Final report

Data description:

We have a categorical variable: Group which has 4 categories: Group A-Single Housed Before and After Sx (all Sx), Group B-Pair Housed Before, Single Housed After Sx (all Sx), Group C-Pair Housed Before and After Sx (10 Sx/10 no Sx*), and Group D-Pair Housed Before and After Sx (all Sx). In each group, there are 10 cages. We also have 7 continuous variables: Weight, BCS, Grimace, Nest build, Tint, Wound and Staple.

Methods:

I calculated the average value of Weight, BCS, Grimace, Nest build, Tint, Wound and Staple for each cage before and after the surgery. Next, I plotted the data based on the new numbers I got.

I do one- way anova to see if there is any difference in mean Weight, BCS, Grimace, Nest build, Tint, Wound and Staple among 4 groups.

Then I calculated the average value for all the pre- and post- surgery for each group then did the repeated measure analysis to compare mean Weight, BCS, Grimace, Nest build, Tint, Wound and Staple before and after surgery for four groups A, B, C, D.

Result:

Based on the plots for pre- and post- surgery for each cage in the 4 groups, we could see that there are a few consistent results: for Group A and D, the weight increases after the surgery for all cages; and the nest increases for all cages in all 4 groups after the surgery. The plots are in Appendix I.

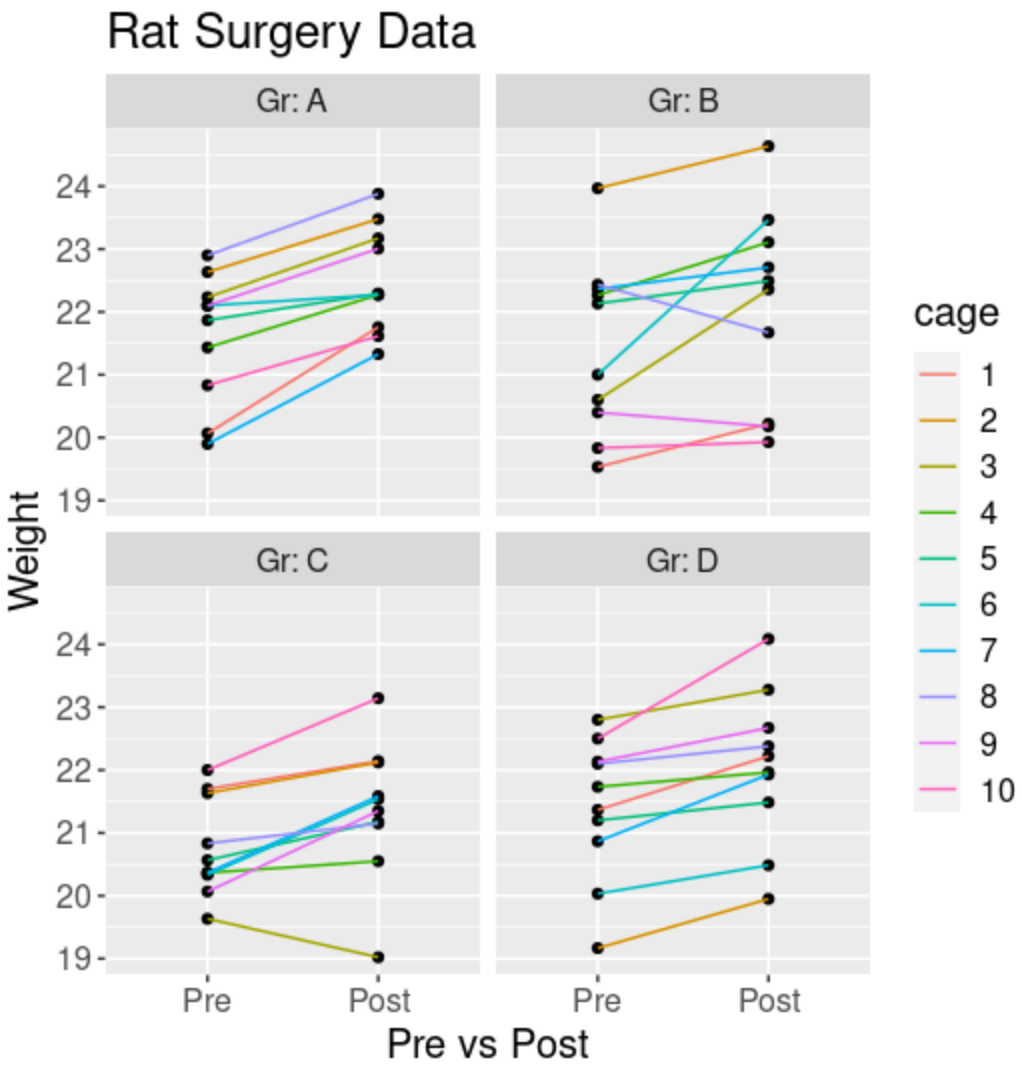
<u>For one way anova result:</u>

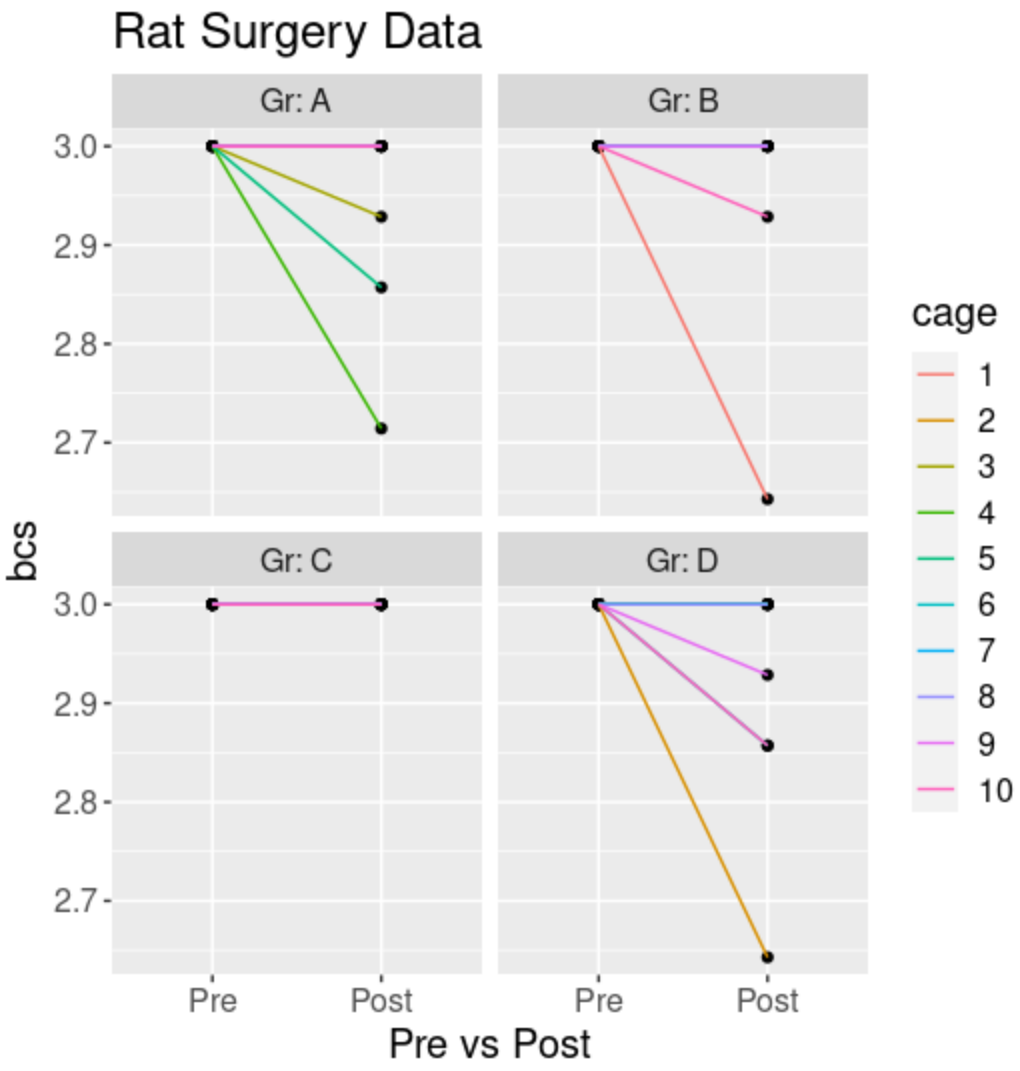
There is significant difference between groups in Nest build ($p=0.003$) and Tint ($p<0.001$). Among the four groups, group D has highest Nest build score (3.79 ± 0.19) compared to other three groups (A 3.42 ± 0.27, B 3.45 ± 0.30, C 3.78 ± 0.20). Among the four groups, group C has highest Tint score (0.93 ± 0.06) compared to other three groups (A 0.44 ± 0.30, B 0.54 ± 0.22, D 0.87 ± 0.08). There is no difference between groups in Weight ($p=0.235$), BCS($p=0.398$), Grimace($p=0.222$), Wound($p=0.156$) and Staple ($p=0.73$). Descriptive statistics and one way anova results are in Appendix II.

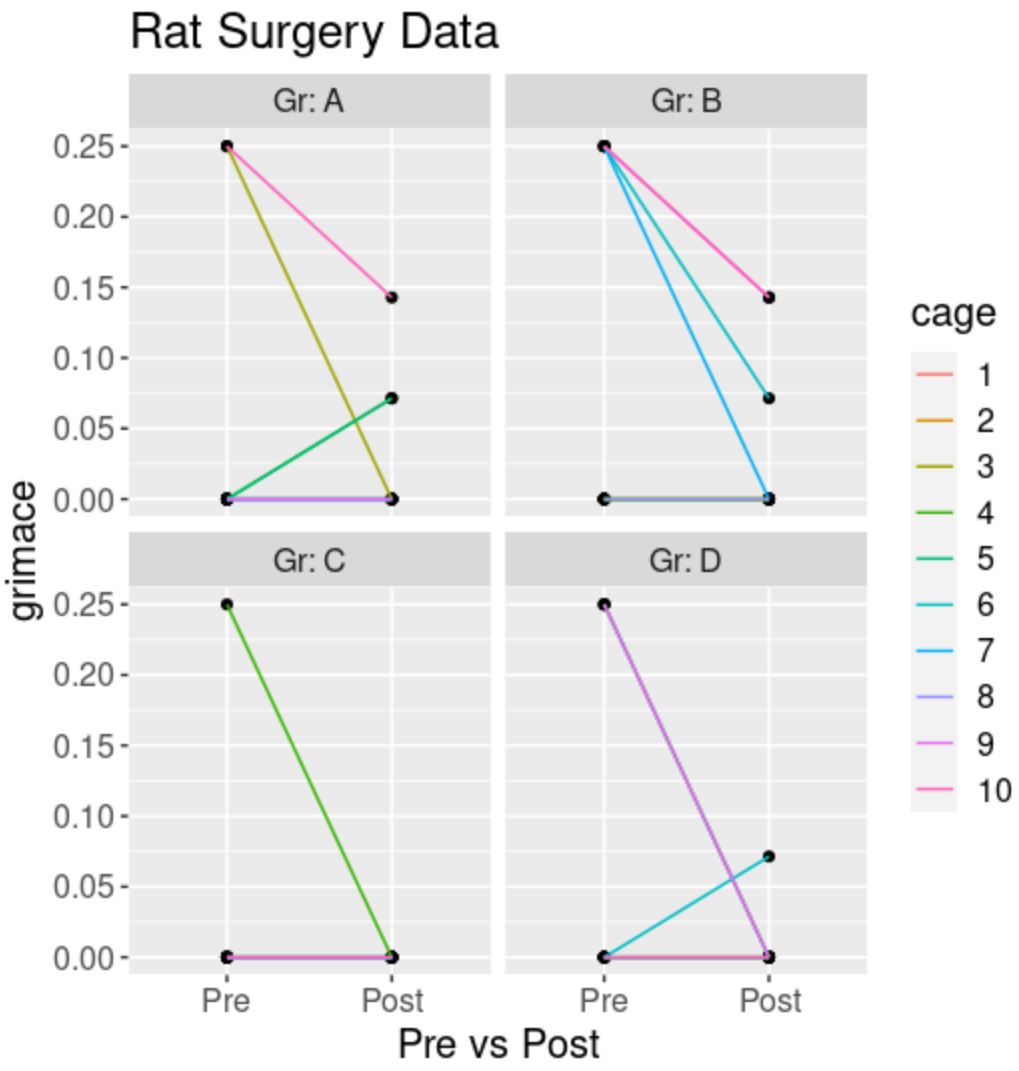
For repeated measure result:

