

Exercise 7- Pennsylvania Fetal Mortality by Age (10 pts)

Using the Pennsylvania Dept. of Health's *County Health Profile 2000* please construct a contingency table for the three Pennsylvania counties of interest and calculate the chi-square statistic for all births and each age group (5 tables total). Follow the instructions below:

Introduction

The Chi-Square (χ^2) statistic is used to determine if there is a difference between observed values and expected values, therefore the null hypothesis is that the frequency of the observations found in the rows are independent of the frequency of observations found in the columns. So in this example the null hypothesis (h_0) would be "the relative frequency of live births and fetal deaths are the same among the three counties." The alternative hypothesis (h_a) would therefore be "the relative frequency of live births and fetal deaths are **not** the same among the three counties." Remember that contingency tables test for differences but not the direction of the difference... that must either be implied from the data or determined using another statistical method. For this exercise we will use an alpha value (α) of 0.05 (or 5%). This number determines how "rare" the results have to be before we reject the null hypothesis.

Procedure:

1. Construct a contingency table from the live births and fetal deaths data.
2. Determine both the row totals and column totals (sum across rows, sum across columns).
3. Calculate the expected frequencies.
4. Calculate the Chi-Square statistic.
5. Determine the Degrees of Freedom.
6. Compare the Chi-Square statistic to the critical value.
7. Write an appropriate statement of your findings.

The equation for determining the expected frequencies (f'_{ij}) is:

$$f'_{ij} = \frac{(R_i)(C_j)}{n}$$

...where f'_{ij} is the expected frequency, R is the row, C is the column, and n total observations.

The equation for calculating the Chi-Square (χ^2) statistic is:

$$\chi^2 = \sum \sum \frac{(f_{ij} - f'_{ij})^2}{f'_{ij}}$$

...where f_{ij} is the observed frequency and f'_{ij} is the expected frequency.

The equation for the degrees of freedom (v) is:

$$V = (r - 1)(c - 1)$$

Chi-Square Example

All Ages

Observed Frequencies

	Live Births	Fetal Deaths	Total
Adams	997	11	1008
Cumberland	2227	22	2249
Franklin	1712	15	1727
Total	4936	48	4984

$$f''_{1,1} = (4936 \times 1008) / 4984 = 998.3$$

$$f''_{1,2} = (48 \times 1008) / 4984 = 9.7$$

$$f''_{2,1} = (4936 \times 2249) / 4984 = 2227.3$$

$$f''_{2,2} = (48 \times 2249) / 4984 = 21.7$$

$$f''_{3,1} = (4936 \times 1727) / 4984 = 1710.4$$

$$f''_{3,2} = (48 \times 1727) / 4984 = 16.6$$

All Ages

Expected Frequencies

	Live Births	Fetal Deaths
Adams	998.3	9.7
Cumberland	2227.3	21.7
Franklin	1710.4	16.6

h_0 : Fetal births and deaths are not significantly different among the three counties.

$$v = (3 - 1)(2 - 1) = (2)(1) = 2$$

$$\chi^2 = \frac{(997 - 998.3)^2}{998.3} + \frac{(11 - 9.7)^2}{9.7} + \frac{(2227 - 2227.3)^2}{2227.3} + \frac{(22 - 21.7)^2}{21.7} + \frac{(1712 - 1710.4)^2}{1710.4} + \frac{(15 - 16.6)^2}{16.6}$$

$$\chi^2 = 0.3358$$

Critical Value, $v = 2$, $\alpha = 0.05$: 5.991 (from Table 14: *Critical values of the chi-square distribution*)

Results: The critical value is greater than the χ^2 value ($5.991 > 0.3358$), therefore we accept the null hypothesis. There is no difference in live births and fetal deaths among the three counties ($\chi^2_{0.05,2} = 0.3358$).

All Ages

Observed Frequencies

	Live Births	Fetal Deaths	Total
Philadelphia			
Dauphin			
Fulton			
Total			

All Ages

Expected Frequencies

	Live Births	Fetal Deaths
Philadelphia		
Dauphin		
Fulton		

 $h_0 :$ $v =$ _____ $\chi^2 =$ _____

Critical Value = _____

Results:

Ages 15-17

Observed Frequencies

	Live Births	Fetal Deaths	Total
Philadelphia			
Dauphin			
Fulton			
Total			

Ages 15-17

Expected Frequencies

	Live Births	Fetal Deaths
Philadelphia		
Dauphin		
Fulton		

 $h_0 :$ $v =$ _____ $\chi^2 =$ _____

Critical Value = _____

Results:

Ages 18-19

Observed Frequencies

	Live Births	Fetal Deaths	Total
Philadelphia			
Dauphin			
Fulton			
Total			

Ages 18-19

Expected Frequencies

	Live Births	Fetal Deaths
Philadelphia		
Dauphin		
Fulton		

 h_0 : $v =$ _____ $\chi^2 =$ _____

Critical Value = _____

Results:

Ages 20-29

Observed Frequencies

	Live Births	Fetal Deaths	Total
Philadelphia			
Dauphin			
Fulton			
Total			

Ages 20-29

Expected Frequencies

	Live Births	Fetal Deaths
Philadelphia		
Dauphin		
Fulton		

 h_0 : $v =$ _____ $\chi^2 =$ _____

Critical Value = _____

Results:

Ages 30+

Observed Frequencies

	Live Births	Fetal Deaths	Total
Philadelphia			
Dauphin			
Fulton			
Total			

Ages 30+

Expected Frequencies

	Live Births	Fetal Deaths
Philadelphia		
Dauphin		
Fulton		

 h_0 : $v =$ _____ $\chi^2 =$ _____

Critical Value = _____

Results: