AP Stats – Quick Review on Error and Power

Slow response times by paramedics, firefighters, and policemen can have serious consequences for accident victims. In the case of life-threatening injuries, victims generally need medical attention within 8 minutes of the accident. Several cities have begun to monitor emergency response times. In one such city, the mean response time to all accidents involving life-threatening injuries last year was $\mu = 6.7$ minutes. Emergency personnel arrived within 8 minutes after 78% of all calls involving life-threatening injuries last year. The city manager shares this information and encourages these first responders to "do better". At the end of the year, the city manager selects an SRS of 400 calls involving life-threatening injuries and examines response times.

a) State the hypotheses for a significance test to determine whether the average response time has decreased. Be sure to define the parameter of interest.

$H_0: \mu = 6.7$
$H_a: \mu < 6.7$

b) Describe a Type I error and a Type II error in this setting, and explain the consequences of each.

Type I – reject H_0 when H_0 is true. We ~~say~~ claim that response times have improved, but they really haven't. People could die ~~to~~ due to slow response times.

Type II – fail to reject H_0 when H_0 is false. We claim that response time is still same, but it's really improved. A consequence could be reckless driving due to trying to improve time.

c) Which is more serious in this setting: a Type I error or a Type II error? Justify your answer.

~~Tp~~ Type I – lives are at stake

$\alpha = .01$ $\alpha = .05$ $\alpha = .10$

You read that a statistical test at significance level $\alpha = 0.05$ has power 0.78. What are the probabilities of Type I and Type II errors for this test?

prob. of Type I $= \alpha = 0.05$
prob. of Type II $= \beta = 1 - \text{Power} = 1 - .78 = .22$

A drug manufacturer claims that fewer than 10% of patients who take its new drug for treating Alzheimer's disease will experience nausea. To test this claim, a significance test is carried out of

$H_0: p = 0.10$ $H_a: p < 0.10$

You learn that the power of this test at the 5% significance level against the alternative p = 0.08 is 0.64.

a) Explain in simple language what "power = 0.64" means in this setting.

• correctly rejecting the null hypothesis.

b) You could get higher power against the same alternative with the same α by changing the number of measurements you make. Should you make more measurements or fewer to increase power. Explain. . To ↑ power, we ↑ n.

c) If you decide to use $\alpha = 0.01$ in place of $\alpha = 0.05$, with no other changes in the test, will the power increase or decrease? Justify your answer. If you shift your interest to the alternative p = 0.07 with no other changes, will the power increase or decrease? Justify your answer.

decrease – decreasing α, increases β, decreases power.