Reliability

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Objectives

- Defines reliability and distinguish among the various types.

- Explores ways of establishing reliability and how it can be reported using descriptive and statistical meth

Reliability

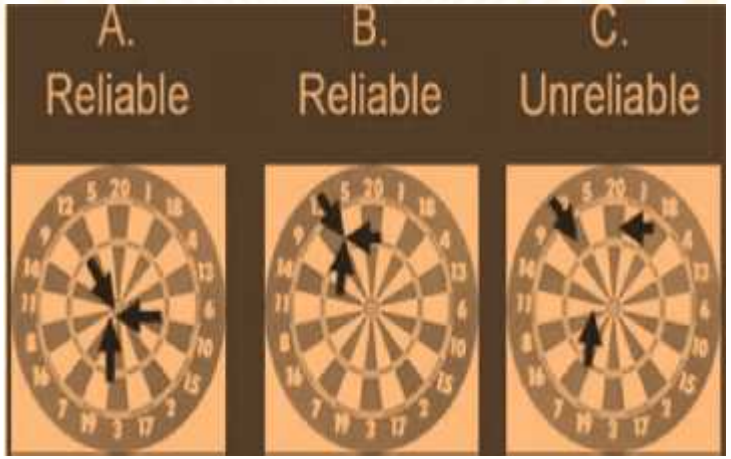
Reliability

- What is reliability and its significant ?
- Types of reliability
- Test-reteset reliability
- Internal consistency
- Parallel form reliability
- Split half reliability
- Intrarater reliability
- Interrater-reliability

Reliability analysis

- How are studies of reliability analyzed?
  - Percentage agreement and kappa
  - Coefficients
  - Intra-class correlation
  - Bland and Altman method
  - Internal consistency
  - Standard error of the measurement

Reliability and its significant



Consistency in results

RELIABILITY is the degree to which a measure is free from **Measurement Error** & CONSISTENT .

What is?

Reliability and its significant

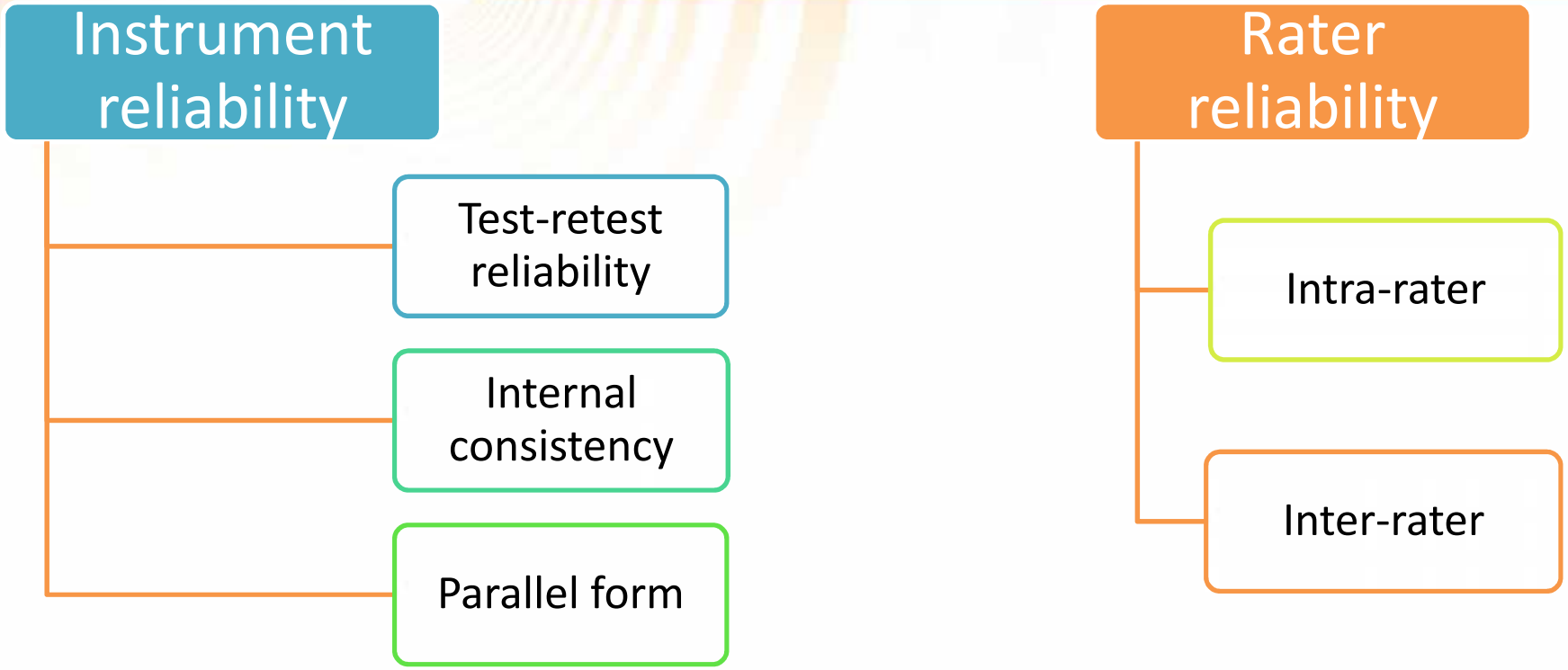
- Reliability is **“not an all-or-none”** phenomenon
- The lower the measurement error, the better the instrument estimates the true score/reliable

