



SARAH CANNON

Development Innovations

Big Lab Data at the Fingertips of the Statistical Reviewers Using R Shiny

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LAB DATA



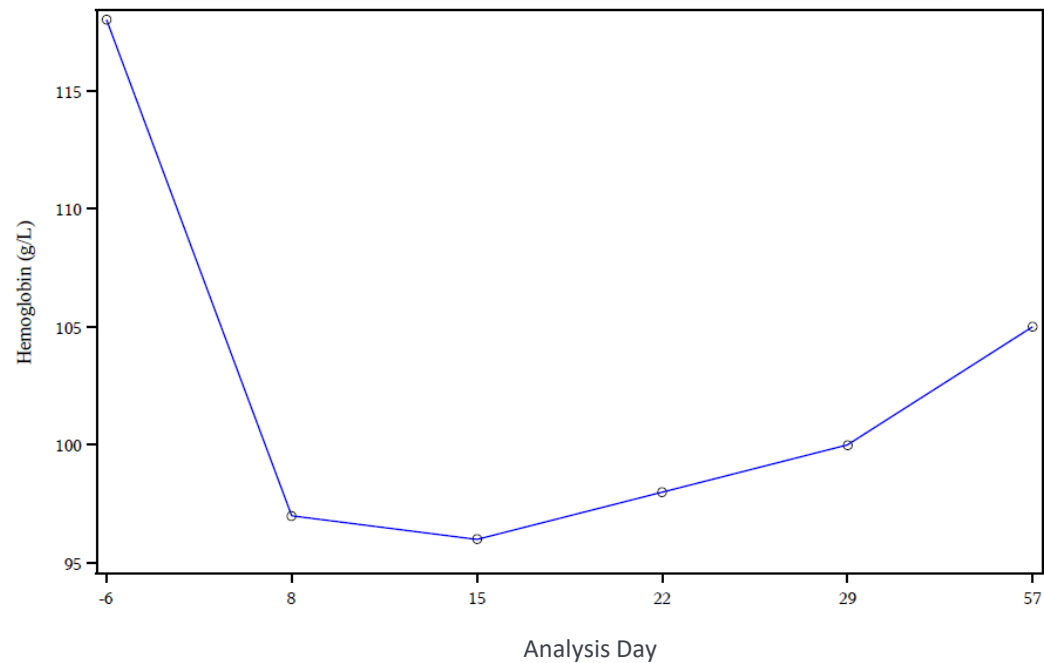


LAB DATA

VIEWTABLE: TMP1.Ib_final									
	Subjid	PARAM	PARCAT1	AVAL	AVALC	BASE	AVISIT	AVISITN	ADY
3	10000003	Alanine Aminotransferase (ukat/L)	CHEMISTRY	0.384	0.384	0.384	Baseline	10000	-1
4	10000003	Albumin (g/L)	CHEMISTRY	40	40.000	40	Baseline	10000	-1
5	10000003	Alkaline Phosphatase (ukat/L)	CHEMISTRY	0.985	0.985	0.985	Baseline	10000	-1
6	10000003	Aspartate Aminotransferase (ukat/L)	CHEMISTRY	0.433	0.433	0.433	Baseline	10000	-1
7	10000003	Bilirubin (umol/L)	CHEMISTRY	17.1	17.1	17.1	Baseline	10000	-1
8	10000003	Blood Urea Nitrogen (mmol/L)	CHEMISTRY	5.4	5.4	5.4	Baseline	10000	-1
9	10000003	Calcium (mmol/L)	CHEMISTRY	2.3	2.30	2.3	Baseline	10000	-1
10	10000003	Carbon Dioxide (mmol/L)	CHEMISTRY	28	28.0	28	Baseline	10000	-1
11	10000003	Chloride (mmol/L)	CHEMISTRY	103	103	103	Baseline	10000	-1
12	10000003	Creatinine (umol/L)	CHEMISTRY	58.344	58.344	58.344	Baseline	10000	-1
13	10000003	Glucose (mmol/L)	CHEMISTRY	7.715	7.715	7.715	Baseline	10000	-1
14	10000003	Potassium (mmol/L)	CHEMISTRY	3.7	3.700	3.7	Baseline	10000	-1
15	10000003	Protein (g/L)	CHEMISTRY	69	69.000	69	Baseline	10000	-1
16	10000003	Sodium (mmol/L)	CHEMISTRY	138	138.000	138	Baseline	10000	-1
17	10000003	Alanine Aminotransferase (ukat/L)	CHEMISTRY	0.434	0.434	0.384	C1D4	20104	4
18	10000003	Albumin (g/L)	CHEMISTRY	41	41.000	40	C1D4	20104	4
19	10000003	Alkaline Phosphatase (ukat/L)	CHEMISTRY	0.985	0.985	0.985	C1D4	20104	4
20	10000003	Aspartate Aminotransferase (ukat/L)	CHEMISTRY	0.4	0.400	0.433	C1D4	20104	4
