Stat 145, Thu 8-Apr-2021 -- Thu 8-Apr-2021
Biostatistics
Spring 2021

Thursday, April 8th 2021

Wk 10, We
Topic:: Chi-square test for association
Read:: Lock5 7.2

Two-way tables
- If both variables are binary, can do 2-proportion inference
  either a CI or an hypothesis test

- No CI construction in chi-square test for association

- example: cocaine addicts

	Relapse	No Relapse
Placebo	20	4
Desipramine	10	14
Lithium	18	6

Two variables
- What drug received?
- Relapse?

Assess whether there is an association between variables

- example: malaria [redacted]

	S.Amer.	Asia	Africa
Strain A	451	313	145
Strain B	532	28	56
Strain C	27	539	456

In R:

```
malariaTable <- matrix(c(451, 532, 27, 313, 28, 539, 145, 56, 456), nrow = 3)
Chisq.test(malariaTable)
```

Note:

`Chisq.test(malariaTable)$expected` reveals the expected counts in all cells

`Chisq.test(malariaTable)$statistic` reveals the value of the X^2-statistic

Setting:

Goal - see if there evidence of an assoc. between cat. vars.

Hypotheses: H_0: There is no association

H_a: There is an association

Technique: Use χ^2 statistic

$$\chi^2 = \sum \frac{[(\text{observed}) - (\text{expected})]^2}{\text{expected}}$$

take sum over cells of my 2-way table

(blank)	Relapse	No Relapse	
Placebo	20	4	24
Desipramine	10	14	24
Lithium	18	6	24
	48	24	72

6 cells, observed counts

Expected counts:

- one for every cell
- obtain by computing

$$\frac{(\text{row total})(\text{col. total})}{\text{grand total}}$$

Expected

$\frac{(48)(24)}{72}$ $\frac{(24)(24)}{72}$

16	8
16	8
16	8

$$\chi^2 = \frac{(20-16)^2}{16} + \frac{(10-16)^2}{16} + \frac{(18-16)^2}{16} + \frac{(4-8)^2}{8} + \frac{(14-8)^2}{8} + \frac{(6-8)^2}{8}$$

$$= 10.5$$

All expected counts ≥ 5 (rule met allowing the use of a chi-square dist.)

Q: How many dfs?

A: For 2-way table

$$df = [(\#\text{ cols}) - 1][(\#\text{ rows}) - 1]$$