Lab 006 - Power Calculations

EPIB607 - Inferential Statistics[a]

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R Code	Value
`qnorm(p = c(0.05, 0.95))`	-1.64, 1.64
`qnorm(p = c(0.025, 0.975))`	-1.96, 1.96
`qnorm(p = c(0.005, 0.995))`	-2.58, 2.58
`qt(p = c(0.025, 0.975), df = 400-1)`	-1.97, 1.97
`qt(p = c(0.025, 0.975), df = 25-1)`	-2.06, 2.06
`qt(p = c(0.025, 0.975), df = 20-1)`	-2.09, 2.09
`qt(p = c(0.025, 0.975), df = 16-1)`	-2.13, 2.13

1. Lake Wobegon

It is claimed that the children of Lake Wobegon are above average. Take a simple random sample of 9 children from Lake Wobegon, and measure their IQ to obtain a sample mean of 112.8. IQ scores are scaled to be Normally distributed with mean 100 and standard deviation 15.

a) Does this sample provide evidence to reject the null hypothesis of no difference between children of Lake Wobegon and the general population?

b) Suppose you hope to use a one-sided test to show that the children from Lake Wobegon are at least 10 points higher than average on the IQ test. What power do you have to detect this with the sample of 9 children if using a 0.05-level test?

c) If you hoped to use a **two-sided** test to show that the children from Lake Wobegon are at least 5 points higher than average on the IQ test, what power do you have with the sample size of 9 and a 0.05-level test?

2. Bias in step counters

Following the study by Case et al., JAMA, 2015, suppose we wished to assess, via a formal statistical test, whether (at an *population*, rather than an individual, level) a step-counting device or app is unbiased (H_0) or under-counts (H_1). Suppose we will do so the way Case et al. did, but measuring n persons just once each. We observe the device count when the true count on the treadmill reaches 500.

a. Using a planned sample size of $n = 25$, and $\sigma = 60$ steps as a pre-study best-guess as to the s that might be observed in them, calculate the critical value at $\alpha = 0.01$.
b. Now imagine that the mean would not be the null 500, but $\mu = 470$. Calculate the probability that the mean in the sample of 25 will be less than this critical value. Use the same s for the alternative that you used for the null. What is this probability called?
c. Determine the sample size required for 80% power using a 1% level of significance. Plot the null and alternative distributions in a diagram using the `plot_power` function.