

Chapter 19

Duplicate Standard Deviation for Reliability Assessment of Continuous Data

The reliability, otherwise called reproducibility of diagnostic tests is an important quality criterion. A diagnostic test is very unreliable, if it is not well reproducible.

Example 1

Test 1	Test 2	Difference	(Difference) ²
Result			
1	11	-10	100
10	0	10	100
2	11	-9	81
12	2	10	100
11	1	10	100
1	12	-11	121
Mean			
6.17	6.17	0	100.3

Duplicate standard deviation = duplicate standard deviation (SD)

$$\begin{aligned}
 &= \sqrt{(1/2 \times \text{mean (difference)}^2)} \\
 &= \sqrt{(1/2 \times 100.3)} \\
 &= 7.08
 \end{aligned}$$

The proportional duplicate standard deviation%

$$\begin{aligned}
 &= \frac{\text{duplicate standard deviation}}{\text{overall mean}} \times 100\% \\
 &= \frac{7.08}{6.17} \times 100\% \\
 &= 115\%
 \end{aligned}$$

An adequate reliability is obtained with a proportional duplicate standard deviation of 10–20%. In the current example, although the mean difference between the two tests equals zero, there is, thus, a very poor reproducibility.

Example 2

Question is this test well reproducible?

Test 1	Test 2
Result	
6.2	5.1
7.0	7.8
8.1	3.9
7.5	5.5
6.5	6.6

Analysis:

Test 1	Test 2	Difference	Difference ²
Result			
6.2	5.1	1.1	1.21
7.0	7.8	-0.8	0.64
8.1	3.9	4.2	17.64
7.5	5.5	2.0	4.0
6.5	6.6	-0.1	0.01
Mean			
7.06	5.78		4.7
Grand mean 6.42			

$$\text{Duplicate standard deviation} = \sqrt{\frac{1}{2} \times 4.7}$$

$$= 1.553$$

Proportional duplicate standard deviation %

$$= \frac{\text{duplicate standard deviation}}{\text{overall mean}} \times 100\%$$

$$= \frac{1.533}{6.42} \times 100\%$$

$$= 24\%$$

A good reproducibility is between 10% and 20%. In the above example reproducibility is, thus, almost good.