- The larger the sample, the more errors in measurement tend to “cancel out.”
- Significance/Necessity for Reliability:
    - Prerequisite to validity because
    - Should not base decisions on test scores that are not reliable

Reliability and its significant

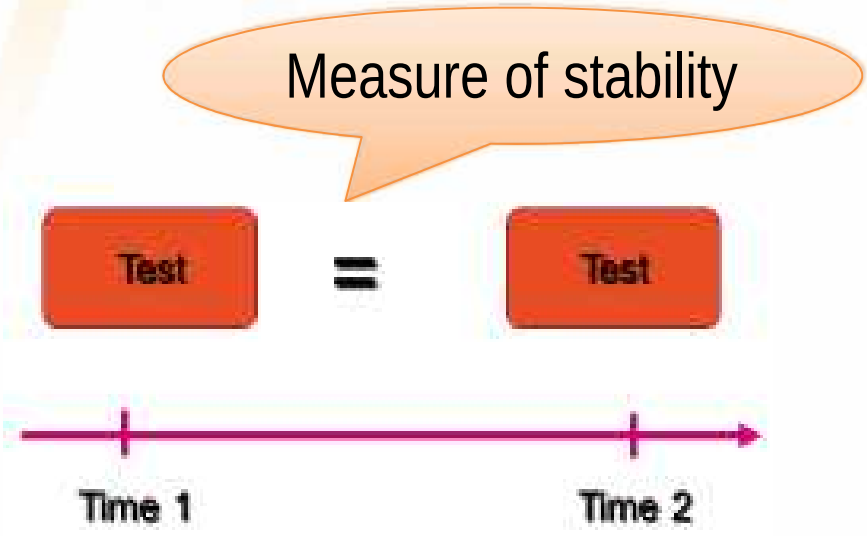
Stability	Equivalency	Homogeneity	Precisions
Consistency across time Test-retest Reliability	Consistency between observers Interrater/intrarater Reliability Consistency between instrument Parallel form reliability	Consistency between items measures the same concept Internal consistency reliability	= Stability + Equivalency + Homogeneity

Types of Reliability



Test-Retest Reliability

- Same raters/observers
- Same groups/individual
- Used same Instrument
- At two different times.



Monitor changes following treatment

Test-Retest Reliability

Issues should considers for test-retest reliability:

- Subject attrition between testing.
- Time laps to measures reliability (2days -4weeks)
  - Longer the time gap, the lower the test-retest reliability (construct my be change)
  - Shorter the time gap, the higher the test-retest reliability (memorization/recall)
  - Traits and actual change in health of over time

- Motivation/ fatigue
- Learning /practice effect (e.g. performance test)

- A single examiner can duplicate the results
- Interclass correlation coefficient (ICC) is the most frequently used to estimate test–retest reliability (group comparisons, ICC ≥ 0.7; individuals comparisons, (ICC ≥0.9)

Internal Consistency Reliability

Internal consistency describes the extent to which all the items in a test measure the same concept or construct. (correlation of test with itself).

It is most commonly associated with PROs (paper & pencil test)

Internal consistency is concerned with the interrelatedness of a sample of test items, whereas homogeneity refers to unidimensionality (measure a single latent trait or construct).

