BIST P8130: Biostatistics Methods I

Recitation 05 – Chi-Squared test, Fisher's Exact test,

McNemar's test in SAS

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This recitation's big ideas:

- Use PROC FREQ to
  - Perform a Chi-squared test
  - Perform a Fisher's Exact test
  - Perform a McNemar's test

Chi-Squared Test and Fisher's Exact test

Is there an association between selfcough and gender?

```
proc freq data=demo14;
   tables selfcough*gender /expected chisq exact;
run;
```

Table of Selfcough by GENDER			
Selfcough	**GENDER**		
Frequency Expected Percent Row Pct Col Pct	**Female**	**Male**	**Total**
FALSE	43 41.667 51.19 61.43 86.00	27 28.333 32.14 38.57 79.41	70 83.33
TRUE	7 8.3333 8.33 50.00 14.00	7 5.6667 8.33 50.00 20.59	14 16.67
Total	50 59.52	34 40.48	84 100.00
Frequency Missing = 7			

Statistics for Table of Selfcough by GENDER

Statistic	DF	Value	Prob
Chi-Square	1	0.6325	0.4265
Likelihood Ratio Chi-Square	1	0.6234	0.4298
Continuity Adj. Chi-Square	1	0.2471	0.6192
Mantel-Haenszel Chi-Square	1	0.6249	0.4292
Phi Coefficient		0.0868	
Contingency Coefficient		0.0864	
Cramer's V		0.0868	

Fisher's Exact Test	
Cell (1,1) Frequency (F)	43
Left-sided Pr <= F	0.8626
Right-sided Pr >= F	0.3067
Table Probability (P)	0.1693
Two-sided Pr <= P	0.5528

Chi-Squared test can also be conducted for grouped data (instead of individual data). For example:

```
/** Reading in 2x2 data from a table **/
data chi;
   input exposure disease Count @@;
   cards;
1 1 5   1 0 78
0 1 21   0 0 63
;
run;

proc freq data = chi;
  tables exposure*disease / chisq expected; *relrisk riskdiff;
  weight Count;
run;
```

The FREQ Procedure

Table of exposure by disease			
exposure	disease		
Frequency Expected Percent Row Pct Col Pct	0	1	Total
0	63 70.922 37.72 75.00 44.68	21 13.078 12.57 25.00 80.77	84 50.30
1	78 70.078 46.71 93.98 55.32	5 12.922 2.99 6.02 19.23	83 49.70
Total	141 84.43	26 15.57	167 100.00

Statistics for Table of exposure by disease

Statistic	DF	Value	Prob
Chi-Square	1	11.4363	0.0007
Likelihood Ratio Chi-Square	1	12.1797	0.0005
Continuity Adj. Chi-Square	1	10.0383	0.0015
Mantel-Haenszel Chi-Square	1	11.3678	0.0007
Phi Coefficient		-0.2617	
Contingency Coefficient		0.2532	
Cramer's V		-0.2617	

Fisher's Exact Test	
Cell (1,1) Frequency (F)	63
Left-sided Pr <= F	0.0006
Right-sided Pr >= F	0.9999
Table Probability (P)	0.0005
Two-sided Pr <= P	0.0010

Sample Size = 167

McNemar's Test

Recall the example from Lecture 10. A group of 75 patients are tested with two different diagnostic procedures: A and B, for determining the presence/absence of a disease. We want to test the hypothesis that the proportions of positives for the two procedures are equal.

```
Data Procedure;
  input Proc_A $ Proc_B $ count;
  cards;
positive positive 41
positive negative 8
negative positive 14
negative negative 12
;
run;

proc freq data = Procedure order = data;
  table Proc_A*Proc_B/ chisq agree;
  weight count;
run;
```

The FREQ Procedure

Table of Proc_A by Proc_B			
Proc_A	**Proc_B**		
Frequency Percent Row Pct Col Pct	**positive**	**negative**	**Total**
positive	41 54.67 83.67 74.55	8 10.67 16.33 40.00	49 65.33
negative	14 18.67 53.85 25.45	12 16.00 46.15 60.00	26 34.67
Total	55 73.33	20 26.67	75 100.00

Statistics for Table of Proc_A by Proc_B

Statistic	DF	Value	Prob
Chi-Square	1	7.7280	0.0054
Likelihood Ratio Chi-Square	1	7.4832	0.0062
Continuity Adj. Chi-Square	1	6.2780	0.0122
Mantel-Haenszel Chi-Square	1	7.6249	0.0058
Phi Coefficient		0.3210	
Contingency Coefficient		0.3056	
Cramer's V		0.3210	

McNemar's Test	
Statistic (S)	1.6364
DF	1
Pr > S	0.2008