

PHUSE EU Connect 2021 - Data Visualisation (DV) : DV10

The Art of Swim Lane Plot

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Disclaimer

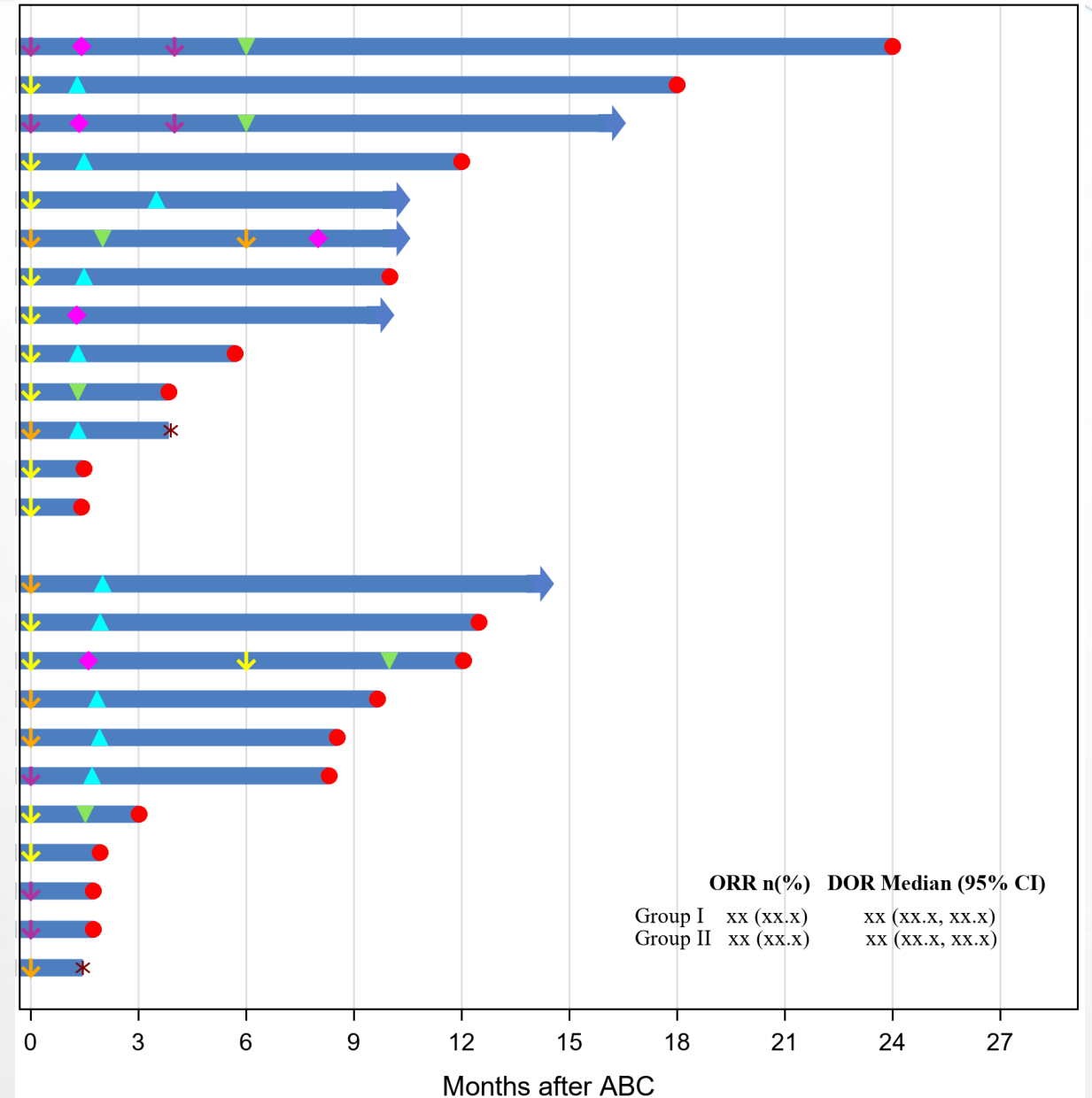
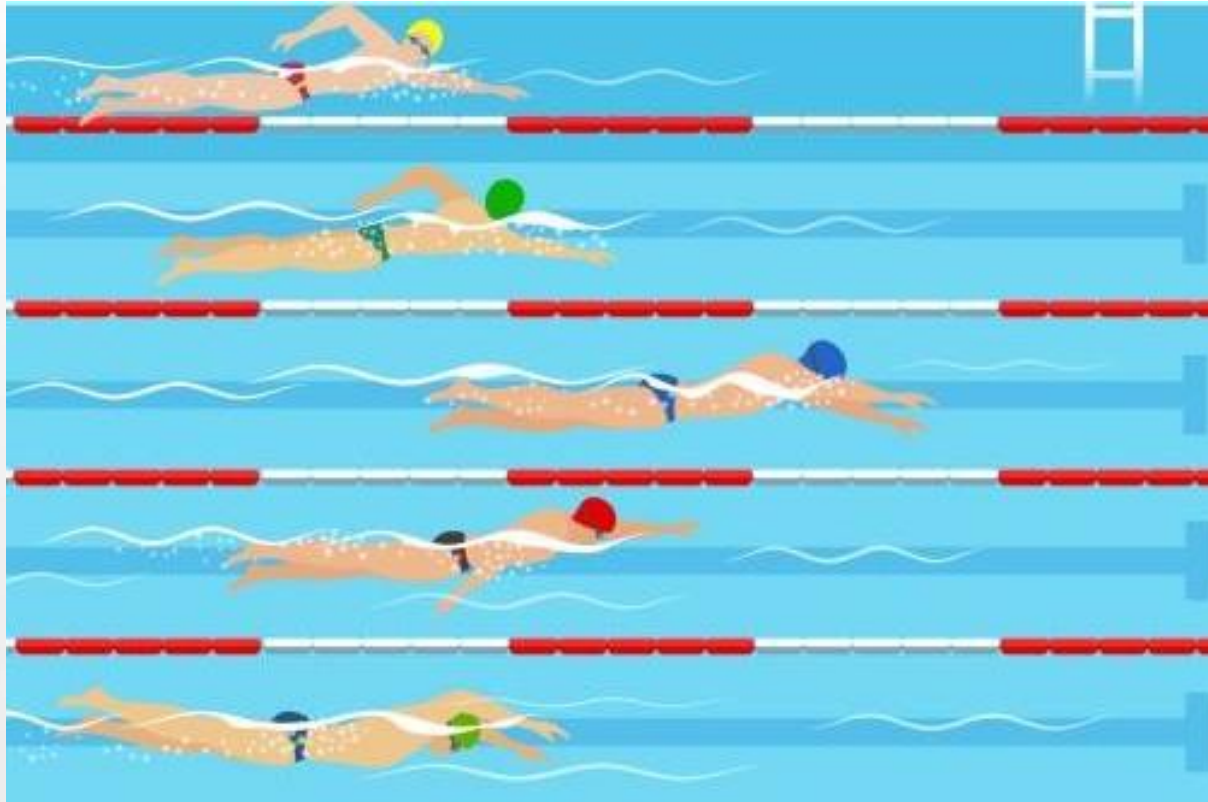
All views or opinions expressed in this presentation are solely the author's , they do necessarily reflect the views of Tessa Therapeutics.

Graph and data used is purely hypothetical in nature whilst maintaining realistic touch.

Agenda - The Art of Swim Lane Plot

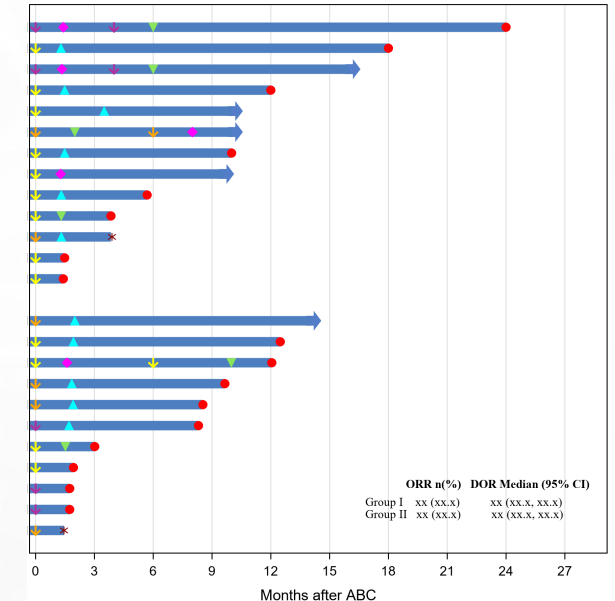
- **What** is swim lane or swimmer plot ?
- **Why** it is needed ? And its use case – Oncology
- **How** to generate swim lane plot with baseline or prior history ?

What is swim lane or swimmer plot ?



