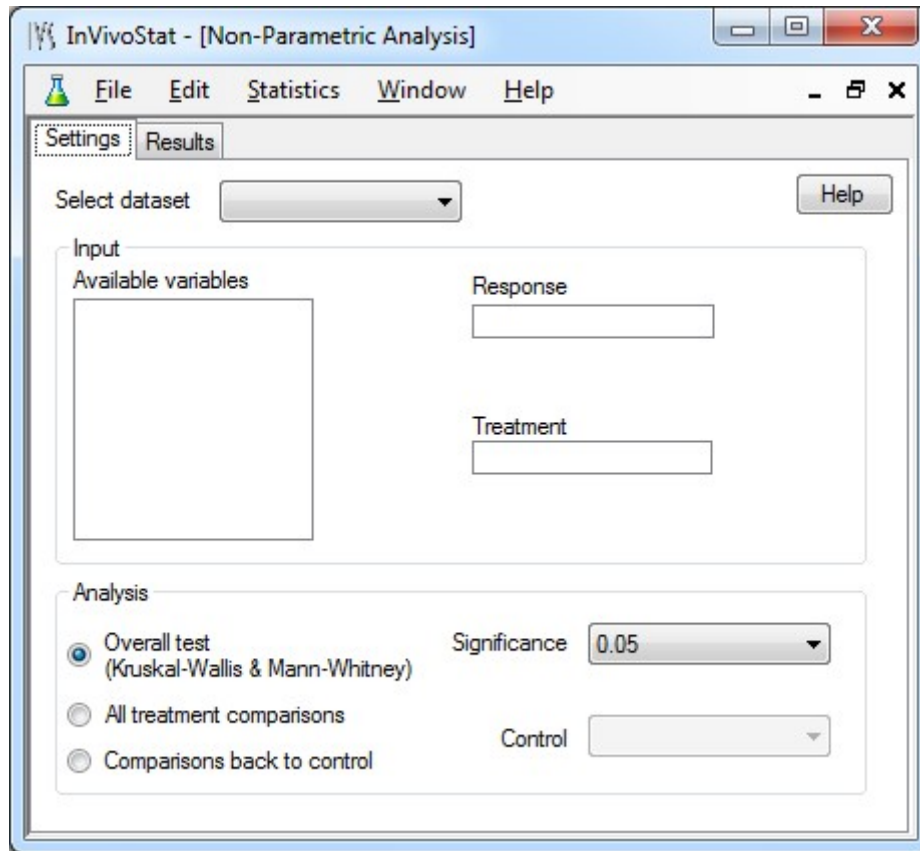


# InVivoStat

## Non-Parametric Analysis Module

### Tipsheet

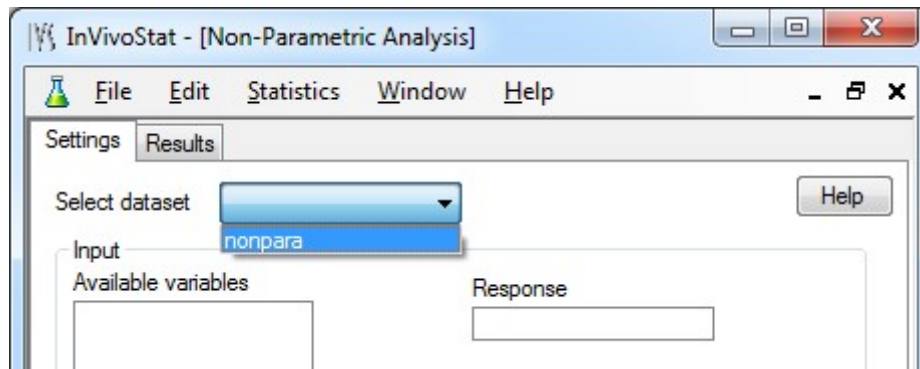
The Non-Parametric Analysis module in InVivoStat is available from the Statistics drop down menu entitled ‘Non-Parametric Analysis’.



