

**Epidemiology-Biostatistics**  
**Exam 2, 2005**

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Instructions: This exam is worth 250 points out of a total 1,000 possible points in the course. There are 20 questions on the exam. Each question is therefore worth 12.5 points. Select the best answer for each question.

1. Researchers want to conduct a randomized controlled trial comparing two treatment protocols for lung cancer. They consult a PhD in Biostatistics concerning how many subjects they'll need to enroll with alpha set at 0.05 and a power of 70% to detect a true difference of at least 10%. The statistician correctly prepares the following initial table for the researchers:

Alpha	Minimum True Difference to Detect	Power	Required Sample Size
0.05	0.10	70%	300

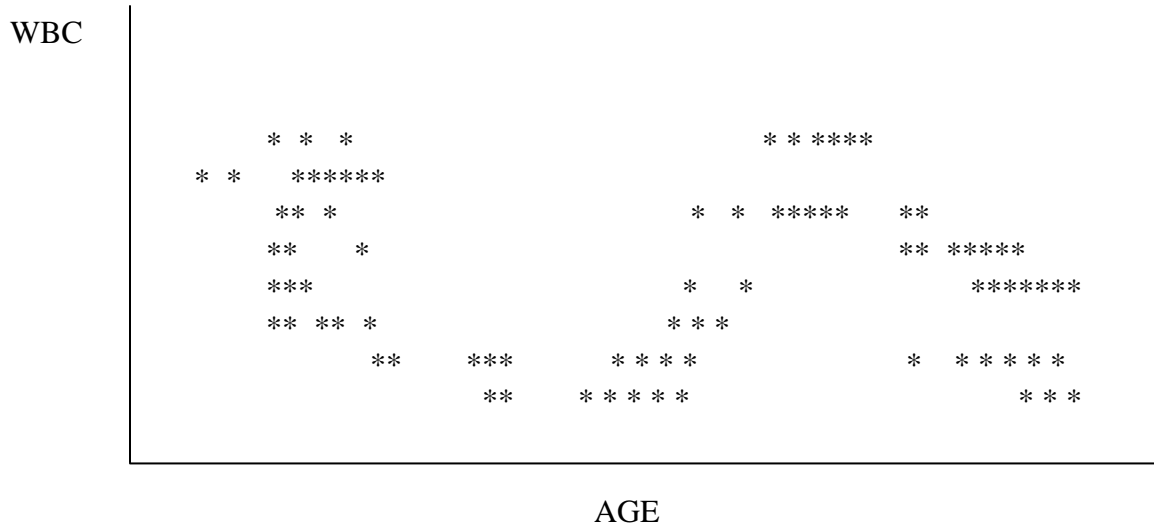
The researchers decide to do their own calculation without the help of the statistician. They prepare five options for consideration. Which one of the following options can be correct:

	Alpha	Minimum True Difference to Detect	Power	Required Sample Size
A	0.05	0.05	80%	300
B	0.05	0.15	70%	280
C	0.05	0.10	65%	320
D	0.10	0.10	70%	325
E	0.01	0.10	70%	250

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2. A student randomly selects subjects and records their white blood cell counts (WBC), which are continuous data, and their ages, also continuous data. The scatterplot of the data follows:



Select the correct statement concerning the scatterplot:

- a. An investigator could use Spearman's Correlation Coefficient to determine the regression coefficient.
- b. If an investigator wants to determine if knowing the white blood cell count can predict age, she must use logistic regression.
- c. It is possible that there is a statistically significant association between age and white blood cell count.
- d. Pearson's Correlation Coefficient would be different if age was on the y axis and white blood cell count was on the x axis.
- e. An investigator must use the log rank test to determine if the differences between age and white blood cell count are statistically significant.

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3. Select the correct statement concerning the gold standard for a diagnostic test for a particular disease:

- a. It should be easily performed.
- b. It should be widely available.
- c. It should only be used when the prevalence of disease warrants its use.
- d. It might be the diagnostic test that has the most risk to harm the patient.
- e. Its predictive value positive should ideally exceed its predictive value negative.

4. Select the correct statement concerning a meta-analysis study:

- a. It is an acceptable study design if both the exposure and outcome are rare.
- b. It is subject to concerns of publication bias.
- c. It can be a prospective study design.
- d. They are more prone to Type II Errors vs. an individual study result.
- e. As it involves results from several studies, it is always the ultimate gold standard of epidemiologic study designs.

5. Select the correct statement concerning power and the p-value:

- a. Higher p-values mean higher powers.
- b. The p-value is calculated under the assumption that the null hypothesis is false.
- c. Power is calculated under the assumption that the null hypothesis is true.
- d. It is possible for a study to have no clinical significance even if the p-value is 0.0001 with alpha set at 0.05.
- e. It is possible to have a Type I Error if alpha is set at 0.001 and the p-value is 0.01.

