

STAT 110: Practice Problem 5 - Solutions

Fall 2017

1. In the general population, the prevalence of Posttraumatic Stress Disorder (PTSD) is estimated to be about 5% in adult males. In a southwestern city, 85 male firefighters were randomly selected and surveyed, and it was found that 9 of the 85 ($\hat{\pi} = 10.6\%$) had PTSD. Clearly, the proportion of male firefighters from this city with PTSD in this sample is greater than 5%, but does this result provide evidence that the prevalence of PTSD is higher for all male firefighters in this southwestern city than for males in the general population?

Research Hypothesis	The prevalence of PTSD is higher for male firefighters in this southwestern city than for males in the general population.
Null and Alternative Hypotheses	<p>Let π = the proportion of <u>all</u> male firefighters in this southwestern city that suffer from PTSD. Equivalently, you could view this as π = the probability a randomly selected male firefighter from this southwestern city suffers from PTSD.</p> <p>$H_0: \pi = .05$ $H_a: \pi > .05$</p>
Calculate the p-value	<p>To find the p-value, we will use the binomial distribution with...</p> <p>$n = 85$ $\pi = .05$</p> <p>Use the file BinomialProbabilities.xls to find the p-value. Using $n = 85$ and $\pi = .05$, p-value = $P(9 \text{ or more have PTSD}) = .0262$.</p>
Conclusion	This study provides evidence that the prevalence of PTSD is higher for male firefighters in this southwestern city than for males in the general population.

2. Census data for a certain county show that 19% of the adult residents in this county are Hispanic. Suppose 72 people are called for jury duty and only 9 of them are Hispanic (so $\hat{\pi} = 12.5\%$). Clearly, the proportion of Hispanics in this sample is less than 19%. Does this apparent underrepresentation of Hispanics call into question the fairness of the jury selection system, overall?

Research Hypothesis	Hispanics are underrepresented during jury selection in this county.
Null and Alternative Hypotheses	Let π = the true, long-run probability that a person selected for jury duty in this county is Hispanic.

	$H_0: \pi = .19$ $H_a: \pi < .19$
Calculate the p-value	<p>To find the p-value, we will use the binomial distribution with...</p> <p>$n = 72$ $\pi = .19$</p> <p>Use the file BinomialProbabilities.xls to find the p-value. Using $n = 72$ and $\pi = .19$, p-value = $P(9 \text{ or fewer are Hispanic}) = .1005$.</p>
Conclusion	<p>The results from this jury selection do not provide enough statistical evidence that Hispanics are underrepresented in the jury selection process in this county.</p>

3. Suppose a governor is concerned about his “negatives” (i.e., the percentage of state residents who express disapproval with his job performance). His campaign pays for a series of television ads, hoping that they can keep the negatives below 30%. They use follow-up polling to assess the ads’ effectiveness.
- a. Set up the null and alternative hypotheses you would use to investigate the governor’s question.

Let π = the proportion of all state residents who express disapproval with his job performance; equivalently, π = the probability a randomly selected state resident expresses disapproval with his job performance.

$H_0: \pi = 30\%$
 $H_a: \pi < 30\%$ (i.e., the ads are effective)

- b. Suppose the test is carried out, and his negatives come in at 28%. The p-value obtained is .18. Write a conclusion that addresses the governor’s question.

Though less than 30% of those surveyed (i.e., the sample) expressed disapproval with his job performance, the results do not provide enough statistical evidence that the governors “negatives” are under 30% (i.e., there is not enough evidence that less than 30% of *all* state residents express disapproval). Therefore, there is not enough statistical evidence that the ads were effective.

- c. Which of the following interpretations of the p-value is most appropriate? Explain.
- ~~i. There is an 18% chance that the ads were effective.~~
 - ~~ii. There is an 82% chance that the ads were effective.~~
 - ~~iii. There is an 18% chance that the poll was conducted correctly.~~
 - iv. There is an 18% chance that natural sampling variation could produce poll results such as these even if the ads weren't really effective.**