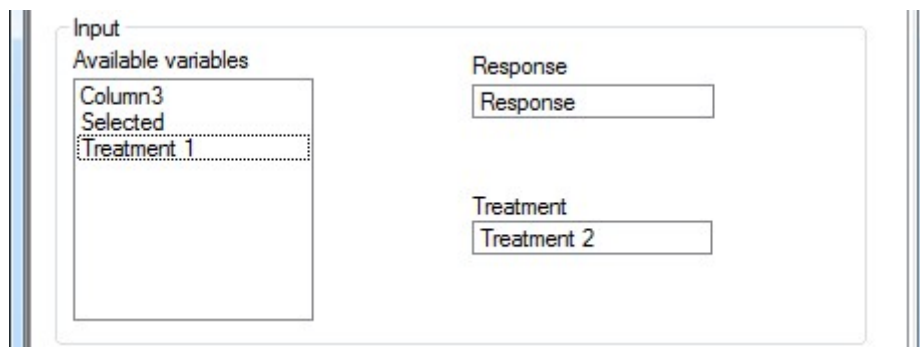
The Non-Parametric Analysis module performs the Kruskal–Wallis test, the Mann-Whitney test (also known as Wilcoxon Rank Sum Test), Steel’s all comparisons back to control test and the Behrens-Fisher all pairwise tests.

## 1 Input selections

To begin with the user selects the dataset.



The response and the treatment factor are then selected from the list of available variables by drag and dropping the relevant variables onto the Response and Treatment boxes.



Finally the user selects either:

- The overall test between the treatment levels (either the Mann-Whitney test if there are only two levels of the treatment factor, or the Kruskal-Wallis test otherwise)
- All treatment comparisons (InVivoStat calculates the Behrens-Fisher all pairwise tests and also all pairwise Mann-Whitney tests). Behrens-Fisher tests are recommended in many texts, although the results generated within InVivoStat have not been independently verified
- Comparisons back to control (InVivoStat performs the Steel's all comparison back to one test). The user is also required to select the control group from a drop down menu
- the user can also choose the significance level for the tests, the default being 0.05 or 5%

Analysis

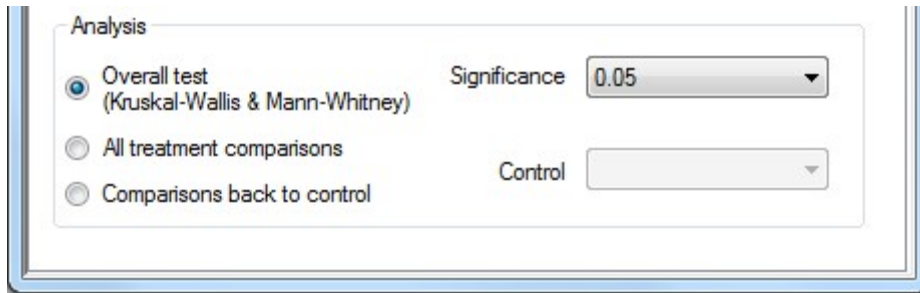
Overall test  
(Kruskal-Wallis & Mann-Whitney)

All treatment comparisons

Comparisons back to control

Significance 0.05

Control



## **2 Output details**

The output consists of a series of non-parametric statistics and figures, including:

- 1) A table of summary statistics including the median, the interquartile range (Q1 and Q3, the minimum and maximum observation. Each row of the table corresponds to a treatment group.
- 2) A box-plot of the data, again categorised by the treatment factor.
- 3) A table of test results, depending on the option selected by the user. This can be either Kruskal-Wallis or Mann-Whitney Test, depending on the number of treatment factor levels, Behrens-Fisher and all pairwise Mann-Whitney tests or Steel's all comparisons back to one.
- 4) A summary of the analysis conclusions, at the selected level of significance
- 5) A description of the analysis performed
- 6) References of the tests employed.

### 3 Controlling the output

The user has the ability to control various aspects of the output. These are available from the

*Statistics* → *Options* → *Output Options*

menu and should be selected before performing the analysis.

Users can manipulate various global characteristics of the box-plot produced. Plots can be generated in pdf format and also in black and white.

