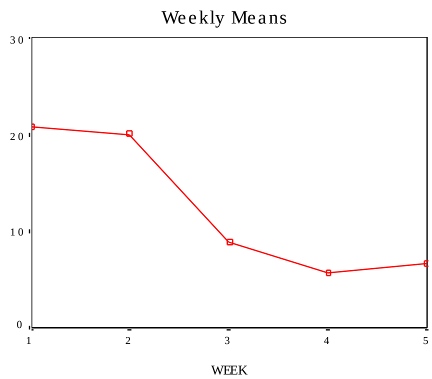
Chapter 18—Repeated-Measures Analysis of Variance

18.1 Descriptive statistics on study of migraines:

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
WEEK1	9	7.0	30.0	20.778	7.1725
WEEK2	9	4.0	33.0	20.000	10.2225
WEEK3	9	5.0	14.0	9.000	3.1225
WEEK4	9	1.0	12.0	5.778	3.4197
WEEK5	9	4.0	17.0	6.778	4.1164
Valid N (listwise)	9				



18.3 I would have liked to collect data from students on the use of pain killers and other ways of dealing with migraines. I might also like to have data on stress levels over time so that I could possibly rule out the effects of stress

Here again we are getting into issues of experimental design, which underlie all meaningful analyses. This design differs from the one in the "suggestions" section of the Resource Manual for Chapter 16. In that design we had separate groups tested at the different times.

18.5 Repeated-measures analysis of variance of data used in Exercise 18.4:

Source	***df***	***SS***	***MS***	***F***
Subjects	8	612.00		
Weeks	1	544.50	544.50	14.424
Error	8	302.00	37.75	
Total	17	1458.50		

[$F_{.05}(1,24) = 4.26$]

There is a significant increase in decrease in severity over time. $F = t^2 = 3.798^2 = 14.424$.

18.7 Effect size for Exercise 18.4

We will use the square root of MS_{error} as our estimate of the standard deviation, because this is a standard deviation corrected for any differences due to subject effects.

$$\hat{d} = \frac{\bar{X}_0 - \bar{X}_3}{\sqrt{MS_{error}}} = \frac{20.00 - 9.00}{\sqrt{10.22}} = \frac{11.00}{3.20} = 3.44$$

The decrease in severity from baseline to training a reduction of approximately three and one half standard deviations. (I used the standard deviation of the baseline scores in line with what I said in the text.

18.9 $\hat{d}$ for difference in Exercise 18.8

I would standardize the difference in means using the square root of the average of the variances of the two baseline measures. This would leave individual differences as part of the standard deviation, which seems appropriate. The average variance is 77.97, so the standard deviation is 8.83

$$\hat{d} = \frac{\bar{X}_{baseline} - \bar{X}_{training}}{s} = \frac{20.39 - 7.19}{8.83} = \frac{13.20}{8.83} = 1.49$$

On average, the severity of headaches decreased by nearly 1.50 standard deviations from baseline to training.

18.11 Exercise 18.10 tested the null hypothesis that condom use did not change over time. We would have hoped to see that the intervention worked and that condom use increased, but that was not what we found. There was an increase, but it was not significant.

18.13 It would appear that without the intervention, condom use would actually have declined. This suggests that the intervention may have prevented that decline, in which case that non-significant result is actually a positive finding.

18.15 Bonferroni *t* tests to compare the beginning and end of Baseline, and the beginning and end of Training for the data in Table 18.1. We can use a standard *t* test because the error term has been corrected by the repeated-measures analysis of variance, which has already removed between subject variability.

Paired Samples Test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	WEEK0 - WEEK6	-2.680	2.6727	.5345	-3.783	-1.577	-5.014	24	.000
Pair 2	WEEK0 - WEEK12	-3.040	2.9928	.5986	-4.275	-1.805	-5.079	24	.000
Pair 3	WEEK3 - WEEK12	-1.600	2.8868	.5774	-2.792	-.408	-2.771	24	.011

The Bonferroni alpha level would be .05/3 = .01667

We will reject all of the null hypotheses because each *p* value is less than .0167.