Chi-Square: Tutorial

Dr Otto H MacLin

Psychology Department
University of Northern Iowa

http://www.uvm.edu/~dhowell/gradstat/psych340/Lectures/Class1.html
http://www.uvm.edu/~dhowell/gradstat/psych340/Final/
Does having a pet help people survive after a heart attack?

92 people recent heart attack

2 x 2
- Pet / No pet
- Alive after 1 year / Dead after 1 year

Friedman, Katcher, Lynch, and Thomas (1980) did an interesting study on the effect of having a pet for people recovering from heart attacks. I don't recall whether they supplied a pet or just found people who did, and did not, have pets.

**What difference would this make from a methodological perspective? (Self selection bias)**

They found 92 people who had recently had a heart attack, and classified them in terms of whether or not they had a pet. They then determined whether these people were alive one year later.

Here we have two variables of classification:
- Pet (yes/no)
- Alive/Dead

Notice that in this case the row frequencies are not equal. That is not a problem, and, in fact, it's kind of nice that so few people died.

We want to test the null hypothesis that Pet and Survival are *independent*. 
For a contingency table, \( df = (R-1)(C-1) \), which is this case is 1.

We already know that with 1 \( df \) the critical value of chi-square = 3.84.

So we will reject our null hypothesis and conclude that there is a relationship between having a pet and living for a decent length of time after a heart attack.
### PET * ALIVE Crosstabulation

<table>
<thead>
<tr>
<th></th>
<th>ALIVE</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dead</td>
<td>Alive</td>
</tr>
<tr>
<td>No pet</td>
<td>11</td>
<td>28</td>
</tr>
<tr>
<td>Pet</td>
<td>3</td>
<td>50</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>78</td>
</tr>
</tbody>
</table>

### Chi-Square Tests

<table>
<thead>
<tr>
<th>Statistic Type</th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
<th>Exact Sig. (2-sided)</th>
<th>Exact Sig. (1-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>8.851b</td>
<td>1</td>
<td>.003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuity Correction</td>
<td>7.190</td>
<td>1</td>
<td>.007</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>9.011</td>
<td>1</td>
<td>.003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fisher’s Exact Test</td>
<td></td>
<td></td>
<td></td>
<td>.006</td>
<td>.004</td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>8.755</td>
<td>1</td>
<td>.003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>92</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- a. Computed only for a 2x2 table
- b. 0 cells (0%) have expected count less than 5. The minimum expected count is 5.93.

Note difference in X² probably due to rounding errors

Let’s assume there are no violations or issues surrounding the data, what can we say about the data?

Just use the top row of the chi square tests. X²=8.85, p > .01
Work SPSS Example

- Using all data
  - If we used all of the data we would have two columns and 92 rows (since there are 92 observations)
  - That is a lot of work
  - There is an easier way to do this....
This is how you would enter the cell frequencies in SPSS.
Notice that we now have 3 columns that allow us to enter frequencies for all four category levels.
Weight Cases
Make sure you weight the cases with the frequency values and not the category levels.
Choose Analyze > Descriptive Statistics > Crosstabs...
Using the categorical variables (Pet & Alive)
Enter one into the rows and one into the columns (it really doesn’t matter which order you choose).
Then click on the Statistics… button to see the following screen…..
After you click on the Statistics… button you will see the above dialog box. There are many options. If you want more information on the options click on the Help button.

The help functions in SPSS are fantastic, get in the habit of clicking on the help button to see what SPSS offers in that department.

For now just select the Chi-Square option then click the Continue button. This will return you back to the Crosstabs dialog box – Click the OK button to run the analysis.
The art of SPSS output is to determine just want you need for your particular analysis.

Above is the full output.

We don’t need the Case Processing Summary

We do need the contingency table (Crosstabulation) we can verify that our weight cases worked and we can use them for descriptive statistics in our write up.

For example, “Of the 53 pet owners 3 died, while 11 of the 39 patients with no pets died.”

In the last box, Chi-Square Tests – we only need the Pearson Chi-Square value and the significance level.

X2 = 8.85, p < .01

Refer to your APA manual for APA guidelines on how to report your chi square results. Also refer to your articles using Chi-Square to see how they reported their results.

In this class you will be required to write up your results in proper APA format.
The End

- I hope that helps
- Let me know if you need additional help