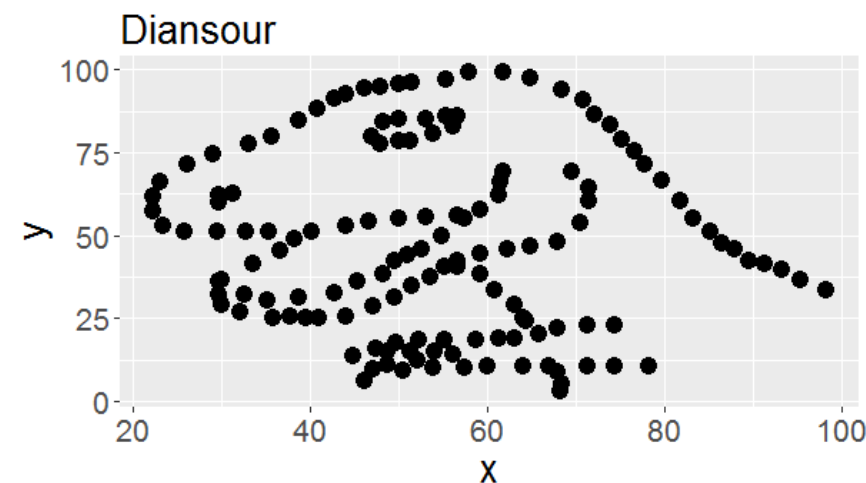
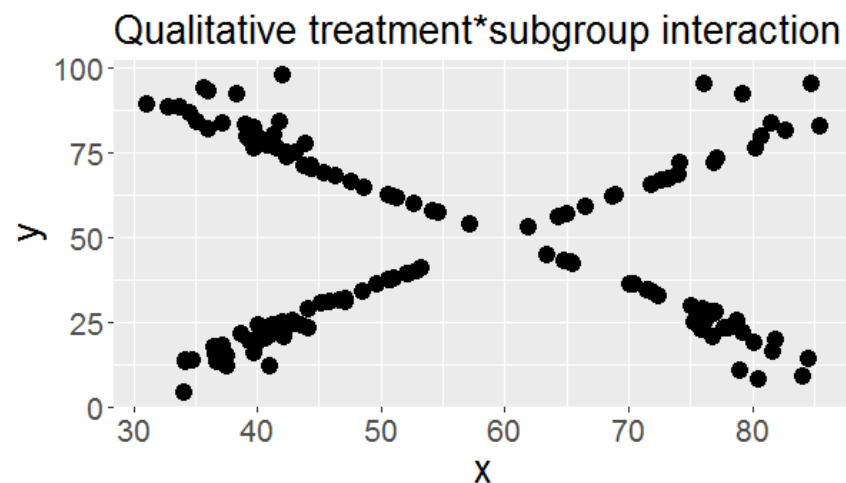
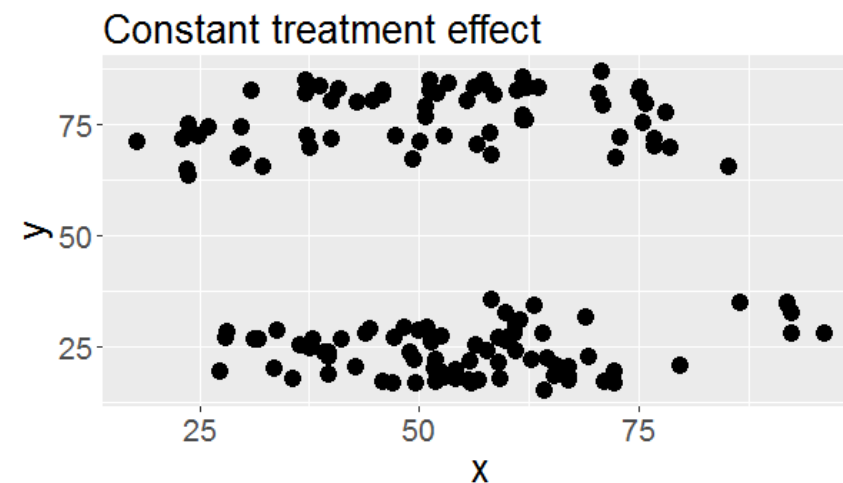
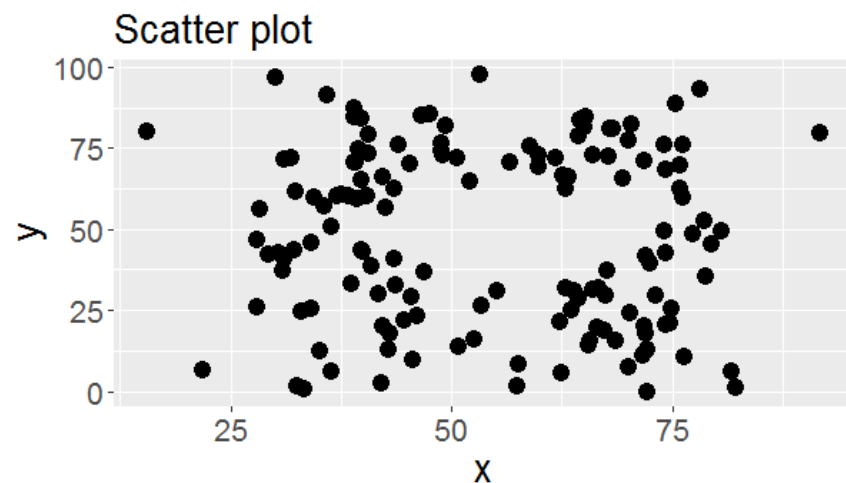
Agenda

