Formative Quiz 3 (Confidence Intervals for Population Comparison Measures) Solutions

1. What is the null value for the mean difference comparing a continuous outcome between two populations?

   Answer: 0

   Reasoning: If the two population means, μ_1 and μ_2 are equal, then their difference , μ_1 - μ_2, will equal 0.

2. Suppose a randomized study is done comparing cholesterol levels between subjects with a history of high cholesterol, randomized to receive either a drug, or a diet intervention. At the end of the study, the average difference in cholesterol levels between the drug group compared to the diet group is 15 mg/dL, with a 95% CI (10 mg/dL, 20 mg/ dL). Suppose the results were re-presented with the direction of comparison being the difference for the diet group compared to the drug group. What would the resulting 95% CI for the mean difference be?

   Answer: (-20 mg/dL, -10 mg/dL)

   Reasoning: If a – b = 20, then b – a = -20, etc.... The absolute magnitude of the endpoints remains the same regardless of the direction of the comparison, but the signs of these endpoints (+ or -) will differ (be exact opposites) depending on the direction of comparion.

3. Suppose a randomized trial estimates that a new flu vaccine is associated with a 10% reduction in absolute risk as compared to the current standard vaccine, with a 95% CI (-0.13, -0.07). How could this confidence interval be expressed in terms of the potential impact of the new vaccine?

   Answer: After accounting for sampling variability, if the new vaccine were given to 1,000 persons (from the same population as the study sample), we would expect to see 70 to 130 fewer flu cases, than if the 1,000 persons were given the standard vaccine.

   Reasoning: Each of the endpoints gives a possibility for the true, population level, risk difference in flu case percentages for those who get the vaccine compared to those who do not get the vaccine. An absolute reduction of 0.13, i.e. 13% would result in a reduction of 0l.13*1,000 =130 cases were the 1,000 persons given the vaccine versus not given the vaccine.

4. Suppose a randomized trial estimates that a new flu vaccine is associated with a 10% reduction in absolute risk as compared to the current standard vaccine, with a 95% CI (-0.13, -0.07). Suppose you wish to present the results for the standard vaccine compared to the new vaccine. What would the 95% CI be for the risk difference be with this direction of comparison?

Answer: (0.07, 0.13)

Reasoning: Same logic as with the reasoning for question 2.

5. What is the null value for a population ratio (relative risk, odds ratio, incidence rate ratio)?

Answer: 1

Reasoning: If a = b, then the ratio $\frac{a}{b} = 1$.

6. What is the null value for the natural ln of a ratio (relative risk, odds ratio, incidence rate ratio)?

Answer: 0

Reasoning: If a = b, then the ratio $\frac{a}{b} = 1$. The natural log of this ratio, $ln\left(\frac{a}{b}\right) = \ln(1) = 0 \ when \ a = b..$

7. Generally Suppose a study estimates the relative risk of disease for those persons with a binary condition compared to persons without the condition to be 3.1, with a 95% CI of 2.4 to 5.3. Why is this confidence interval not symmetric around the sample relative risk of 3.1? (i.e. the endpoints not equal distance from the endpoints)

Answer: Confidence intervals for ratios are not necessarily symmetric around the sample estimate on the ratio scale, but they are on ln(ratio) scale.

8. Suppose a study estimates the relative risk of disease for those persons with a binary condition compared to persons without the condition to be 3.1, with a 95% CI of 2.4 to 5.3. What are the natural In values of the confidence interval endpoints?

Answer: (0.88, 1.67)

Reasoning: ln(2.4) = 0.88; ln(5.3) = 1.67

9. Suppose a study estimates the relative risk of disease for those persons with a binary condition compared to persons without the condition to be 3.1, with a 95% CI of 2.4 to 5.3. Suppose you wish to report the results in the opposite direction,

Answer: (0.19, 0.42)

Reasoning: If we have a ratio comparing group 1 to group 2, i.e. $\frac{a}{b}$, then the corresponding ratio comparing group 1 to group 2 will be the reciprocal of $\frac{a}{b}$, i,e, $\frac{b}{a}$. So for example, the reciprocal of 2.4 is $\frac{1}{2.4} \approx 0.42$.

10. What is the null value for a population risk difference (difference in proportions)?

Answer: 0

Reasoning: Same as reasoning for question 2.