BI476: Biostatistics - Case Studies

Exercise 04 - Family of Analysis of Variance

Spring, 2018

1 Choices

Which of the following statements is true?

A The independent t-test is analogous to repeated measures ANOVA and the paired-sample t-test is analogous to between-groups ANOVA.

B The independent t-test is analogous to between-groups ANOVA and the paired-sample t-test is analogous to repeated measures ANOVA.

C ANOVA is analogous to t-tests, only a t-test is used when two group means are compared and ANOVA is used when more than two group means are compared.

D ANOVA and t-tests are totally different. There is no analogy

2 Answer the following questions

(1) What is the difference between a **between-groups** design (i.e. traditional ANOVA) and a **within-subject** design (i.e. repeated measures ANOVA)?

(2) Suppose that you want to test the effect of alcohol on test score of students. There are three conditions: no alcohol, two glasses of beer, or five glasses of beer. Alcohol tolerance and time spent studying should also be considered somehow. Which group design should you use, between-groups design or within-groups design?

(3) Why is a repeated measures design statistically more powerful?

(4) What is the denominator degree of a 3×4 ANOVA with interaction and total sample size of 625?

(5) To compute the sample size for one-way three-group ANOVA with equal variance, what kinds of information do you need to pre-specify? Can you infer the formula, using the similar fashion as we discuss in lecture 5.

(6) Now if the data are repeated measures, how do we change the formula to fit the requirement?

(7) How do we analyze the data from a factorial design with continous outcome? Write down the ANOVA table.

(8) If one of the two factors in a factorial design is ordinal, then how to analyze the data?

3   Case study

Use R to import the example data of the clinical trial in the lecture, and answer the following questions:

(1) How many different treatments did each subject receive?

(2) How many times was the diastolic blodd pressure for each subject measured?

(3) Is it appropriate to use the one-way independent ANOVA to analyze the mean blood pressures across different time points? Why? How to correct it? Write down the procedure and the final result.

(4) How to assess the treatment effect of the drug A, B on the blood pressure?

Nonsmoker	56	53	53	65	70	58	51
Lightsmoker	78	62	70	73	67	75	65
Heavysmoker	77	86	65	83	79	80	77

4 Case study

A physician wanted to determine the impact of smoking on the resting heart rate. He randomly chose 7 individuals from each of the three categories: non-smokers, light-smokers (¡10 cigarettes/day) and heavy smokers (¿10 cigarettes/day) and obtained the following resting heart rate data (in beats/min):

(1) Make a side-by-side boxplot showing the distribution of resting heart beat for the three different groups.

(2) State the null and alternative hypotheses to test whether the mean heart beat rate differs between three groups.

(3) Perform one-way ANOVA on the data. What can you conclude?

(4) If ANOVA reached a significant result, perform a post-hoc test to determine which groups differ in terms of the average resting heart rate.