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What you might see from CSR



What you might NOT see from CSR



DataSaurus Dozen

Clinical data Analysis

It is always of interest to look at more endpoints, subgroups and visualizations for a more comprehensive understanding and a more informed decision making

This may lead to many similar analyses for different variables/subgroups

- Data-driven in nature
- Resource intensive for pre-specified analyses

There is an increased emphasis on data exploration within studies/indications/compounds and across compounds

- Empower statisticians and programmers to do more interesting value-adding work exploring data
- In turn, this may increase the complexity of future data analysis

One Secukinumab study FIRs

A Phase III study to evaluate Secukinumab in subjects with moderate to severe chronic plaque-type psoriasis

- Many binary efficacy endpoints
- Many pre-defined subgroups

Study objectives

- Primary objective

To demonstrate the superiority of secukinumab in subjects with moderate to severe chronic plaque-type psoriasis in terms of both PASI 75 and IGA mod 2011 0/1 response (co-primary endpoints) at Week 12 compared to placebo

- Secondary objectives

To demonstrate the superiority of secukinumab in terms of PASI 90 response at Week 12 compared to placebo

To investigate the clinical safety and tolerability of secukinumab, as assessed by vital signs, clinical laboratory variables, ECG and adverse events monitoring compared to placebo

Study XXX FIR



② About

② Study information <

Executive summary

Study design

Study objectives

① Baseline <

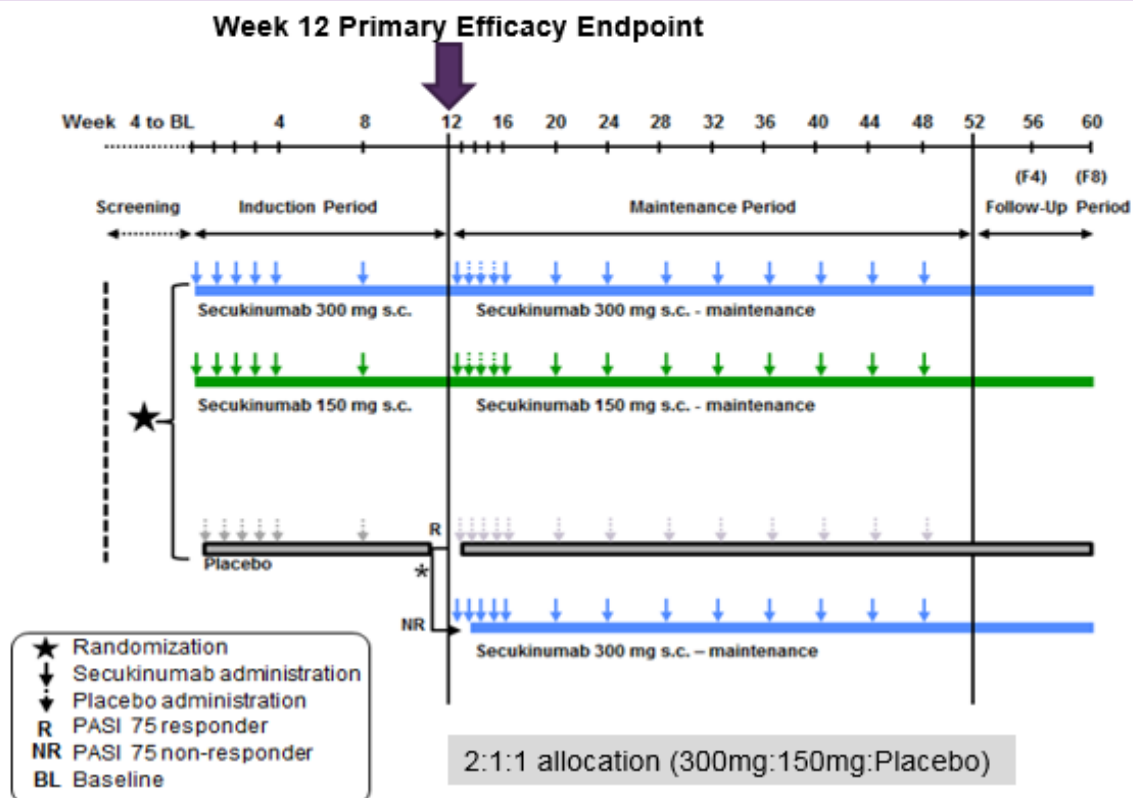
😊 Efficacy <

🌐 Safety <

📊 Exploratory analysis <

📄 eFIR <

Study Design



- About
- Study information <
- Baseline <
- Disposition**
- Baseline information
- Demographics and Disease
- Efficacy <
- Safety <
- Exploratory analysis <
- eFIR <

