INFORMATION POINT:

Wilcoxon Signed Rank Test

The Wilcoxon signed rank test, also known as the Wilcoxon matched pairs test, is a non-parametric test used to test the median difference in **paired data**. This test is the non-parametric equivalent of the paired *t*-test. The distinction between parametric and non-parametric techniques is discussed by Crichton (1998). The main difference is that parametric techniques make distributional assumptions, usually that data follow a normal distribution.

Paired data means that the values in the two groups being compared are naturally linked, and usually arise from individuals being measured more than once. For example, if Patient A has their symptoms measured before and after treatment, then the before measurement is naturally paired with the after measurement. They certainly cannot be considered independent, because characteristics of Patient A will affect both measurements. In studies that gather before and after measurements like this, interest focuses on the difference between the observations for each individual.

To carry out the test we calculate for each patient the difference between their before and after measurements. We then rank the differences by their absolute value, that is ignoring the sign, giving 1 for the smallest difference, 2 for the next smallest and so on. Then we sum the ranks of the positive differences and sum the ranks of the negative differences. The test statistic is the lesser of these two sums. If the null hypothesis were true and there was no difference, then we would expect the rank sums for positive and negative ranks to be the same. Further detail about the calculation and interpretation of the Wilcoxon signed rank test can be found in Bland (1995) and Conover (1980).

The test is based on the magnitude of the difference between the pairs of observations. Since we have to calculate the difference, the actual data values must be measured on an interval scale, as is required for the *t*-test. However, for a *t*-test to be valid we also need to make the distributional assumption that the differences follow a normal distribution. This distributional assumption is avoided in the Wilcoxon signed rank test, because the test is based on the rank order of the differences rather than the actual value of the differences. However, it is still necessary to make an assumption that the distribution of the differences is symmetric.

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Further reading

Bland J.M. (1995) *An introduction to medical statistics*. 2nd edn. Oxford University Press, Oxford. pp. 212–215.

Conover W.J. (1980) *Practical nonparametric statistics*. 2nd edn. John Wiley and Sons, New York. pp. 278–292.

Crichton N.J. (1998) Statistical considerations in design and analysis. In: *Research and development in clinical nursing practice*. (Roe B. & Webb C., eds). Whurr, London. p. 209.