

Univariate Polychotomous
variables

more than 2
categories

multinomial distribution

Ott p. 218

k possible outcomes for each
trial ($k=2$ Bernoulli trial)

$j = 1, \dots, k$ $\pi_j = \Pr \{ \text{outcome } j \}$

$$\sum_{j=1}^k \pi_j = 1$$

Ott Ex 6.2 $k=4$
p. 221-2

Category	Percentage
Marked decrease in blood pressure	50%
Moderate decrease in blood pressure	25%
Slight decrease in blood pressure	10%
Stationary or slight increase in blood pressure	15%

1x4 table example blood pressure drug

many different locations, patients suffering from comparable hypertension (as measured by the New York Heart Association (NYHA) Classification) have been administered the standard therapy. Responses to therapy for this large patient group were classified into one of four response categories. Table 6.1 lists the categories and percentages of patients treated on the standard preparation who have been classified in each category.

A clinical trial is conducted with a random sample of 200 patients suffering from high blood pressure. All patients are required to be listed according to the same hypertensive categories of the NYHA Classification as those studied under the standard preparation. Use the sample data in Table 6.2 to test the hypothesis that the cell probabilities associated with the test preparation are identical to those for the standard. Use $\alpha = .05$.

This experiment possesses the characteristics of a multinomial experiment, with $n = 200$ and $k = 4$ outcomes.

Outcome 1: A person's blood pressure will decrease markedly after treatment on the test drug.

Outcome 2: A person's blood pressure will decrease moderately after treatment on the test drug.

Outcome 3: A person's blood pressure will decrease slightly after treatment on the test drug.

Outcome 4: A person's blood pressure will remain stationary or increase slightly after treatment on the test drug.

The null and alternative hypotheses are then

$$H_0: \pi_1 = .50, \pi_2 = .25, \pi_3 = .10, \pi_4 = .15$$

Sample Data for Example 6.2

Category	Observed Cell Counts
1	120
2	60
3	10
4	10

Hypothesized Multinomial Probabilities
 $C=4$ (OM ex. "drug first injected")

$$H_0: \pi_1 = .5 \quad \pi_2 = .25 \quad \pi_3 = .10 \quad \pi_4 = .15$$

H_a : cell prob's not H_0 .

Observed + Expected Counts

1	2	3	4
120	60	10	10
100	50	20	30

Measure discrepancy by chi-square
Statistic

$$\sum_{j=1}^4 \frac{(O_j - E_j)^2}{E_j}$$

Test statistic =

$$\frac{(120-100)^2}{100} + \frac{(60-50)^2}{50} + \frac{(10-20)^2}{20} + \frac{(10-30)^2}{30}$$

$$= 24.33$$

Reject if test statistic exceeds
critical value χ^2_{c-1} ($\chi^2_{[c-1]}$)

χ^2_3 for $\alpha = .05$ is 7.81