AS2 (Assignment 2, Unit 4): Computing the Z-test Statistic

Research Scenario #1

A researcher hypothesizes that zylex, a new antidepressant, will affect concentration. It is known that scores on a standardized concentration test are normally distributed with a μ= 50 and a σ= 12. A random sample of n=16 participants, aged 19-35, are chosen from the State of New Jersey. The sample is put on a six month dosage plan of zylex. After six months, all the participants are given a standardized concentration test. The researcher records the data and calculates a sample mean of M=56. Is the data sufficient to conclude that the drug, zylex, does have an effect on concentration?

Based on the above research scenario, please answer the following questions:

1. Name the population: all individuals who may take Zylex as an antidepressant

2. Name the sample: the group of 16 participants aged 19-35 who were selected from New Jersey

3. What is the independent variable? the dosage plan of Zylex that participants were put on

4. What is the dependent variable? the participants' score on the standardized concentration test

5. What is the appropriate hypothesis test? z-test

6. What two means are you comparing in this test? the sample mean (M=56) to the population mean (μ=50)

7. Please calculate the appropriate hypothesis test using all four steps:

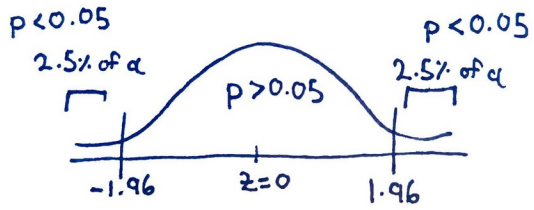
Step 1: Name the Hypothesis

H_0: Zylex will NOT affect concentration

H_1: Zylex WILL affect concentration

Step 2: Set a Critical Region

If α = 0.05



If α=0.05, the critical regions are where z<-1.96 or z>1.96

But if α=0.01, the critical regions would be where z<-2.58 or z>2.58

and if α=0.001, the critical regions would be where z<-3.30 or z>3.30

Step 3: Math

$$Z=\frac{M-\mu}{\frac{\sigma}{\sqrt{\square}}} \rightarrow Z=\frac{56-50}{\frac{12}{\sqrt{\square}}} \rightarrow Z=\frac{6}{3}$$

Z = 2

Step 4: Make a Decision

Reject the null hypothesis (There is an effect)

Write the statistical statement for your results: Z = 2, p < 0.05

Interpret your results (relating back to the hypothesis):
The study supports that Zylex DOES have an effect on concentration. The data was SIGNIFICANT.

Is there a probability of Type I error? Yes

If yes, what is the probability of a Type I error? 0.05

Is yes, how could you have decreased that probability?
Decreasing alpha could decrease the probability of Type I error.

Is there a probability of Type II error? No

If it is appropriate, please calculate effect size:

$$d = \frac{M - \mu}{\sigma} \rightarrow d = \frac{56 - 50}{12}$$

Answer: 0.5

Research Scenario #2:

A researcher wanted to study the effect of alcohol on reaction time. She hypothesized that alcohol will INCREASE reaction time (participants will take longer to react). She selected a sample of n= 36 participants from Rutgers University. The 36 participants each consumed a 6-ounce glass of wine. Thirty minutes later, the researcher measured each participant's reaction time, using a standardized driving simulation task for which the regular population has a $\mu = 400$ msec reaction time with a $\sigma = 48$. The reaction time mean for the sample was M= 412 msec. Are the data sufficient to conclude that the alcohol significantly increased reaction time?

Based on the above research scenario, please answer the following questions:

1. Name the population: all individuals who consume alcohol

2. Name the sample: the group of 36 participants who were selected from Rutgers University

3. What is the independent variable? the alcohol consumption of each participant, taken as a 6-ounce glass of wine

4. What is the dependent variable? the participants' reaction time to the standardized driving simulation task

5. What is the appropriate hypothesis test? z-test

6. What two means are you comparing in this test? sample mean (M=412 msec) to the population mean ($\mu = 400$ msec)

7. Please calculate the appropriate hypothesis test using all four steps:

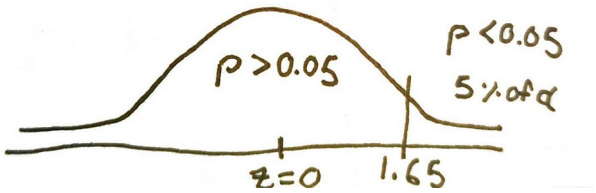
Step 1: Name the Hypothesis

H_0: Alcohol will NOT increase reaction time

H_1: Alcohol WILL increase reaction time

Step 2: Set a Critical Region

If α = 0.05



If α=0.05, the critical regions are where z>1.65

Step 3: Math

$$Z=\frac{M-\mu}{\frac{\sigma}{\sqrt{\square}}} \rightarrow Z=\frac{412-400}{\frac{48}{\sqrt{\square}}} \rightarrow Z=\frac{12}{8}$$

Z = 1.5

Step 4: Make a Decision

Fail to reject the null hypothesis (There is no effect)

Write the statistical statement for your results: Z = 1.5, p > 0.05

Interpret your results (relating back to the hypothesis):
The study supports that alcohol consumption will NOT increase reaction time. The data was NOT SIGNIFICANT.

Is there a probability of Type I error? No

Is there a probability of Type II error? Yes

If it is appropriate, please calculate effect size:

Not appropriate because did not reject the null hypothesis.