Why it is needed ? and its use case – Oncology

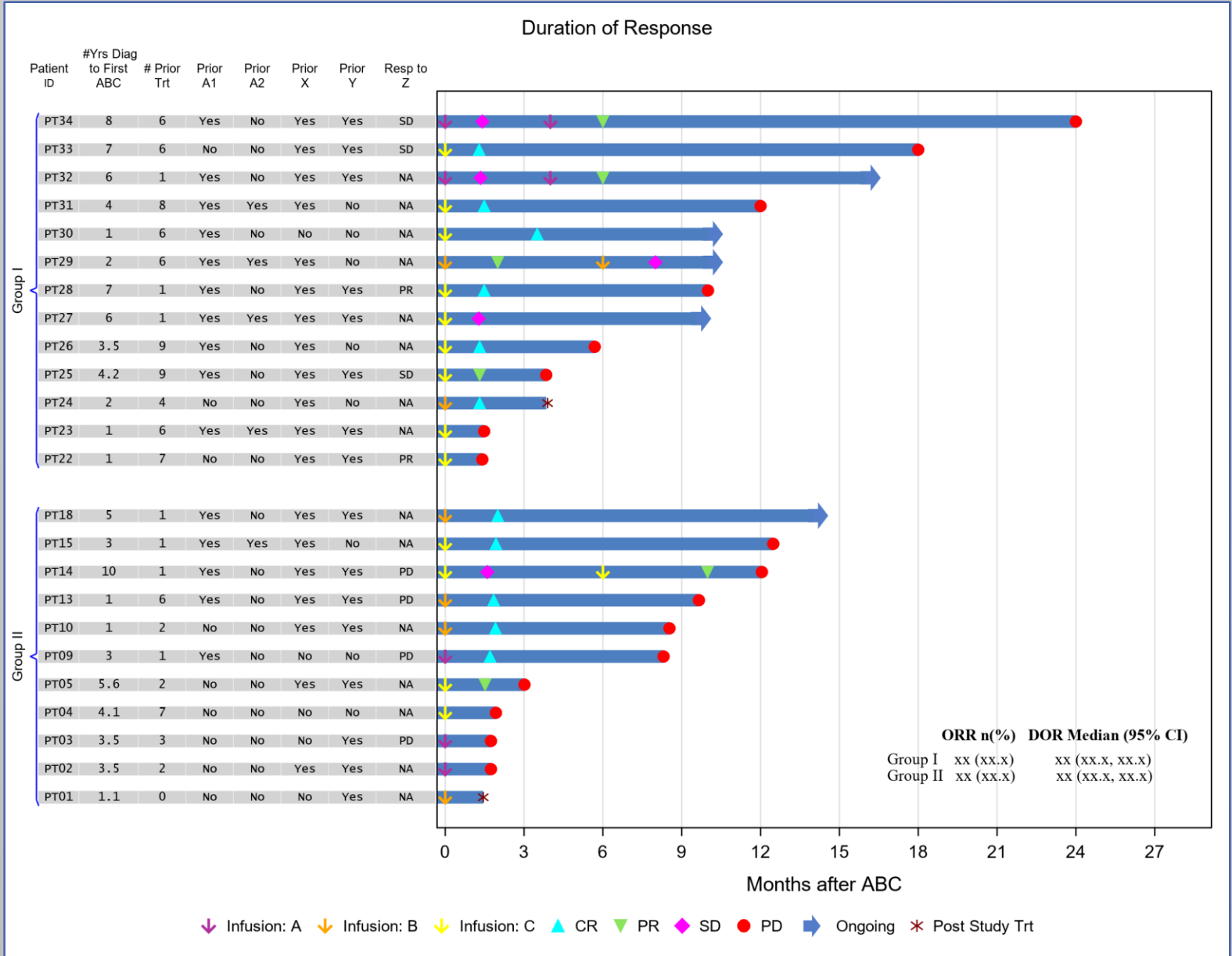
- A bird's-eye view at one glance
- Easy to track individual patient
- Oncology - Duration of Response (DOR)
- After first response (CR/PR), DOR is until PD/Death/Post TRT



Why it is needed ? and its use case – Oncology

- Apart from study TRT observed response and DOR may depend on
 - patient's prior TRT and disease history
 - baseline characteristics
 - bridging therapy prior to study TRT
- Above info together with swimmer plot

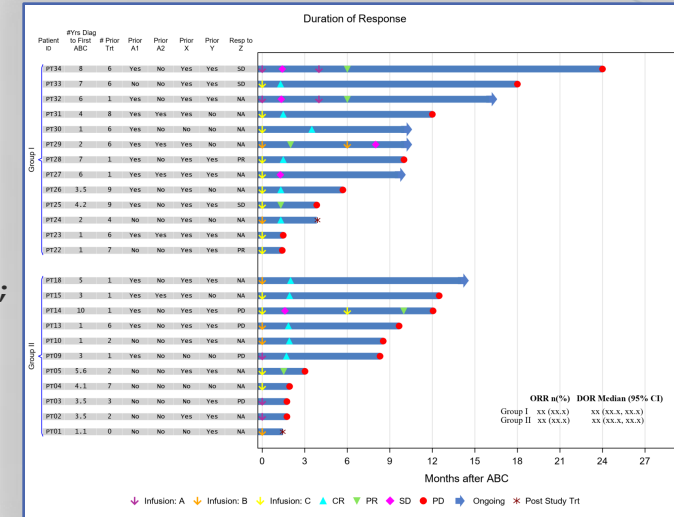
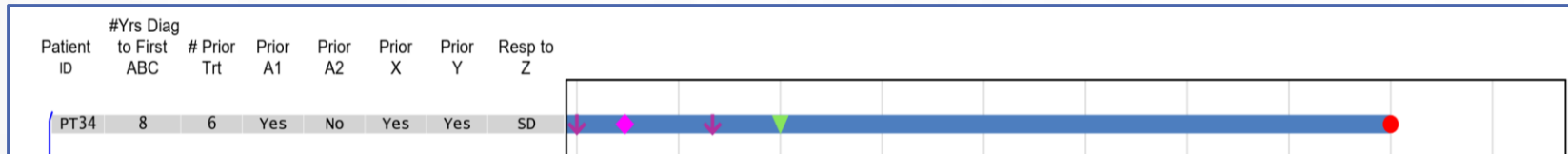
How to generate swim lane plot with baseline or prior history?



How to generate swim lane plot with baseline or prior history? #1

- Entire graph is generated using SAS/GTL PROC TEMPLATE followed by PROC SGRENDER
- LAYOUT LATTICE to divide graph in 9 columns - 45% for baseline and 65% for swim lane

```
layout lattice / columns = 9 columnweights=(0.05 0.05 0.04 0.04 0.04 0.04 0.04 0.05 0.65);
```



- Column labels for baseline or prior history are displayed using SIDEBAR : bottom-up approach

#Yrs Diag
to First
ABC

```
sidebar / align=top;
  layout lattice / columns=9 columnweights=(0.05 0.05 0.04 0.04 0.04 0.04 0.04 0.05 0.65) backgroundColor=white opaque=true;
  entry textattrs=(size=6 weight=Normal) halign=center "ABC" ;
endlayout;
endsidebar;
sidebar / align=top;
  layout lattice / columns=9 columnweights=(0.05 0.05 0.04 0.04 0.04 0.04 0.04 0.05 0.65) backgroundColor=white opaque=true;
  entry textattrs=(size=6 weight=Normal) halign=center "to First" ;
endlayout;
endsidebar;
sidebar / align=top;
  layout lattice / columns=9 columnweights=(0.05 0.05 0.04 0.04 0.04 0.04 0.04 0.05 0.65) backgroundColor=white opaque=true;
  entry textattrs=(size=6 weight=Normal) halign=center "#Yrs Diag" ;
endlayout;
endsidebar;
```

How to generate swim lane plot with baseline or prior history? #2

- Eight LAYOUT OVERLAY statements to display baseline or prior history columns
- Within each LAYOUT OVERLAY,
 - YAXISOPTS provides Y-axis reference in the order 1 to last observation
 - XAXISOPTS ✖
 - REFERENCELINE statement - background line for each patient
 - SCATTERPLOT statement – to print actual values e.g. Patient IDs

```
layout overlay /
  pad=(left=13 bottom=0)
  yaxisopts=( label=' ' linearopts=(viewmin=1 viewmax=&lastob TICKVALUESEQUENCE=(start=1
end = &lastob INCREMENT=1) ) display=none) walldisplay=none xaxisopts=(display=none) ;
referenceline y = sort_swim_lane_1 / lineattrs=(color=lightgrey THICKNESS=9) ;
scatterplot y=sort_swim_lane x= zero / MARKERCHARACTER = Subject_ID_
markercharacterattrs=(family='Lucida Console' size=6 weight=normal) ;
endlayout ;
```

Patient ID	#Yrs Diag to First ABC	# Prior Trt	Prior A1	Prior A2	Prior X	Prior Y	Resp to Z
PT34							
PT33							
PT32							
PT31							
PT30							
PT29							
PT28							
PT27							
PT26							
PT25							
PT24							
PT23							
PT22							
PT18							
PT15							
PT14							
PT13							
PT10							
PT09							
PT05							
PT04							
PT03							
PT02							
PT01							

How to generate swim lane plot with baseline or prior history? #3

- Annotation dataset
- Patient group labels 'Group 1' and 'Group 2'

Summary stats **Sort_swim_lane**: min, max, and med by Group

```
data anno ;  
  set summ ;  
  length function $9 label drawspace x1space $60 ;  
  function="text"; TEXTFONT = "ARIAL" ; textsize =7; TEXTWEIGHT="NORMAL";  
  drawspace="datavalue"; x1space = "graphpercent" ;x1=1; y1=med;  
  width=50; widthunit="pixel"; anchor="centre";  
  border="flase"; linecolor="black"; linepattern="solid";  
  label=strip(Group);  
  rotate = 90 ;  
run ;
```



ANNOTATE; statement

within LAYOUT LATTICE besides annotation dataset in PROC SGRENDER



Subject_ID_	sort_swim_lane	Group
PT01	1	Group II
PT02	2	Group II
PT03	3	Group II
PT04	4	Group II
PT05	5	Group II
PT09	6	Group II
PT10	7	Group II
PT13	8	Group II
PT14	9	Group II
PT15	10	Group II
PT18	11	Group II
	12	
PT22	13	Group I
PT23	14	Group I
PT24	15	Group I
PT25	16	Group I
PT26	17	Group I
PT27	18	Group I
PT28	19	Group I
PT29	20	Group I
PT30	21	Group I
PT31	22	Group I
PT32	23	Group I
PT33	24	Group I
PT34	25	Group I
	26	

How to generate swim lane plot with baseline or prior history? #4

- Annotation dataset
- Curly brackets around 'Group 1' and 'Group 2' patients

Summary stats **Sort_swim_lane**: min, max, and med by Group

```
data curlyb ;
set summ ;
function="polyline";
drawspace="datavalue"; x1space = "graphpercent"; x2space = "graphpercent";
x1=2.7; y1=min-0.3; /* Draw Segment 1 */
linepattern="solid"; linecolor="blue"; linethickness=1;
output;
function="polycont";
x1=2.5; y1=min-0.1; /* Draw Segment 2 */
output ;
function="polycont";
x1=2.5; y1=med-0.1; /* Draw Segment 3 */
output ;
function="polycont";
x1=2.0; y1=med; /* Draw Segment 4 */
output ;
function="polycont";
x1=2.5; y1=med+0.1; /* Draw Segment 5 */
output ;
function="polycont";
x1=2.5; y1=max+0.1; /* Draw Segment 6 */
output ;
function="polycont";
x1=2.7; y1=max+0.3; /* Draw Segment 7 */
output ;
run ;
11
```



Patient ID
PT34
PT33
PT32
PT31
PT30
PT29
PT28
PT27
PT26
PT25
PT24
PT23
PT22
PT18
PT15
PT14
PT13
PT10
PT09
PT05
PT04
PT03
PT02
PT01

Subject_ID_	sort_swim_lane	Group
PT01	1	Group II
PT02	2	Group II
PT03	3	Group II
PT04	4	Group II
PT05	5	Group II
PT09	6	Group II
PT10	7	Group II
PT13	8	Group II
PT14	9	Group II
PT15	10	Group II
PT18	11	Group II
PT22	12	
PT23	13	Group I
PT24	14	Group I
PT25	15	Group I
PT26	16	Group I
PT27	17	Group I
PT28	18	Group I
PT29	19	Group I
PT30	20	Group I
PT31	21	Group I
PT32	22	Group I
PT33	23	Group I
PT34	24	Group I
	25	Group I
	26	

How to generate swim lane plot with baseline or prior history? #5

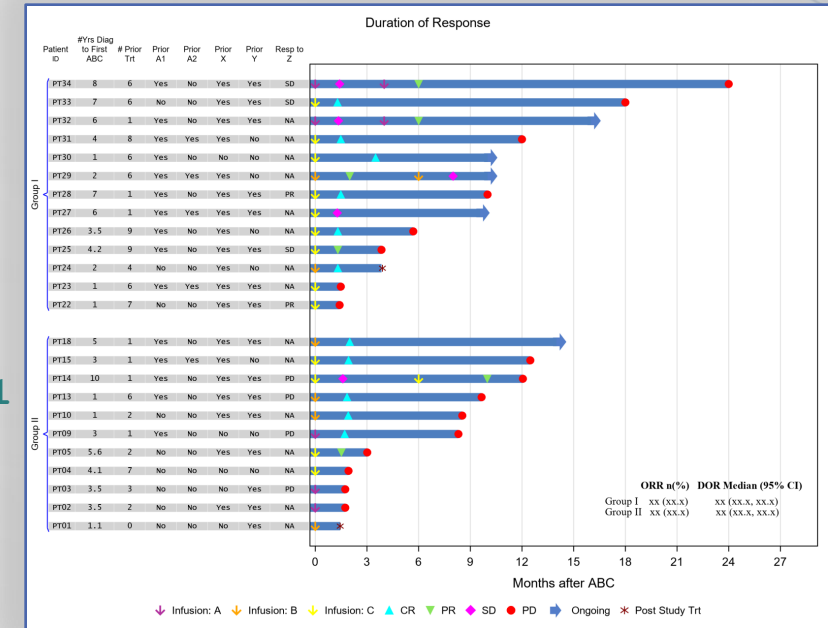
➤ DROPLINE statement : swim lanes

```
layout overlay / pad=(left=0 bottom=0)
yaxisopts=( label=' ' linearopts=(viewmin=1 viewmax=&lastob
TICKVALUESEQUENCE=(start=1 end = &lastob INCREMENT=1) )
display=none)
xaxisopts=( label='Months after ABC' GRIDDISPLAY=on offsetmin=0.01
linearopts=(viewmin=0 viewmax=28 TICKVALUESEQUENCE=(start=0
end = 28 INCREMENT=3) )) ;

dropline y=sort_swim_lane x=linestop / dropto=y
lineattrs=(color=BIGB THICKNESS=9) ;
```

➤ SCATTERPLOT statements : for all symbols

```
scatterplot y=sort_swim_lane x=FIDUR_l1 / group = Inf_l1 ;
```



GROUP	SUBJECT_ID	SORT_SWIM_LANE	PDDUR	LINESTOP	FIDUR_L1	INF_L1
Group II	PT01	1		1.4455852156		Inf_11
Group II	PT02	2	1.7412731006	1.7412731006	0	Inf_11
Group II	PT03	3	1.7412731006	1.7412731006	0	Inf_11
Group II	PT04	4	1.9383983573	1.9383983573		Inf_11
Group II	PT05	5	3.022587269	3.022587269		Inf_11
Group II	PT09	6	8.3121149897	8.3121149897	0	Inf_11
Group II	PT10	7	8.5420944559	8.5420944559		Inf_11
Group II	PT13	8	9.659137577	9.659137577		Inf_11
Group II	PT14	9	12.057494867	12.057494867		Inf_11
Group II	PT15	10	12.484599589	12.484599589		Inf_11
Group II	PT18	11		14		Inf_11
		12				Inf_11
Group I	PT22	13	1.4127310062	1.4127310062		Inf_11
Group I	PT23	14	1.4784394251	1.4784394251		Inf_11
Group I	PT24	15		3.8439425051		Inf_11
Group I	PT25	16	3.8439425051	3.8439425051		Inf_11
Group I	PT26	17	5.6837782341	5.6837782341		Inf_11
Group I	PT27	18		9.5605749487		Inf_11
Group I	PT28	19	10	10		Inf_11
Group I	PT29	20		10		Inf_11
Group I	PT30	21		10		Inf_11
Group I	PT31	22	12	12		Inf_11
Group I	PT32	23		16	0	Inf_11
Group I	PT33	24	18	18		Inf_11
Group I	PT34	25	24	24	0	Inf_11
		26				Inf_11

How to generate swim lane plot with baseline or prior history? #6

➤ SCATTERPLOT statements : for all symbols

```
scatterplot y=sort_swim_lane x=FIDUR_L1 / group = Inf_L1 ;
```

➤ Symbols and legends

▪ On swim lane

```
discreteattrmap name="symbols" / ignorecase=true trimleading=true;
value "Inf_L1" / markerattrs=(color=STPPK symbol=ArrowDown
size=9 WEIGHT=bold);
enddiscreteattrmap;
discreteattrvar attrvar=Inf_L1 var=Inf_L1 attrmap="symbols";
```

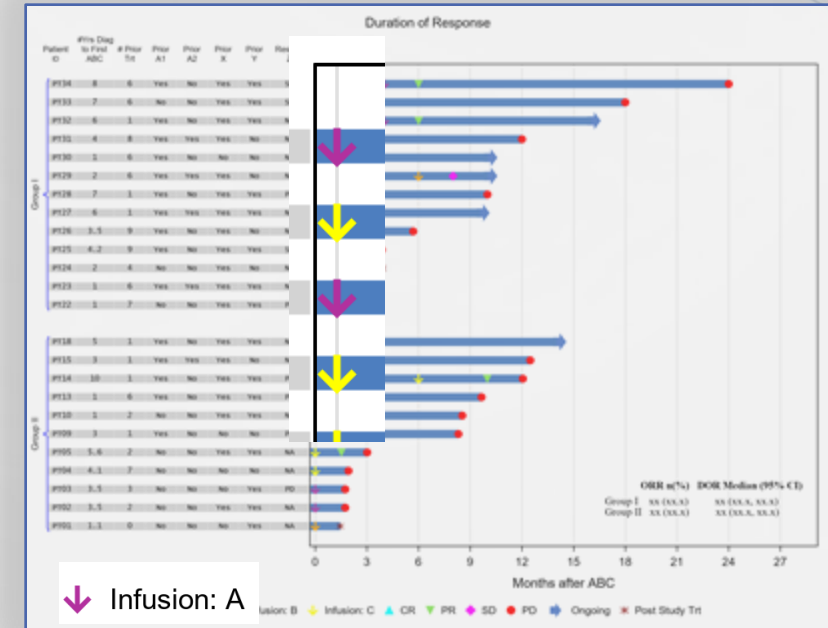
▪ Legend

```
legendItem type=marker name="Inf_L1" / markerattrs=(color=STPPK
symbol=ArrowDown size=9 WEIGHT=bold) label="Infusion: A"
LABELATTRS=(size = 8 FAMILY= "ARIAL" ) ;

layout globallegend/ type=column weights=preferred legendtitleposition
=top border=false;
discretelegend "Inf_L1"/ border=false ITEMSIZE =( FILLASPECTRATIO=10 )
autoitemsiz=false;

endlayout;
```

13



GROUP	SUBJECT ID	SORT_SWIM_LANE	PDDUR	LINESTOP	FIDUR_L1	INF_L1
Group II	PT01	1	1.4455852156			Inf_L1
Group II	PT02	2	1.7412731006	1.7412731006	0	Inf_L1
Group II	PT03	3	1.7412731006	1.7412731006	0	Inf_L1
Group II	PT04	4	1.9383983573	1.9383983573		Inf_L1
Group II	PT05	5	3.022587269	3.022587269		Inf_L1
Group II	PT09	6	8.3121149897	8.3121149897	0	Inf_L1
Group II	PT10	7	8.5420944559	8.5420944559		Inf_L1
Group II	PT13	8	9.659137577	9.659137577		Inf_L1
Group II	PT14	9	12.057494867	12.057494867		Inf_L1
Group II	PT15	10	12.484599589	12.484599589		Inf_L1
Group II	PT18	11		14		Inf_L1
		12				Inf_L1
Group I	PT22	13	1.4127310062	1.4127310062		Inf_L1
Group I	PT23	14	1.4784394251	1.4784394251		Inf_L1
Group I	PT24	15		3.8439425051		Inf_L1
Group I	PT25	16	3.8439425051	3.8439425051		Inf_L1
Group I	PT26	17	5.6837782341	5.6837782341		Inf_L1
Group I	PT27	18		9.5605749487		Inf_L1
Group I	PT28	19	10	10		Inf_L1
Group I	PT29	20		10		Inf_L1
Group I	PT30	21		10		Inf_L1
Group I	PT31	22	12	12		Inf_L1
Group I	PT32	23		16	0	Inf_L1
Group I	PT33	24	18	18		Inf_L1
Group I	PT34	25	24	24	0	Inf_L1
		26				Inf_L1

How to generate swim lane plot with baseline or prior history? #7

SAS symbols

> GreaterThan	┐ Tack	Y Y	▼ TriangleDownFilled
< LessThan	┌ Tilde	Z Z	◀ TriangleLeftFilled
# Hash	△ Triangle	● CircleFilled	▶ TriangleRightFilled
▽ HomeDown	▽ TriangleDown	◆ DiamondFilled	

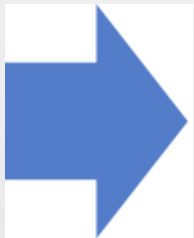
Unicode symbols



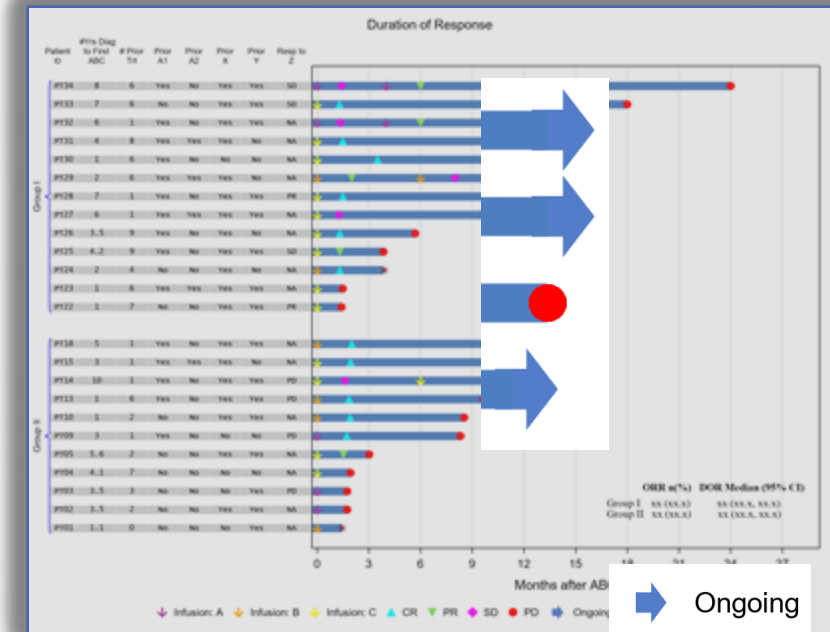
```
symbolchar name=Arrow_right char='2192'x ;
```



