Biostat 513: **Discussion Section #1** April 8, 2002 - April 12, 2002

Overview: We will primarily use discussion section to work through a pair of case studies: a binary response data set for weeks 3-5; and a survival data set for weeks 7-9. However, this first week will be used to review some key ideas from linear regression, and to discuss some scenarios where categorical data methods might be used.

Format: Students will be given lab exercises that are to be considered before coming to discussion section. The section time will be used for small group discussion of the section activity, as well as for discussion of course material and exercises as needed.

Linear Regression

1. Carpal Tunnel Syndrome (CTS) is the most common peripheral nerve entrapment syndrome, with an annual incidence of 50-100 cases/100,000. In recent years CTS has reached almost epidemic proportions with a six fold increase in the diagnosis of CTS since the 1980's. Because CTS is extremely common, any change in the diagnosis and treatment may have a large impact on health care resources. The societal impact is amplified due to CTSs association with chronic work disability, resulting in important workers' compensation costs.

A pilot study was conducted to evaluate whether magnetic resonance neurographic imaging (MRNI) looked promising as a diagnostic measure that could indicate which CTS subjects are likely to benefit from surgery. A prospective cohort of $n = 96$ subjects was assembled with clinically suspected carpal tunnel syndrome (CTS). A total of $n = 28$ patients were treated surgically, while $n = 68$ were treated non-surgically. All patients were imaged at baseline (prior to treatment/surgery) and then again at 1 year follow-up. The primary outcome variables include the Carpal Tunnel Syndrome Assessment Questionnaire (CTSAQ) with a functional status scale comprised of 8 items, and a symptom severity scale comprised of 11 items. The main MRNI imaging measures include:

`median nerve signal`: degree and length of signal abnormality.
`overall imaging rating`: score that combines several imaging features.
`length of abnormal signal`: length (mm) of abnormal median nerve signal.

The following analysis focuses on the length of abnormal signal. Below are univariate summaries of the key variables:

`delta.fnx`	change from 1 year to baseline (post-pre) in CTSAQ function
`surgery`	1 = surgical intervention, 0 = non-surgical
`signal.length`	length of the abnormal median nerve signal

```
> summary( delta.fnx )
   Min. 1st Qu.  Median    Mean 3rd Qu.  Max.
 -2.981  -0.876 -0.2946 -0.4309  0.1069 1.299

> summary( signal.length )
 Min. 1st Qu. Median  Mean 3rd Qu. Max.
    0       9  21.25 22.38      35   72

> table( surgery )
  0  1
 68 28
```

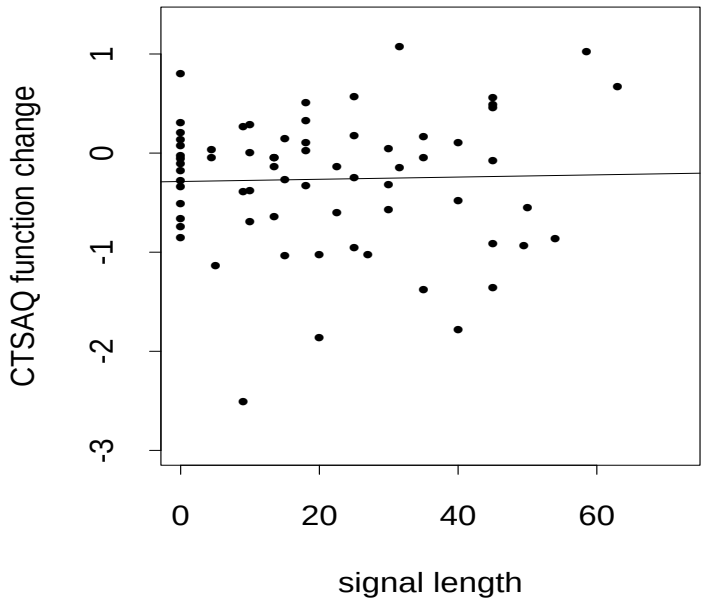
Answer the following questions:

1(a) Interpret the regression results for the analyses that are conducted separately for surgery==0 and surgery==1 groups. In particular, give a careful interpretation of the regression coefficients and state whether or not the coefficients are significant.

