

Quiz Solution

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Part 1A

Consider that a research team is designing a study to evaluate the effect of a therapy on eating disorder (γ_{01}), and they will test against a null hypothesis ($H_0 : \gamma_{01} = 0$). Consider also that we are in an omniscient god view, and we know whether the null hypothesis is indeed true or false.

1. If the null hypothesis is, indeed, true (the therapy is ineffective),
 - a. what is the probability that they will make a Type I error?
 - (A) α
 - (B) β
 - (C) 0
 - (D) None of the above
 - b. what is the probability that they will make a Type II error?
 - (A) α
 - (B) β
 - (C) 0
 - (D) None of the above
2. If the null hypothesis is, indeed, false (the therapy is effective),
 - a. what is the probability that they will make a Type I error?
 - (A) α
 - (B) β
 - (C) 0
 - (D) None of the above
 - b. what is the probability that they will make a Type II error?
 - (A) α
 - (B) β
 - (C) 0
 - (D) None of the above

Part 1B

Consider we collected some data about the effect of a therapy on eating disorder (γ_{01}), and we test against the null hypothesis ($H_0 : \gamma_{01} = 0$).

3. If we retain the null hypothesis,
 - a. what is the probability that we made a Type I error?
 - (A) α
 - (B) β

- (C) 0
 - (D) None of the above
- b. what is the probability that we made a Type II error?
- (A) α
 - (B) β
 - (C) 0
 - (D) None of the above
4. If I reject the null hypothesis,
- a. what is the probability that we made a Type I error?
- (A) α
 - (B) β
 - (C) 0
 - (D) None of the above
- b. what is the probability that we made a Type II error?
- (A) α
 - (B) β
 - (C) 0
 - (D) None of the above

Part 2A

When we design a study that evaluates the effect of a therapy on eating disorder, assuming $\alpha = .05$, if we

5. increase sample size,
- a. what happens to statistical power of detecting an effect (in this example, γ_{01})?
 - b. what happens to standard error (SE)?
 - c. what happens to the width of 95% confidence interval (CI) for an effect estimate (in this example, $\hat{\gamma}_{10}$)?
6. How does the width of 95% CI relate to
- a. standard error?
 - b. precision?

Part 2B

Consider we are planning for a study that evaluates an educational program on students' self efficacy. Again, here we have an omniscient god view and know the true parameter values.

7. In which study we need a larger sample size? A study that examines
- (A) Program A, with a true effect size of .5, or
 - (B) Program B, with a true effect size of .2
8. In which study we need a larger sample size? A study that has
- (A) Classes as level-2 clusters, with a true ICC of .3
 - (B) Schools as level-2 clusters, with a true ICC of .1

(Hint: try to play around with the PowerUpR shiny app which we will discuss more in the lecture. Use their default values (main effect, statistical power, two-level CRT), change only the value of rho2, and see what happens to the resulting power)