21	10000003	Bilirubin (umol/L)	CHEMISTRY	15.4	15.4	17.1	C1D4	20104	4
22	10000003	Blood Urea Nitrogen (mmol/L)	CHEMISTRY	7.9	7.9	5.4	C1D4	20104	4
23	10000003	Calcium (mmol/L)	CHEMISTRY	2.27	2.27	2.3	C1D4	20104	4
24	10000003	Carbon Dioxide (mmol/L)	CHEMISTRY	27	27.0	28	C1D4	20104	4
25	10000003	Chloride (mmol/L)	CHEMISTRY	104	104	103	C1D4	20104	4
26	10000003	Creatinine (umol/L)	CHEMISTRY	59.228	59.228	58.344	C1D4	20104	4
27	10000003	Glucose (mmol/L)	CHEMISTRY	5.384	5.384	7.715	C1D4	20104	4
28	10000003	Potassium (mmol/L)	CHEMISTRY	4.2	4.200	3.7	C1D4	20104	4
29	10000003	Protein (g/L)	CHEMISTRY	71	71.000	69	C1D4	20104	4
30	10000003	Sodium (mmol/L)	CHEMISTRY	139	139.000	138	C1D4	20104	4
31	10000003	Alanine Aminotransferase (ukat/L)	CHEMISTRY	0.484	0.484	0.384	C1D8	20108	8
32	10000003	Albumin (g/L)	CHEMISTRY	39	39.000	40	C1D8	20108	8
33	10000003	Alkaline Phosphatase (ukat/L)	CHEMISTRY	0.919	0.919	0.985	C1D8	20108	8
34	10000003	Aspartate Aminotransferase (ukat/L)	CHEMISTRY	0.4	0.400	0.433	C1D8	20108	8
35	10000003	Bilirubin (umol/L)	CHEMISTRY	17.1	17.1	17.1	C1D8	20108	8
36	10000003	Blood Urea Nitrogen (mmol/L)	CHEMISTRY	7.1	7.1	5.4	C1D8	20108	8
37	10000003	Calcium (mmol/L)	CHEMISTRY	2.22	2.22	2.3	C1D8	20108	8
38	10000003	Carbon Dioxide (mmol/L)	CHEMISTRY	25	25.0	28	C1D8	20108	8
39	10000003	Chloride (mmol/L)	CHEMISTRY	103	103	103	C1D8	20108	8
40	10000003	Creatinine (umol/L)	CHEMISTRY	56.576	56.576	58.344	C1D8	20108	8
41	10000003	Glucose (mmol/L)	CHEMISTRY	8.27	8.270	7.715	C1D8	20108	8
42	10000003	Potassium (mmol/L)	CHEMISTRY	3.8	3.800	3.7	C1D8	20108	8
43	10000003	Protein (g/L)	CHEMISTRY	64	64.000	69	C1D8	20108	8
44	10000003	Sodium (mmol/L)	CHEMISTRY	139	139.000	138	C1D8	20108	8

