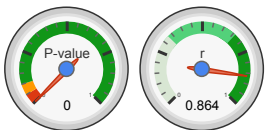# Wilcoxon Signed Rank test calculator

Reporting results in APA style

Results of the Wilcoxon Signed-Rank test indicated that there is a significant large difference between Before (Mdn = 2 ,n = 56) and After (Mdn = 4 ,n = 56), Z = 5.8, p < .001, r = 0.9.

Parameter	Value
P-value	6.901e-9
Surprisal (S-value)	27.1106
Effect Size (r)	0.8636
Z	5.7933
W, (W-, W+)	11, (11, 1024)
Number of pairs (N)	56
Non-zero difference pairs (n)	45
Ties Correction	220.125
S.E	87.342
Average of differences ($\bar{x}_d$)	1.6786
SD of differences (S_d)	1.252
Normality p-value	0.0004918
Skewness	-0.3363
Skewness Shape	Potentially **Symmetrical** (pval=0.292)
Excess kurtosis	-0.7532
Kurtosis Shape	Potentially **Mesokurtic**, normal like tails (pval=0.231)
Outliers	

Wilcoxon Signed-Rank-test, using Z distribution (two-tailed)

[Validation]

Because the data contains ties, equal differences (C_{ties} = 220.125), we use the **normal approximation**.

1. H_0 hypothesis

Since the p-value < α, H_0 is rejected.
The population's change is considered to be not equal to the expected change (0).
In other words, the difference between the sample change and the expected change is big enough to be statistically significant.

2. P-value

The p-value equals **6.901e-9**, (P(x≤5.7933) = 1). It means that the chance of type I error (rejecting a correct H_0) is small: 6.901e-9 (6.9e-7%). The smaller the p-value the more it supports H_1.

3. Test statistic

W can get values in the following range:[0, 1035]
W+ = 1024, W+ ~ $N(517.5, 87.342^2)$.
The test statistic **Z** equals **5.7933**, which is not in the 95% region of acceptance: [-1.96, 1.96].

4. Effect size

The observed effect size **r** is **large**, **0.86**. This indicates that the magnitude of the difference between the mean ranks is large.

The observed **common language effect size** is **0.011**, this is the probability that a random value from **Before** is greater than a random value from **After**.

If you like the page, please share or like. Questions, comments and suggestions are appreciated. (**statskingdom@gmail.com**)

All series on a given axis must be of the same data type ✖

Significance level (α)

W statistics

Averages and Medians

Histogram of the differences
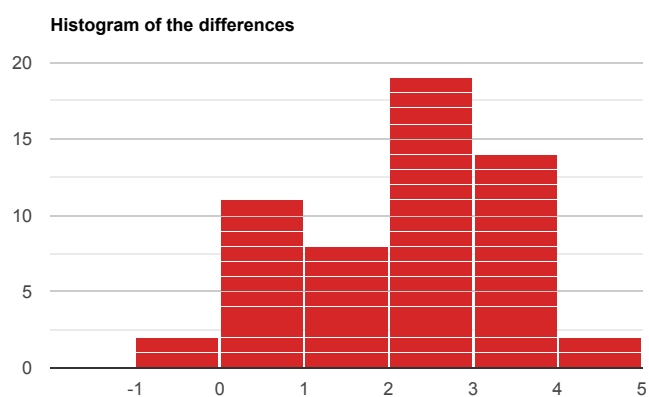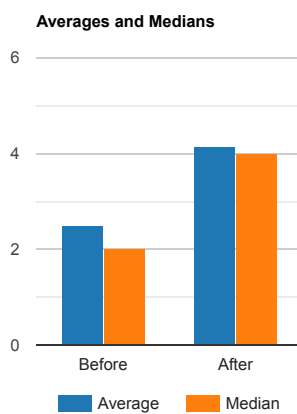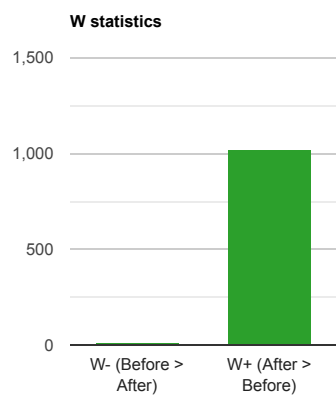
Validation

The data doesn't meet all the Wilcoxon signed-rank assumptions.

○ **Sample size**

The number of pairs with a non-zero difference is **45**.
For the normal approximation you usually need at least sample size 16.

○ **Outliers**

Outliers' detection method: Tukey Fence, k=1.5.
The data doesn't contain outliers.Outliers have **minimal impact** on non-parametric tests and can be optimal for outlier-rich data, yet identifying the cause of outliers is important as they may suggest a normal data distribution.

○ **Normality**

Normality is **not** an assumption for the Wilcoxon Signed-Rank test! We only check for normality to determine if a better test could be used. Normality was assessed using the Shapiro-Wilk Test with a significance level of α=0.05
When this test was run on the differences, the resulting p-value was **0.0004918**. It is assumed that the data distribution is not normal. In other words, the difference between the data sample and the normal distribution is big enough to be statistically significant.
Since the number of pairs is bigger than 29 (which is a general guideline), you can use the **paired t** test, which is considered a more powerful test than the Wilcoxon Signed-Rank test.