AMS 572, Fall 2016

Example: Treatment of Kidney Cancer

Historically, one in five kidney cancer patients (i.e. 20%) survive 5 years past diagnosis. An oncologist using an experimental therapy treats n = 40 kidney cancer patients and 16 of them survive at least 5 years. Is there evidence that patients receiving the experimental therapy have a higher 5-year survival rate? Please test at the significance level of $\alpha = 0.05$.

Solution 1. (Large sample approximate test)

Let p be the proportion of kidney cancer patients receiving the experimental therapy that survive at least 5 years.

H_0: $p = 0.2$ versus H_a: $p > 0.2$

Since $np(1-p) = 40(0.2)(0.8) = 6.4 < 10$, large sample may not work well. However, we will use it regardless as illustration:

$\hat{p} = \frac{16}{40} = .40$ or a 40% $5-$ yr. survival rate

z $= \frac{\hat{p}-p_o}{\sqrt{\frac{p_o(1-p_o)}{n}}} = \frac{.40-.20}{\sqrt{\frac{.20(1-.20)}{40}}} = 3.16$

Since $p = 0.0008 < \alpha = 0.05$, we conclude that the 5-year survival rate for kidney cancer patients undergoing the experimental therapy is greater than the current 5-yr. survival rate of 20%.

Solution 2. (Exact test)

In our example we had n = 40 patients and if we assume the experimental therapy is no better than current treatments then probability of 5-year survival is p = .20.

Thus the number of patients in our study surviving at least 5 years has a binomial distribution, i.e. $X \sim B(40, 0.2)$. The exact test p-value $= P(X \geq 16) = P(X = 16) + P(X = 17) + \cdots + P(X = 40) = 0.002936$

Since $p = 0.0002396 < \alpha = 0.05$, we conclude that the 5-year survival rate for kidney cancer patients undergoing the experimental therapy is greater than the current 5-yr. survival rate of 20%.