



EXCEL TUTORIAL:

PAIRED SAMPLES t & WILCOXON SIGNED RANKS TESTS

Frances Chumney, PhD



parametric analysis for within-subjects designs

PAIRED SAMPLES t TEST

COMPARE MEANS (PAIRED SAMPLES t)

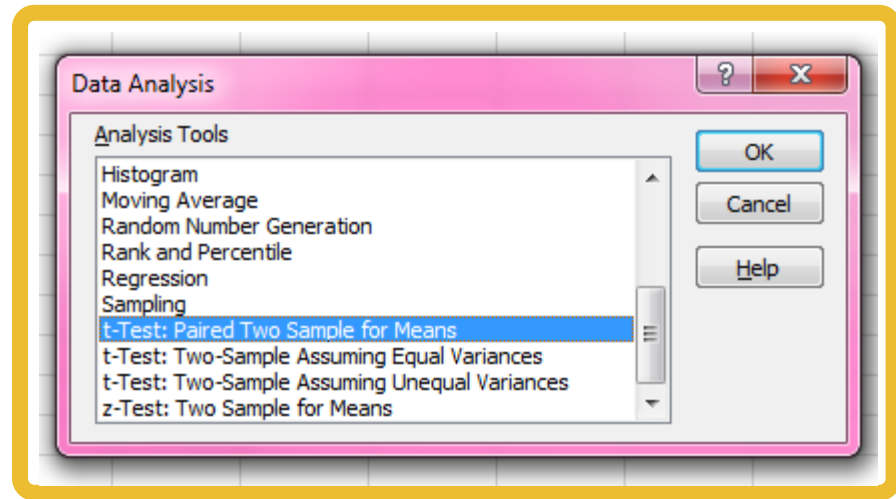
Use the *DataAnalysis* button on the *Data* tab to select the *t-Test :Paired Two Sample for Means* test, click on *OK*.

Enter the data range for the dependent variable into the *t-Test: Paired Two Sample for Means* dialogue box.

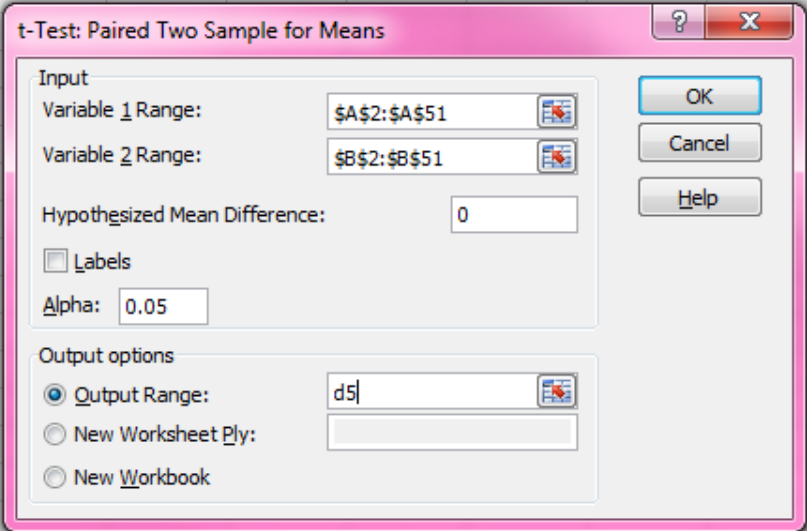
Variable 1 = cells of DV which correspond to time1/group1

Variable 2 = cells of DV which correspond to time2/group2

Specify hypothesized mean difference (H_0), alpha level, output location, click on *OK*.



	A	B	C	D	E	F	G	H	I
1	Var1	Var2							
2	0.0265	1.0170							
3	0.3856	0.6742							
4	0.2449	0.6630							
5	0.2432	1.2952							
6	0.8494	0.5053							
7	0.2441	1.2034							
8	0.6415	0.7734							
9	0.9672	0.2899							
10	0.6281	0.5307							
11	0.7345	0.4790							
12	0.8739	1.4677							
13	0.9438	1.4164							
14	0.7445	1.1199							
15	0.5067	0.7152							
16	0.8787	1.0983							



COMPARE MEANS (PAIRED SAMPLES t)

Inspect output to determine if the means are significantly different from each other.