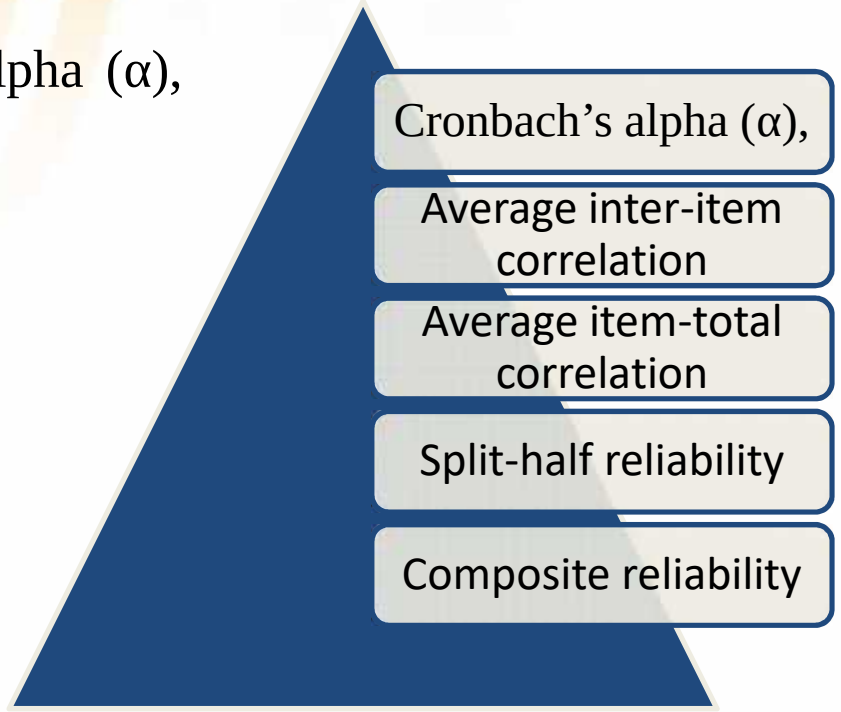
Internal consistency should be determined before a test can be used for research or examination purposes to ensure validity

Internal Consistency Reliability

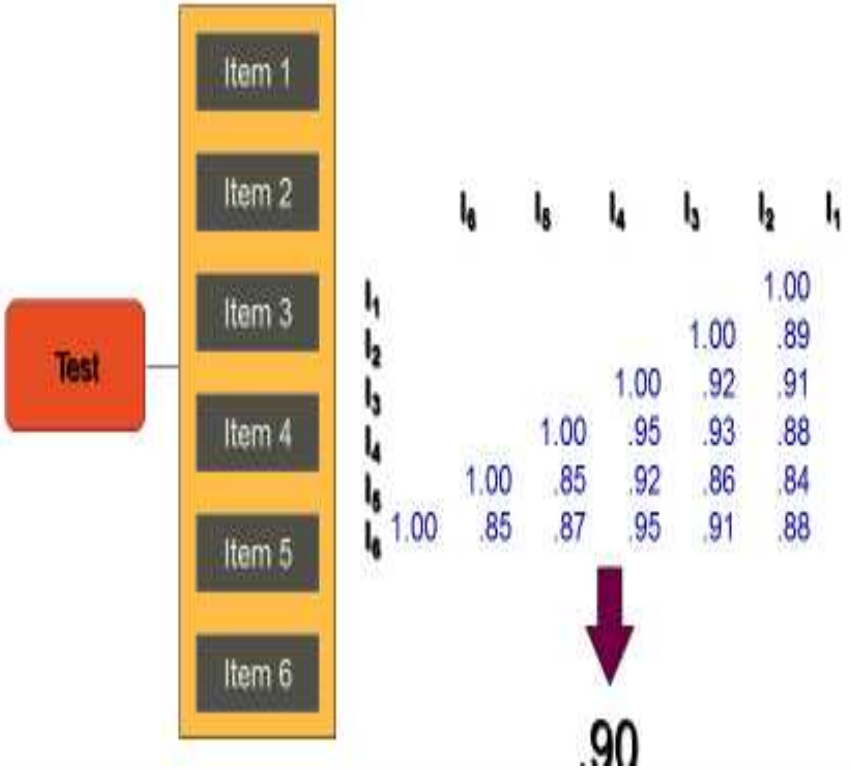
Internal consistency

Frequently evaluated with Cronbach's alpha (α), generally acceptable at values of 0.7-0.9.7

