

For the 0 ppm group, the average weight increases from week 5 to 25, from weeks 25 – 50, the increase is still there but at a smaller slope. From 50-75, there is still an increase but the slope is smaller than the previous. From 75-100, the weight decreases.

For the 10 ppm group, the average weight increases from week 5 to 25, from weeks 25 – 50, the increase is still there but at a smaller slope. From 50-75, there is still an increase but the slope is smaller than the previous. From 75-100, the weight decreases.

For the 30 ppm group, the average weight increases from week 5 to 25, from weeks 25 – 50, the increase is still there but at a smaller slope. From 50-75, there is still an increase but the slope is smaller than the previous. From 75-100, the weight decreases.

For the 90 ppm group, the average weight increases from week 5 to 25, from weeks 25 – 50, the increase is still there but at a smaller slope. From 50-75, there is still an increase but the slope is smaller than the previous. From 75-100, the weight decreases.

For weeks 5-25, the effects of urethane seem to be the same. However, once we enter weeks 25 and later, the differences can be seen. From week 25-50, we can see that the higher the exposure to urethane, the higher the increase of growth. This is the same from weeks 50-75. However, from week 75-100 we lower increase in growth. Of the 4 categories, the 90 ppm group dropped the most, followed by 30, 10, then 0.

= animal weight of *j*th subject assigned to treatment *i* at time *k*.

*i=*1,2,3,4; *j*=1,…20;*k*=1,2,3,4,5

= overall mean response

= main effect of treatment *I* (0, 10, 30, and 90 ppm dose of urethane).

= main effect of time *k* (measured in weeks from 5 to 109 with time points 5,25,50,75,100).

= interaction effect of *i*th treatment with *k*th time

= Random effect of *j*th patient given *i*th treatment

Assumed Normal with mean 0, variance

’s are independent

= Random effect of *j*th patient given *i*th treatment at *k*th time

Assumed Normal with mean 0, variance

’s are independent

Each is independent of each

Assumptions

is normal

E(=

Compound Symmetry (CS)

Measurements made on the same subject at different time points has correlation

1. 

Computing SSAB – CHECKS OUT WITH THE TABLE ABOVE

SSAB = TSS-SSA-SSB-SSP(A)-SSE = 43967.7756-125.3438-37615.8763-3115.7158-2564.55209 = 546.288 = week\*urethane

Computing df – ALL CHECK OUT WITH THE TABLE

a=4 n=20 b=5

Total: axnxb-1 = 4\*20\*5-1 = 399

(urethane): a-1 = 4-1 = 3 (animal\*urethane): a(n-1) = 4 x (20-1) = 76

(week): b-1 = 5-1 = 4 (week\*urethane): (a-1)(b-1) = 3\*4 = 12

(Residual) a(n-1)(b-1) = 4\*19\*4 = 304

* 1. Test of Dose-by-time interaction

H0: There is no interaction between the dosage of urethane and time

Ha: There is an interaction between the dosage of urethane and time

F0.95(12,304) = 1.784

5.40 > 1.784 Reject the null hypothesis. There is sufficient evidence to suggest that there is an interaction between the dosage of urethane given and time.

* 1. The main effect of dose

H0: There is no difference in mean weight by dose group.

Ha: At least one of the dose groups has a different mean weight than the others.

F0.95(3,76) = 2.72

1.02 < 2.72 Fail to Reject the null hypothesis. There is not enough evidence to suggest that there are differences in mean weight between dosage groups of urethane.

* 1. The main effect of time

H0: There is no difference in mean weight by over time.

Ha: There is a difference in mean weight over time.

F0.95(4,304) = 2.40

1114.74 > 2.40 Reject the null hypothesis. There is sufficient evidence to suggest that there is a difference in mean weight over time.

It does not make sense to test dose and time since our result from the interaction test was significant.

Epsilon value for G-G is .7797.

* 1. Test of Dose-by-time interaction

H0: There is no interaction between the dosage of urethane and time

Ha: There is an interaction between the dosage of urethane and time

F0.95((.7797)12,(.7797)304) = 1.901

5.40 > 1.901 Reject the null hypothesis. There is sufficient evidence to suggest that there is an interaction between the dosage of urethane given and time.

* 1. The main effect of dose

H0: There is no difference in mean weight by dose group.

Ha: At least one of the dose groups has a different mean weight than the others.

F0.95((.7797)3,(.7797)76) = 2.992

1.02 < 2.992 Fail to Reject the null hypothesis. There is not enough evidence to suggest that there are differences in mean weight between dosage groups of urethane.

* 1. The main effect of time

H0: There is no difference in mean weight by over time.

Ha: There is a difference in mean weight over time.

F0.95((.7797)4,(.7797)304) = 2.609

1114.74 > 2.609 Reject the null hypothesis. There is sufficient evidence to suggest that there is a difference in mean weight over time.

All the F-critical values in the three tests rose by some amount after adjusting the degrees of freedom. However, all of the conclusions remained the same as those in Q3. The G-G adjusted tests while adjusting for violation of compound symmetry, resulted in the same conclusions as if there was no violation in this particular case.

The estimated correlation between weight measurements at 25 and 75 weeks for unstructured: is =

For CS:

For Power:

The estimates are all different from each other. Out of the 3, the power model and the unstructured model are the closest together, 0.9563 and 1.06 respectively.

1. Using the AIC, it would seem that the model with the best variance/covariance structure is the unstructured model with 1995.6 as the AIC. The CS model had 2072.8 and the power model had 2047.1. CS by dose was 2071.9 and power by dose was 2044.7. Having a lower AIC is nominal.
2. Using the unstructured model:
   1. Dose by time interaction
      1. With an F-statistic of 3.75 and a p-value of less than 0.0001, there is sufficient evidence to suggest that there is interaction between dosage of Urethane and time.
   2. Main effect of Dose
      1. With an F-statistic of 1.02 and a p-value of .3890, there is not sufficient evidence that there are difference in mean weight between dosage groups of urethane.
   3. Main effect of Time
      1. With an F-statistic of 1015.81 and a p-value of less than 0.0001, there is sufficient evidence to suggest that there is a difference in mean weight over time.

Compared to Q3 and Q4, the conclusions are the same.

An autoregressive variance/covariance structure is not an appropriate model given our study design. The model assumes equally spaced time points, which we do not have (5, 25, 50, 75, 100).

* 1. This is more of a case of MCAR, not MAR, violating the MAR assumption since it can be attributed to a random process completely unrelated to observed data and data that would have been observed if not missing.
  2. Does not violate the MAR assumption. Drop-out was attributed to previous response values, in this case, low body weight at week 25.
  3. Does not violate the MAR assumption. Drop-out was attributed to previous response values, in this case, low body weight at week 50.