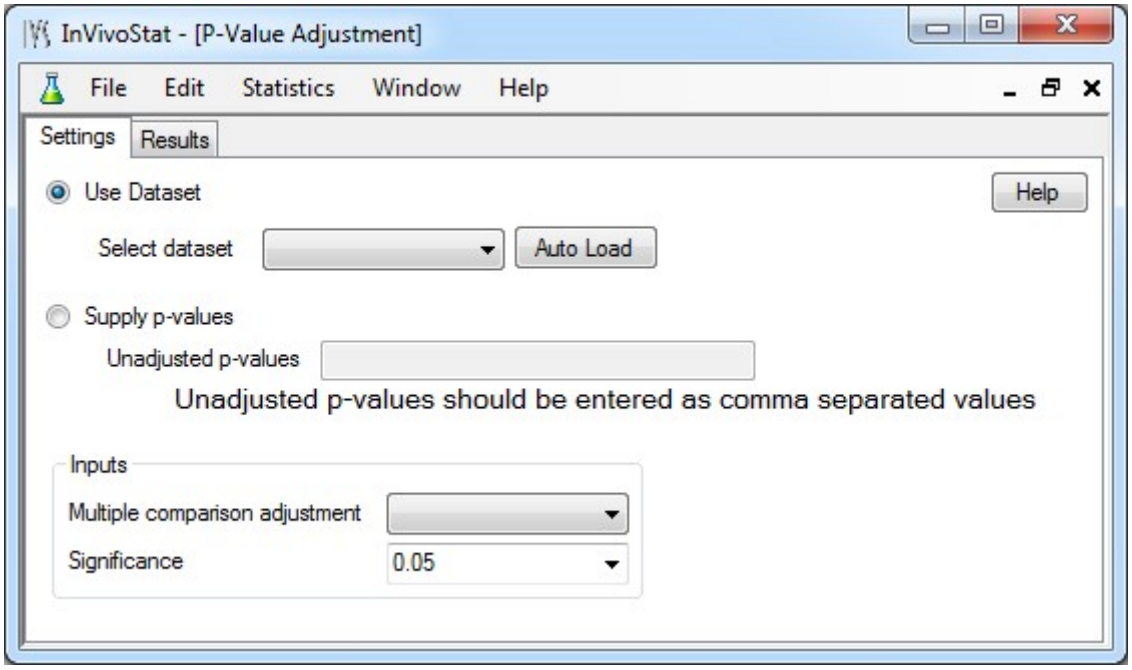
# InVivoStat

# P-Value Adjustment Module

# Tipsheet

Within the InVivoStat software there is a module called P-Value Adjustment. This module allows the user to apply a multiple comparison adjustment to a set of unadjusted *p*-values. These *p*-values may have been created in one of the other InVivoStat modules or another statistical software package. The user can also auto load a set of p-values previously generated in the Single and Repeated Measures Parametric Analysis modules.

The module provides a flexible way of performing multiple comparison adjustments as it makes the requested adjustments to only those *p*-values of interest. Hence unlike other automated implementations it is not overly conservative by adjusting for too many comparisons. Available procedures include Holm, Hochberg, Hommel and Benjamini-Hochberg.

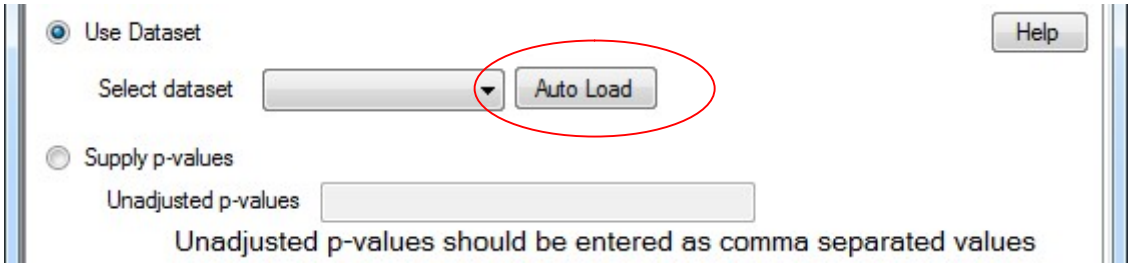


# 1 Analysis procedure

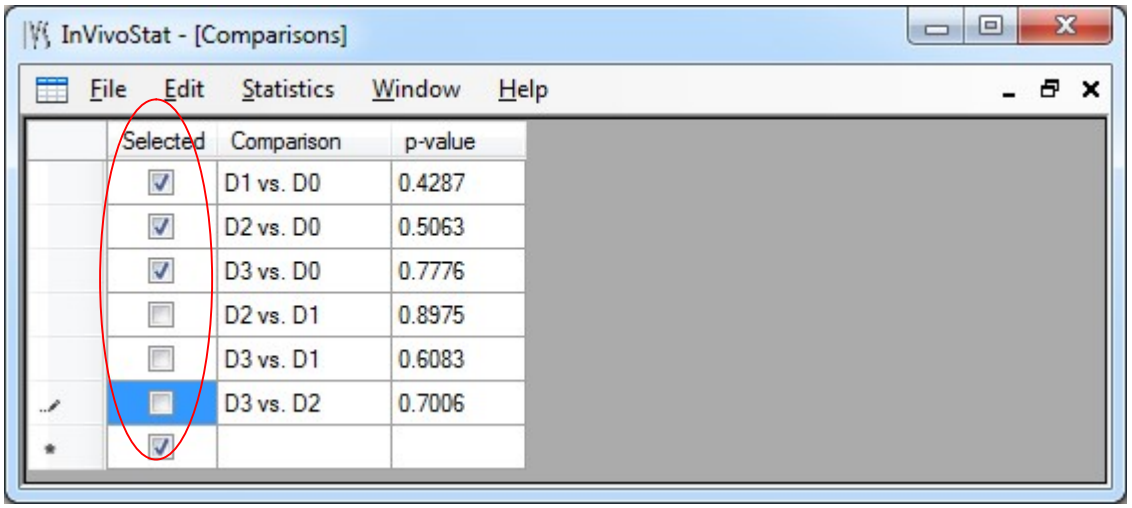
## 1.1 Input selection

1. Entering the *p*-values

The user can load a dataset of p-values that have been generated by the Single or Repeated Measures Parametric Analysis modules by clicking on the Auto Load button

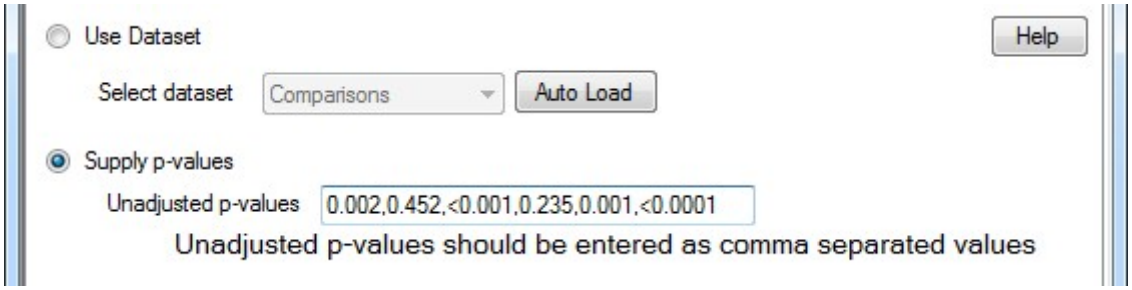



The last set of pairwise comparisons will now be loaded into InVivoStat. The user should now deselect those comparisons that are not of interest.




2. Entering the *p*-values manually

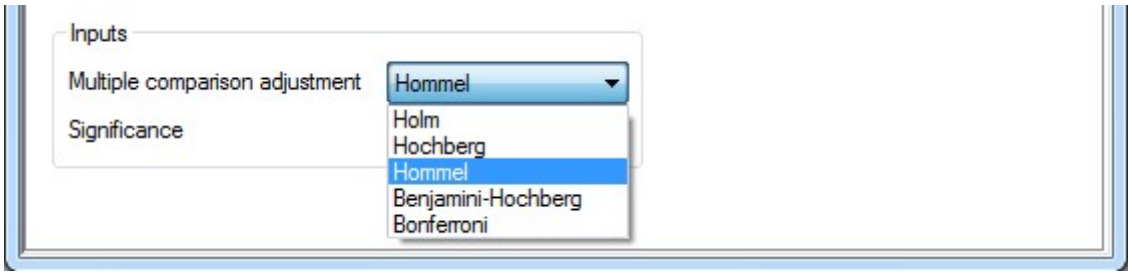
Alternatively, the *p*-values can be entered in the input box (comma separated). The user can enter *p*-values of the form <0.001 and <0.0001 if they need to.



## 1.2 Output selection

3. Defining the test

The user then selects the adjustment approach of choice from the drop-down list.




4. Significance level

The user can also choose the significance level for the tests, the default being 0.05 or 5%.


## 1.3 Output details

The output contains a table of the adjusted and unadjusted *p*-values. If the user enters a *p*-value of the form <0.001 then the *p*-value adjustment module assumes the true *p*-value is 0.0009. This will give a conservative adjusted *p*-value. The user is warned in the output that this approach has been applied.