Disposition by treatment

total population

Disposition/ reason	Treatment A N=136 n (%)	Treatment B N=272 n (%)	Treatment C N=135 n (%)	Total N=543 n (%)
Randomized	136	272	135	543
Completed	134 (98.5)	270 (99.3)	133 (98.5)	537 (98.9)
Discontinued	2 (1.5)	2 (0.7)	2 (1.5)	6 (1.1)
Primary reason for discontinuing				
Adverse event	2 (1.5)	2 (0.7)	1 (0.7)	5 (0.9)
Pregnancy	0 (0.0)	0 (0.0)	1 (0.7)	1 (0.2)
Subject/guardian decision	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

sub population

Disposition/ reason	Treatment A N=110 n (%)	Treatment B N=221 n (%)	Treatment C N=110 n (%)	Total N=441 n (%)
Randomized	110	221	110	441
Completed	109 (99.1)	219 (99.1)	109 (99.1)	437 (99.1)
Discontinued	1 (0.9)	2 (0.9)	1 (0.9)	4 (0.9)
Primary reason for discontinuing				
Adverse event	1 (0.9)	2 (0.9)	0 (0.0)	3 (0.7)
Pregnancy	0 (0.0)	0 (0.0)	1 (0.9)	1 (0.2)
Subject/guardian decision	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

☒ Discontinuing due to AE information

Country/Subject Identifier	Age/Sex/Race	Period(C)	Serious	Reported term/PT/SOC	Start date	End date	Duration days	Severity	Causality	Action taken	Outcome
xxx/xxxxxxx	xx/x/xx	INDUCTION	Yes	Crohn's disease/ Crohn's disease/ Gastrointestinal disorders	2017- 08-06/ 46	2017- 08-17/ 57	12	MOD	2	5	2
				Edema limbs grade3/ Oedema	2017-	2017-					

Study XXX FIR

? About

? Study information <

i Baseline <

Disposition

Baseline information

Demographics and Disease

😊 Efficacy <

🛡️ Safety <

📄 Exploratory analysis <

📁 eFIR <

Select variable:

Age group in years, -n (%)

Active psoriatic arthritis present -n (%)

Age (years)

Age group in years, -n (%)

Baseline IGA mod 2011 score, -n (%)

Baseline PASI score

Baseline PASI, -n (%)

Baseline total BSA affected (%)

BMI (kg/m**2)

Ethnicity, -n (%)

Gender, -n (%)

Height (cm)

65-74

>=75

Characteristics	Treatment A N=136	Treatment B N=272	Treatment C N=135
	133 (97.8)	265 (97.4)	133 (98.5)
	3 (2.2)	3 (1.1)	1 (0.7)
	0 (0.0)	4 (1.5)	1 (0.7)

Characteristics	Treatment A N=110	Treatment B N=221	Treatment C N=110
	109 (99.1)	217 (98.2)	108 (98.2)
	1 (0.9)	3 (1.4)	1 (0.9)
	0 (0.0)	1 (0.5)	1 (0.9)

Study XXX FIR



- ② About
- ② Study information <
- ① Baseline <
- Disposition
- Baseline information
- Demographics and Disease
- 😊 Efficacy <
- 🛡️ Safety <
- 📊 Exploratory analysis <
- 📄 eFIR <

Select variable:

Age (years) ▼

total population

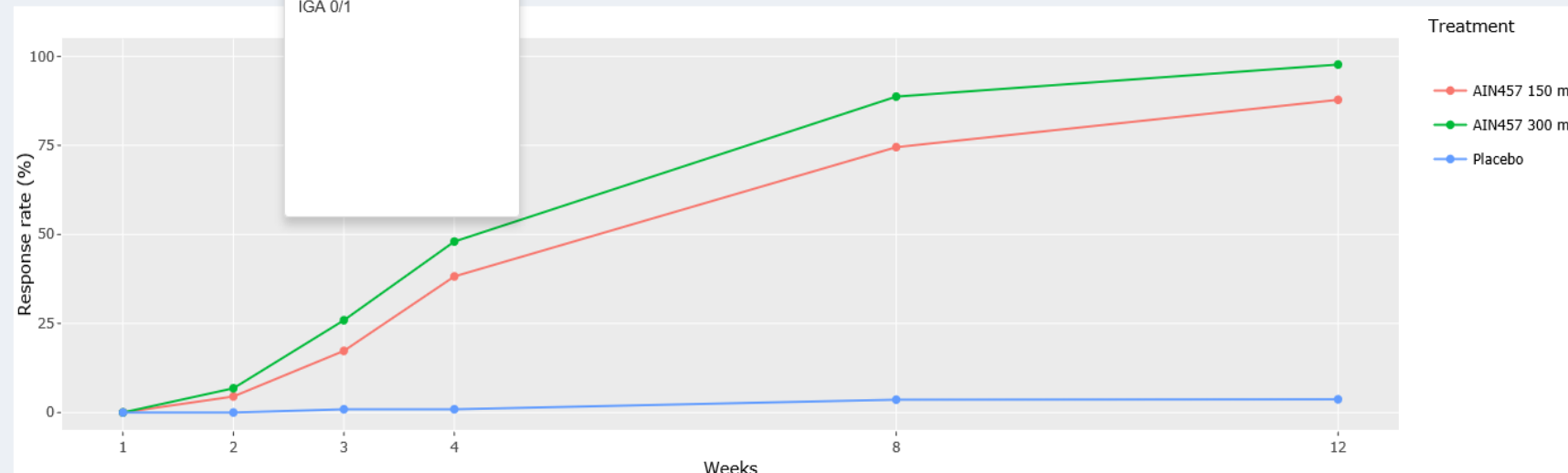
Demographic / Baseline characteristics	Treatment A N=136	Treatment B N=272	Treatment C N=135
n	136	272	135
Mean	41.0	39.9	40.1
SD	11.39	12.35	11.01
Minimum	17	17	19
Q1	32.0	30.0	32.0
Median	40.0	38.0	38.0
Q3	48.0	49.0	48.0
Maximum	69	79	75