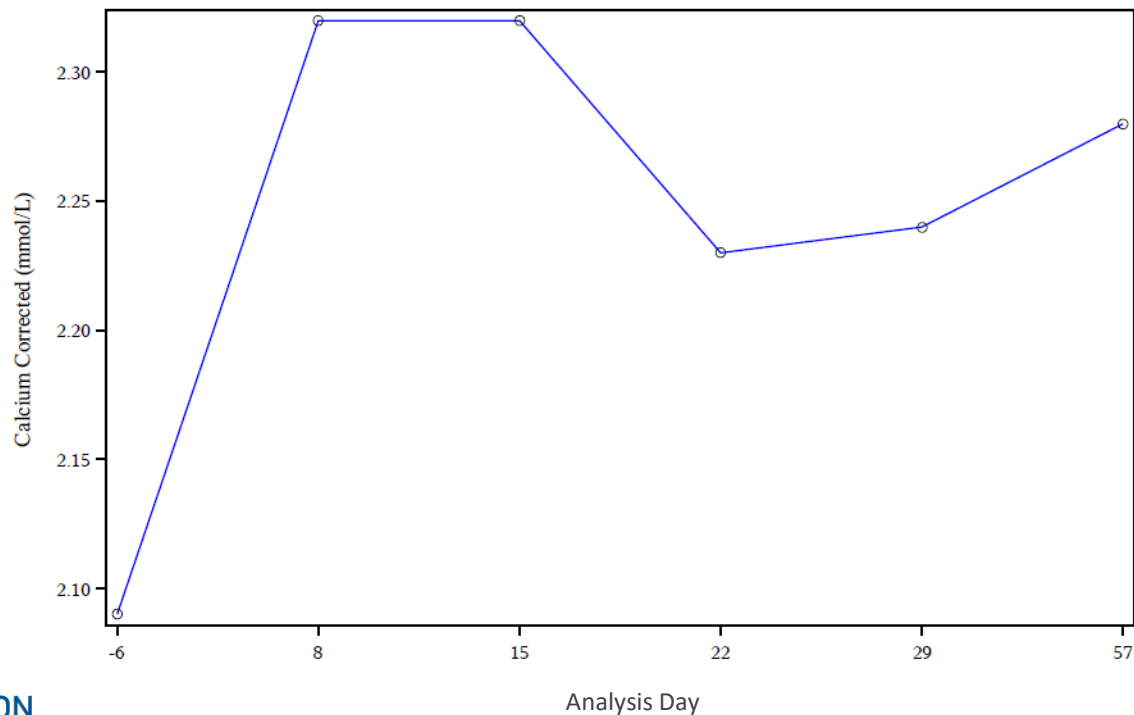
LAB DATA OUTPUTS

Hematology results over time (Full analysis set)



LAB DATA OUTPUTS

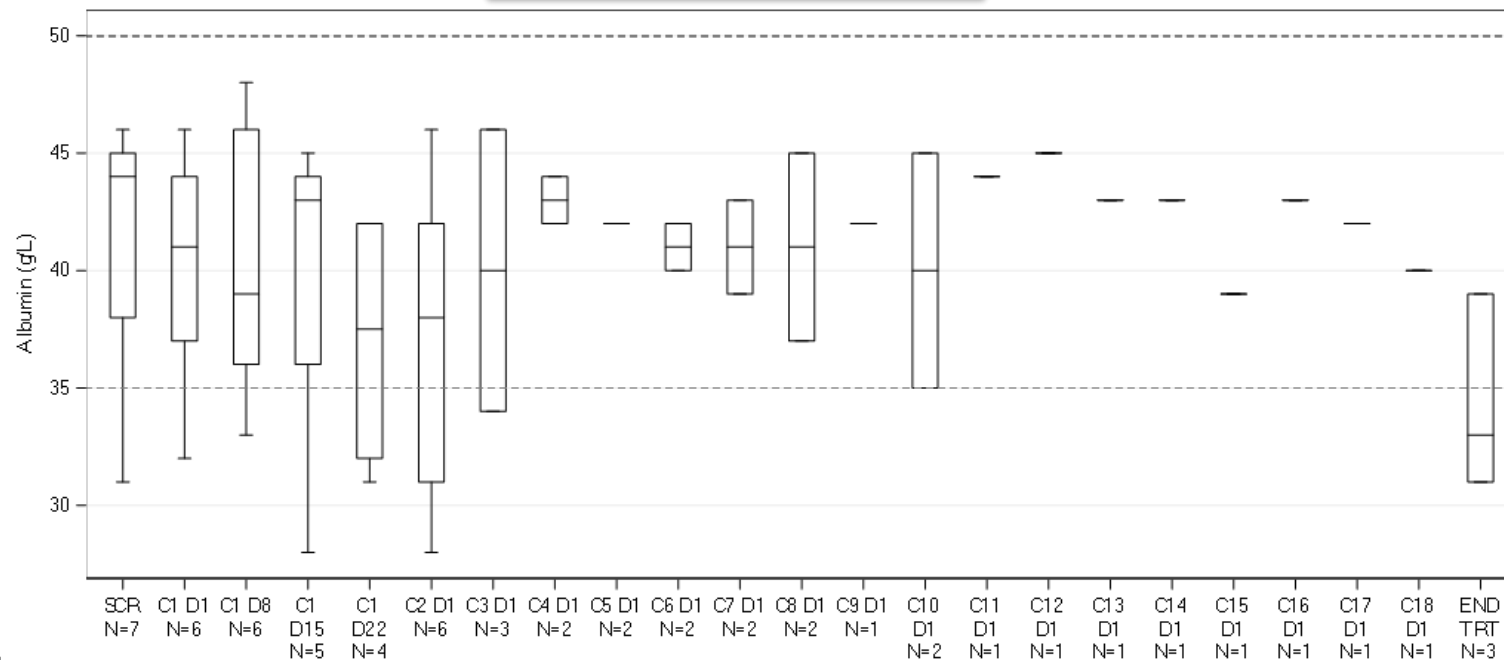
Chemistry parameter results over time (Full analysis set)



LAB DATA OUTPUTS

Albumin (g/L)

