

11/03/2011

SAS macros for graphical presentation of clinical trial results

PhUSE One-day Event
Copenhagen 08Mar2011
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Novo Nordisk A/S



Who am I?

- Statistician for 30 years
- In Novo Nordisk for 20 years
- SAS user for 30+ years

- In Clinical Statistics for <1 year
- NOT A SAS EXPERT!

Outline

- Platforms / Software
- Brief presentation of some standard Figures
- Common Features
- Selected details
- Questions

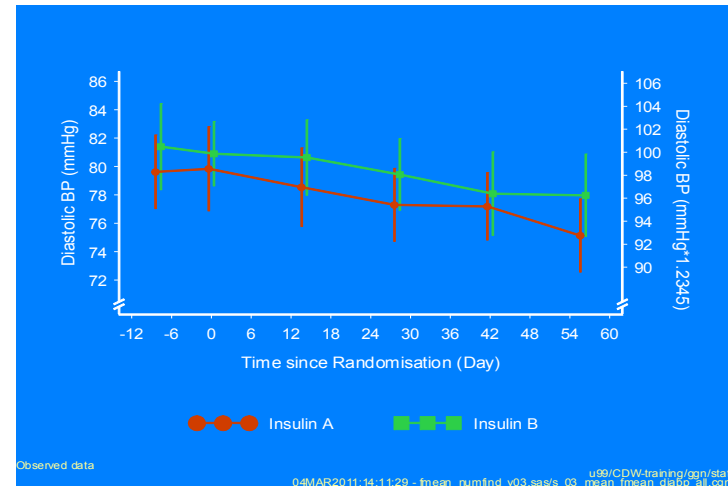
Platforms / Software

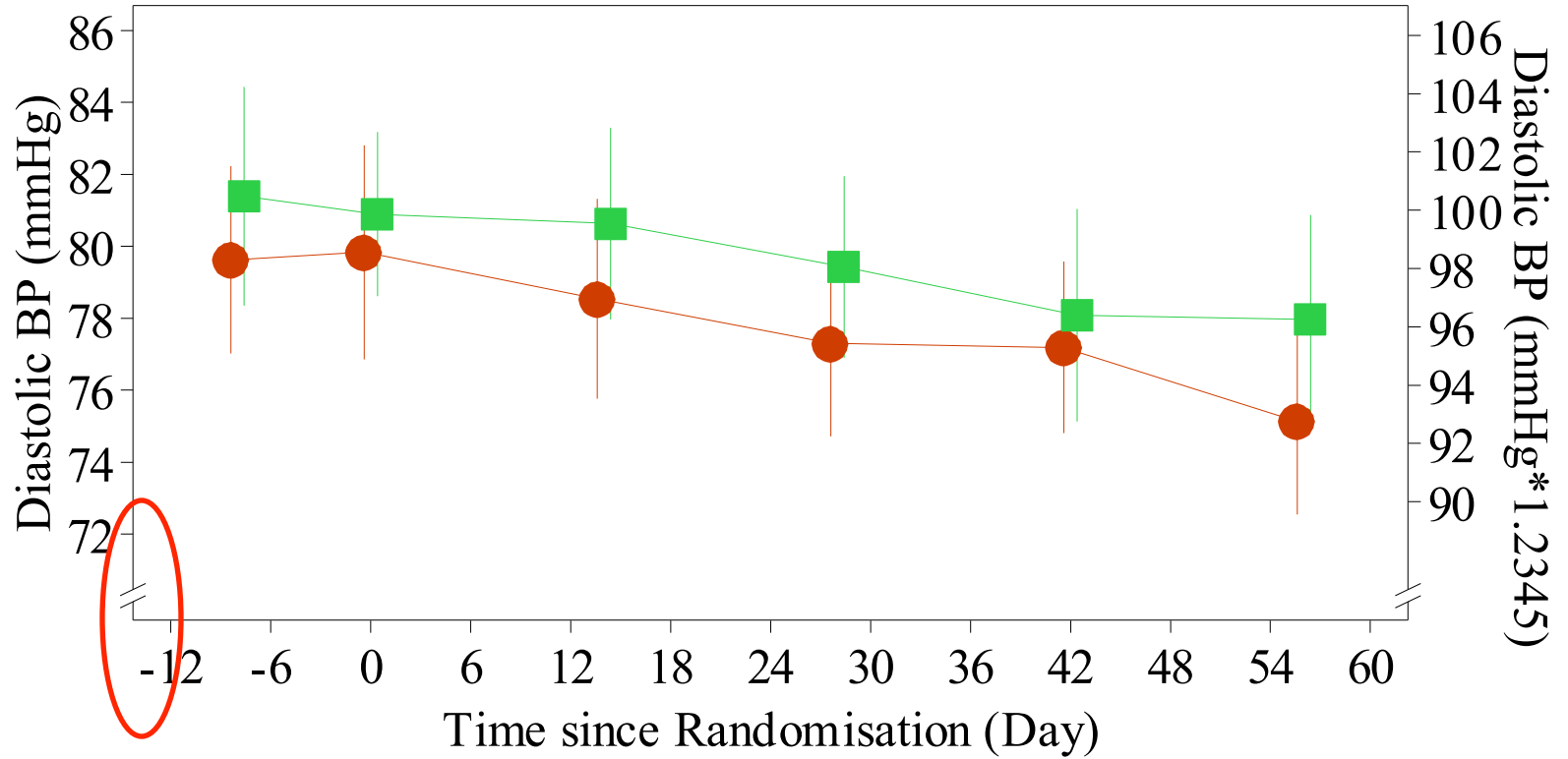
All clinical trials in Novo Nordisk are reported using SAS 9.1 in a UNIX environment.