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable



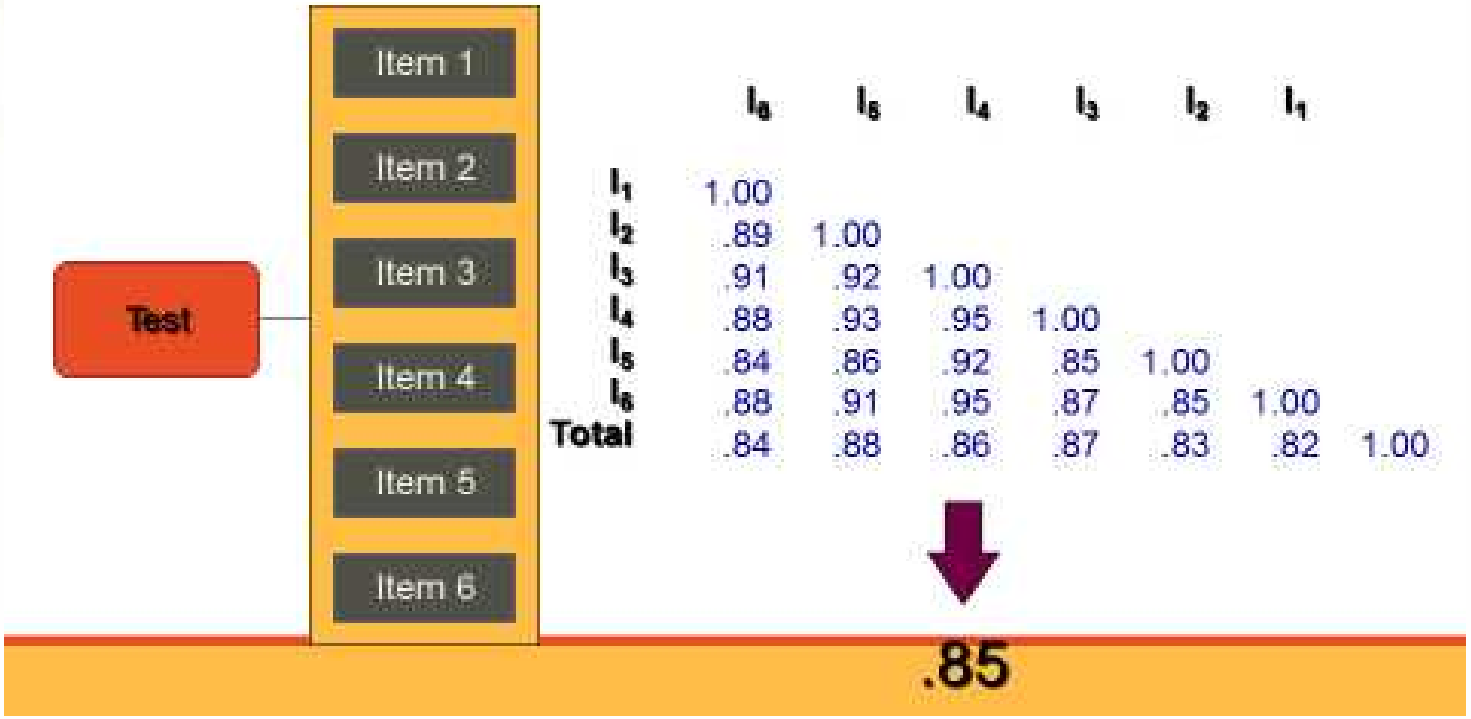
Average inter-item correlation



Inter-item correlations examine the extent to which scores on one item are related to scores on all other items in a scale.