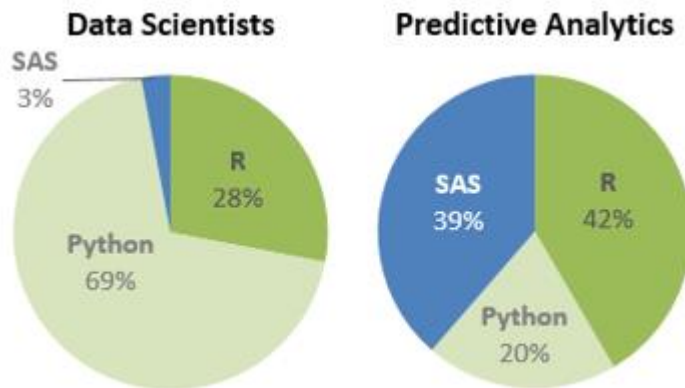
Boxplot



R PROGRAMMING LANGUAGE

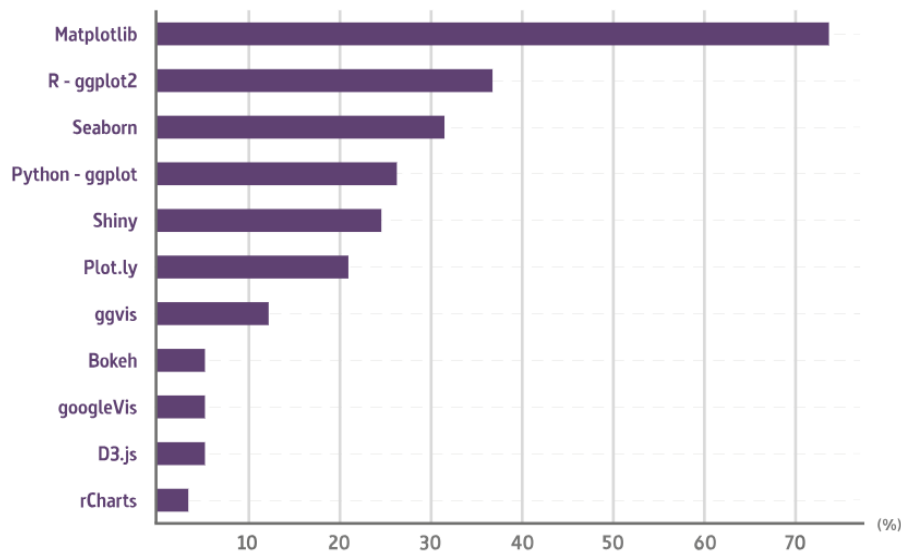
- R is a open-source programming language and widely used by data scientists and major corporations like Google, Airbnb, Facebook etc. for data analytics.