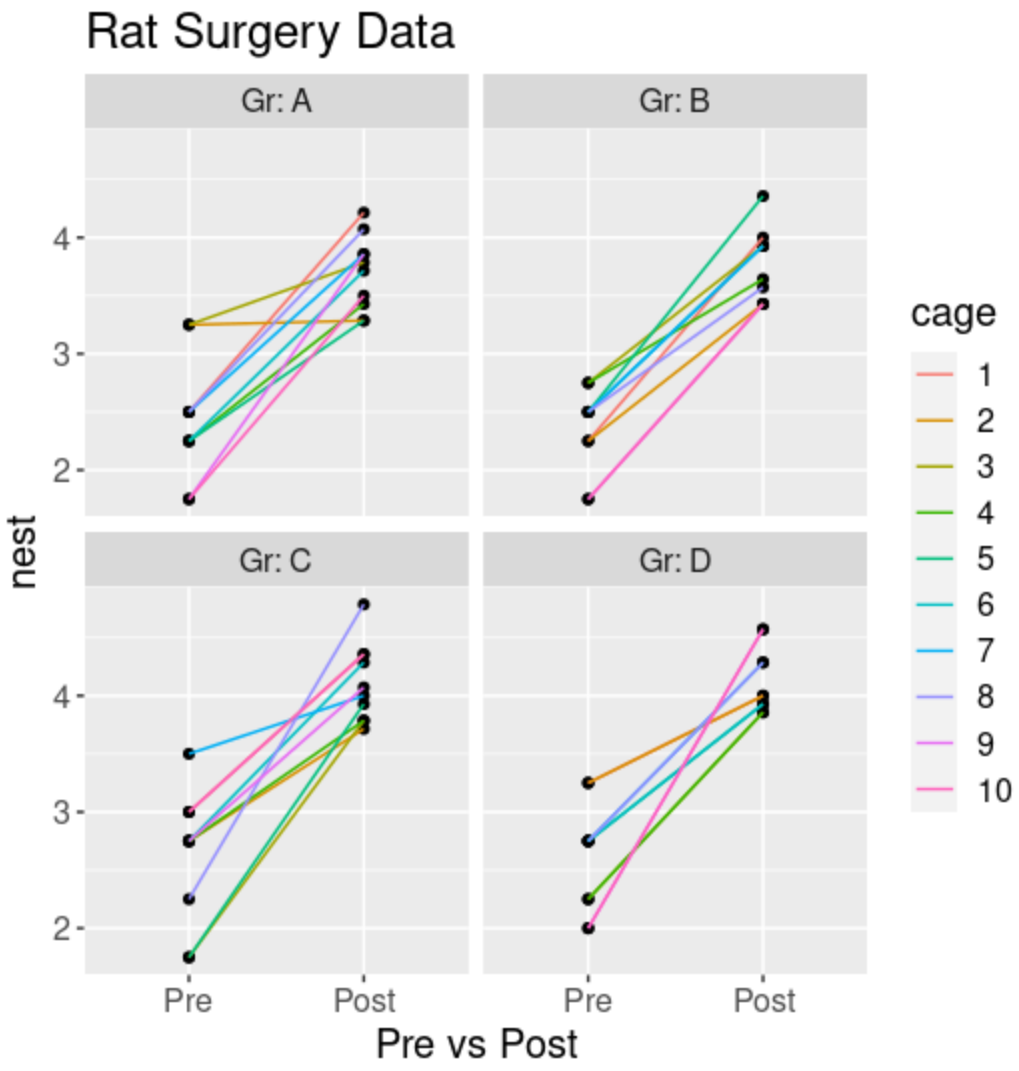
For weight, p value = 001832 so mean weight differs between pre- and post-surgery. From the plot we could see that group 1 has highest weight for both pre- and post- surgery, then group 2, 4 and last is group 3. For bcs, p value = 0.07119 so mean bcs does not differ between pre- and post- surgery. From the plot, we could see that all 4 groups start at same point for pre- surgery, but for post- surgery, group 3 has highest bcs while group 4 has lowest bcs. For grimace, p value = 0.03687 so mean grimace differs between pre- and post- surgery. From the plot we could see that overall group 2 has highest grimace while group 3 has lowest grimace both pre- and post- surgery. For nest, p value = 0.0001277 so mean nest differs between pre- and post- surgery. From the plot we could see that overall group 3 and 4 have higher grimace than group 1 and 2. For tint, p value = 0.584012 so mean tine does not differ between pre- and post- surgery. From the plot we could see that group 3 has highest tint while group 1 has lowest tint. For wound, p value = 0.1508 so mean wound does not differ between pre- and post-surgery. From the plot, we could see that all 4 groups start at same point for pre-surgery, but for post- surgery, group 1 has highest wound while group 4 has lowest wound. For staple, p value =0.06 so there's no mean difference in staple between 4 groups. From the plot we could see that all 4 groups start at same point for pre but for post, group 3 has highest staple while group 4 has lowest staple. Repeated measures results and plots are in Appendix III.

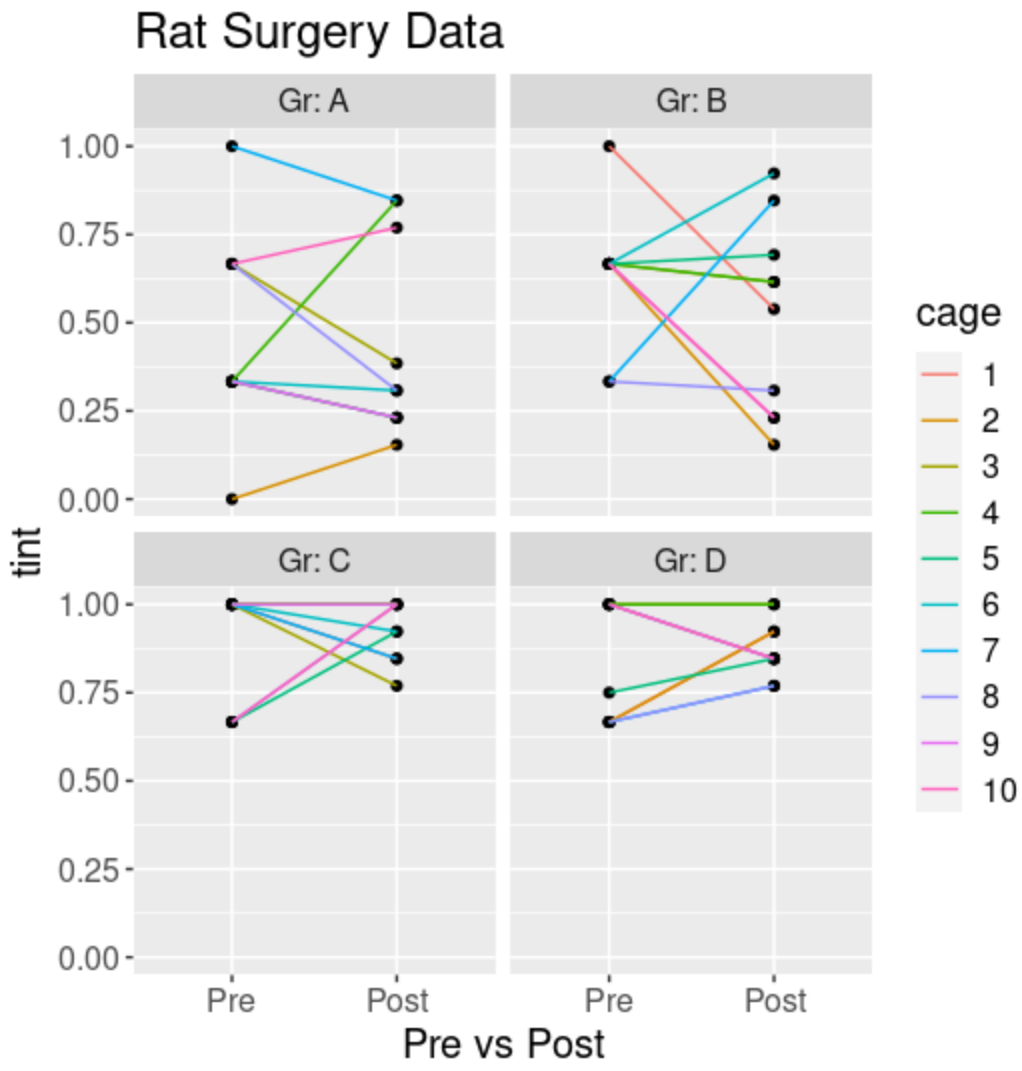
Appendix I:

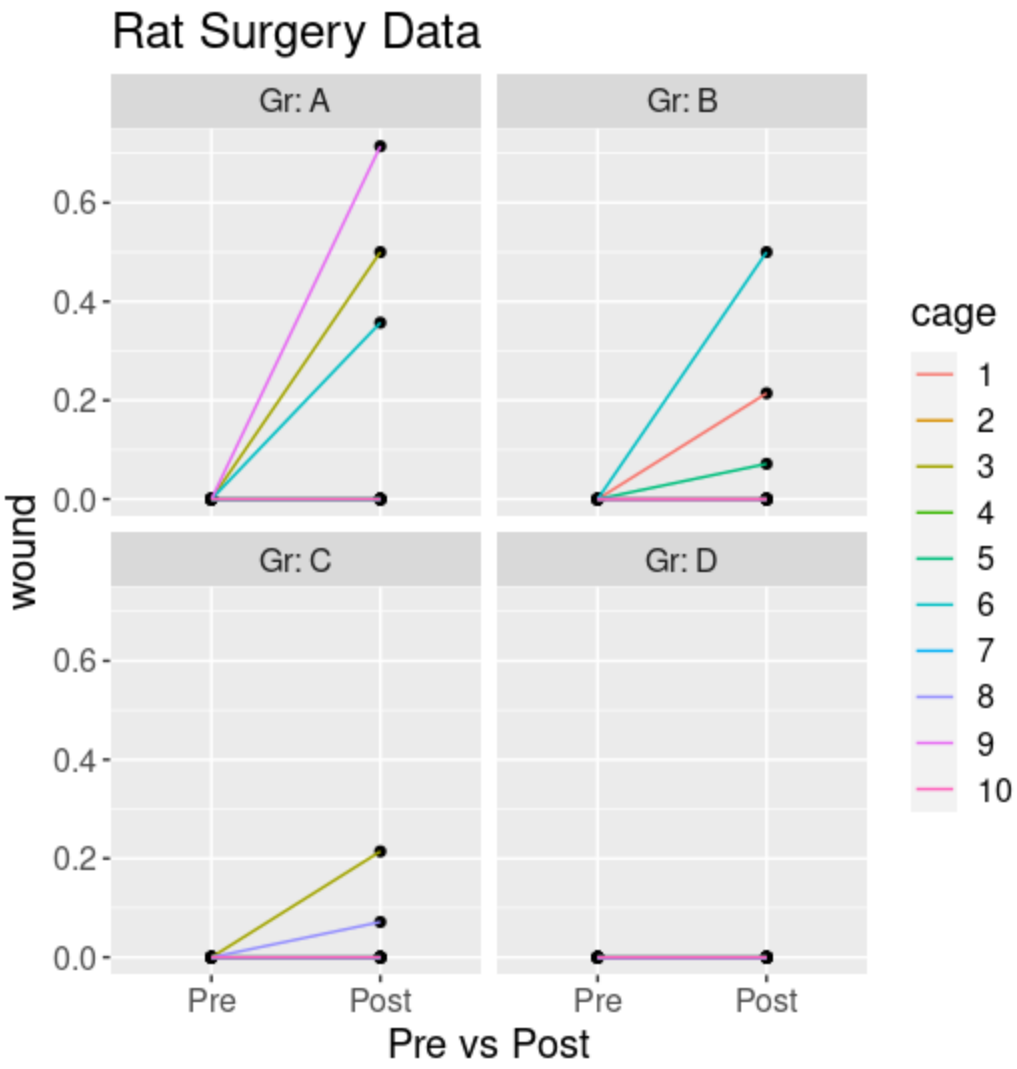

Rat Surgery Data
Gr: A
Gr: B
Gr: C
Gr: D
Weight
24
23
22
21
20
19
Pre
Post
Pre vs Post
cage
1
2
3
4
5
6
7
8
9
10