Output Options

Graphics: Appearance Graphics: Font Graphics: Colour Advanced Output Options

Points	Lines	Error Bars	Scatterplot Jitter Amount
Size 4	Lines size 1	Width 0.7	Horizontal 0.1
Shape 21	Solid type solid		Vertical 0.1
	Dashed type dashed		

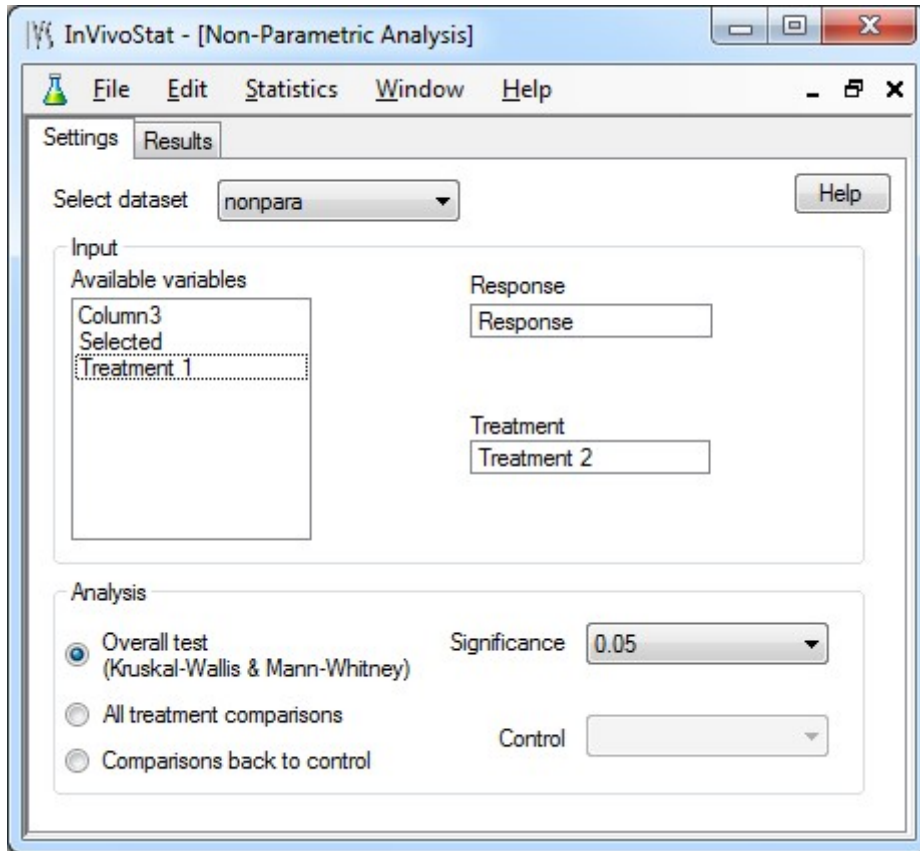
Warning: Be careful when editing the free-text boxes on this interface, output may not be generated as expected if the edited option is not recognised.

Help Reset Save Cancel

More information on the options can be found in the Getting Started Tipsheet.

## 4 Sample Output

Options:



# InVivoStat Non-Parametric Analysis

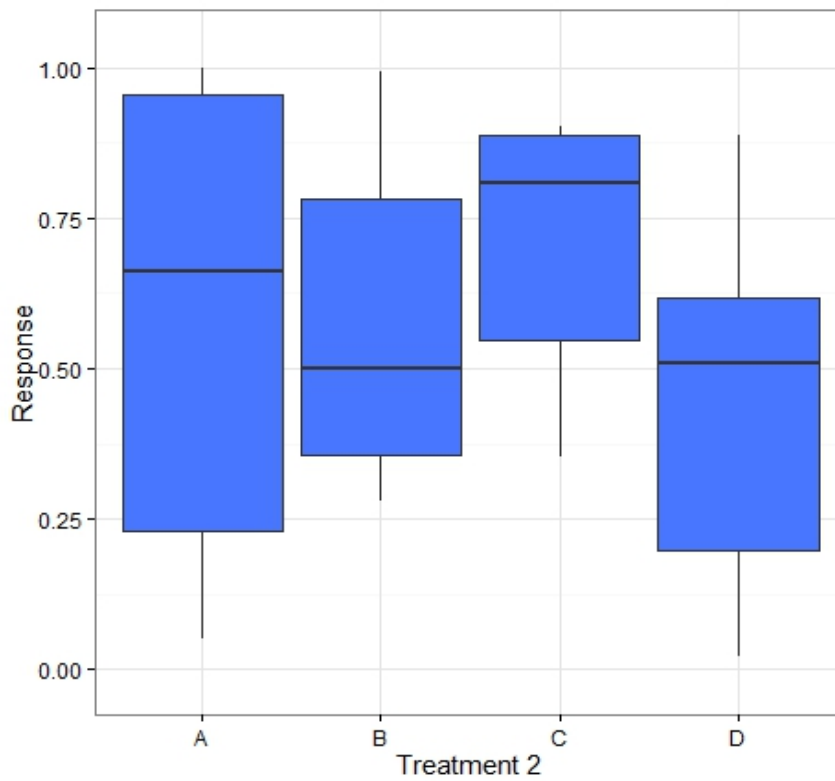
## Response

The Response response is currently being analysed by the Non-Parametric Analysis module, with Treatment 2 fitted as the treatment factor.

