

Alternatives to t -tests with Matched Pairs (Sign test & Signed-rank test)

Recall when we had matched pairs (Y_{1i}, Y_{2i}) (*i.e.*, first observation Y_{1i} was naturally matched with a second Y_{2i}), we used a t -test to examine

$H_0 : \mu = 0$ (no difference on average, no treatment effect)

$H_a : \mu \neq 0$ (some difference)

$\mu =$ **mean difference** $Y_{1i} - Y_{2i}$ over all possible pairs in the population
(with observational studies)

or

$\mu =$ **mean difference** in two treatment responses over all experimental units
(with experiments)

Sign test & Signed-rank Tests:

As alternatives to the t -test with matched pairs (if, say, there are outliers), we may use the *Sign test* or the *Signed-Rank Test*.

- The sign test is easy to do but usually inefficient.
- If results from the sign test are inconclusive, try the signed-rank test.
- On a technical note, sign and signed-rank tests are formulated in terms of

$M =$ **median difference** $Y_{1i} - Y_{2i}$ over all possible pairs in the population

or

$M =$ **median difference** in two treatment responses for all experimental units

- We usually test

$H_0 : M = 0$ (“overall” no difference in responses)

$H_a : M \neq 0$ (some difference in responses)