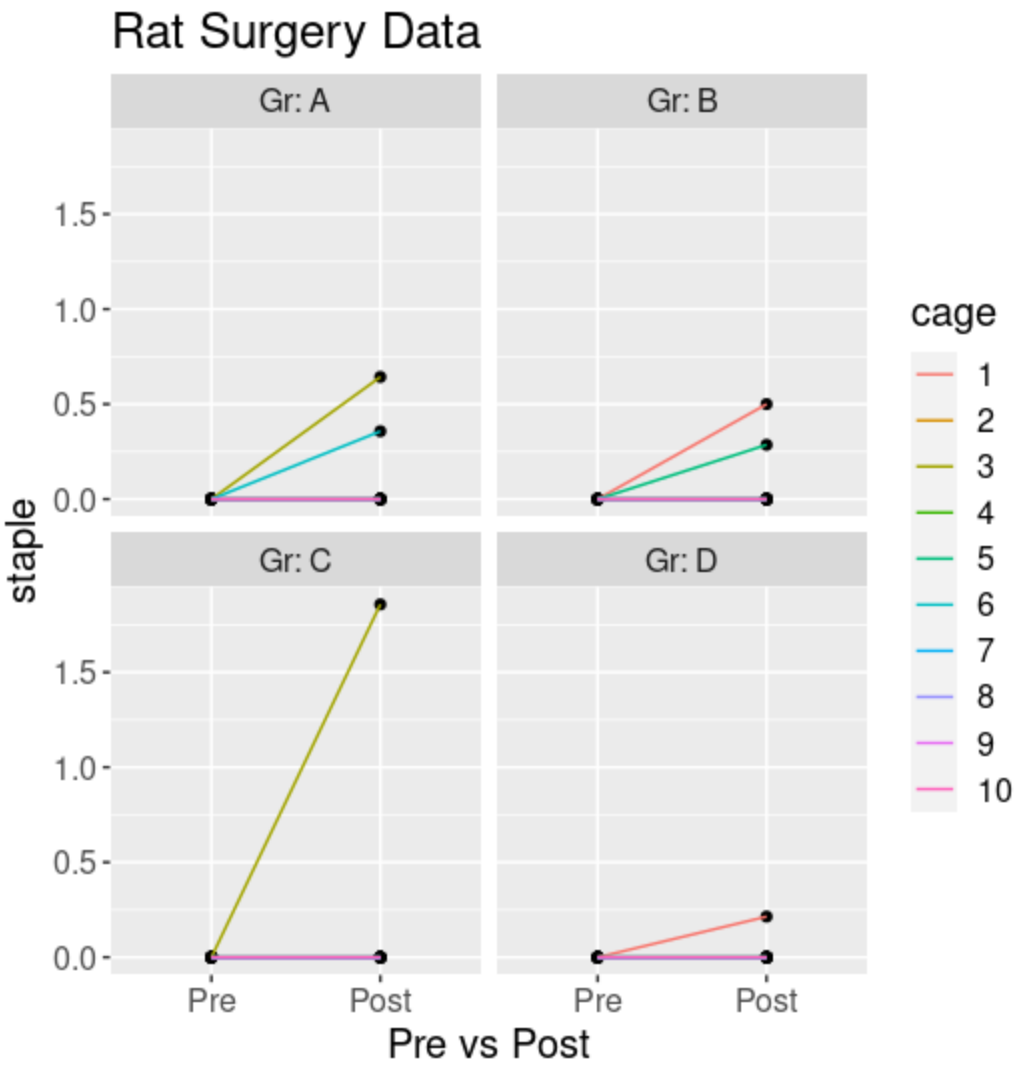

Rat Surgery Data
Gr: A
Gr: B
Gr: C
Gr: D
bcs
3.0
2.9
2.8
2.7
Pre
Post
Pre vs Post
cage
1
2
3
4
5
6
7
8
9
10


Rat Surgery Data
Gr: A
Gr: B
Gr: C
Gr: D
grimace
0.25
0.20
0.15
0.10
0.05
0.00
Pre
Post
Pre vs Post
cage
1
2
3
4
5
6
7
8
9
10


Rat Surgery Data
Gr: A
Gr: B
Gr: C
Gr: D
nest
2
3
4
Pre
Post
Pre vs Post
cage
1
2
3
4
5
6
7
8
9
10


Rat Surgery Data
Gr: A
Gr: B
Gr: C
Gr: D
tint
1.00
0.75
0.50
0.25
0.00
Pre
Post
Pre vs Post
cage
1
2
3
4
5
6
7
8
9
10


Rat Surgery Data
Gr: A
Gr: B
Gr: C
Gr: D
wound
0.0
0.2
0.4
0.6
Pre
Post
Pre vs Post
cage
1
2
3
4
5
6
7
8
9
10



Appendix II:

Table 1- Descriptive statistics for Wound healing and other Welfare-related variables (n=40)

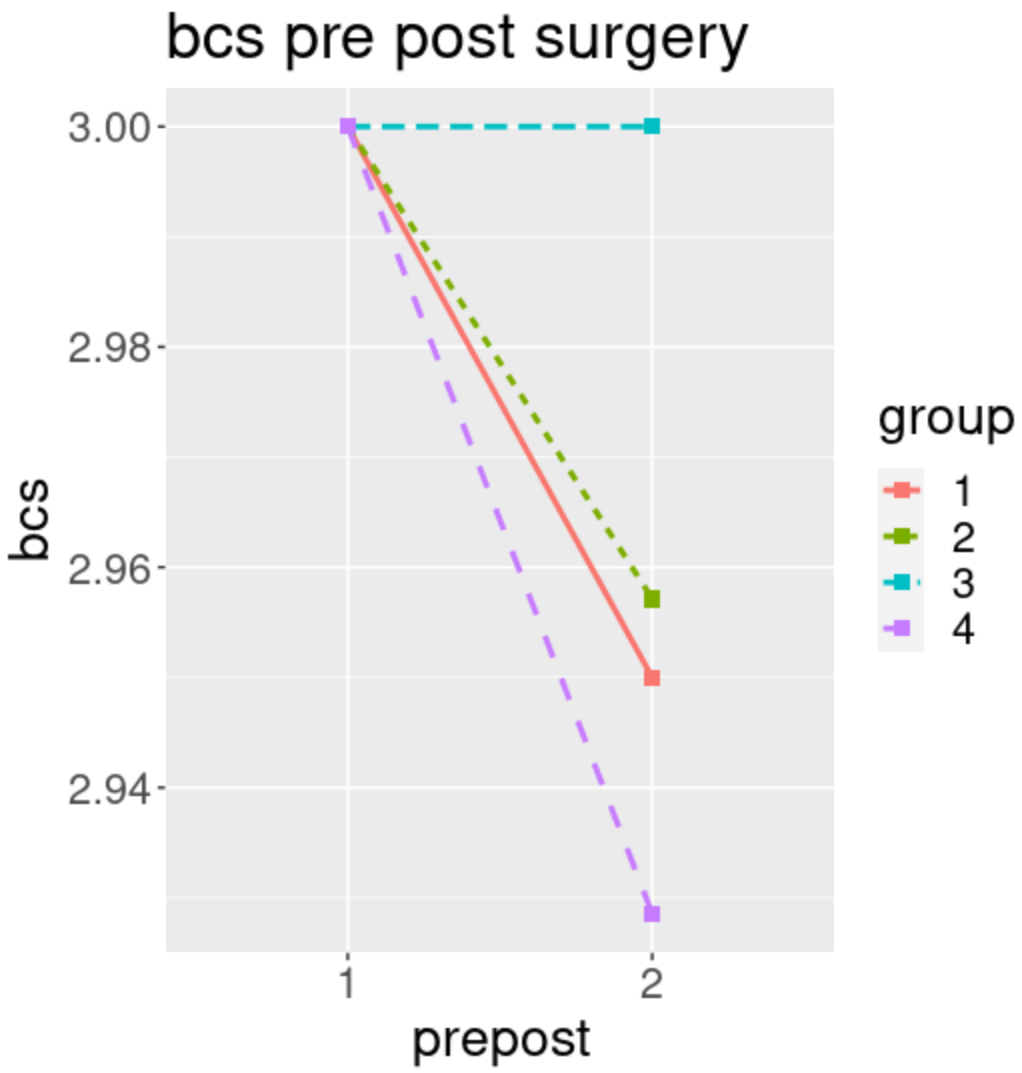
	Mean ± SD			
Variable	**Group A (n=10)**	**Group B (n=10)**	**Group C (n=10)**	**Group D (n=10)**
Weight	22.35±0.87	22±1.50	21.27±1.01	21.93±1.20
BCS	3 ±0.1	3±0.09	3±0	2.94±0.09
Grimace	0.03±0.05	0.05±0.07	0±0.02	0.02±0.03
Nest build	3.42±0.27	3.45±0.30	3.78±0.20	3.79±0.19
Tint	0.44±0.30	0.54±0.22	0.93±0.06	0.87±0.08
Wound	0.15±0.25	0.07±0.2	0.03±0.06	0±0
Staple	0.09±0.2	0.07±0.2	0.2±0.55	0.02±0.06