sub population

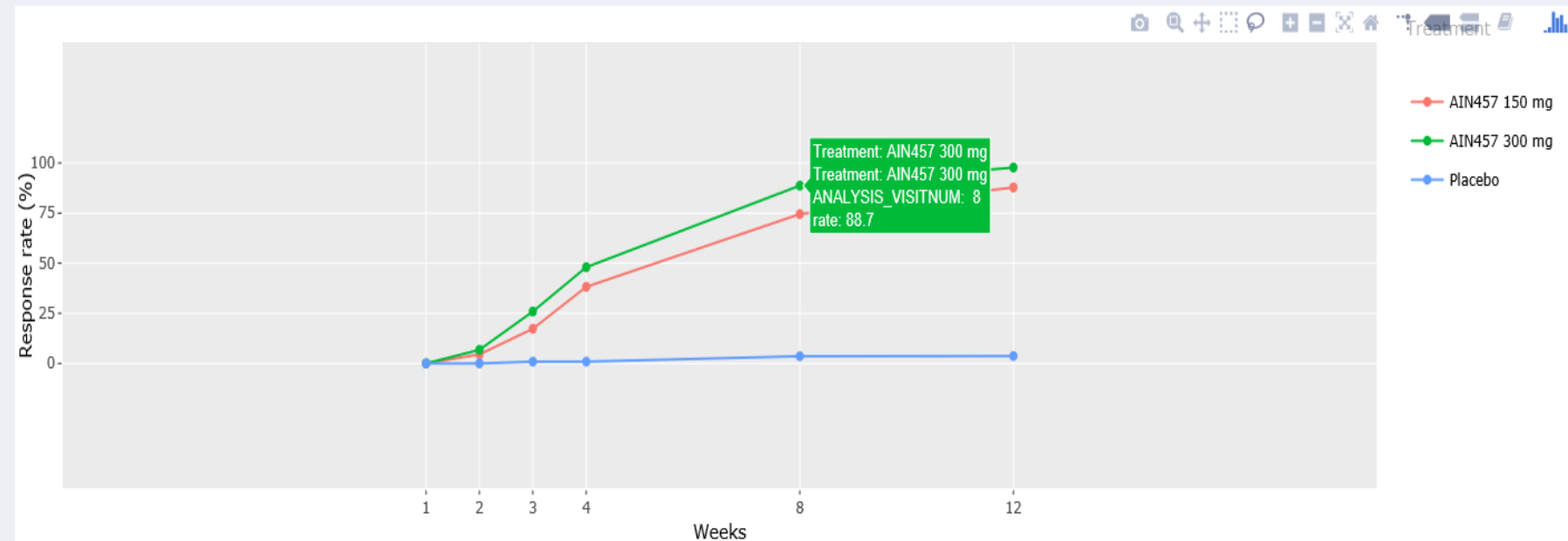
Demographic / Baseline characteristics	Treatment A N=110	Treatment B N=221	Treatment C N=110
n	110	221	110
Mean	40.5	38.9	38.7
SD	10.83	11.55	10.30
Minimum	17	18	19
Q1	33.0	30.0	31.0
Median	39.0	37.0	36.0
Q3	47.0	48.0	46.0
Maximum	67	77	75

Visit: Week 12
 Parameter: PASI 75
 Imputation: Multiple imputation
 Treatment: All
 Pool data: total