Exploratory analyses and SAS program development can be done in PC SAS, ver. 9.1 or 9.2

Mean plot - Development of some parameter over time in clinical trial

- Error bars (1 or 2 SEM/STD)
- Shifted x-values
- 2nd Y axis w. diff scale (typically mcg vs nmol)
- Broken y-axes
- Error bars made by 'pure annotate'





●●● Insulin A ■■■ Insulin B

Observed data

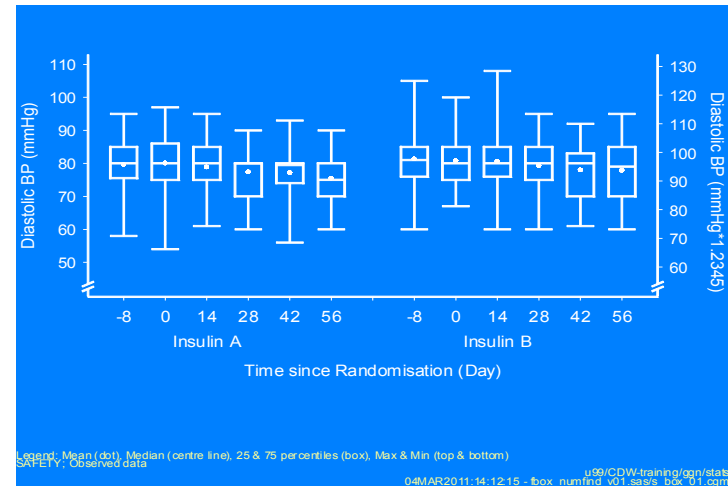
04MAR2011:14:11:32 - fmean_numfind_v03.sas/e_03_mean_fmean_diabp_all.cgm

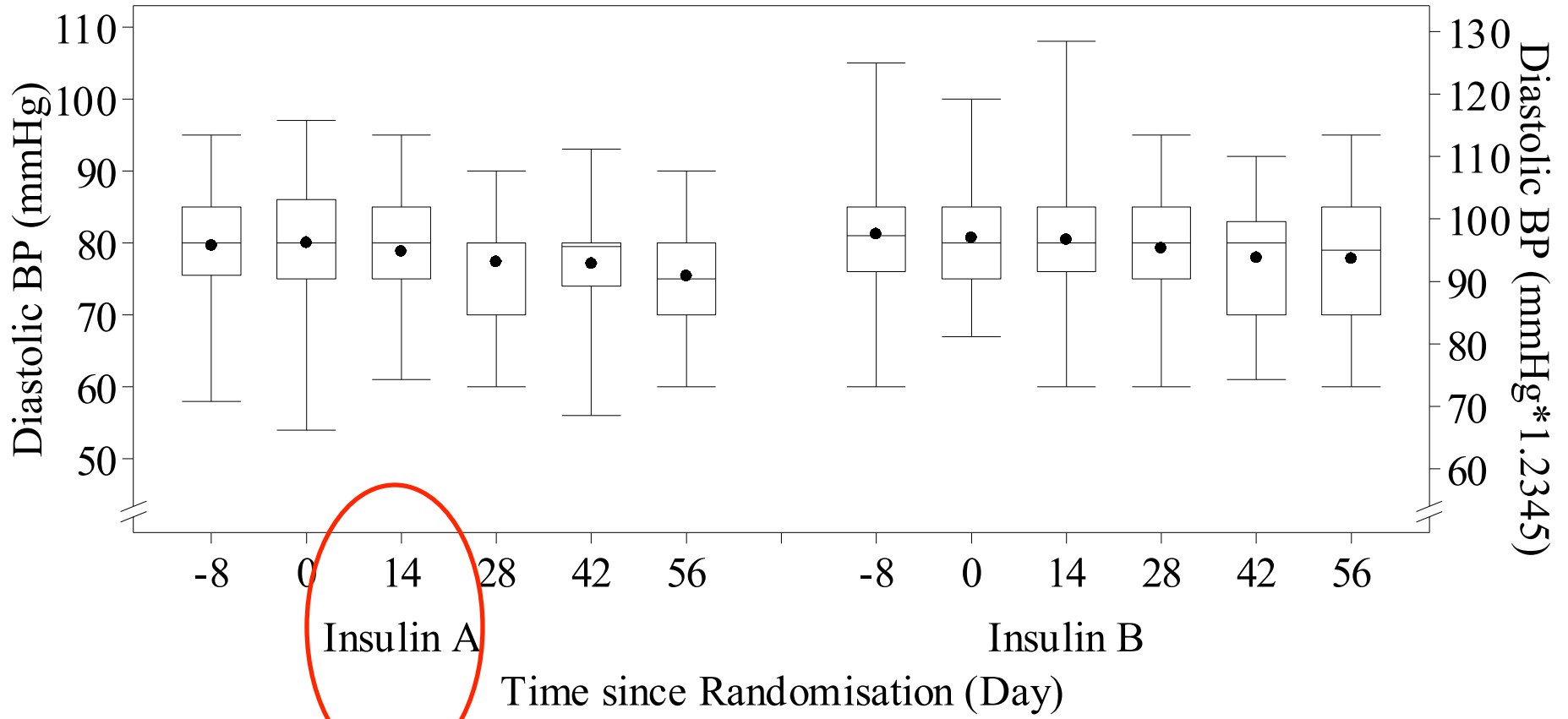
u99/CDW-training/ggn/stats



Box plot

- Standard Boxplot (explanation in first footnote)
- Note the X-axis
- 2nd Y axis w. diff scale (typically mcg vs nmol)
- Broken y-axes
- Boxes made using INT=BOX





Legend: Mean (dot), Median (centre line), 25 & 75 percentiles (box), Max & Min (top & bottom)
SAFETY; Observed data

