

Chi-square Tests

KEY

As part of a study, a random sample of people was obtained. The subjects were asked about their television-viewing time (per day, rounded to the nearest hour) and whether or not they are physically fit.

TV Group	Fitness		
	Physically Fit	Not Physically Fit	
0	37	145	182
1-2	100	630	730
3 or More	27	261	288
	164	1036	1200

Is there evidence to suggest that there is an association between fitness level and tv-viewing time?

P: We are interested in if there is an association between fitness level and tv-viewing time.

H: H_0 : There is no association between fitness level and tv-viewing time

H_a : There is an _____ " _____"

A: ✓ Random - a random sample of 1200 people was obtained

✓ Independent - there are at least 12,000 people to select from

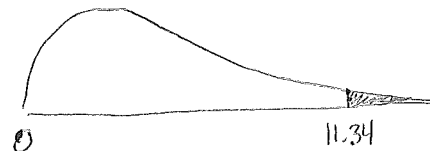
✓ Large Counts - all expected counts are at least 5 (see these in the table)

N: Since we took one sample from one population, we will use a Chi-Square Test for Association/Independence

$$T: \chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(37-24.873)^2}{24.873} + \frac{(145-157.127)^2}{157.127} + \frac{(100-99.77)^2}{99.77} + \frac{(630-630.23)^2}{630.23} + \frac{(27-39.36)^2}{39.36} + \frac{(261-248.64)^2}{248.64} = 11.34$$

$$df = (r-1)(c-1) = (3-1)(2-1) = 2$$

O: P-value = between .0025 and .005 (table)
= .0034 (calc)



M: Because the P-value is significant at the $\alpha = .05$ level, we reject H_0 .

S: There is strong evidence that there is an association between fitness level and tv-viewing time.

Random samples of 981 adult men and 1036 adult women were obtained and respondents were asked how many alcoholic drinks they consume in a typical week.

Drinking Level	Observed		
	Men	Women	Total
None	140	186	326
Low (1-2 drinks/week)	478	661	1139
Moderate (3-7 drinks/week)	300	173	473
High (8+ drinks/week)	63	16	79
Total	981	1036	2017

	Expected	
	Men	Women
None	158.56	167.44
Low	553.97	585.03
Moderate	230.05	242.95
High	38.423	40.577

Is there evidence to suggest that men and women are different with respect to their drinking level?

P: We are interested in if men and women are different with respect to their drinking level.

H: H_0 : Men and women are no different with respect to their drinking level.

H_a : Men and women differ with respect to their drinking level.

A: \checkmark Random - separate random samples of men and women were obtained

\checkmark Independent - there are at least 9,810 adult men and 10,360 adult women

\checkmark Large Counts - all expected counts are at least 5 (see table above)

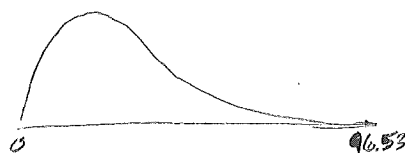
N: Since we took separate samples from two populations, we will use a Chi-Square Test for Homogeneity

$$T: \chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(140-158.56)^2}{158.56} + \frac{(186-167.44)^2}{167.44} + \frac{(478-553.97)^2}{553.97} + \frac{(661-585.03)^2}{585.03} + \frac{(300-230.05)^2}{230.05} + \frac{(173-242.95)^2}{242.95} + \frac{(63-38.423)^2}{38.423} + \frac{(16-40.577)^2}{40.577} = 96.53$$

$$df = (r-1)(c-1) = (4-1)(2-1) = 3$$

O: P-value \ll .0005 (table)

$$= 8.68 \times 10^{-21} \text{ (calc)}$$



M: Because the P-value is significant at the $\alpha = .05$ level, we reject H_0 .

S: There is strong evidence that men and women differ with respect to their drinking level.