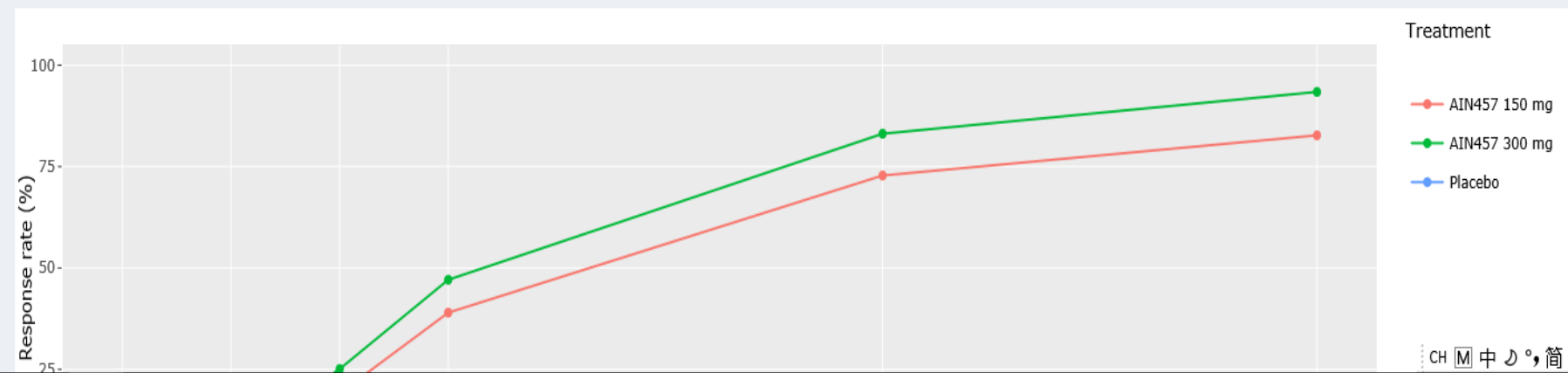
Table Figure



Response rates overtime: sub population



Response rates overtime: total population



About

Study information <

Baseline <

Efficacy <

Safety <

Summary

Adverse Event

Exploratory analysis <

eFIR <

Pool data:

total

Study period:

Entire up to week 16

Threshold(>=):

0

AE:

AE

AE group:

SOC

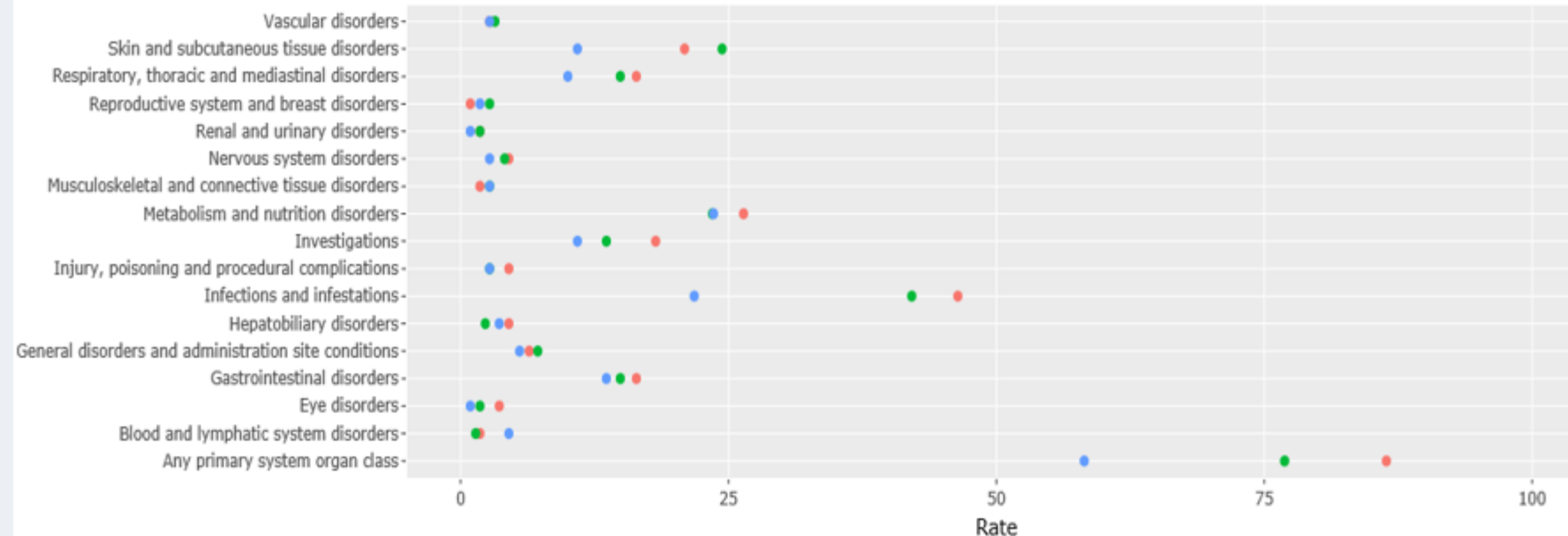
Population:

sub

Table

Figure

Incidence Rates(%)



1

- About
- Study information <
- Baseline <
- Efficacy <
- Safety <
- Exploratory analysis <
- Patient profile**
- Subgroup analysis
- eFIR <

Select patient:

XXXXXXXXXX_9999999

Country/Subject Identifier: xxx/xxxxxxx

Age/Sex/Race: xx/x/xx

Actual Sequence of Treatments: xxx

Date of First/Last Exposure to Treatment: 2017-04-10 / 2017-07-31

Safety

Efficacy

Colour AEs by:

Severity

Plot of adverse events ordered by start date

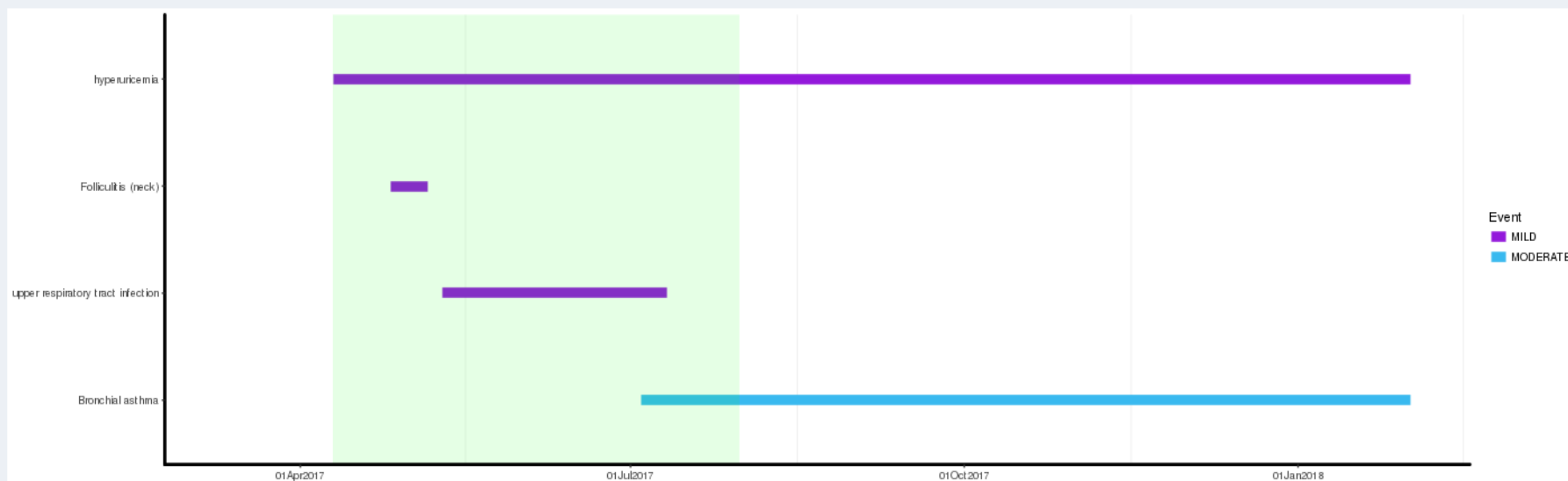
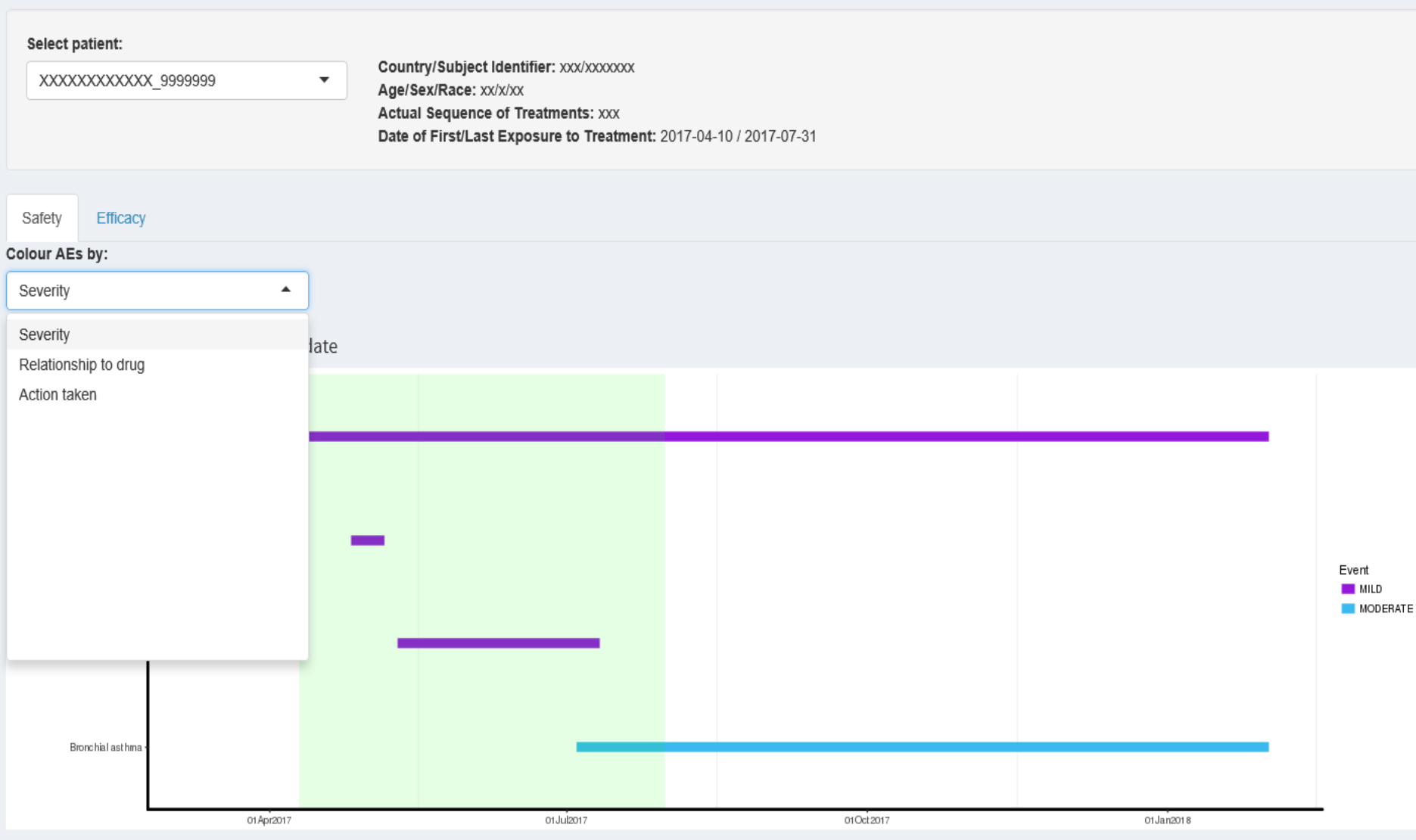


Table of adverse events

Start Date of AE	End Date of AE	Reported Term for the Adverse Event	Body System or Organ Class	Action Taken with Study Treatment	Severity	Causality
2017-07-04		Bronchial asthma	Respiratory, thoracic and mediastinal disorders	DOSE NOT CHANGED	MODERATE	YES

- ② About
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- 📄 Exploratory analysis <
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About

Study information

Baseline

Efficacy

Safety

Exploratory analysis

Patient profile

Subgroup analysis

eFIR

Select patient:

XXXXXXXXXX_9999999

Country/Subject Identifier: xxx/xxxxxxx

Age/Sex/Race: xx/x/xx

Actual Sequence of Treatments: xxx

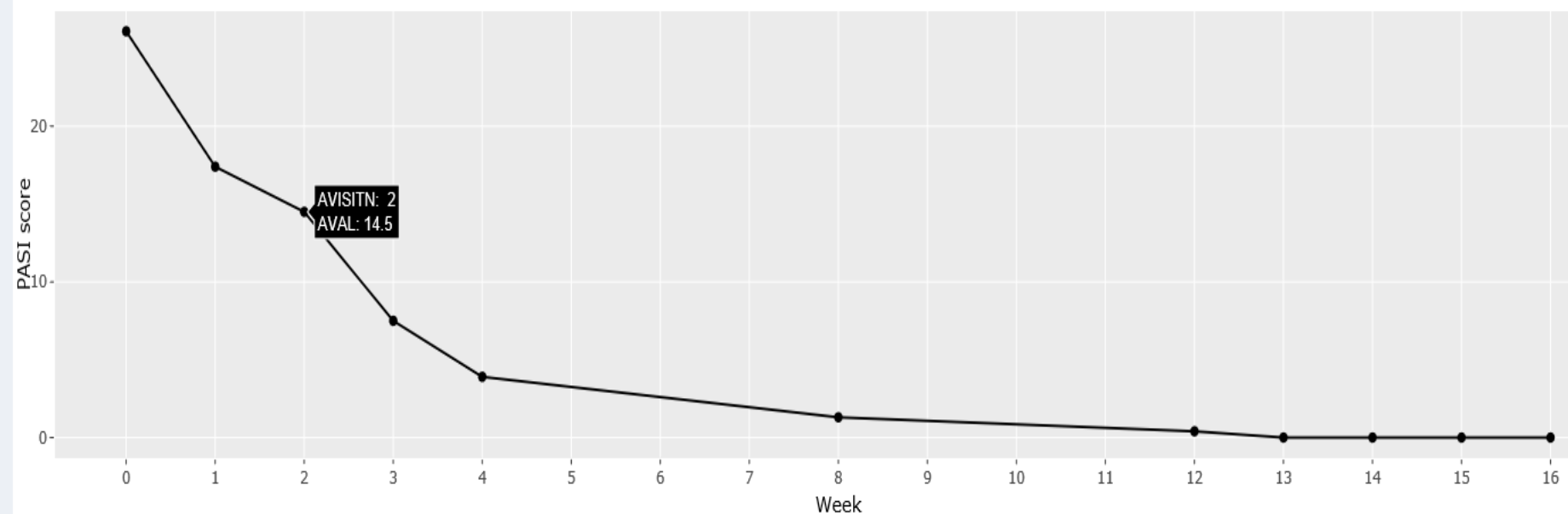
Date of First/Last Exposure to Treatment: 2017-04-10 / 2017-07-31

Safety

Efficacy

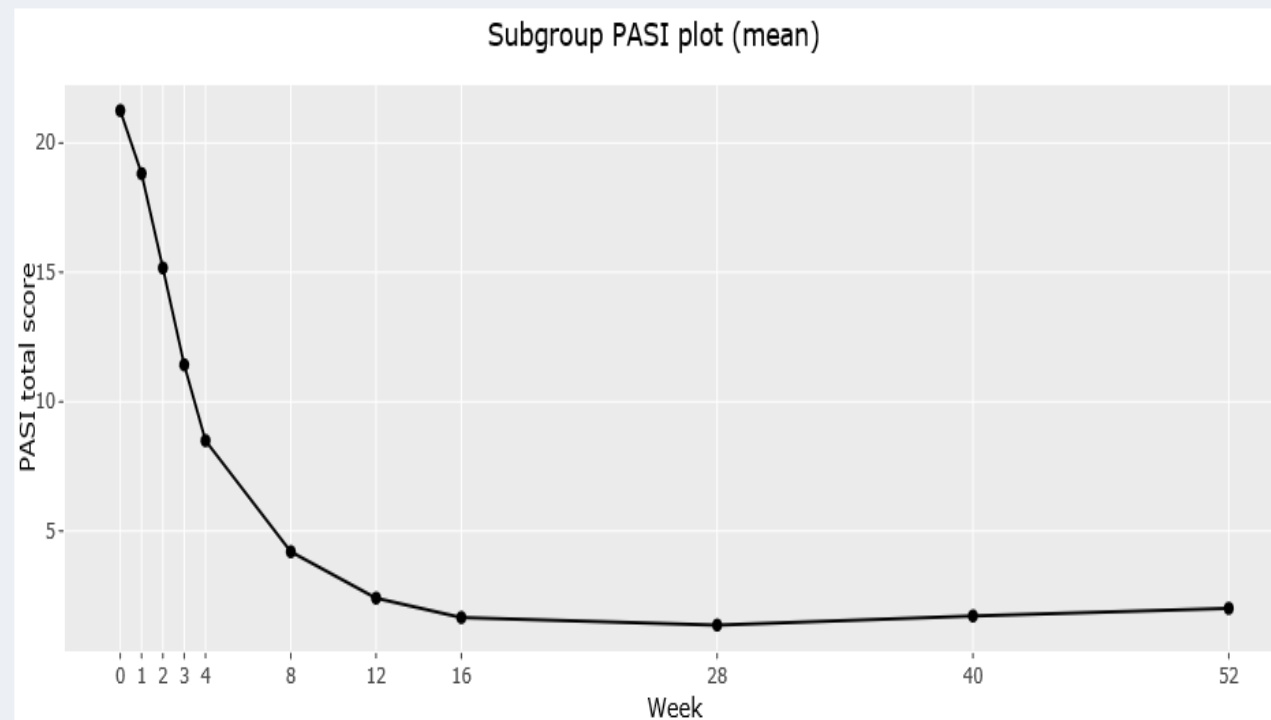
PASI score plot

PASI total score plot



- About
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- Subgroup analysis
- eFIR

Plot of subgroup analysis



Number of subjects in subgroup: 39

Subgroup Selection

Parameter:

PASI total score

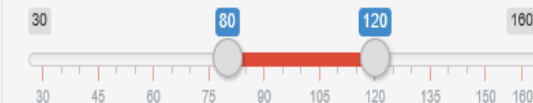
Treatment:

AIN457 300 mg (2mL PFS)

Previous biologic therapy:

ALL

Weight (kg):



Apply

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Summary on Shiny

Especially suitable for efficient exploration of data

- Analysis on the fly (dynamic analyses on demand)
- Engagement with the team (dynamic display and visualization)

Save resources for repeating many similar analyses

- One variable → Many similar variables using the same analysis model
- One subgroup → Many subgroups
- And more

Further discussion

More studies started to use Shiny

Shiny is not limited to FIRs

- CSR outputs
- Pooling data

Machine learning

Resources

Tutorial from RStudio

- <http://shiny.rstudio.com/tutorial/>
- The two-hour video is enough for a good start

Gallery from RStudio

- <http://shiny.rstudio.com/gallery/>
- For inspiration
- For code to implement a feature
 - Eg., how to add a multiple-choice drop-down menu?

Acknowledgements

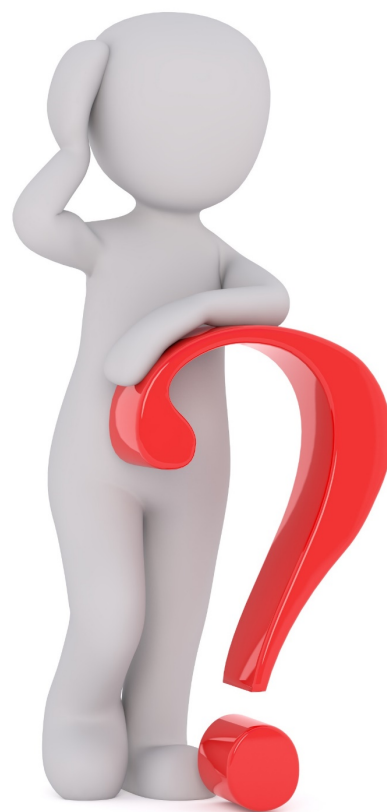
1. Ruquan You
2. Lillian Yau
3. Sijia Zhang

Further Information



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 [/PhUSE](https://www.facebook.com/PhUSE)
 phusewiki.org



Back up

R-shiny template

```
library(shiny)

ui <- fluidPage()

server <- function(input, output) {}

shinyApp(ui = ui, server = server)
```

R, R studio and Shiny

What is R ?

- Programming language
- Free software environment for statistical computing and graphics

What is Rstudio?

- RStudio offers quick and easy ways to build interactive applications for statistical models.

What is Shiny?

- R package created by RStudio
- Framework for building browser-based applications
- Turns R code into interactive and dynamic displays