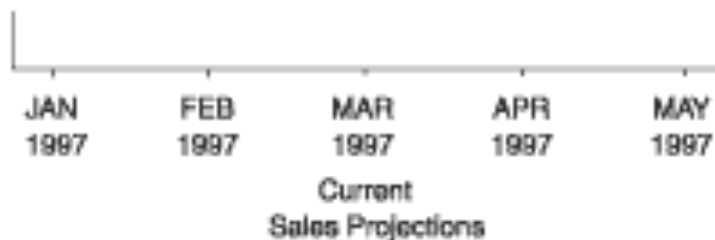
u99/CDW-training/ggn/stats
04MAR2011:14:12:18 - fbox_numfind_v01.sas/e_box_01.cgm



JUSTIFY suboption of VALUE specification:

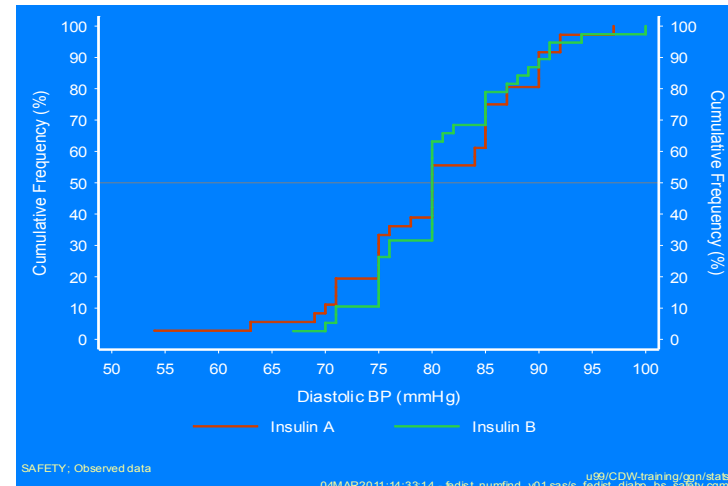
```
axis label=('Current' justify=c
           'Sales Projections')
value=(tick=1 'JAN' justify=c '1997'
       tick=2 'FEB' justify=c '1997'
       tick=3 'MAR' justify=c '1997'
       tick=4 'APR' justify=c '1997'
       tick=5 'MAY' justify=c '1997');
```

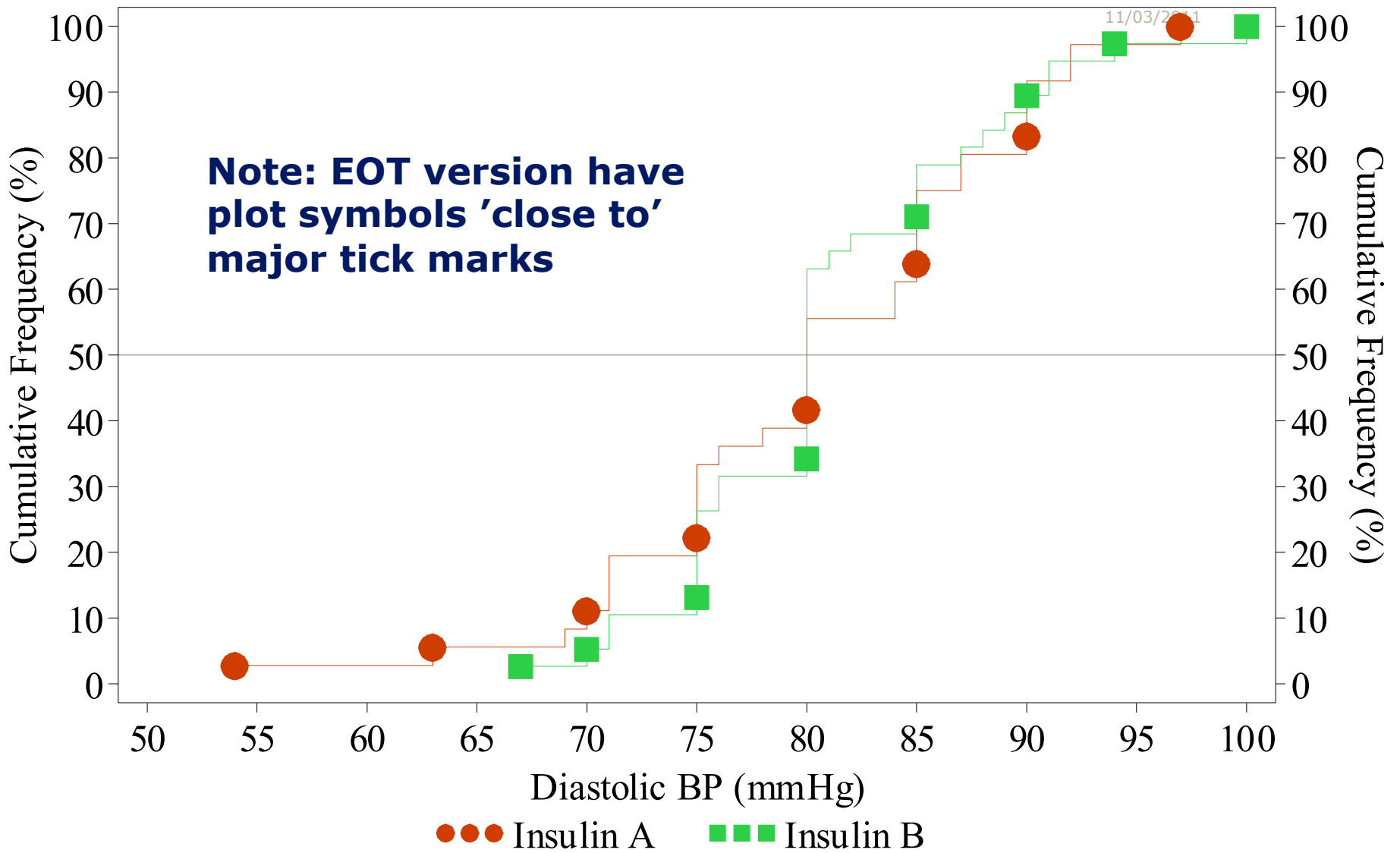
The JUSTIFY= suboption



Empirical Distribution (CDF)

