

EXAMPLE:

The standard treatment for a disease works in 0.675 of all patients. A new treatment is proposed. Is it better? (The scientists who created it claim it is. You - as an advocate for a patient or sales personnel for the company that eventually would market it - must be more skeptical. Where's the data?) An initial clinical trial of $n = 100$ patients (of similar general health) is conducted: 77 people are cured. Assume the selection of patients is random. Test appropriate hypotheses at the 1% significance level.

ANSWER:

$$H_0: p = 0.675$$

$$H_A: p > 0.675$$

level of significance: $\alpha = .01$ two tailed means 98% level of confidence

$$\text{Standard Error: } z^* \cdot \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = 2.33 \sqrt{\frac{.77(.23)}{100}} = .098$$

$$\text{Test Statistic: } z = \frac{\hat{p}-p}{\sqrt{p(1-p)/n}} = \frac{.77-.675}{\sqrt{.675(1-.675)/100}} = 2.03$$

$$\text{p-value: } 0.0212 = \frac{1}{47}$$

So, if $p = 0.675$ for the new treatment, then only 0.0212 (1 in 47) of all samples of size 100 result in a z-score of 2.03 or larger.

The math demonstrates an acceptance of the Null.

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- 1) Mississippi Department of Motor Vehicle (DMV) records indicate that of all vehicles undergoing emissions testing during 2009, 70% passed on the first try. Late in 2009 the state implemented a program designed to encourage preventative service to improve emissions compliance. Does this program work? Test at the 5% level. Of 126 randomly selected reports on emissions, 95 cars pass on the first try.

- 2) 51.5% of all adults in the U.S. are female. A study of state lotteries included a random digit dialing (RDD) survey. Of the surveyed adults, 248 were classified as "heavy lottery players." Of these, 96 were female. Test to determine whether females are under-proportionately represented among heavy lottery players.

- 3) Census data suggests that in the early 1960s, 25% of those eligible for grand jury service in Alabama were black. A civil rights lawyer alleges that there has been discrimination against blacks in the actual grand jury selection (which is supposed to be done at random). Test at the 0.01 level. Of 434 jurors, 85 are black.

- 4) Some couples turn to the right, and some turn to the left, when they kiss. Do a majority turn in one direction? Test at the 5% level. Of 240 couples observed, 150 turn to the right.

- 5) The CEO of a large electric utility claims that 80 percent of his 1,000,000 customers are very satisfied with the service they receive. To test this claim, the local newspaper surveyed 100 customers, using simple random sampling. Among the sampled customers, 73 percent say they are very satisfied. Based on these findings, can we reject the CEO's hypothesis that 80% of the customers are very satisfied? Use a 0.05 level of significance.