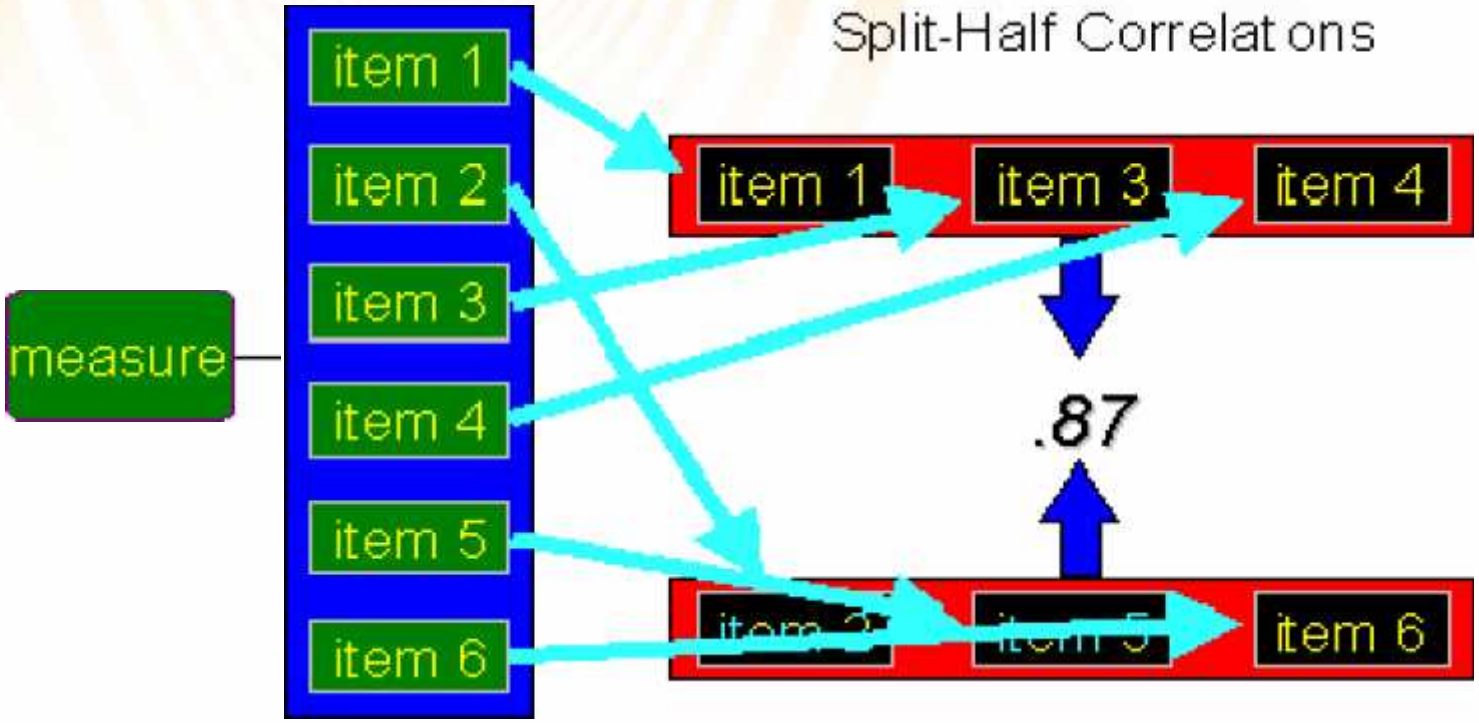
It provides an assessment of item redundancy: the extent to which items on a scale are assessing the same content

Average item-total correlation



	I_6	I_5	I_4	I_3	I_2	I_1	
I_1	1.00						
I_2	.89	1.00					
I_3	.91	.92	1.00				
I_4	.88	.93	.95	1.00			
I_5	.84	.86	.92	.85	1.00		
I_6	.88	.91	.95	.87	.85	1.00	
Total	.84	.88	.86	.87	.83	.82	1.00

