

BIOS 6621 Statistical Consulting -- Brief presentation topics

“If you can’t explain it simply, you don’t understand it well enough” – Albert Einstein

Below are some examples of questions you might be asked during a consulting session. For each, give a short (1-2 minute at most) verbal explanation to an investigator who is not a statistician. Examples sometimes help such explanations.

Watch these two 3-minute animated movies, in the order below. They are a little silly but they do illustrate some of the challenges statisticians have working with some investigators, and vice versa. The second one shows one thing we want to avoid in these short presentations.

<http://www.youtube.com/watch?v=PbODigCZqL8>

<http://www.youtube.com/watch?v=s5tV727P0Gc&NR=1>

statistical power is the likelihood that a study will detect an effect when there is an effect there to be detected. If statistical power is high, the probability of making a Type II error, or concluding there is no effect when, in fact, there is one, goes down.

1. What does ‘power’ mean?
2. What does a ‘p-value’ mean? A small p-value (typically ≤ 0.05) indicates strong evidence against the null hypothesis, so you reject the null hypothesis.
3. What is a ‘Type 2 error’? Is it worse than a Type 1 error?
4. What is the difference between sensitivity and positive predictive value, and when would I use each? Sensitivity: probability that a test result will be positive when the disease is present (true positive rate).
= $a / (a+b)$ Positive predictive value: probability that the disease is present when the test is positive.
= $a / (a+c)$
5. What is the difference between a ‘standard deviation’ and a ‘standard error’? When would I use each?
6. What is the difference between a ‘standard deviation’ and a ‘variance’? When would I use each?
7. My data are cost of a hospitalization for a number of patients, and the histogram is very skewed. Should I use mean or median, and why?
8. My cost data are skewed, so is there any use for the SD?
9. I’m comparing two groups and my p-value is not significant ($p=0.65$). What does that tell me?
10. Someone said my study is overpowered. What does that mean, and what should I do about it?
11. I received the following table giving differences between my two groups ($n=52$ in group 1, $n=41$ in group 2). How can I easily tell if the groups are different?

Variable	Difference (G1-G2)	SE
Weight (lbs)	4.3	1.9
Height (in)	1.1	0.9

12. The weight loss data in the following table are in pounds, but the journal I’m submitting to requires kg. Is there a way to change it without getting them to redo the analysis?
 $N=38$, $\text{Mean}=3.4$ lbs, $\text{SD}=9.3$ lbs, $\text{SE}=1.5$ lbs
 $p=0.03$, 95% CI (0.4, 4.4)
13. The mean, SE, and 95% CI for β are 1.1, 0.4, and (0.3, 1.9). Inference is desired on e^β . How can the 95% CI for e^β be computed?

14. Someone said I should use a CI instead of a p-value to show my results. What additional information would I get from that?

15. I’ve never really understood the terms ‘efficacy’ and ‘effectiveness’, can you explain them, and the difference?

16. I was told I need to do an ‘intent-to-treat’ analysis. What is that, and should I do it?

17. I’m doing a survey and would like to state the ‘margin of error’, like they do in the newspaper. Can you tell me how to calculate it, and what it means?

18. Sometimes I’m told to use a t-test and sometimes a z-test. What’s the difference, and how do I know when to use which one?

19. My data are counts, which should I use, a Binomial or Poisson method? How do I decide?

20. What’s the difference between statistical and clinical significance? How do I decide each one?

21. What is a z-score? How can I describe it in simple terms?

22. My colleague said my data show evidence of ‘digit preference’, what does that mean?

23. I have a two by two table, and conducted a chi-square test to see if there was an association between the two factors. My colleague says I should have used a z test of proportions. What is the difference?

7. In a skewed (unbalanced, lopsided) distribution, the mean is farther out in the long tail than is the median.

13. multiply

16. Intention-to-treat analysis is a method for analyzing results in a prospective randomized study where all participants who are randomized are included in the statistical analysis and analyzed according to the group they were originally assigned, regardless of what treatment (if any) they received.

Standard deviation looks at how spread out a group of numbers is from the mean, by looking at the square root of the variance. The variance measures the average degree to which each point differs from the mean—the average of all data points.

8. for skewed distributions, the standard deviation gives no information on the asymmetry. It is better to use the first and third quartiles

10. An overpowered study has too large a sample size and wastes resources

The power of a study is the likelihood that it will distinguish an effect of a certain size from pure luck.

one distinguishes median-unbiased from the usual mean-unbiasedness property.

14. mean standard deviation

15. Efficacy can be defined as the performance of an intervention under ideal and controlled circumstances, whereas effectiveness refers to its performance under ‘real-world’

24. I want to look at whether the risk of death within 5 years after a particular surgery differs between men and women. But some patients just had their surgeries within the past few years so we don't yet know if they'll die. Can I still do a 2x2 table and Chi-square test? Or should I omit patients who haven't yet reached the 5 years?
25. My statistician did an analysis to evaluate whether certain provider characteristics influence whether a provider is likely to accept a certain kind of patient referral. The outcome was binary and they conducted a logistic regression, and provided an odds ratio of 1.5 (CI: 1.25 – 1.75) for the association between years of experience and acceptance of the referral. What does this odds ratio mean?
26. I submitted a manuscript where we were looking at whether 30ish patient factors are associated with increased hypertension. The reviewers have asked us whether we corrected for multiple comparisons. What does this mean, and why would we need to do it?
27. Is it ever appropriate to dichotomize a continuous variable?