SAN JOSÉ STATE UNIVERSITY **College of Social Work**
S. W. 242
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Prep for *t*-test
Example of Independent Sample *t*-test with randomly assigned groups

Consider the following data. “Treatment” is a variable indicating assignment to experimental treatment (coded “1”) or treatment-as-usual (coded “2”). “Pre-test anxiety score” and “Post-test anxiety score” are from a ratio-level anxiety scale, where lower scores indicate lower anxiety. **We are interested in the change in anxiety as a result of treatment, from pre- to post-. We will be comparing both groups on a “Change score” that we will compute with SPSS.** (Note: even though this example uses repeated measurements, we will be using the Independent Sample *t*-test. We could also use a Dependent sample *t*-test, running it twice—*once for each treatment group*, to compare the pre- post-test score for each treatment group. Why would it be better to compute the *change score* and then use the Independent groups *t*-test on that variable?

Treatment	Pre-test anxiety score	Post-test anxiety score	Change score (to be computed)
1.0	10.0	8.78	
1.0	11.85	9.0	
1.0	8.0	10.88	
1.0	7.5	5.5	
1.0	11.99	7.7	
1.0	12.34	12.05	
1.0	10.8	9.0	
1.0	9.8	7.78	
1.0	5.46	5.58	
1.0	12.80	8.5	
1.0	13.9	8.0	
1.0	7.79	7.6	
1.0	8.03	7.79	
1.0	12.85	10.89	
1.0	13.88	12.07	
2.0	10.0	10.89	
2.0	11.85	10.08	
2.0	8.0	9.9	
2.0	7.5	7.77	
2.0	11.99	10.78	
2.0	12.34	12.0	
2.0	10.8	11.88	
2.0	9.8	9.78	
2.0	5.46	6.0	
2.0	12.80	12.05	
2.0	13.9	13.93	
2.0	7.79	7.5	
2.0	8.03	8.4	

2.0	12.85	12.0	
2.0	13.88	12.5	

Once the data for the three variables are entered into SPSS, let's compute the Change Score: In SPSS Data View, go to **Transform, Compute Variable.** Enter **Target variable "**Change", **Type and Label—**for Label enter "Post- minus pre-" and click **Continue**. For the **Numeric Expression** box, move over "Post-treatment anxiety…", hit the minus sign on your keyboard, then move over "Pre-treatment anxiety", then click **OK**. Review the Data View screen to see your new variable.

Now, let's go through the 8 Steps to a Happy Life (8 Steps to Hypothesis Testing with the Independent *t*-test):

1. What's the independent variable and level of measurement? **Treatment (nominal level of measurement)**
2. What's the dependent variable? **Anxiety change score (ratio level of measurement)**
3. State the Null Hyphothesis (H_O): **There is no difference in the change scores of the two groups.**
4. State the Alternative Hypothesis (H_A): **The treatment will result in decreased anxiety for the experimental group compared to the treatment group. (One-tailed hypothesis).**
5. Select the appropriate statistical test and alpha level: **Independent *t*-test, alpha = .05**.
    a. In SPSS, click **Analyze, Compare Means, Independent-Samples T Test…**
    b. Move "difference" variable to **Test Variable** box
    c. Move "Experimental vs. TAU" variable to **Grouping variable** box. Click **Define groups**, and enter 1 for **Group 1:** and 2 for **Group 2:** then click **Continue**
    d. See Output screen (remember to scroll down to bottom for most recent output!)
6. Review SPSS table of results: see next page

7. Describe results and decision to accept or reject Null

The first table shows each group's N, mean, standard deviation and standard error of the mean for the variable "change". The experiment group mean is lower (-1.72) than the TAU group, in the direction we hypothesized (lower scores indicate lower anxiety). The next table shows the test results. **What is "Equal Variances Assumed"?** The table gives two different options for *t* statistics and *p* values. This has to do with whether or not the variances of the two groups are the same. There are different *t*-test formulas for both scenarios. This is a separate test, Levene's Test, for "equal variances"with its own statistic and *p* value. For now let's stick with the first set of results.

The *t* value is -2.671. "Degrees of freedom" is interpreted just like the Chi Square degrees of freedom, except the calculation is different. The *p* value is *p* = .012. Since this is less than our alpha of .05, we can *reject the null* that states the groups' difference scores are the same. They are indeed different! Note: the *p* value is shown as "Sig. (2-tailed)." Even though our alternative hypothesis is one-tailed, the *t* test tests the Null of "no difference", and since the means go in the direction of our one-tailed alternative hypothesis (see the Group Statistics box in the output), we can still reject the Null with these results. *You need both types of information—the p value from* *the t test, and the actual means—to test your hypotheses.*

The 95% Confidence Interval of the Difference shows the range of possible *t* statistics that could exist in several samples drawn from the population of “change” scores. So, we can be 95% sure that the *true population mean* of “change” scores would fall within this range.

8. Discuss results, implications

“The experimental treatment has been shown to be effective in a randomized trial, since we can reject the Null Hypothesis of no difference between the change scores from pre- to post-treatment. The experimental treatment results in lower anxiety scores, $p < .05$. The implications for practice are that the experimental treatment may be effective in community settings, however, further implementation research should be conducted with the types of diverse populations seen in those settings.”

```
GET
  FILE='C:\Documents and Settings\ecohen\My Documents\Complete_use these first\242 analys
is\labs\independent group t test example.sa
   v'.
DATASET NAME DataSet1 WINDOW=FRONT.
COMPUTE Change=Post_anxiety-Pre_anxiety.
VARIABLE LABELS  Change 'Change score'.
EXECUTE.
T-TEST GROUPS=Treatment(1 2)
  /MISSING=ANALYSIS
  /VARIABLES=Change
  /CRITERIA=CI(.9500).
```

T-Test

```
[DataSet1] C:\Documents and Settings\ecohen\My Documents\Complete_use these first\242 ana
lysis\labs\independent group t test example.sav
```

Group Statistics

	Experimental vs. TAU group	N	Mean	Std. Deviation	Std. Error Mean
Change score	Experment	15	-1.7247	2.13187	.55045
	Treatment as usual	15	-.1021	.99652	.25730

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Change score	Equal variances assumed	3.399	.076	-2.671	28	.012
	Equal variances not assumed			-2.671	19.839	.015

Independent Samples Test

		t-test for Equality of Means			
				95% Confidence Interval of the Difference	
		Mean Difference	Std. Error Difference	Lower	Upper
Change score	Equal variances assumed	-1.62267	.60761	-2.86731	-.37803
	Equal variances not assumed	-1.62267	.60761	-2.89079	-.35455