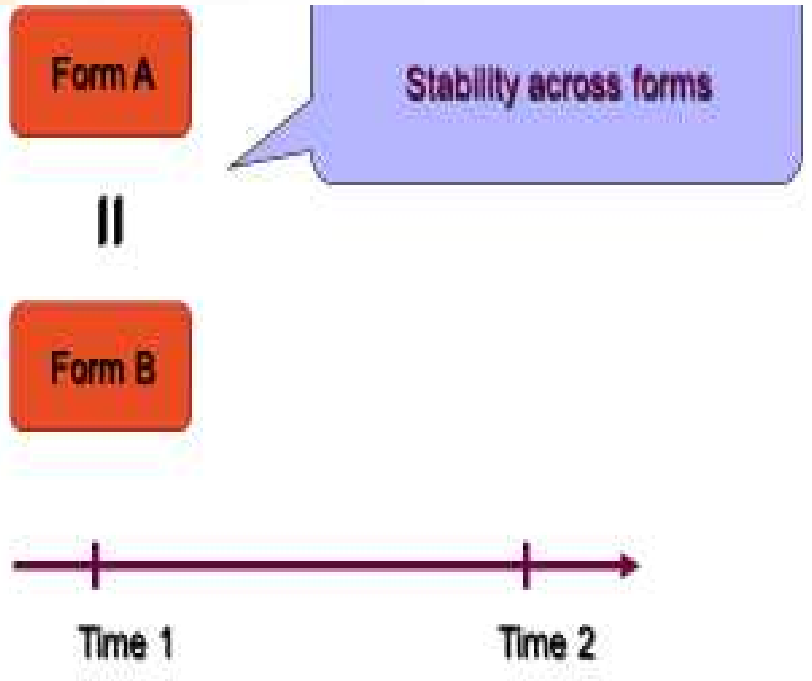
Split-half reliability



Parallel Test Reliability

- Used when development of multi-item parallel tests (alternative-form tests) is desirable.

- Parallel tests can be created by randomly selecting two sets of items from a tested item pool.



Parallel Test Reliability

Advantage

- Eliminates the problem of memory effect.
- Reactivity effects (i.e., experience of taking the test) are also partially controlled.

Disadvantage

- Are the two forms of the test actually measuring the same thing.
- More Expensive
- Requires additional work to develop two measurement tools.

Interrater and Intrarater Reliability

Rater reliability

Intra-rater

- Assesses the consistency of the same rater measuring on two or more occasions, blinded to the scores he or she assigned on any previous measurements.

Inter-rater

- Assessment involves having two or more observers independently applying the same instrument with the same people and comparing scores for consistency.

Inter-Rater Reliability

There are a number of statistics that have been used to measure interrater and intra-rater reliability.

- A percent of agreement
- Cohen's kappa (for two raters),
- Adaptation of Cohen's kappa (3 or more raters)
- Pearson intra-class correlation coefficient
- **Spearman** intra-class correlation coefficient

Factors Affecting Reliability

1) **Lengthen of test (Number** of items) (the more questions, the higher the reliability)

2) Item **difficulty** (moderately difficult items lead to higher reliability, e.g., p-value of .40 to .60)

3) **Homogeneity/similarity** of item content (e.g., item x total score correlation; the more homogeneity, the higher the reliability)

4) Scale format/number of response **options** (the more options, the higher the reliability)

Exercises -1-

- Place the letter of the type of reliability listed in the left-hand column next to the term that best matches it in the right-hand column:

Types of Reliability	Related Terms
A. Test-Retest	___ Used when multi-item tests are needed that measure same the construct.
B. Parallel Test	___ Assesses responses from the same scorer at different times.
C. Interrater	___ Stability, Reproducibility.
D. Intrarater	___ Assesses responses from different scorers.

Designing a Reliability Study

Study Design	Types of reliability	*Timing of Measurements*	Target Population / sampling	Other Design Issues
?????	Test-Retest Parallel Test Interrater Intrarater Internal consistency	Simultaneity Interrater reliability interval for PRO 1-2wks Physical performance Short interval	Sample recruitment Sample characteristics A sample size of 50 is adequate in most reliability studies 3-5 participants /item	• Blinding. • Training. • Attrition. • Random ordering of items or subscales.

Exercises -2-

Checking the attached files and answer the following

- Describe the scale/instrument /questionnaire used , timing of measurement, target population and sampling types of included reliability and how they are assessed and interpreter

Exercises -2-

- Validity and Reliability of the Chronic Respiratory Disease Questionnaire in Elderly Individuals with Mild to Moderate Non-Cystic Fibrosis Bronchiectasis Respiration 2015;90:89–96

- Reliability and validity of 4-metre gait speed in COPD, European Respiratory Journal 2013 42: 333-340;

Exercises -2-

- Reliability of Ashworth and Modified Ashworth Scales in Children with Spastic Cerebral Palsy BMC Musculoskeletal Disorders 2008, 9:44

- Reliability and validity of the Chinese version of the pediatric quality of life inventoryTM (PedsQLTM) 3.0 neuromuscular module in children with Duchenne muscular dystrophy Health Qual Life Outcomes. 2013; 11: 47.