

Solution

1. Psychologists wish to investigate the learning ability of schizophrenic people after they have taken a specified dose of a tranquilizer. Thirteen patients were given the drug and one hour later they were given a standardized exam. Their scores are listed here:

15 20 30 27 24 22 22 17 21 25 23 27 25

Generally patients score around 20 on the exam. Is there statistical evidence that taking the tranquilizer has made significant changes in their scores given significance level 0.05?

- 1) **State the hypotheses:** $H_0: \mu = 20$ vs. $H_1: \mu \neq 20$

- 2) **Sample size** $n = \underline{13}$ **Sample mean** $\bar{X} = \frac{1}{n} \sum_{i=1}^n X_i = \underline{22.92}$

Sample standard deviation $S = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (X_i - \bar{X})^2} = \underline{4.13}$

- 3) **Compute the test statistic**

$$t_o = \frac{\bar{X} - \mu}{\left(\frac{S}{\sqrt{n}}\right)} = \frac{22.92 - 20}{\left(\frac{4.13}{\sqrt{13}}\right)} = 2.55 > 0$$

- 4) **Calculate the p-value** degrees of freedom = $n - 1 = 12$

The test is a two-sided test since $H_1: \mu \neq 20$.

$$0.01 < P(t > t_o) < .025 \quad \text{since } 2.179 < 2.55 < 2.681$$

$$p\text{-value} = 2 \cdot P(t > t_o), \text{ then } p\text{-value} < .05$$

- 5) **Conclusion and interpret the results.**

There is significant evidence to indicate that the mean score is different from 20 after the tranquilizer has been taken.

2. In 1999, 17% of high school students smoked frequently (20 or more days a month). An education campaign aimed at reducing teen smoking was instituted. To determine whether it was effective, a new study interviewed 500 high-school students. Of these, 80 smoked frequently. Our job is to decide whether this is attributable to a real drop in smoking or can be attributed to the fact that we've only looked at a sample.

1). **Hypotheses:** $H_0 : \underline{p=0.17}$ vs. $H_1 : \underline{p<0.17}$

2). **Sample size** $n = \underline{500}$, **sample proportion** $\hat{p} = \underline{0.16}$.

3). **Level of significance** $\alpha = 0.10$. **Rejection region is** $\underline{\{ z < -1.282 \}}$

4). **Observed value of the test statistic:**

$$z_o = \frac{\hat{p} - p_o}{\sqrt{p_o(1 - p_o)/n}} = \frac{0.16 - 0.17}{\sqrt{0.17 \cdot (1 - 0.17)/500}} = -0.595$$

5). **Calculate the p-value**

$$\text{p-value} = P(Z < z_o) = P(Z < -0.595) = \Phi(-0.595) = 0.2743$$

6). **Conclusion and interpret the results.**

Since p-value 0.2743 is greater than the significance level $\alpha = 0.10$, there is not enough evidence to reject H_0 .