Lecture 18c: SPSS Output for Two-Sample Hypothesis Test of Means

The purpose of this lecture is to illustrate the how to create SPSS output for two-sample hypothesis test of means (or two sample t-tests).

Do BAC test “refusers” have more prior DUI arrests than BAC test “non-refusers?” $\alpha=.01$

I did a study in Hawaii on drunk driving and one idea was that people who refuse to take a Blood Alcohol Content Test (BAC test) are refusing because they have been arrested for DUI before and are trying to avoid “being caught” again. So we compared the mean number of prior DUI arrests between BAC test “refusers” and non-“refusers.” These are actual real life data!

You can do the following two sample hypothesis test of means (t-tests) with this output:

\[ H_0: \mu_1 = \mu_2 \quad H_1: \mu_1 \neq \mu_2 \]
\[ H_0: \mu_1 \leq \mu_2 \quad H_1: \mu_1 > \mu_2 \]
\[ H_0: \mu_1 \geq \mu_2 \quad H_1: \mu_1 < \mu_2 \]

$\mu_1 =$ people who REFUSED to take the BAC test $\mu_2 =$ people who took the BAC test

Doing the test on SPSS

You will need two variables from your study:

- An interval/ratio level variable for the mean. (I will use a variable that measures the number of prior DUI arrests of drivers arrested for DUI in Honolulu. Recall everyone in this data set were arrested for DUI in 2001. This variable measures how many prior DUI arrests they had prior to this one in 2001. This is a ratio level variable.)

- A discrete variable with two categories. (I will use a nominal and discrete variable that measure whether or not they refused to take a BAC test. 0=no 1=yes.

To have SPSS perform this operation from the menus choose:

Analyze

Compare Means >

Independent Samples T-Test...
A window will pop up and you highlight and move your interval/ratio variable over to the “Test Variables:” box with the arrow.

Pushing the arrow it will move it over
Move your discrete variable into the “Grouping Variable” box with the arrow. You will notice there are two ??? next to your variable.

Push the **Define Groups** button. Give the coding for each group. Recall in this variable 1 = yes and 0 = no. Press Continue button.
Then press **OK**. Below is the output you will see:

### Group Statistics

<table>
<thead>
<tr>
<th>Total Number of Pre-DUI study DUI Arrests - Just DUI ARRESTS regardless of severity</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>refused to take test</td>
<td>28</td>
<td>1.96</td>
<td>3.564</td>
<td>.674</td>
</tr>
<tr>
<td>took bac test</td>
<td>433</td>
<td>.99</td>
<td>2.341</td>
<td>.112</td>
</tr>
</tbody>
</table>

### Independent Samples Test

<table>
<thead>
<tr>
<th>Total Number of Pre-DUI study DUI Arrests - Just DUI ARRESTS regardless of severity</th>
<th>Levene's Test for Equality of Variances</th>
<th>t-test for Equality of Means</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>Sig</td>
<td>t</td>
<td>df</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>3.759</td>
<td>.053</td>
<td>2.030</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>1.422</td>
<td>28.526</td>
<td>.166</td>
</tr>
</tbody>
</table>

---

4 of 6
There is one major difference between this output and the output from lecture 17 (one sample t-tests)

You will notice that in the bottom box there are two lines each with a separate “t”, “Sig. (2-tailed)” etc. “t” = the test ratio (TR) from step 6.

Which line you look at depends upon the Levene’s test of variances which tests:

\[ H_0: \sigma_1^2 = \sigma_2^2 \quad \text{versus} \quad H_1: \sigma_1^2 \neq \sigma_2^2. \]

These two lines refer to this part of the flow chart from the start of this lecture:

How to choose correct TR value for step 6

To make a decision about the Levene’s test, look at the p-value for the Levene’s test is under “Sig.” (Above our p-value for the Levene’s test is \(=.053\))

Typically \( \alpha \) is either \( \alpha=.05 \) or \( \alpha=.01 \), depending upon your desired level of significance. For this class we will use \( \alpha=.05 \).

- If \( p<\alpha \) (another way to say that is if \( p < .05 \)) then you reject null and conclude the alternative: \( \sigma_1^2 \neq \sigma_2^2 \) (Equal variances NOT assumed). If you reject null on Levene's test \([p<.05]\) look at bottom line, "equal variances not assumed -- I call this formula 2 on test 3. This TR is computed using procedure 3 in the picture above.
• If \( p > \alpha \) (another way to say that is if \( p > \alpha = 0.05 \)) you FAIL to reject the null and conclude \( \sigma_1^2 = \sigma_2^2 \) (Equal variances assumed). If you fail to reject on the Levene's [\( p \geq 0.05 \)] test look at top line "equal variance assumed" -- I call this formula 1 on test 3. This TR is computed using procedure 4 in the picture above.

Which TR do we use in the example used above in this lecture?

In this class we will be using \( \alpha = 0.05 \), \( p = 0.053 \) \( p > \alpha \) therefore FAIL to reject the null and ASSUME EQUAL VARIANCES which is the top line in the output.

So the TR from step 6 =2.05. SPSS uses what I call “formula 1” on test 3 to compute this TR.

and p-value for a TWO TAILED test =.041 or \( p = .041 \) or 4.1%

If you have too much time on your hands you can plug the numbers into the appropriate formulas and see that SPSS computes formulas correctly.

For computing the p-value of ONE-TAILED tests the same rules from lecture 17a p-values apply.