## Summary data

	Min	Lower quartile	Median	Upper quartile	Max
Group					
A	0.051	0.231	0.661	0.955	0.999
B	0.281	0.356	0.501	0.782	0.995
C	0.354	0.547	0.808	0.889	0.901
D	0.022	0.199	0.510	0.617	0.887

## Box-plot





On the box-plot the median is denoted by the horizontal line within the box. The box indicates the interquartile range, where the lower and upper quartiles are calculated using the type 2 method, see Hyndman and Fan (1996). The whiskers extend to the most extreme data point which is no more than 1.5 times the length of the box away from the box. Individual observations that lie outside the outlier range are included on the plot using circles.

## Kruskal-Wallis test

	Test statistic	Degrees of freedom	p-value
Result	1.16	3	0.7617

## Analysis conclusions

The overall difference between the treatment groups is not statistically significant at the 5% level of significance as the p-value is greater than 0.05 (Kruskal-Wallis test).

## Analysis description

The overall treatment effect was assessed using the non-parametric Kruskal-Wallis test, see Kruskal and Wallis (1952, 1953).

Non-parametric tests should be used if the data is non-normally distributed, the variability is different between treatment groups or the responses are not continuous and numerical.

For more information on the theoretical approaches that are implemented within this module, see Bate and Clark (2014).

## Statistical references

Bate ST and Clark RA. (2014). *The Design and Statistical Analysis of Animal Experiments*. Cambridge University Press.

Hyndman RJ and Fan Y. (1996). Sample quantiles in statistical packages. *American Statistician* 50, 361-365.

Kruskal, WH and Wallis, WA (1952). Use of ranks in one criterion variance analysis. *JASA*, 47, 583-621.

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## R references

R Development Core Team (2013). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <http://www.R-project.org>.

Alan Genz, Frank Bretz, Tetsuhisa Miwa, Xuefei Mi, Friedrich Leisch, Fabian Scheipl, Torsten Hothorn (2014). mvtnorm: Multivariate Normal and t Distributions. R package version 0.9-9997. URL <http://CRAN.R-project.org/package=mvtnorm>

Barret Schloerke, Jason Crowley, Di Cook, Heike Hofmann, Hadley Wickham, Francois Briatte, Moritz Marbach and Edwin Thoen (2014). GGally: Extension to ggplot2. R package version 0.4.5. <http://CRAN.R-project.org/package=GGally>

Erich Neuwirth (2011). RColorBrewer: ColorBrewer palettes. R package version 1.0-5. <http://CRAN.R-project.org/package=RColorBrewer>

H. Wickham. ggplot2: elegant graphics for data analysis. Springer New York, 2009.

H. Wickham. Reshaping data with the reshape package. Journal of Statistical Software, 21(12), 2007.

Hadley Wickham (2011). The Split-Apply-Combine Strategy for Data Analysis. Journal of Statistical Software, 40(1), 1-29. URL <http://www.jstatsoft.org/v40/i01/>.

Hadley Wickham (2012). scales: Scale functions for graphics. R package version 0.2.3. <http://CRAN.R-project.org/package=scales>

Joerg Helms and Ullrich Munzel (2008). NPMC: Nonparametric Multiple Comparisons. R package version 1.0-7.

Lecoutre, Eric (2003). The R2HTML Package. R News, Vol 3. N. 3, Vienna, Austria.

Louis Kates and Thomas Petzoldt (2012). proto: Prototype object-based programming. R package version 0.3-10. <http://CRAN.R-project.org/package=proto>

## Analysis dataset

	Response Treatment 2	
1	0.999	A
2	0.911	A
3	0.411	A
4	0.051	A
5	0.281	B
6	0.570	B
7	0.995	B

8	0.431	B
9	0.877	C
10	0.354	C
11	0.901	C
12	0.739	C
13	0.887	D
14	0.022	D
15	0.586	D
16	0.617	D
17	0.199	D
18	0.433	D