Table 2- One-way ANOVA result for differences in Weight, BCS, Grimace, Nest build, Tint, Wound and Staple among four groups

Variable	p value
Weight	0.235
BCS	0.398
Grimace	0.222
Nest build	0.003 *
Tint	<0.001 *
Wound	0.156
Staple	0.73
*indicates statistically significant variable ($p<0.05$)	

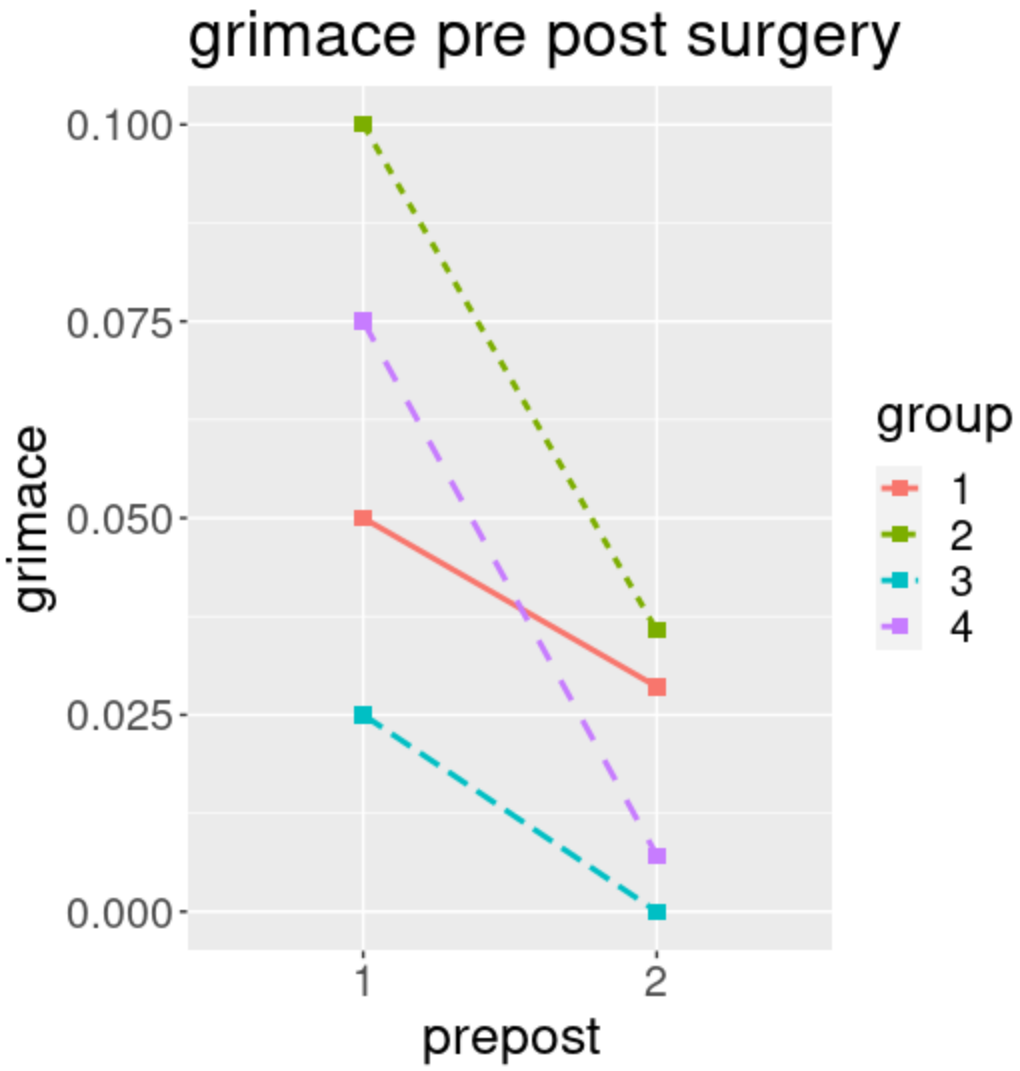
Appendix III:

```
Response: weight
          Df  Sum Sq Mean Sq F value   Pr(>F)
group      3 1.05361 0.35120  39.517 0.006534 **
prepost    1 0.98451 0.98451 110.776 0.001832 **
Residuals  3 0.02666 0.00889
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```



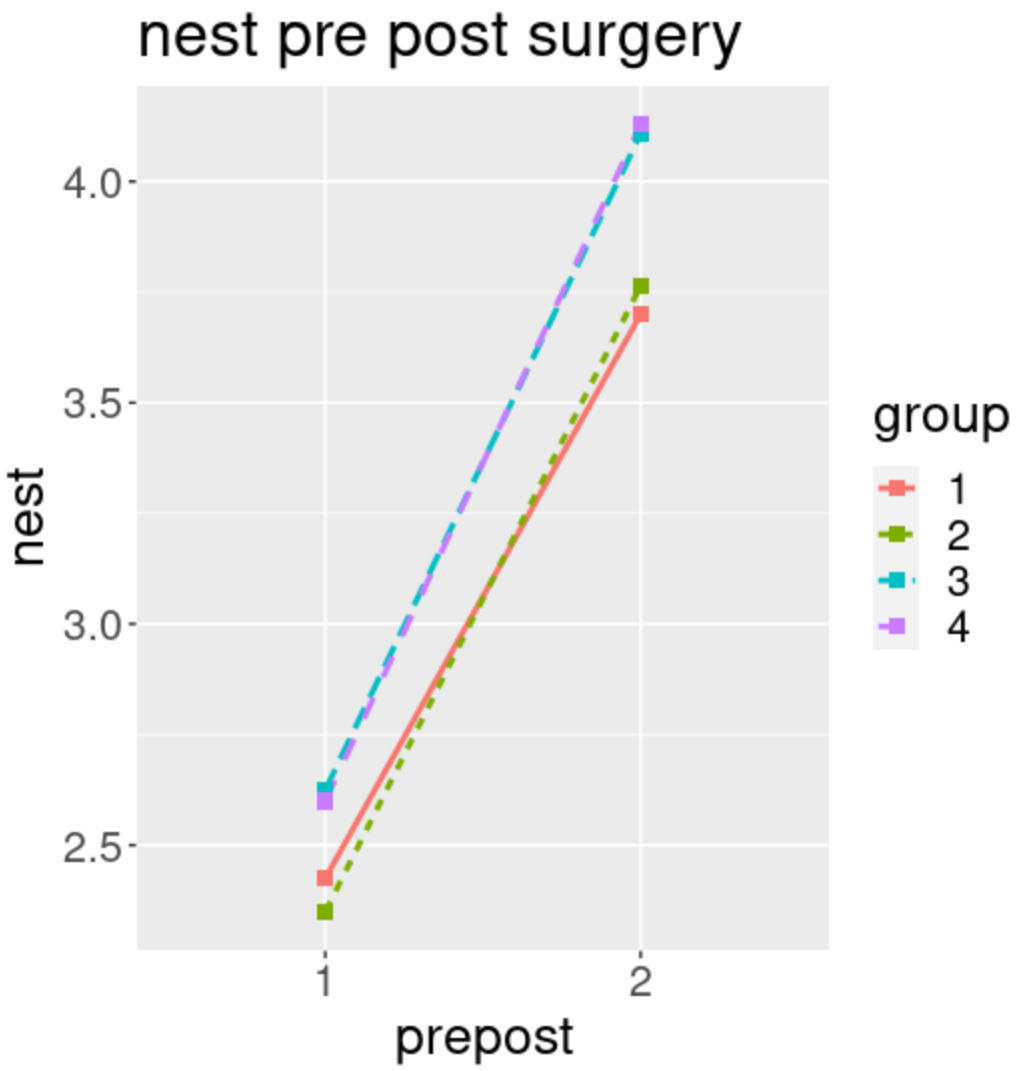

