Example: Reproducible research using `knitr`

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Background

We want to study the effect of different treatment methods in young women suffering from anorexia. We compare the effects of cognitive behavioral therapy (CBT) and family therapy (FT) with a control group in a randomized clinical trial.

Methods

The data set is part of the R package MASS.

For each subject, we have the body weight reported in pounds (lbs) before and after treatment. We study the effect of the different treatment regimes on weight gain, i.e. the difference between weight after minus weight before.

We use analysis of variance to test the null hypothesis that there is no effect of treatment on weight gain. We use pairwise t-tests with the pooled standard error from the Anova table to test differences between treatment groups, and Bonferroni correction to adjust for multiple testing.

Results

Table 1 shows means and standard errors of weight gain for the treatment groups. Figure 1 shows the distribution of weight gains in each group.

The ANOVA table is shown in Table 2. We see that there is a significant difference between treatment groups at $p = 0.006$.

The result of the pairwise t-tests are shown in Table 3: we find that the only significant difference is between control group and family therapy (Bonferroni adjusted $p = 0.005$, whereas there is no difference between CBT and FT or CBT and control group (Bonferroni adjusted $p = 0.205$ and $p = 0.281$, respectively).

	Mean	StdError
FT	7.26	1.74
CBT	3.01	1.36
Cont	-0.45	1.57

Table 1: Mean weight gain and standard errors
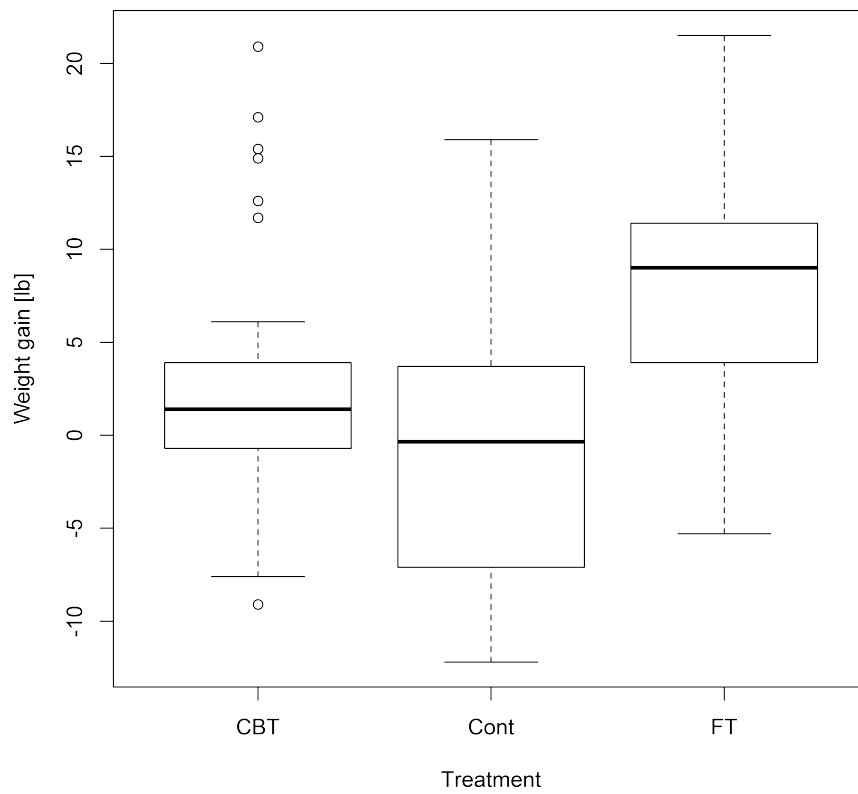
Figure 1: Boxplots of weight gain by treatment

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Treat	2.00	614.64	307.32	5.42	0.01
Residuals	69.00	3910.74	56.68		

Table 2: Anova table for weight gain by treatment

	CBT	Cont
Cont	0.281	
FT	0.205	0.005

Table 3: Adjusted p-values for all three comparisons

Discussion

We find that family therapy leads to a significant weight gain compared to the control group. CBT has an intermediate status between family therapy and the control group, but is not significantly different from control.

Further research will be necessary.

Ok, this of course *not* a submission ready output as we would expect from true reproducible research. However, it shows that we will have large chunks of text that are entirely data- and result-dependent, so this is quite different from an automated report that just dumps numbers and plots into a file. Also, it indicates that getting ready-to-print outoput requires substanatially more effort; some use of LaTeXis probably unavoidable, either by switching completely to LaTeXmarkup or by using raw LaTeXwithin markdown (which pandoc passes on to pdflatex).