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6. Researchers decide to assess ten subgroups to determine if interaction is present. The study's overall power was set at 80% to detect at least a 12% difference between the two study arms and alpha was set at 0.05. Select the correct statement:

- a. The likelihood of committing at least one Type One Error will increase if eight subgroups are assessed vs. ten.
- b. There is no relationship between the number of subgroups analyzed and the likelihood of committing Type One Errors.
- c. The researchers should increase alpha above 0.05 when doing the subgroup analyses to avoid committing at least one Type One Error.
- d. The researchers should consider lowering alpha below 0.05 to reduce the likelihood of committing at least one Type One Error.
- e. The researchers should only be concerned about committing Type II Errors rather than Type One Errors when multiple subgroups are assessed.

7. Select the correct statement concerning the strength of association between an exposure and an outcome:

- a. A relative risk of 20.0 has the same strength of association as a relative risk of 0.05.
- b. An odds ratio of 0.7 has a weaker strength of association vs. a relative risk of 0.7.
- c. The closer the odds ratio is to one, the stronger the strength of association is.
- d. When completing a two by two table, if the disease (outcome) is placed on the y axis, and the exposure is placed on the x axis, the strength of association will not be accurate.
- e. A randomized controlled trial is more likely to produce a stronger strength of association vs. a retrospective cohort study.

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8. Which of the following statements is correct concerning screening test results:
- It is preferable to have more false positives vs. more false negatives.
  - False positive results are more likely to occur with a test whose sensitivity is 60% vs. a test whose sensitivity is 70%
  - False positives are less likely to occur with a test whose sensitivity is 60% vs. a test whose sensitivity is 50%.
  - Predictive value positive will be higher when testing a group of 1,000 with a disease prevalence of 80% vs. another group of 450 with a disease prevalence of 20%. (Assume the sensitivity and specificity of the test do not change.)
  - False positive results can be reduced by lowering the specificity and increasing the sensitivity.
9. Select the correct statement concerning a chi square test and a two sample t-test:
- The p-values resulting from these tests are always interpreted the same way.
  - If the variables have been transformed, both tests can be used when assessing categorical data.
  - If the categorical data fall into three or more categories, one should use ANOVA rather than the chi square test.
  - The two sample t test is more reliable than the chi square test when the sample sizes are small.
  - One may use the two sample t test when assessing continuous outcomes in discrete categories if the sample size is large.
10. Select the false statement concerning a p-value:
- Under certain circumstances it can be used to quantify the likelihood that the null hypothesis is false.
  - A small difference from a large sample size can have the same p-value as a large difference from a small sample size.
  - A p-value less than 0.05 may not be statistically significant.
  - A Type I Error could occur with a p-value of 0.02 and alpha set at 0.10.
  - A Type II Error might occur if a p-value is 0.15 and alpha was set at 0.10.

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11. PSA is a screening test for prostate cancer whose values in subjects with and without prostate cancer have a normal distribution. Some labs consider a result less than 4 units to be normal and results of 4 units or larger abnormal, warranting further testing. However, there is an overlap of values between subjects with and without prostate cancer. Using a value of 4 units as the cutoff value, the sensitivity of the PSA test for prostate cancer is 80% and the specificity is 80%. If the cutoff value is lowered from 4 units to 3 units, what will be the affect on the sensitivity of the test and the specificity of the test?

12. A randomized controlled trial concludes that 50% of subjects with a serious disease assigned to med A died over a five year period while 25% of subjects assigned to med B died during that period. The results were statistically significant. How many patients over a five year period would you need to treat to prevent one death, on average, from this disease? Show your work.

13. A researcher is studying the cumulative incidence of the common cold in 10,000 children who take and do not take a daily multivitamin tab. There is a right skewed distribution of the ages, which range from four to eleven. What statistical test should she use to determine if there is an association between daily multivitamin use and the cumulative incidence of the common cold.

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14. An epidemiologist notes the following baseline characteristics in a randomized controlled trial study whose outcome is CVA (stroke):

Table 1

	Med A (n = 50)	Med B (n = 40)
Smoking History	10%	10%
High Cholesterol	50%	20%
Family History	5%	5%
Hypertension	20%	50%

Given the data in Table 1, the epidemiologist is concerned about confounding. What statistical techniques could he use to remove potential confounding. Be specific. It is not enough to say that he should do an adjustment; you need to specify how the adjustment would be done.

15. In the context of evidence based medicine, what is meant by primary evidence?

16. The average BMI of 50 randomly selected students from a high school of 2,000 students is 27. The 95% confidence interval ranges from 25 to 29. Interpret the meaning of this confidence interval. Be specific.

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17. What is the standard deviation of the sampling distribution of the mean called?

18. What is the main advantage of using incidence density data rather than cumulative incidence data?

19. When is it appropriate to use a Log Rank test?

20. Define the p-value.

END OF EXAM

From the faculty: Best of luck with your medical careers.