```
Analysis of Variance Table

Response: bcs
          Df    Sum Sq   Mean Sq F value  Pr(>F)
group      3 0.0013457 0.0004486  1.0000 0.50000
prepost    1 0.0033737 0.0033737  7.5213 0.07119 .
Residuals  3 0.0013457 0.0004486
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```



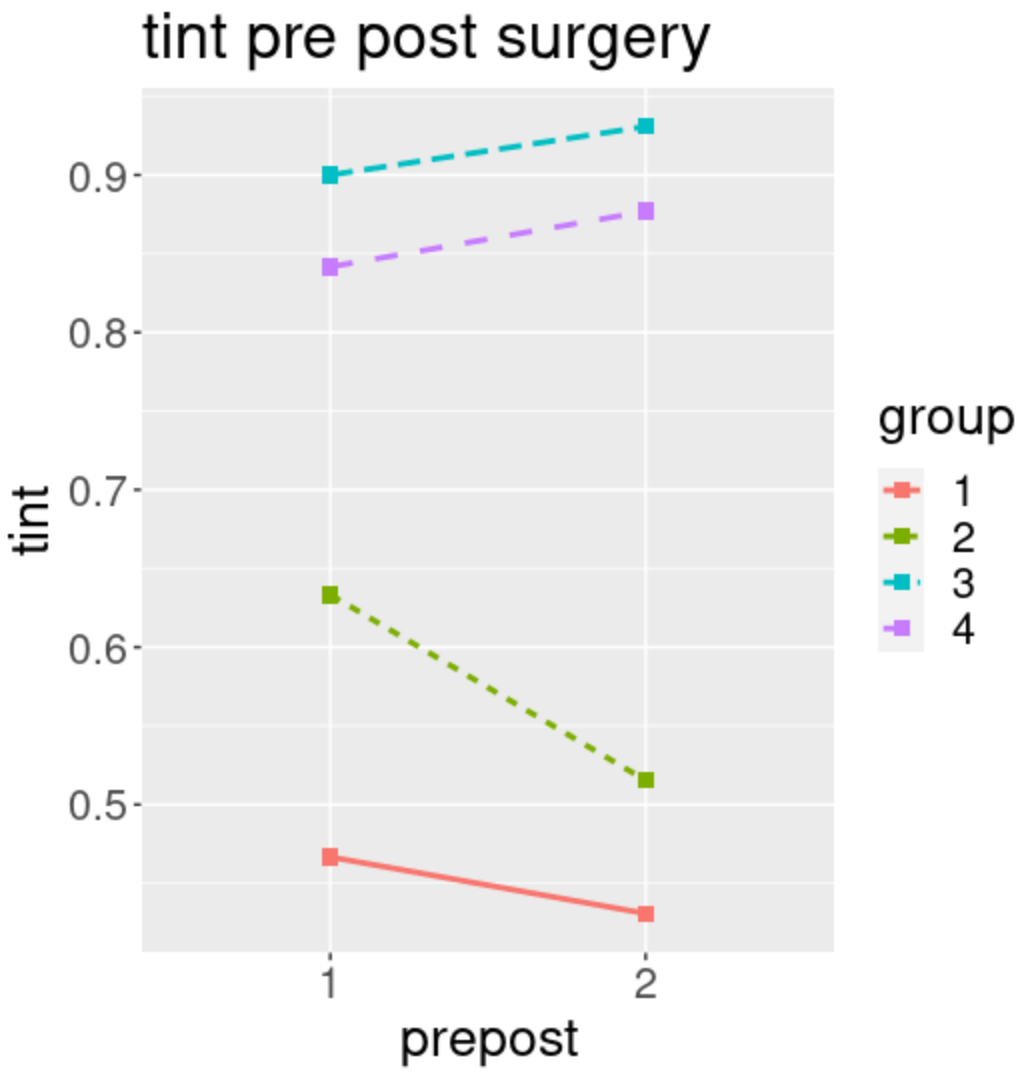

```
Analysis of Variance Table

Response: grimace
          Df    Sum Sq   Mean Sq F value  Pr(>F)
group      3 0.0030676 0.0010225  3.3172 0.17550
prepost    1 0.0039860 0.0039860 12.9310 0.03687 *
Residuals  3 0.0009247 0.0003082
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```



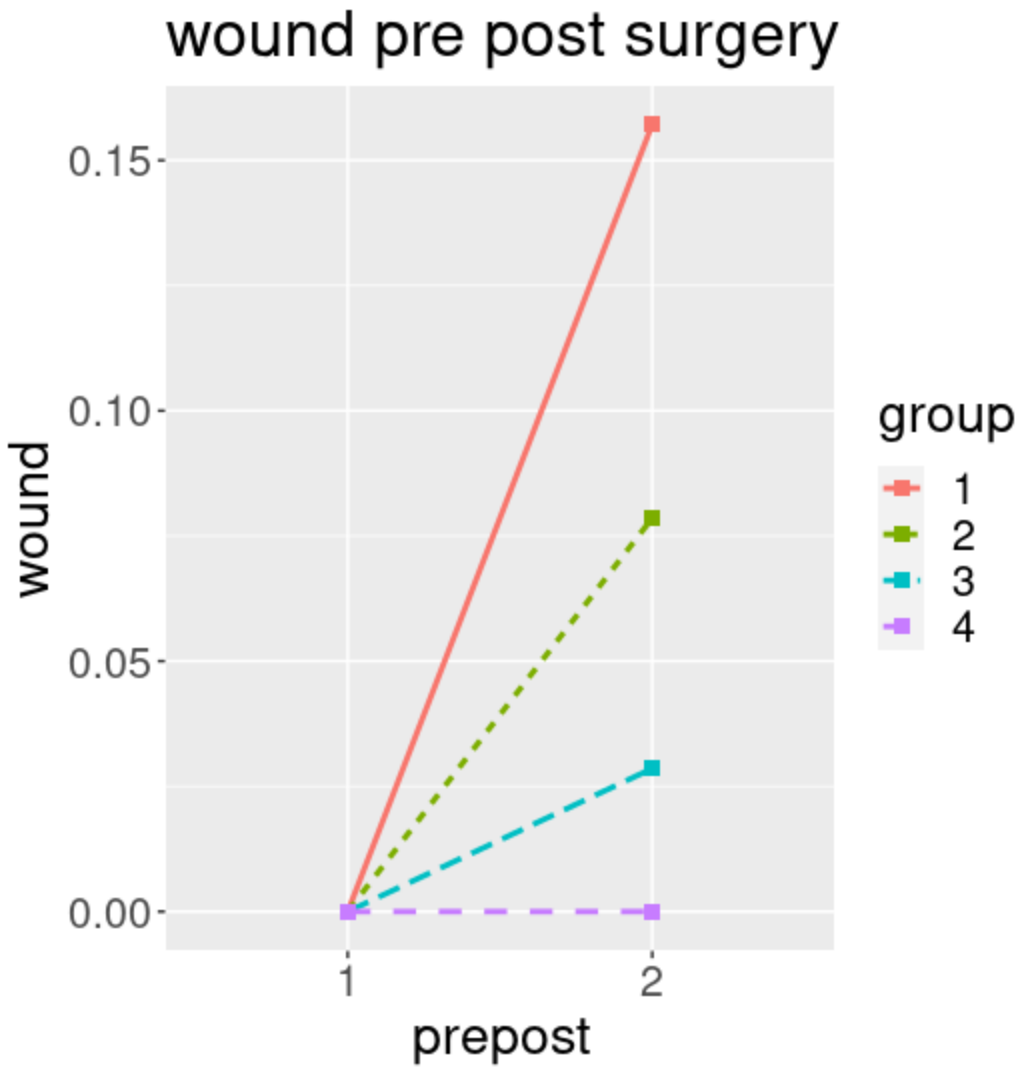