- Fixed Y-axis, 0 to 100 %
- Identical y2-axis
- No plot symbols
 - except EOT
- 3 variants of this Figure using the same basic print macro





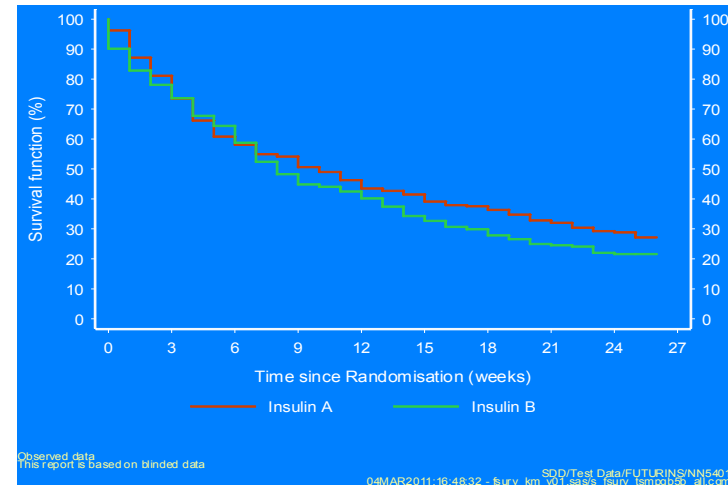
SAFETY; Observed data

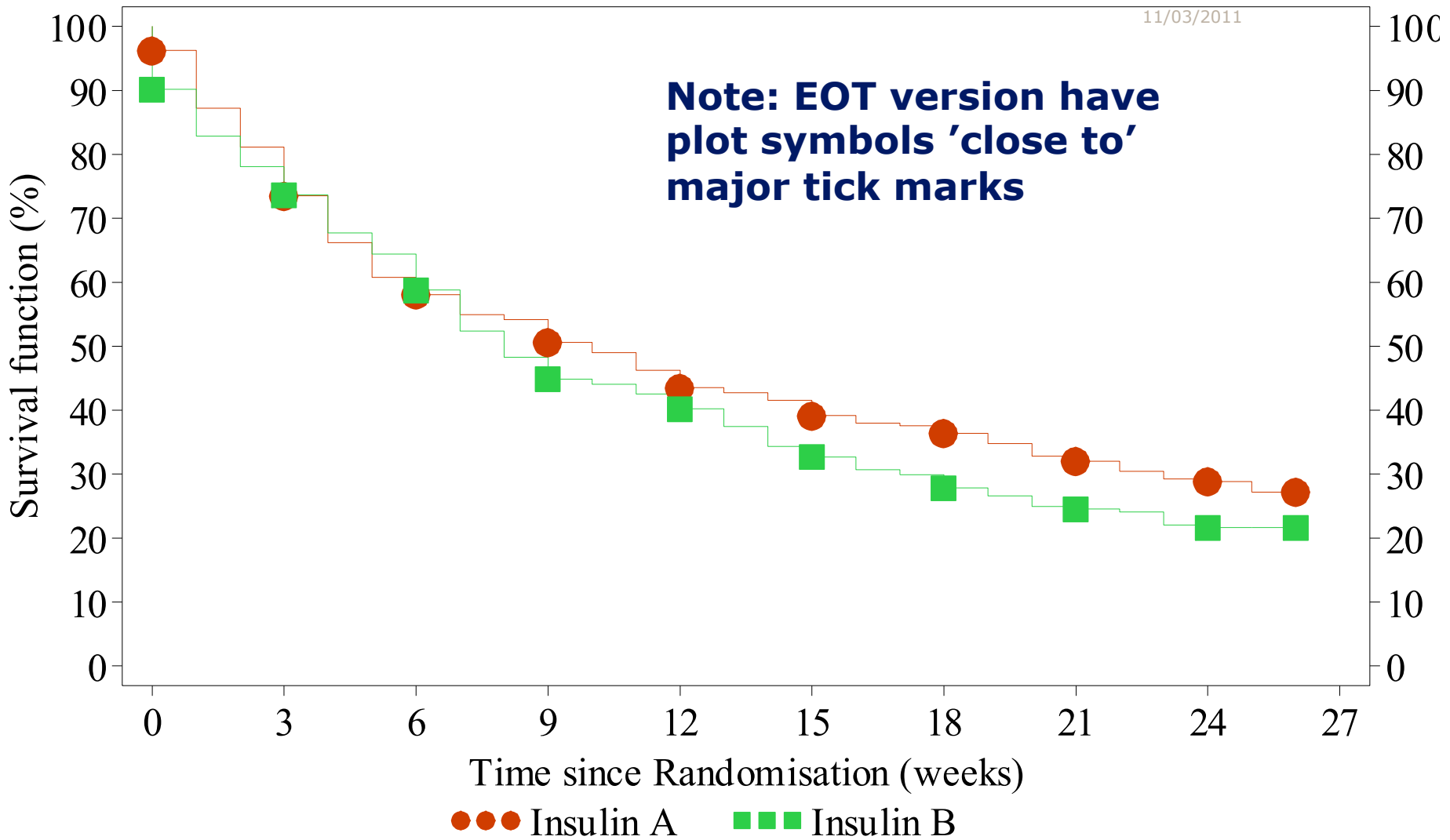
04MAR2011:14:33:18 - fedist_numfind_v01.sas/e_fedist_diabp_bs_safety.cgm



Kaplan Meier Plots

- Fixed y-axis, 0 to 100 %
- Identical y2-axis
- Data generated from standard extract macros and PROC LIFETEST.
- Uses basic plot macro 'print_line_plot'

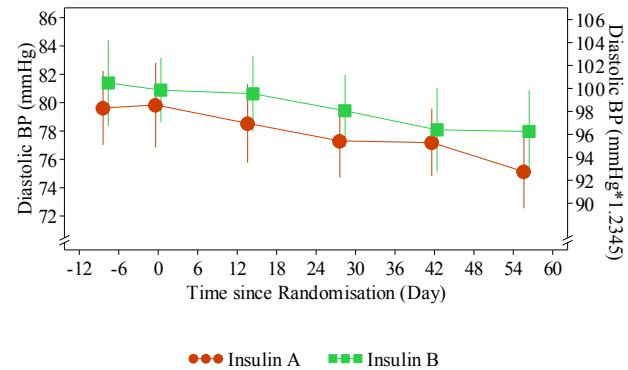




Observed data
This report is based on blinded data

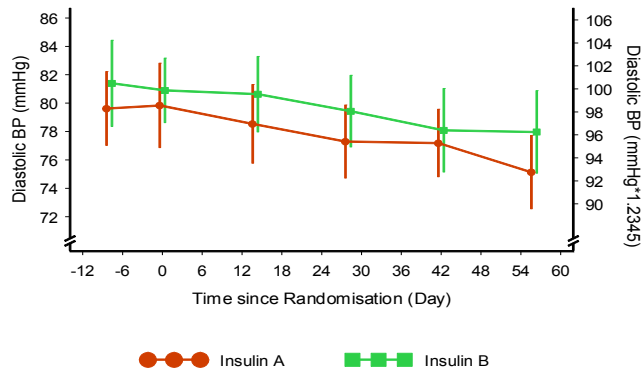
Common Layout features 1

Same figure – 3 different layouts generated automatically



Observed data

04MAR2011:14:11:32 - fmean_numfind_v03.sas/e_03_mean_fmean_diabp_all.cgm
 u99/CDW-training/gn/stat



Observed data

04MAR2011:14:11:31 - fmean_numfind_v03.sas/k_03_mean_fmean_diabp_all.cgm
 u99/CDW-training/gn/stat

Observed data

04MAR2011:14:11:29 - fmean_numfind_v03.sas/e_03_mean_fmean_diabp_all.cgm
 u99/CDW-training/gn/stat



Common Layout features 2

- Symbol statements are generated from metadata
 - one for each Figure Type and 'treatment value'
 - symbol, font, color, size
 - interpolation line type, thickness, color
- Thus, same visual appearance of each treatment across different figures and trials is automated
 - e.g. Insulin A is red, B is green and C is blue also for trials where only A and C are used

Common Layout features 3

Titles and Footnotes **can be** generated automatically from meta-data or be user specified

Certain information **will always** be included automatically:

- Analysis Set (FAS, SAFETY, ...)
- Observed Data / LOCF
- Blinded data (e.g. fake randomisation)
- Study ID
- (*program*) output ID

Common Layout features 4

No titles in the plots, however

- Titles and other info are sent to a separate XML file
- Titles are included in CTR as a Figure caption using VB script file

Special Case – Y2 axis

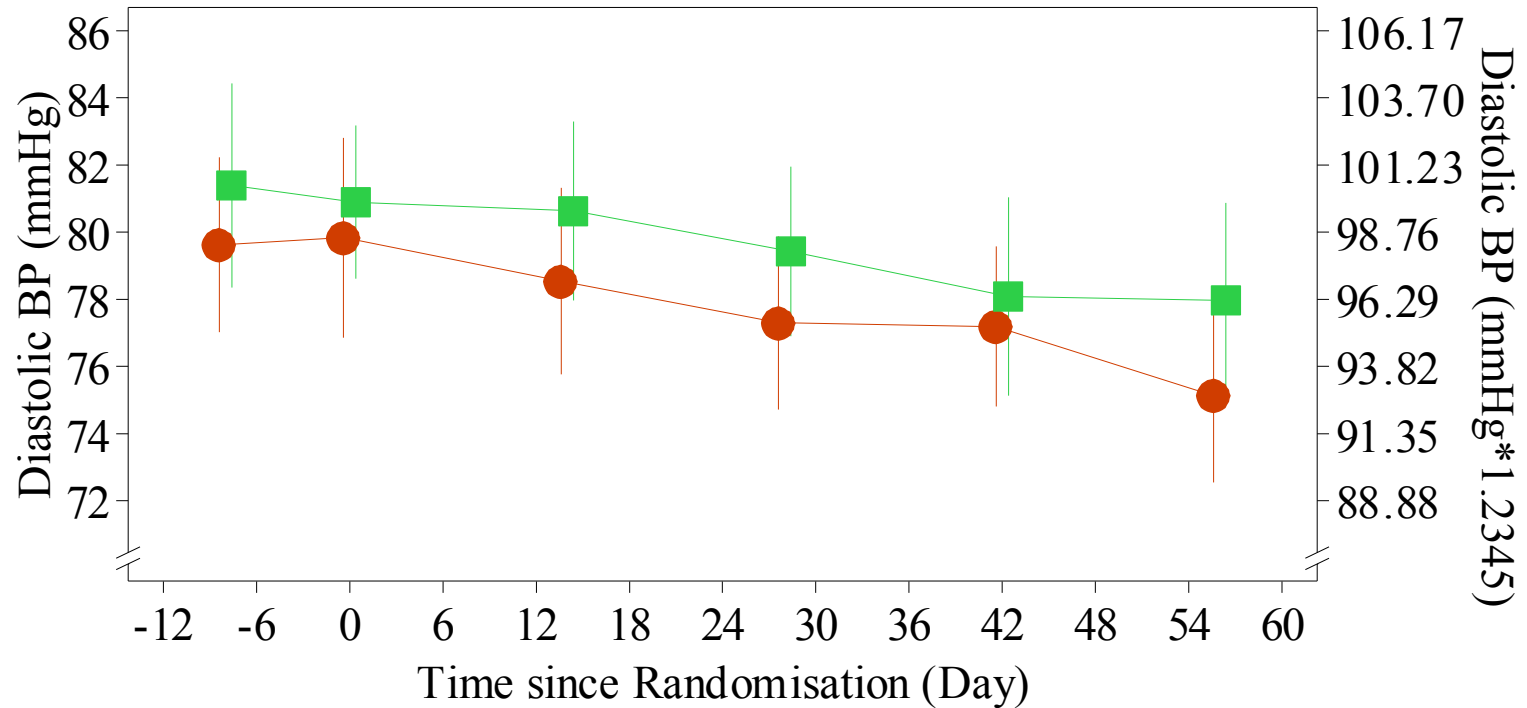
Y2-axis equal to y1-axis except for a specified unit conversion factor

- made by PLOT2 statement
 - ‘invisible data’
 - no automatic link between the two axes

Default solution

- left y-axis order (specified or found from data): x to y by z
- calculate corresponding values on Y2
- let right y-axis order: $x*f$ to $y*f$ by $z*f$

Y2 axis – order not specified



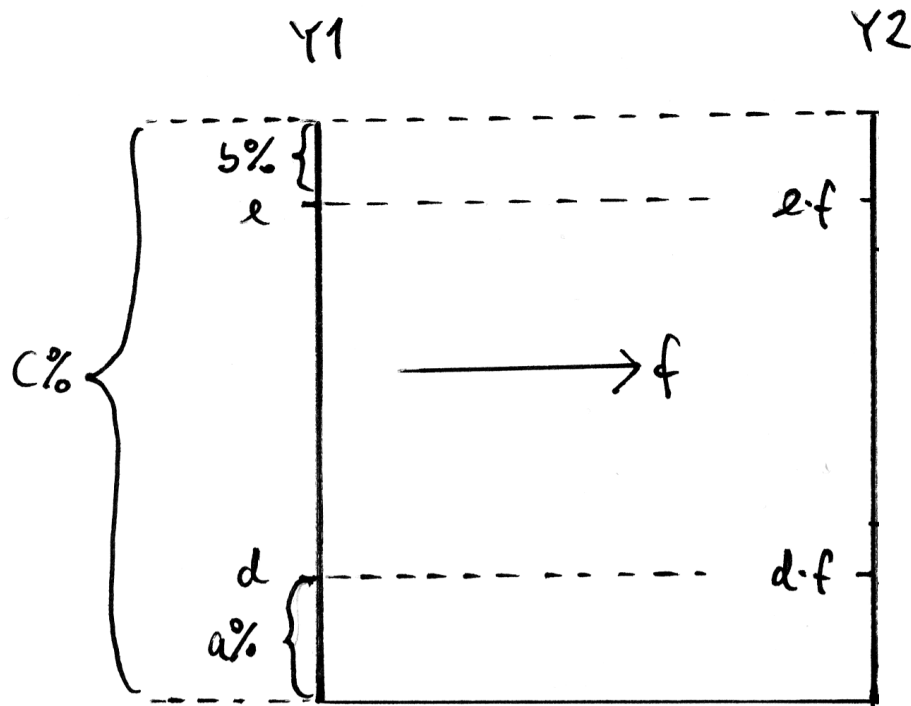
●●● Insulin A ■■■ Insulin B

Observed data

04MAR2011:14:11:25 - fmean_numfind_v03.sas/e_02_mean_fmean_diabp_all_cam

Fully user specified Y2

- User must specify y1 axis order: x1 to y1 by z1
- User must specify y2 axis order : x2 to y2 by z2
- User must assure that the y2 axis 'will fit' i.e.
 - $(x2/f, z2/f)$ must be within $(x1, z1)$
- User must specify y axes length!

