PRECISION AND VALIDITY

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- Lecture objectives:

1- To clarify the concepts of validity and precisions.

2- To demonstrates related terms.

3- To verify how to ensure and estimate each.

PRECISION AND VALIDITY

- Both are concepts used to evaluate the quality of research.
- They indicate how well a research, method, technique or test measures something.
- Precision means how consistent the results are.
- Validity means how accurate the results are.
- Reliability is the agreement between 2 efforts to measure the same trait through maximally similar methods.
- Validity addresses the question, how close is the **measured value** to the **true value**?

PRECISION (الدقة)

Refers to the degree to which the results obtained by a measurement and procedure or research can be replicated or reproduced when it is repeated under the same condition

SYNONYMS:

- Reliability

- Consistency

- Replicability, Repeatability.

- Reproducibility

- Agreement

What's the difference between reproducibility and replicability?

- **Reproducibility and replicability** are related terms.

- **Reproducing** research entails reanalyzing the existing data in the same manner.

- **Replicating** (or **repeating**) the research entails reconducting the entire procedure, including the collection of new data, and analysis.

Precision (الدقة)

A very precise measurement is a one that has nearly the same value each time it is measured. <u>A scale measurement is more precise than a qualitative one.</u>

The more precise a measurement the greater the statistical power.

Precision is usually affected by random errors, there are 3 sources of errors:

✳ **Subjective:- subject variability due to intrinsic biological variability ex.: fluctuation in mood, B.Pr., heart rate…**

✳ **Observer:** divergence between observers… **hand-eye coordination**

✳ **Instruments: divergence of** instruments of measurement … **due to fluctuating** or instability of the attribute in **environmental factors such as temperature, background noise,…**

Strategies For enhancing precision:

Through decreasing random errors, and this is done by:

1- Standardizing the measurement method.. Why?

2- Training & certifying the observer

3- Refining the instruments or maneuver.

4- Automating the instruments

5- Repetition: impact of random error of any source can be reduced by:

repeating measurement .. using mean of the two or more readings

There are types of reliability. Each estimated by comparing different sets of results.

- - Test-Retest Reliability.

- - inter-rater Reliability

- - Internal Consistency Reliability

Dividing an instrument into 2 equivalent halves and correlating the scores of each half. Determining how all items of an instrument relate to all other items and to the overall instrument.

ASSESSING PRECISION STATISTICALLY

- **Using S. D.**

- **Using Coefficient of variance. or correlation coefficient r2**

- **Using Kappa statistic**

- **Using Cronbach's alpha**

- How to manage the precision ?

(الضبط) VALIDITY (ACCURACY) CONFORMITY

- The degree to which a data collection instrument "accurately" measures what it is supposed to measure for a particular study.

- Validity includes the appropriateness and meaningfulness of the specific inferences a researcher makes on the basis of the data the researcher collects.

- Validity is a function of "SYSTEMATIC RROR" **??**

Noting that validity .....

- **Is attributed to:**
  - **Methodological aspect of study design or analysis**
  - **Selection of subject**
  - **Quality of information obtained**
  - **Confounding**
  - **Misclassification**

Accuracy is affected by systematic errors (bias).

 there are 3 main sources of bias:

1- **Subjective: Co-operation, re-call..**

2- **observer:** *he gave the question in different manner. OR he understood the answer in different manner consciously or unconscious (bias), or….*

 3- **Instruments: which are not calibrated recently.**

Strategies for enhancing accuracy

1. Standardizing measurement methods
2. Training and certifying the observers
3. Refining the instruments or maneuver.
4. Automating the instruments
5. Making informal measures (the observer is unaware of)
6. Blinding .. HOW ??
7. Calibrating the instrument

- How vigorously to follow each of these strategies depends on feasibility and cost of the strategy

TYPES OF VALIDITY

- *Content validity*: evaluates how well a test measures all the aspects of a topic.

- *Internal validity*: the tool measured what intended to measure precisely and accurately.. So reach to real association

- *External validity:* How accurately the measures obtained from the study sample described the reference population from which the study sample was drawn. … So generalizability of the results ..

HOW RESEARCH VALIDITY BE ASSESSED ?

- Validity is harder to assess than reliability, but more important ..

- It can be estimated by comparing the results to gold standard test, measure, or other established relevant data or theory of the same concepts, OR experts assessment.

ENSURING VALIDITY… HOW?

1. choose appropriate methods of measurement technique with high quality to measure exactly what you want to measure..(standardized questionnaire, high carefully and precisely instruments).

2. Use appropriate sampling methods, enough and representative sample to produce valid generalizable results.

3. Valid methods of data collection .. Valid data analysis .. this ensures that the conclusions you draw are also valid …

4. Means the results corresponds to real properties, characteristics and variations in the physical or social world … SO … WHAT ??

	Precision	Accuracy
Definition	Refers to the degree to which the results obtained reproduced when it is repeated under the same condition	The extent to which the results really measure what is suppose to measure.
Best way to assess	Comparison among repeated measures	comparison with a reference standard
threatened by	Random error(chance) subjective, observer, instrument.	systematic error (bias) Subjective, observer, instrument.
Value to study	Increase power to detect effects	Increase validity of conclusions

Does a reliable measurement is always valid??

- Though <u>reliability importantly contributes to the validity</u> of a questionnaire, it is however not a sufficient condition for the validity of a questionnaire.

- A reliable test is not always valid… <u>but if not reliable it probably not valid …</u> if thermometer is malfunctioning and give different result in a same patient therefore its measurements are not valid.

- A valid test is generally more or less reliable.

To achieve a high standard (valid, reliable) study:

→ Ensure right answers to study questions

→ Good the study design

→ Valid and reliable the measurements

→ Control for any possible bias (careful conduction)

→ Good cooperation between
     * research group and
     * study population