```
Analysis of Variance Table

Response: nest
          Df Sum Sq Mean Sq F value    Pr(>F)
group      3 0.1865  0.0622   10.19 0.0441153 *
prepost    1 4.0613  4.0613  665.65 0.0001277 ***
Residuals  3 0.0183  0.0061
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```



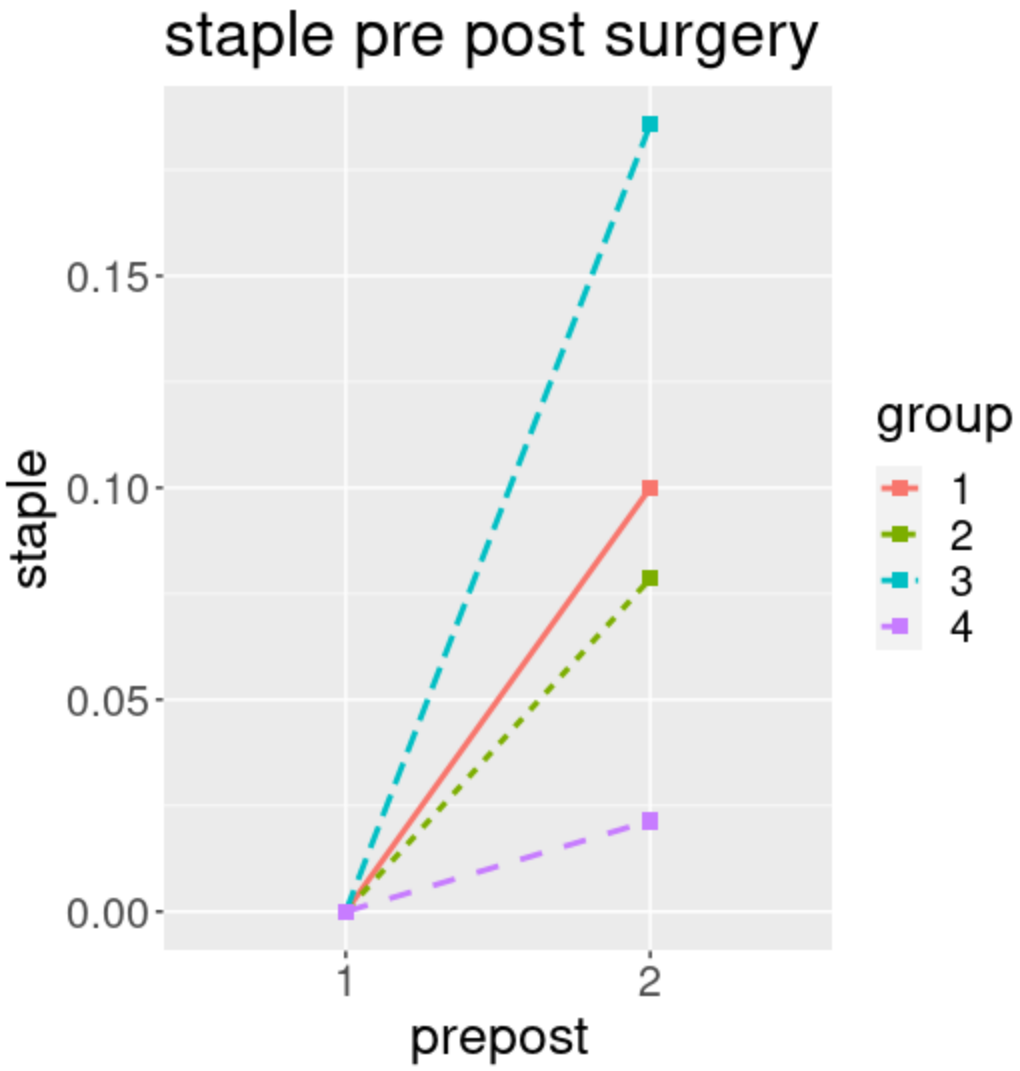

```
Analysis of Variance Table

Response: tint
          Df   Sum Sq  Mean Sq F value   Pr(>F)
group      3 0.301385 0.100462 38.9835 0.006664 **
prepost    1 0.000964 0.000964  0.3741 0.584012
Residuals  3 0.007731 0.002577
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```




```
Analysis of Variance Table

Response: wound
          Df    Sum Sq   Mean Sq F value Pr(>F)
group      3 0.0071110 0.0023703  1.0000 0.5000
prepost    1 0.0087309 0.0087309  3.6834 0.1508
Residuals  3 0.0071110 0.0023703
```




```
Analysis of Variance Table

Response: staple
          Df    Sum Sq   Mean Sq F value  Pr(>F)
group      3 0.0069643 0.0023214   1.000 0.50000
prepost    1 0.0185969 0.0185969   8.011 0.06617 .
Residuals  3 0.0069643 0.0023214
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```