If $p > \alpha$, t test is not significant, and null hypothesis should be retained.

t-Test: Paired Two Sample for Means		
	Variable 1	Variable 2
Mean	0.500772757	0.986656537
Variance	0.0845837	0.13479887
Observations	50	50
Pearson Correlation	0.052675192	
Hypothesized Mean Difference	0	
df	49	
t Stat	-7.530894641	
P(T<=t) one-tail	5.01483E-10	
t Critical one-tail	1.676550893	
P(T<=t) two-tail	1.00297E-09	
t Critical two-tail	2.009575237	

CALCULATE EFFECT SIZE (COHEN'S d)

Use the online effect size calculator to calculate the Cohen's d effect size for the paired samples t test statistic

<http://www.uccs.edu/~lbecker/>

Calculate d and r using means and standard deviations

Calculate the value of Cohen's d and the effect-size correlation, $r_{Y\lambda}$, using the means and standard deviations of two groups (treatment and control).

$$\text{Cohen's } d = M_1 - M_2 / \sigma_{\text{pooled}}$$

$$\text{where } \sigma_{\text{pooled}} = \sqrt{[(\sigma_1^2 + \sigma_2^2) / 2]}$$

$$r_{Y\lambda} = d / \sqrt{(d^2 + 4)}$$

Note: d and $r_{Y\lambda}$ are positive if the mean difference is in the predicted direction.

Group 1	Group 2
M_1 .9867	M_2 .5008
SD_1 .1348	SD_2 .0846
<input type="button" value="Compute"/>	<input type="button" value="Reset"/>
Cohen's d 4.3177722	effect-size r 0.9073842

nonparametric analysis for within-subjects designs

WILCOXON SIGNED RANKS TEST

COMPARE DIFFERENCE RANKS (WILCOXON)

Step 1: Calculate difference scores for the two variables

=CELL1-CELL2

	A	B	C
1	Var1	Var2	DIFFERENCE
2	0.0265	1.0170	=A2-B2
3	0.3856	0.6742	0.2886

Step 2: Calculate absolute values of difference scores

=ABS(DIFFERENCESCORE)

	A	B	C	D
1	Var1	Var2	DIFFERENCE	ABS-difference
2	0.0265	1.0170	-0.9905	=ABS(C2)
3	0.3856	0.6742	-0.2886	0.288618068

Step 3: Calculate ranks for absolute values of difference scores

=RANK.AVG(CELL,RANGE,1)

	A	B	C	D	E	F	G
1	Var1	Var2	DIFFERENCE	ABS-difference	RANK-corrected	POSITIVE	NEGATIVE
2	0.0265	1.0170	-0.9905	0.990484412	=RANK.AVG(D2,\$D\$2:\$D\$5,1)		
3	0.3856	0.6742	-0.2886	0.288618068	RANK.AVG(number, ref, [order])		
4	0.2449	0.6630	-0.4181	0.418123464		21	

COMPARE DIFFERENCE RANKS (WILCOXON)

Step 4: Create column for ranks of positive difference scores

`=IF(DIFFERENCESCORE>0,VALUE,CELL,"")`

	A	B	C	D	E	F	G
1	Var1	Var2	DIFFERENCE	ABS-difference	RANK-corrected	POSITIVEr	NEGAT
2	0.0265	1.0170	-0.9905	0.990484412	43	=IF(C2>0,E2,"")	
3	0.3856	0.6742	-0.2886	0.288618068	13	IF(logical test, [v	

Step 5: Create column for ranks of negative difference scores

`=IF(DIFFERENCESCORE<0,VALUE,CELL,"")`

	A	B	C	D	E	F	G	H
1	Var1	Var2	DIFFERENCE	ABS-difference	RANK-corrected	POSITIVEr	NEGATIVErank	
2	0.0265	1.0170	-0.9905	0.990484412	43		=IF(C2<0,E2,"")	
3	0.3856	0.6742	-0.2886	0.288618068	13		IF(logical test, [v	

Step 6: Sum positive ranks, sum negative ranks

`=SUM(RANGE)`

	F	G	H	I	J	K	L
d	POSITIVEr	NEGATIVErank					
13			43	sum positi		=SUM(F2:F51)	
13			13	sum negative ranks =		SUM(number1, [r	
11			21				

COMPARE DIFFERENCE RANKS (WILCOXON)

Step 7: Calculate sample size of ranks in positive and negative values columns

=COUNT(RANGE)

F	G	H	I	J	K	L	M
POSITIVEranks	NEGATIVEranks						
	43			sum positive ranks =	96		
	13			sum negative ranks =	1179		
	21						
	44			sample size =	=COUNT(F2:G51)		
14	**						

Step 8: Compare smaller of two ranked sum values and sample size to the *Wilcoxon Distribution Table* of critical values

sum of ranks (smaller)	96	1179
sample size	50	
p < 0.01 (obtained from critical value table)		