

AP Statistics – Chi-squared Tests

1. **THE DENTIST PROBLEM** In the past, a number of professions were prohibited from advertising. In 1977, the U.S. Supreme Court ruled that prohibiting doctors and lawyers from advertising violated their right to free speech. The article "Should Dentists Advertise?" compared the attitudes of consumers and dentists toward the advertising of dental services.

Separate random samples of 101 consumers and 124 dentists were asked to respond to the following statement "**I favor the use of advertising by dentists to attract new patients.**" The authors were interested in determining whether the two groups differed in their attitudes toward advertising.

Is there evidence that the opinions of consumers are different from those of dentists regarding this topic?

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Consumers	34 (19.3)	49 (30.00)	9 (14)	4 (14)	5 (23)
Dentists	9 (23.69)	18 (36.924)	23 (18)	28 (18)	46 (28)

(Expected counts)

χ^2 test of homogeneity (of proportions)

$$df = 4 \left(\begin{matrix} 5 \text{ columns} \\ -1 \\ -1 \end{matrix} \right) \left(\begin{matrix} 2 \text{ rows} \\ -1 \end{matrix} \right) = 4 \times 1$$

H_0 : the distribution of proportions of opinions is the same for consumers & dentists.

H_A : _____ is different...

[from calculator... refer to page 623 in textbook]

$$\chi^2 = 84.4958$$

$$p\text{-value} \approx 0$$

At $\alpha = 0.05$: Since $p \ll \alpha$, we reject H_0 .

We have evidence that the distributions of proportions of opinions are different for consumers & dentists.

Conditions:

- We have separate random samples of consumers & dentists, which are reasonably independent groups.
- All expected counts are ≥ 5 (shown in table above)

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2. An administrator at a large university is interested in determining whether the residential status of a student is associated with level of participation in extracurricular activities. Residential status is categorized as on campus for students living in university housing and off campus otherwise. A simple random sample of 100 students in the university was taken, and each student was asked the following two questions.

- Are you an on campus student or an off campus student?
- In how many extracurricular activities do you participate?

The responses of the 100 students are summarized in the frequency table shown.

Level of Participation in Extracurricular Activities	Residential Status		Total
	On campus	Off campus	
No activities	9 (12.87)	30 (26.13)	39
One activity	17 (13.86)	25 (28.14)	42
Two or more activities	7 (6)	12 (13)	19
Total	33	67	100

(Expected counts in parentheses)

Do the survey results provide statistical evidence of an association between residential status and level of participation in extracurricular activities among the students at the university?

χ^2 test of independence, $df = 2$

H_0 : There is NO association between residential status and level of participation in extracurricular activities among students at this university.

H_A : There IS an association.....

[from calculator... refer to page 623 in textbook]

$$\chi^2 = 2.925$$

$$p = 0.2316$$

$$\alpha = 0.05$$



Since $p > \alpha$, we fail to reject H_0 .

We lack evidence of an association between residential status and level of participation in extracurricular activities among students at this university.

Conditions:

- We have a SRS of students at this university
- Expected counts ≥ 5 ✓