Programming language usage



www.burtchworks.com

Visualization library ranking



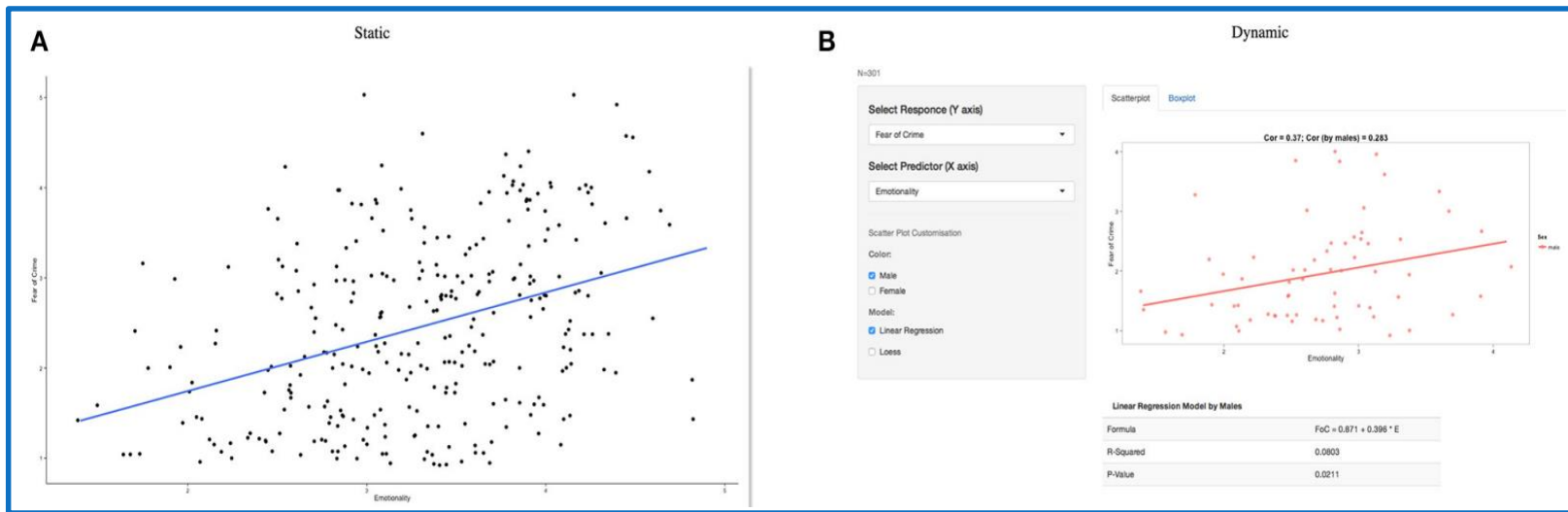
www.keedio.org

R SHINY

- **Shiny is an R package that makes it easy to build interactive web apps straight from R.**
- You can host standalone apps on a webpage or embed them in R Markdown documents or build dashboards.
- **Shiny is based on a reactive programming model, similar to a spreadsheet.**
- You can host your Shiny apps on the web in minutes with Shinyapps.io. It is easy to use, secure, and scalable. No hardware, installation required.

STATIC VS INTERACTIVE VISUALIZATION

- **Figures are part of any submission to a regulatory authority in clinical trials, however, these usually do not include interactive clinical data visualizations.**
- Static visualization do not change with time and we have to edit every time for required parameters, while interactive graphs change as per user requirement and carry tons of information.



CURRENT STUDY/PRESENTATION

✦ **Line plots**

✦ **Boxplots**

✦ **Descriptive statistics**

✦ **Dataset**

USER INTERFACE (UI)

http://127.0.0.1:5225 | Open in Browser

Analysis of lab data

Enrollment Flag:

Safety Flag:

Cohort:

Race:

Sex:

Lab category:

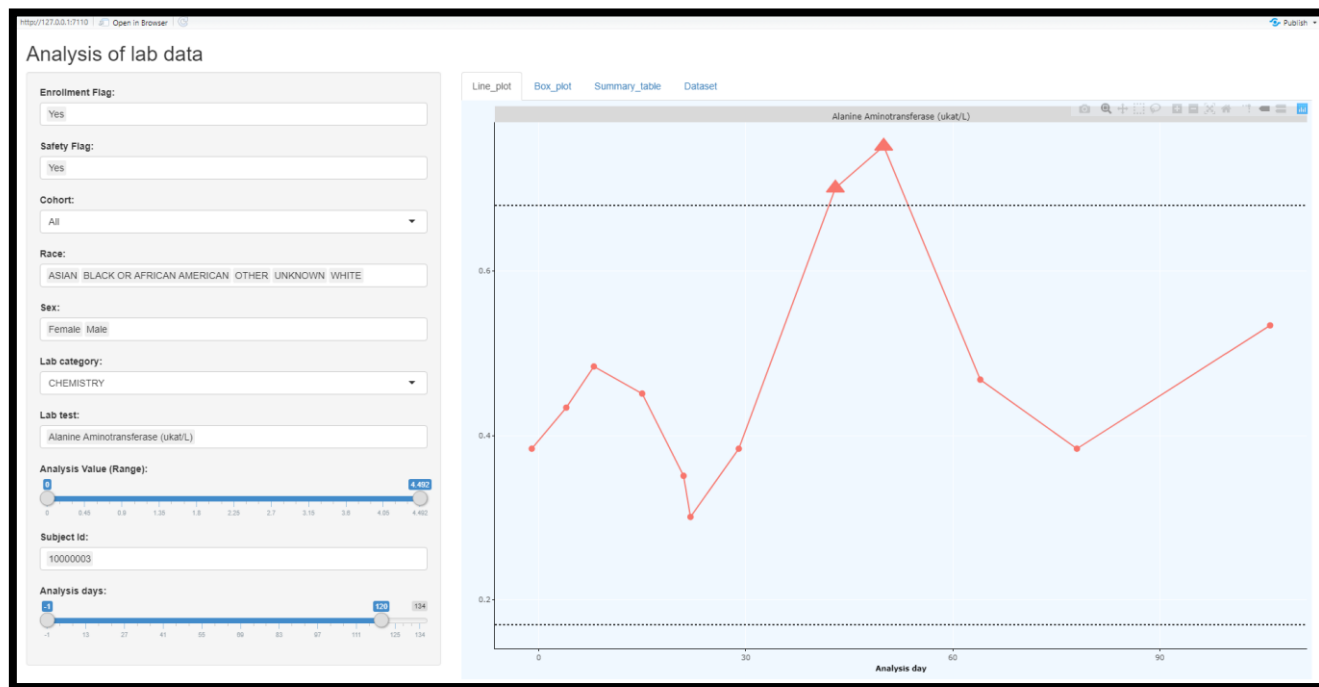
Lab test:

Analysis values (Range):

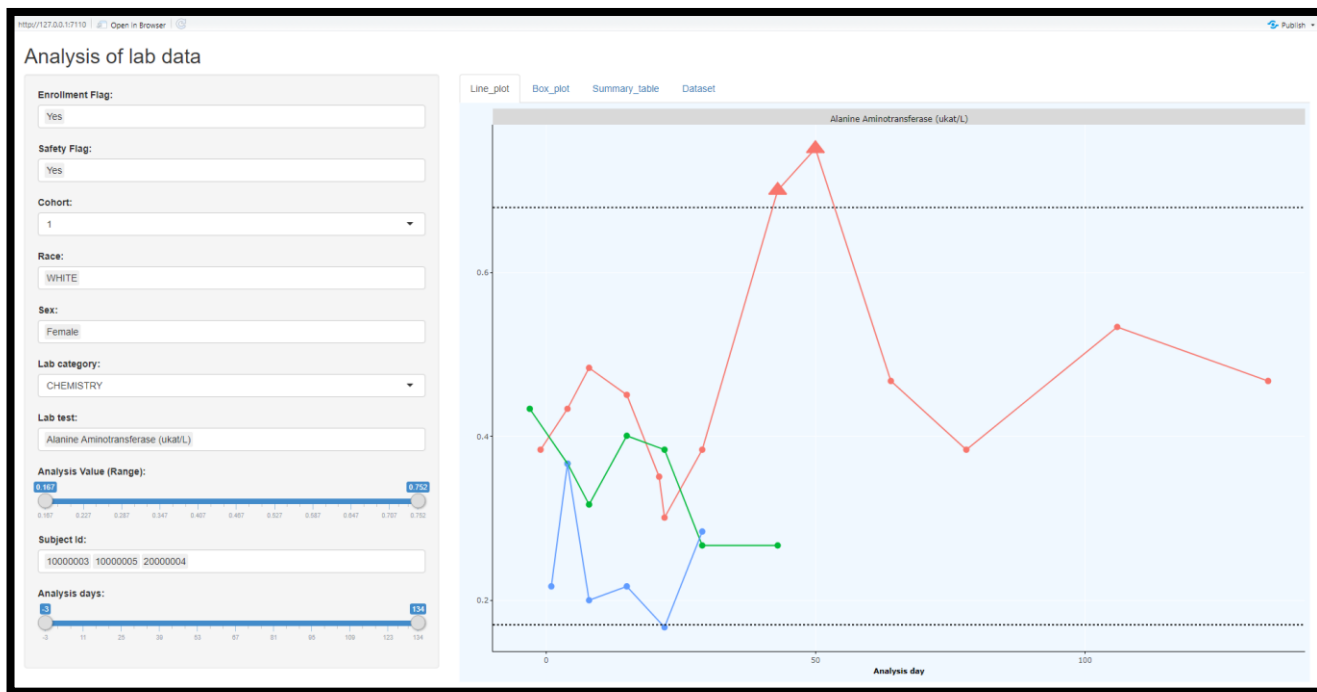
Subject id:

Analysis days:

LINE PLOT



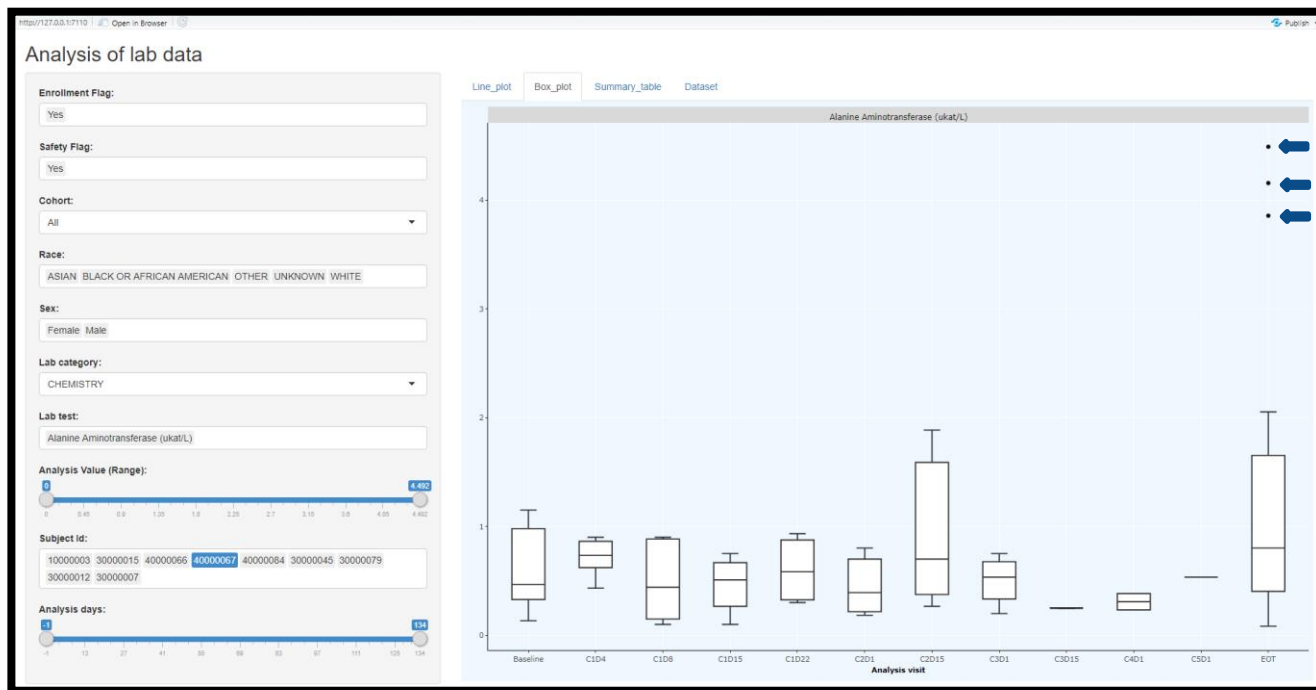
LINE PLOT: MULTIPLE SUBJECTS



LINE PLOT: MULTIPLE SUBJECTS AND TESTS



BOXPLOT



DESCRIPTIVE STATISTICS

http://127.0.0.1:7110 Open in Browser

Analysis of lab data

Enrollment Flag:
Yes

Safety Flag:
Yes

Cohort:
1

Race:
WHITE

Sex:
Female

Lab category:
CHEMISTRY

Lab test:
Alanine Aminotransferase (ukat/L)

Line_plot Box_plot Summary_table Dataset

Copy CSV Excel PDF Print

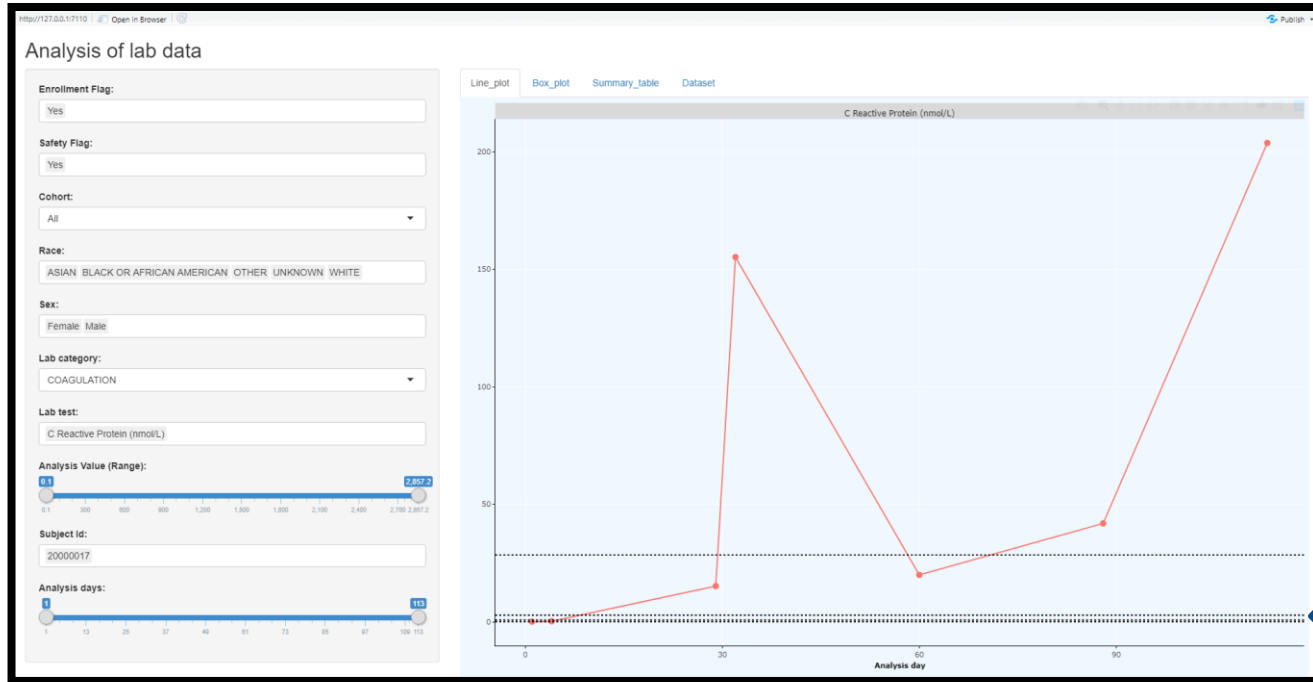
Search:

PARAM	COHORT	visit	Total_count	Mean	Min	Max	Median	SD
Alanine Aminotransferase (ukat/L)	1	Baseline	3	0.345	0.217	0.434	0.384	0.114
Alanine Aminotransferase (ukat/L)	1	C1D4	3	0.389	0.367	0.434	0.367	0.039
Alanine Aminotransferase (ukat/L)	1	C1D8	3	0.334	0.200	0.484	0.317	0.143
Alanine Aminotransferase (ukat/L)	1	C1D15	3	0.356	0.217	0.451	0.401	0.123
Alanine Aminotransferase (ukat/L)	1	C1D22	4	0.301	0.167	0.384	0.326	0.095
Alanine Aminotransferase (ukat/L)	1	C2D1	3	0.312	0.267	0.384	0.284	0.063
Alanine Aminotransferase (ukat/L)	1	C2D15	1	0.701	0.701	0.701	0.701	NA
Alanine Aminotransferase (ukat/L)	1	C3D1	2	0.610	0.468	0.752	0.610	0.201
Alanine Aminotransferase (ukat/L)	1	C4D1	1	0.384	0.384	0.384	0.384	NA
Alanine Aminotransferase (ukat/L)	1	C5D1	1	0.534	0.534	0.534	0.534	NA
Alanine Aminotransferase (ukat/L)	1	EOT	2	0.368	0.267	0.468	0.368	0.142

Showing 1 to 11 of 11 entries

Previous 1 Next

ANOMALY DETECTION



ANOMALY DETECTION

http://127.0.0.1:7119 | Open in Browser

Line_plot Box_plot Summary_table Dataset

Copy CSV Excel PDF Print Search:

Subjid	Gender	ETHNIC	RACE	ENRFL	SAFL	COHORT	PARCAT1	PARAM	AVAL	BASE	AVISIT	AVISITN	ADY	ABLFL	ANRLO	ANRHI	ATOXGR1	ATOXGR
20000017	Female	NOT HISPANIC OR LATINO	WHITE	Yes	Yes	5	COAGULATION	C Reactive Protein (nmol/L)	0.1	0.1	Baseline	10000	1 Y		0.076	2.85		
20000017	Female	NOT HISPANIC OR LATINO	WHITE	Yes	Yes	5	COAGULATION	C Reactive Protein (nmol/L)	0.26	0.1	C1D4	20104	4		0.076	2.85		
20000017	Female	NOT HISPANIC OR LATINO	WHITE	Yes	Yes	5	COAGULATION	C Reactive Protein (nmol/L)	15.24	0.1	C2D1	20201	29		0.76	28.5		
20000017	Female	NOT HISPANIC OR LATINO	WHITE	Yes	Yes	5	COAGULATION	C Reactive Protein (nmol/L)	155.24	0.1	C2D4	20204	32		0.76	28.5		
20000017	Female	NOT HISPANIC OR LATINO	WHITE	Yes	Yes	5	COAGULATION	C Reactive Protein (nmol/L)	20	0.1	C3D4	20304	60		0.76	28.5		
20000017	Female	NOT HISPANIC OR LATINO	WHITE	Yes	Yes	5	COAGULATION	C Reactive Protein (nmol/L)	41.91	0.1	C4D4	20404	88		0.76	28.5		

DATA DOWNLOAD

http://127.0.0.1:7110 Open in Browser

Line_plot Box_plot Summary_table Dataset

Copy CSV Excel PDF Print Search:

Subjid	Gender	ETHNIC	RACE	ENRFL	SAFL	COHORT	PARCAT1	PARAM	AVAL	BASE	AVISIT	AVISITN	ADY	ABLFL
10000003	Female	NOT HISPANIC OR LATINO	WHITE	Yes	Yes	1	CHEMISTRY	Alanine Aminotransferase (ukat/L)	0.384	0.384	Baseline	10000	-1	Y
10000003	Female	NOT HISPANIC OR LATINO	WHITE	Yes	Yes	1	CHEMISTRY	Alanine Aminotransferase (ukat/L)	0.434	0.384	C1D4	20104	4	
10000003	Female	NOT HISPANIC OR LATINO	WHITE	Yes	Yes	1	CHEMISTRY	Alanine Aminotransferase (ukat/L)	0.484	0.384	C1D8	20108	8	

SUMMARY

- **Interactive visualization help better communication of the data to all stakeholders.**
- **Multiple tests and subjects can be visualized side by side.**
- **Data trend or anomalies can be detected easily.**
- **Statistical review will be more efficient. Shiny with Plotly adds interactivity to the graphs, which in turn help reviewers to visualize data at more granular levels.**
- **Data can be downloaded in multiple formats e.g. excel, csv, pdf etc.**
- **Figures can also be downloaded and presented elsewhere.**
- **Overall R Shiny make lab data analysis easy, efficient and informative for quick decision making.**

ACKNOWLEDGMENTS



Tracy Parker



Aicha Bassile



Srinivasulu Kapa

Aditya Rachoori

William Noble



SARAH CANNON

Development Innovations

Thank You!

Questions?

Comments?

Suggestions?