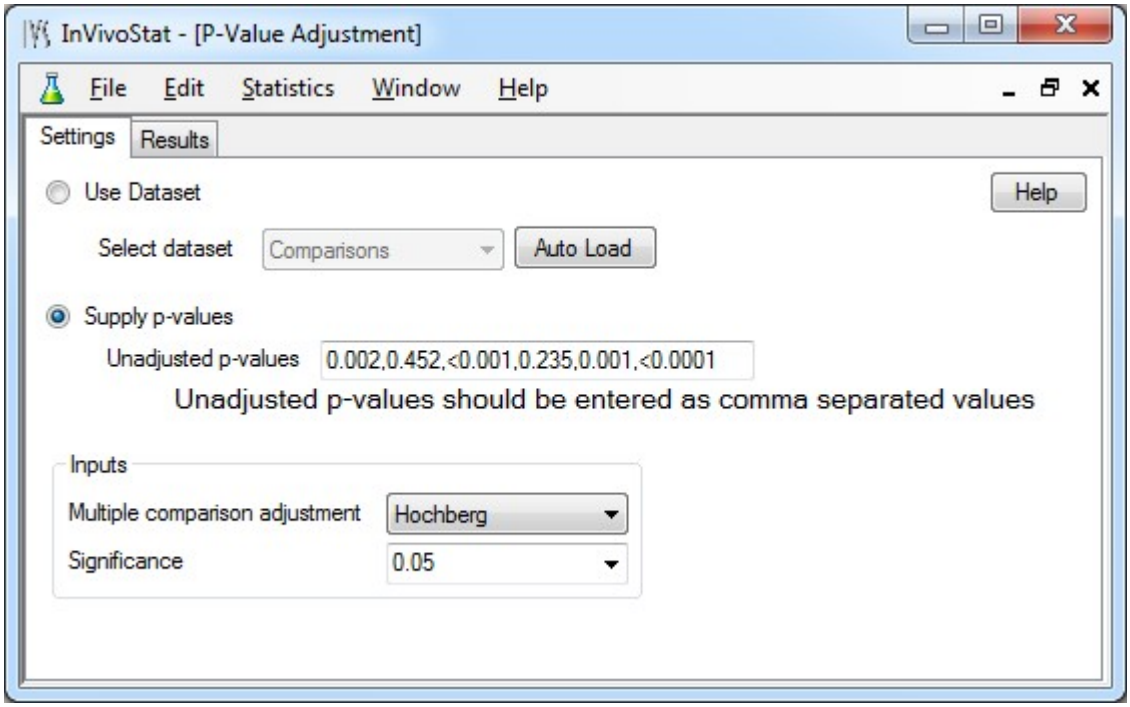
# 2 Sample Output

Consider an example where the analyst has calculated the unadjusted *p*-values:

*0.002, 0.452, <0.001, 0.235, 0.001* and *<0.0001*

They then decided to adjust these *p*-values using the Hochberg approach (at the 5% level of significance) to reduce the risk of making any false positive conclusions.

Options:



# InVivoStat P-Value Adjustment

The input p-values for this module should be unadjusted p-values. These unadjusted p-values are adjusted using Hochberg's multiple comparison procedure.

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

## Results

| | Unadjusted p-value | Adjusted p-value |
|---|---|---|
| 1 | <0.0001 | 0.0006 |
| 2 | <0.001 | 0.0040 |
| 3 | 0.001 | 0.0040 |
| 4 | 0.002 | 0.0060 |
| 5 | 0.235 | 0.4520 |
| 6 | 0.452 | 0.4520 |

WARNING: You have entered unadjusted p-values of the form <0.001 and <0.0001. For the purposes of the numerical calculation these values has been replaced with 0.00099 and 0.000099 respectively and hence the adjusted p-values may be unduly conservative.

## Conclusions

The unadjusted p-values <0.0001, <0.001, 0.001 and 0.002 are statistically significant at the 5% level, using Hochberg's multiple comparison procedure.

## Statistical references

Bate ST and Clark RA. (2014). The Design and Statistical Analysis of Animal Experiments. Cambridge University Press.
Hochberg Y. (1988). A sharper Bonferroni procedure for multiple tests of significance. Biometrika, 75, 800-803.

## 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.
Lecoutre, Eric (2003). The R2HTML Package. R News, Vol 3. N. 3, Vienna, Austria.
Torsten Hothorn, Frank Bretz and Peter Westfall (2008). Simultaneous Inference in General Parametric Models. Biometrical Journal 50(3), 346--363.