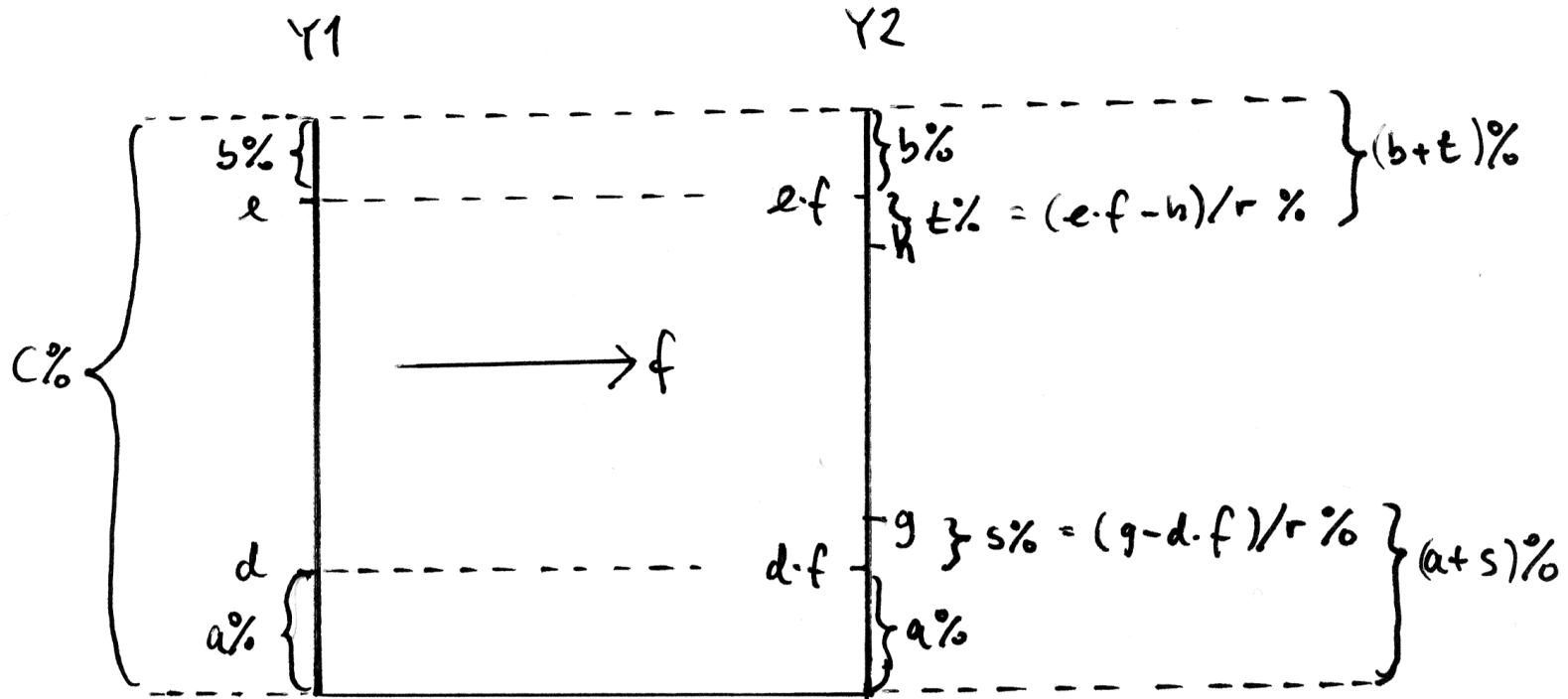


Offset a, b, and the y axes lengths c are given in % of the total plot height

On Y1 axis, d and e are user specified or found from data

$$(e-d)/(c-a-b) = \text{1\% of plot height on Y1 scale} \Rightarrow (e-d).f/(c-a-b) = r = \text{1\% of plot height on Y2 scale}$$

**On Y2, user specifies order=g to h by u
and the offset values on Y2 can be calculated**



$$(e-d)/(C-a-b) = \text{1\% of plot height on Y1 scale} \Rightarrow$$

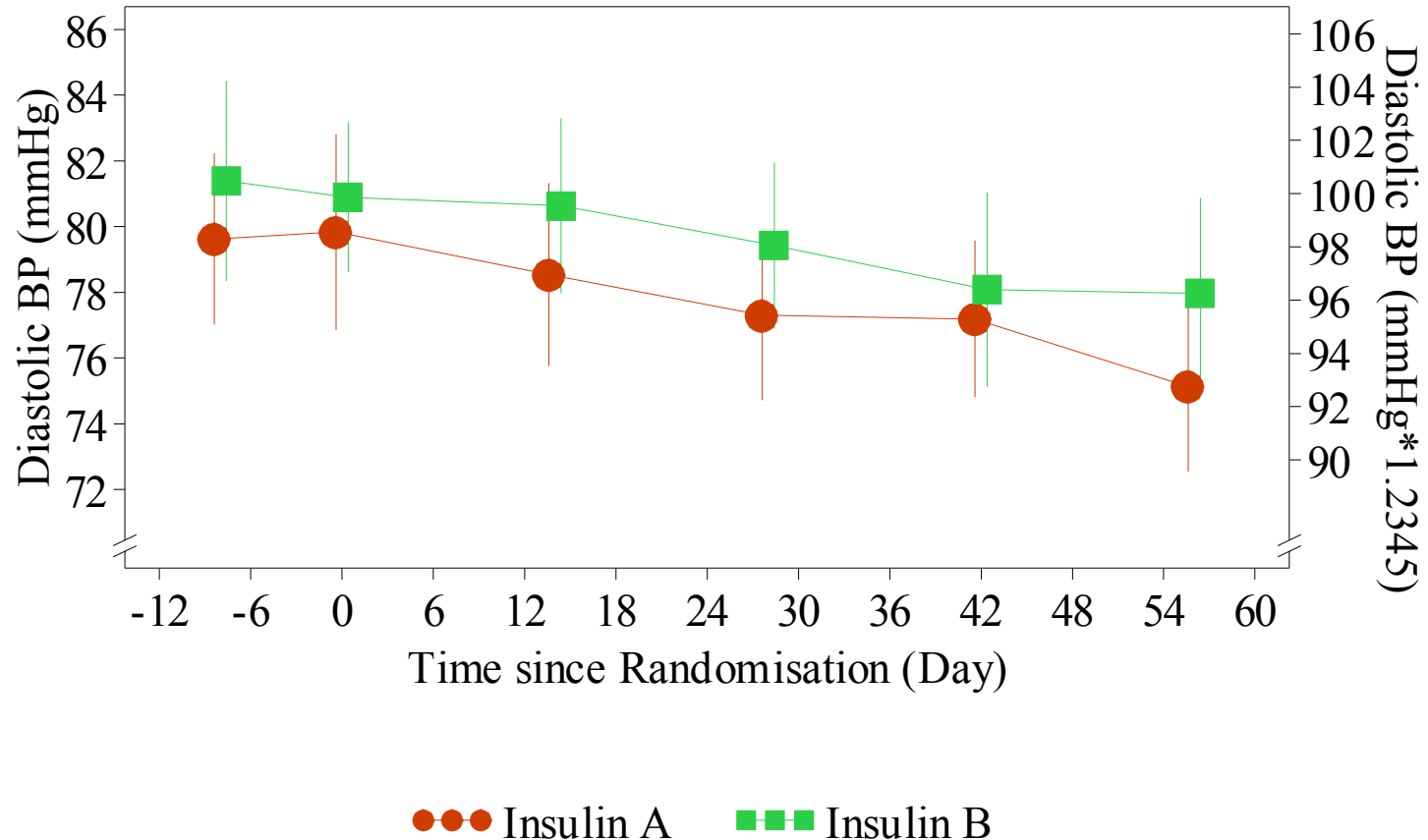
$$(e-d).f/(C-a-b) = r \text{ 1\% of plot height on Y2 scale}$$