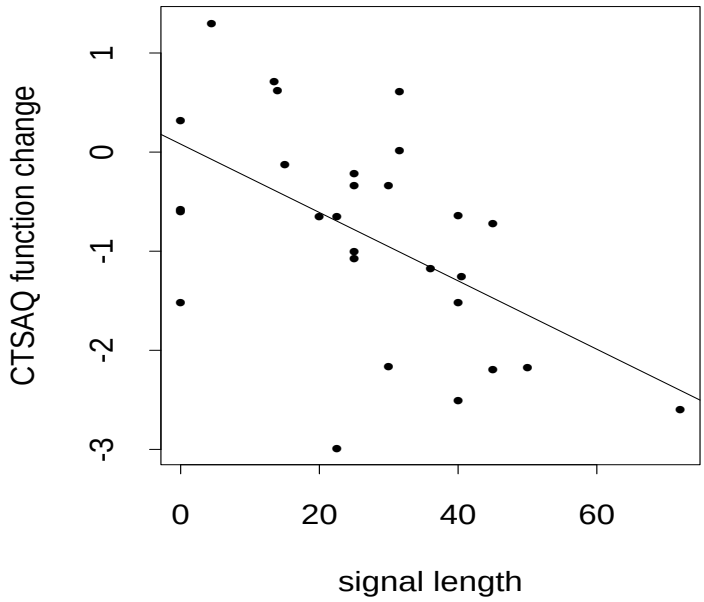
1(b) Interpret the regression results for the analysis that combines both groups (ie. uses surgery as a covariate). In particular, give a careful interpretation of the regression coefficients and state whether or not the coefficients are significant.

1(c) Discuss whether/how the analysis using both groups combined is the same as conducting separate regressions. Are the coefficients of `signal.length` for each group (surgery==0 and surgery==1) the same? Are the standard errors the same?

CTSAQ change vs Length: non-Surgical



CTSAQ change vs Length: Surgical



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SUBSET TO Subjects with SURGERY==0

Model:  delta.fnx = signal.length

Coefficients:
                Value Std. Error t value Pr(>|t|)
  (Intercept) -0.2887  0.1271    -2.2714  0.0264
signal.length  0.0011  0.0047     0.2410  0.8103

Residual standard error: 0.6724 on 66 degrees of freedom
Multiple R-Squared: 0.000879
F-statistic: 0.05806 on 1 and 66 degrees of freedom,
the p-value is 0.8103

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SUBSET TO Subjects with SURGERY==1

Model: delta.fnx = signal.length

Coefficients:
                Value Std. Error t value Pr(>|t|)
  (Intercept)  0.0825  0.3264     0.2528  0.8024
signal.length -0.0345  0.0104    -3.3286  0.0026

Residual standard error: 0.9294 on 26 degrees of freedom
Multiple R-Squared: 0.2988
F-statistic: 11.08 on 1 and 26 degrees of freedom,
the p-value is 0.002615

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COMBINED GROUPS (both SURGERY==0 and SURGERY==1)

Model:  delta.fnx = surgery + signal.length + surgery*signal.length

Coefficients:
                         Value Std. Error t value Pr(>|t|)
          (Intercept) -0.2887  0.1425    -2.0257  0.0457
              surgery  0.3712  0.3007     1.2344  0.2202
        signal.length  0.0011  0.0053     0.2149  0.8303
surgery*signal.length -0.0356  0.0099    -3.5869  0.0005

Residual standard error: 0.754 on 92 degrees of freedom
Multiple R-Squared: 0.2342
F-statistic: 9.379 on 3 and 92 degrees of freedom, the p-value is 1.802e-05

Correlation of Coefficients:
                     (Intercept) surgery signal.length
              surgery -0.4739
        signal.length -0.7670      0.3635
surgery:signal.length  0.4086     -0.8218 -0.5327

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Contingency Tables

2. The following questions are taken from:
   "Practical Statistics for Medical Research"
   by Douglas Altman.
   Chapman and Hall
   1991

Please come to discussion section prepared to discuss the following questions:

question 10.3
question 10.4
question 10.5
question 10.6
question 10.2 (time permitting)