Symbol from image



blue_arrow.png file



GROUP	SUBJECT_ID	SORT_SWIM_LANE	Ongoing	Ongoing1
Group II	PT01	1	.	Ongoing
Group II	PT02	2	.	Ongoing
Group II	PT03	3	.	Ongoing
Group II	PT04	4	.	Ongoing
Group II	PT05	5	.	Ongoing
Group II	PT09	6	.	Ongoing
Group II	PT10	7	.	Ongoing
Group II	PT13	8	.	Ongoing
Group II	PT14	9	.	Ongoing
Group II	PT15	10	.	Ongoing
Group II	PT18	11	14.2	Ongoing
		12	.	Ongoing
Group I	PT22	13	.	Ongoing
Group I	PT23	14	.	Ongoing
Group I	PT24	15	.	Ongoing
Group I	PT25	16	.	Ongoing
Group I	PT26	17	.	Ongoing
Group I	PT27	18	9.7605749487	Ongoing
Group I	PT28	19	.	Ongoing
Group I	PT29	20	10.2	Ongoing
Group I	PT30	21	10.2	Ongoing
Group I	PT31	22	.	Ongoing
Group I	PT32	23	16.2	Ongoing
Group I	PT33	24	.	Ongoing
Group I	PT34	25	.	Ongoing
		26	.	Ongoing

How to generate swim lane plot with baseline or prior history? #8

➤ Symbol from image

```
scatterplot y=sort_swim_lane x=Ongoing / group = groupmarkers7;
```

■ On swim lane

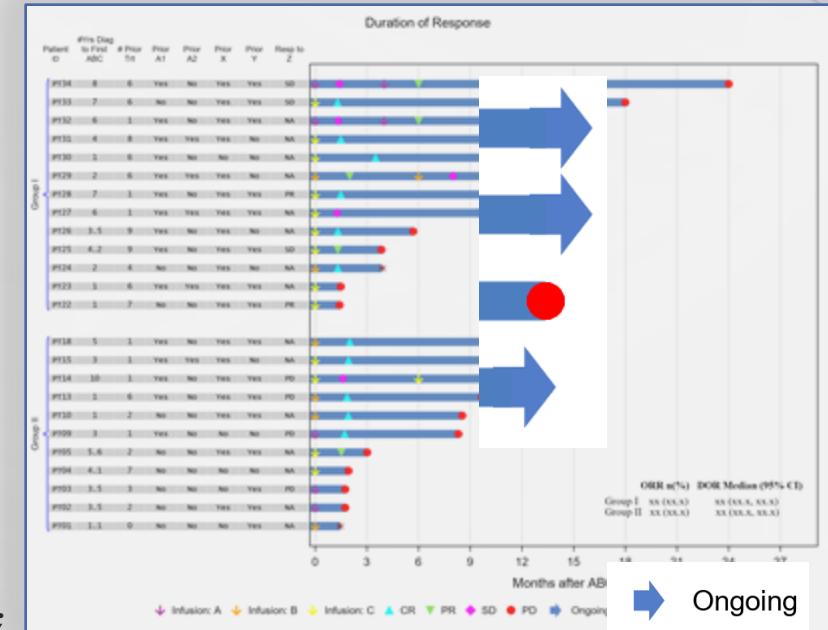
```
symbolimage name=blue_arrow image="&ExtMarkers\blue_arrow.png"  
/voffset=0 ;
```

```
discreteattrmap name="symbols" / ignorecase=true trimleading=true;  
value "Ongoing"/markerattrs=(symbol=blue_arrow size=21 );  
enddiscreteattrmap;  
discreteattrvar attrvar=groupmarkers7 var=Ongoing1 attrmap="symbols";
```

■ Legend

```
legendItem type=marker name="Ongoing" /markerattrs=(color=BIGB  
symbol=blue_arrow size=16 ) label="Ongoing"  
LABELATTRS=(size = 8 FAMILY= "ARIAL" ) ;  
  
layout globallegend/ type=column weights=preferred legendtitleposition  
=top border=false;  
discretelegend "Ongoing"/ border=false ITEMSIZE =( FILLASPECTRATIO=10 )  
autoitemsiz=false;  
  
endlayout;
```