SAS code

```
%let right_low_offset=%sysevalf
  (  &left_low_offset +
    (  (&y2from-&start*&y_axis_2_factor)
      /  (  ((&end-&start)*&y_axis_2_factor)
          /  (&v_axis_length_pct-&left_low_offset-2)
        )
    )
  );
```

```
%let right_upp_offset=%sysevalf
  (  2 +
    (  (&end*&y_axis_2_factor -&y2to)
      /  (  ((&end-&start)*&y_axis_2_factor)
          /  (&v_axis_length_pct-&left_low_offset-2)
        )
    )
  );
```

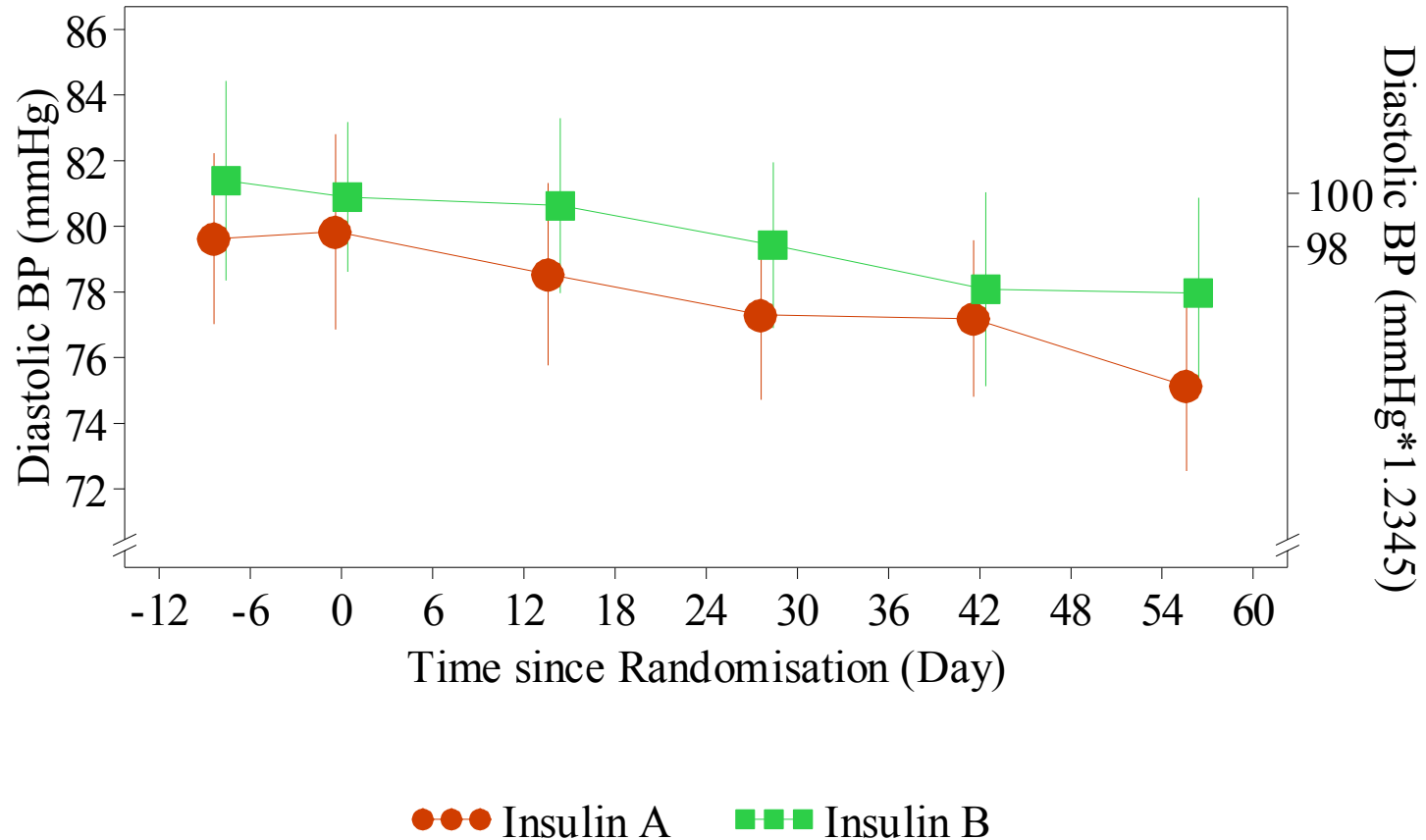
Fully user specified Y2 axis order



Observed data

04MAR2011:14:11:32 - fmean_numfind_v03.sas/e_03_mean_fmean_diabp_all.cgm

Check with odd specification



Observed data

Questions