Paired-Sample T-Tests in SPSS

Eight samples of effluent from a pulp mill were each divided into ten batches. From each sample, five randomly selected batches were subjected to a treatment process intended to remove toxic substances. Five fish of the same species were placed in each batch, and the mean number surviving in the five treated and untreated portions of each effluent sample after five days were recorded and are given below. Test to see if the treatment increased the mean number of surviving fish. (Use $\alpha = 0.01$.)

Sample No.	1	2	3	4	5	6	7	8
		Mean	Numb	er Surv	viving			
Untreated	5	1	1.8	1	3.6	5	2.6	1
Treated	5	5	1.2	4.8	5	5	4.4	2

1. Enter the values for "Untreated" into one variable and values for "Treated" into another variable *(see left figure, below)*. Be sure the pairings are correct from row to row. Now select "Compute Variable" from the "Transform" menu. Name the target variable "diff" and create the Numeric Expression "treated" minus "untreated". After selecting "OK," the computed differences will appear in the Data Window *(see left figure, below step 3)*. Be sure to create a Normal Q–Q Plot to assess the normality of the created differences *(see separate handout on Normal Q–Q Plots)*.

			Target Variable: Numeric Expression:
			diff = treated - untreated
		Transform Analyze Graphs Utilities Add-ons	Type & Label
		Compute Variable	Vuntreated [untreated]
ated	treated	Count Values within Cases	√ Treated [treated]
5.0	5.0	Recode into Same Variables	* = *= 123 Conversion
1.0	5.0	Recode into Different Variables	Z & O. Date Arithmetic Date Arithmetic
1.8	1.2	Automatic Recode	Date Extraction
1.0	4.8	V Visual Binning	Functions and Special Variables:
3.6	5.0	P Rank Cases	
5.0	5.0	Date and Time Wizard	
2.6	4.4	h Create Time Series	
1.0	2.0	Replace Missing Values	
		Random Number Generators	If (optional case selection condition)
		Run Pending Transforms Ctrl+G	OK Paste Reset Cancel Help

Compute Variable

- 2. Select Analyze \rightarrow Compare Means \rightarrow One-Sample T Test... (see middle figure, below).
- 3. Select "diff," and then click the arrow button to enter it as the test variable. Click the "Options…" button and enter the appropriate confidence level (98%), if needed. Click "Continue" to close the options and then click "OK" (see the 2 right figures, below).

	untreated	treated	diff
1	5.0	5.0	.0
2	1.0	5.0	4.0
3	1.8	1.2	6
4	1.0	4.8	3.8
- 5	3.6	5.0	1.4
6	5.0	5.0	0.
- 7	2.6	4.4	1.8
8	1.0	2.0	1.0
0			

untre

Reports Descriptive Statistics Tables)))	 Image: Image: Ima
Compare Means	•	Means
General Linear Model	×	One-Sample T Test
Generalized Linear Models	•	Independent-Samples T Test
Mixed Models	•	Paired-Samples T Test
Correlate	•	One-Way ANOVA
Regression	÷	
Loglinear	•	
Classify	۲	
Data Reduction	۲	
Scale	•	
Nonparametric Tests		
Time Series	•	
Survival	Þ	
Multiple Response	۲	
Missing Value Analysis		
Ouality Control	•	
ROC Curve		
	-	1

✓ Untreated [untreated] ✓ Treated [treated]	Test Variable(s):	= treate OK Past Resi Canc
One-Sample T 1	Test Value: 0	

4. Your output should look like this.



5. You should use the output information in the following manner to answer the question.

Let the differences be computed as "Treated" minus "Untreated."

- <u>Step 0</u>: The data is approximately normal since the points lie close to the diagonal line in the Normal Q-Q Plot.
- Step 1: Hypotheses

$$H_0: \mu_d = 0$$

 $H_1: \mu_d > 0$

Step 2: Signific $\alpha = 0.01$

Step 3: Rejection Region

Since we have paired data and don't know the population variance of the differences (σ_d^2) , we'll use the paired *t*-test.

Reject the null hypothesis if p-value ≤ 0.01 .

Step 4: Test Statistic

One-Sample Test



From the output, T = 2.3407 with 7 degrees of freedom. p-value = $Sig.(2 - tailed) \div 2 = 0.0518 \div 2 = 0.0259$

Step 5: Conclusion

Since *p*-value = $0.0259 > 0.01 = \alpha$, we fail to reject the null hypothesis.

Step 6: State conclusion in words

At the α = 0.01 level of significance, there is not enough evidence to conclude that the treatment increased the mean number of surviving fish. [Since we failed to reject the null hypothesis, no confidence interval is needed.]