15



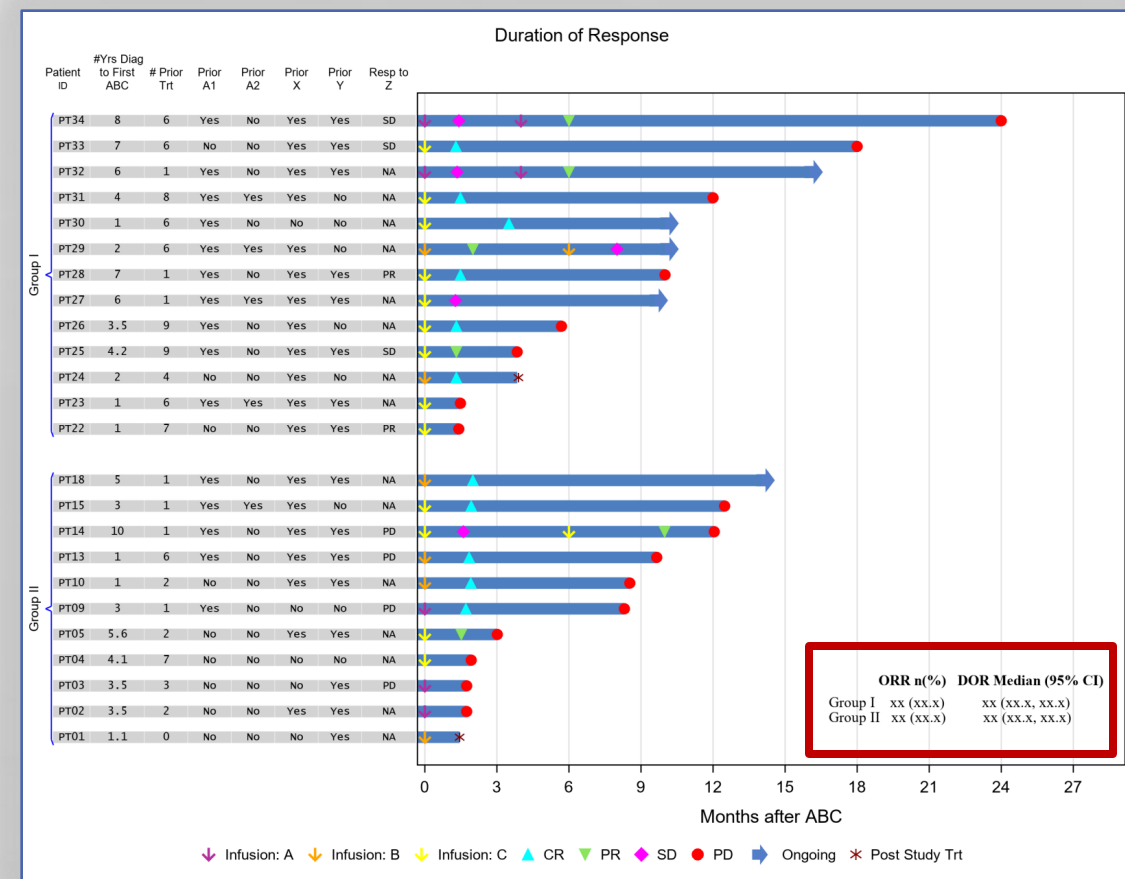
GROUP	SUBJECT_ID	SORT_SWIM_LANE	Ongoing	Ongoing1
Group II	PT01	1	.	Ongoing
Group II	PT02	2	.	Ongoing
Group II	PT03	3	.	Ongoing
Group II	PT04	4	.	Ongoing
Group II	PT05	5	.	Ongoing
Group II	PT09	6	.	Ongoing
Group II	PT10	7	.	Ongoing
Group II	PT13	8	.	Ongoing
Group II	PT14	9	.	Ongoing
Group II	PT15	10	.	Ongoing
Group II	PT18	11	14.2	Ongoing
Group II	PT22	12	.	Ongoing
Group I	PT23	13	.	Ongoing
Group I	PT24	14	.	Ongoing
Group I	PT25	15	.	Ongoing
Group I	PT26	16	.	Ongoing
Group I	PT27	17	.	Ongoing
Group I	PT28	18	9.7605749487	Ongoing
Group I	PT29	19	.	Ongoing
Group I	PT30	20	10.2	Ongoing
Group I	PT31	21	10.2	Ongoing
Group I	PT32	22	.	Ongoing
Group I	PT33	23	16.2	Ongoing
Group I	PT34	24	.	Ongoing
Group I	PT35	25	.	Ongoing
Group I	PT36	26	.	Ongoing

How to generate swim lane plot with baseline or prior history? #9

➤ Efficacy summary table on swim lane plot

```
drawtext textattrs=(FAMILY="Times New Roman"
style=normal size=8pt weight=bold)
"ORR n(%)   DOR Median (95% CI)" / anchor=LEFT
width=100 widthunit=percent xspace=LAYOUTPERCENT
yspace=LAYOUTPERCENT x=65 y=20 justify=center ;
```

```
drawtext textattrs=(FAMILY="Times New Roman"
style=normal size=8pt weight=normal)
"Group I    xx (xx.x)          xx (xx.x, xx.x) " /
anchor=LEFT width=100 widthunit=percent
xspace=LAYOUTPERCENT yspace=LAYOUTPERCENT
x=58 y=17 justify=center ;
```



Learnings and challenges



- **Multiple stakeholder value**
- **Program template – Macro not recommended**
- **Works well with ~ 50 patients**
- **Unicode rendering**

References

1. SAS GTL documentation
2. <https://unicode.org/>
3. <https://blogs.sas.com/content/graphicallyspeaking/>
4. Swimmer Plot: Tell a Graphical Story of Your Time to Response Data Using PROC SGPLOT
Stacey D. Phillips, Inventiv Health Clinical, Princeton, NJ

Thank you!