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Midterm November 2022

IST 772

1. (1 point) What are the lower bound and upper bounds of the (frequentist) 95% confidence interval of the mean difference?
   1. The lower bound is -12.35 and the upper bound is 24.3, which accounts for the range of the mean difference between the control and treatment groups.
2. (1 point) What is the point estimate of the mean difference?
   1. The point estimate is 8.2 which is an estimate of what the potential population mean difference is.
3. (1 point) Report the outcome of the null hypothesis significance test on the difference of means. Make sure to state the null hypothesis.
   1. The null hypothesis is that there is no mean difference between the treatment and control groups. Our alpha is greater than our p value so therefore we fail to reject the null hypothesis.
4. (1 point) Report the lower and upper bounds of the 95% Highest Density Interval for the difference of means.
   1. The lower bound is .0193 and the upper bound is 16.2, which accounts for the range of the mean difference between the control and treatment groups but has a smaller range than the 95% CI.
5. (1 point) Report the percentages of values in the posterior distribution of mean differences that are above zero and below zero.
   1. 2.8% of values are below 0 and 97.2% are above 0.
6. (5 points) Write a 1-2 paragraph technical report. The technical report should contain the detailed information that it would be *important for other statisticians to know* about the data, about the analytical results, about any anomalies you observed, and about how any such anomalies may have affected the reported results. You can cut and paste any of the graphics included above, as long as you provide a 2-3 sentence explanation of what the graphic means.
   1. This experiment has shown that there is not a mean difference among the groups. We have a p-value greater than alpha which also proves we would fail to reject the null hypothesis. We do have a wide range which does overlap with 0 even though we do have outliers in the treatment group. Our 95% confidence interval is -12.35 and the upper bound is 24.3. Our HDI is between is .0193 and the upper bound is 16.2.
7. (5 points) Write a 1-2 paragraph report of the results of your analysis for presentation to the company’s biologists and investors. *This report should be in plain language, interpretable by non-statisticians*. Make sure to integrate the Bayesian evidence, the frequentist confidence interval, and the results of the null hypothesis significance test. The biologists and investors need to decide what the startup should do next: The essential question they want to answer is whether or not the biofilm shows promise as an alternative to traditional filtering techniques. Use the results of these statistical analysis to provide them with guidance.

Our data has shown that there is not a significant difference in the means between the control group and the treatment group. We do have an overlap with 0 which means there is not a difference among the means that is statistically significant. Our Boxplot shows many outliers which does skew our data to a favored result, but the majority of our samples tested do not have a difference from the results in the control group. Based on all of the data provided, we fail to reject the null hypothesis which is that there is not a difference among the means.