Codes, Scores and scales:

Codes: giving a code 1,2,3, ex.:

1- Not diabetic

2- Type I DM

3- Type II DM.

Scores: ex. how important are these items for maintaining health?

HEALTHY FOOD				
	1	2	3	4
Drinking a lot of water	1	2	3	4
Practicing exercise	1	2	3	4

Types Of Scales

Summative (Likert) scale:

To rate the respondent's attitudes ….

ex. For each item mark your opinion :

Neurotic type of mental health problem is very prevalent:

Strongly agree Agree Neutral Disagree Strongly disagree

OR

Agree Neutral Disagree

Ex. To what extent the information obtained from the web based resources are useful to you?

1- Unsatisfied ,, 2- Somewhat satisfied ,, 3- Neutral ,,

4- Satisfied ,, 5 Extremely satisfied

Cumulative (Guttman) Scale:

ex. circle the letter of every statement that you agree:

A. smoking can cause illness.

B. Smoking is an important cause of illness

C. smoking is a very important cause of illness

D. smoking is the most import. cause of illness

Reliability and validity

Prof. Dr. Maha Al-Nuaimi

- ***One must follow all the basic guidelines and methods of constructing a questionnaire and test it before using it. Why ??***
- **The quality of the inferences, depend on the quality and appropriateness of the "questions", (questionnaires or interviews schedule) i.e; Which will reflect in the validity and reliability of the study.**

Lecture objectives:

1. The concept of validity and reliability
2. Different types of validity & reliability
3. Factors affecting the reliability & validity
5. How to enhance and assess validity & reliability.

Reliability and validity

- Both are concepts used to evaluate the quality of a test or research.
- Both indicate how well a research, technique, instrument or test measures something.
- ***Reliability means how consistent the results are.***
- ***Validity means how accurate the results are.***
- ***Reliability*** addresses, ***how consistently***, the instrument measures what it is supposed to measure?
- ***Validity*** addresses, the how ***accurately***, the instrument measures what it is supposed to measure. OR; How close is the measured value, to the true value?

Relaibility (المصداقية)

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

SYNONYMS:

- Precision
- Consistency
- Replicability, Repeatability.
- Reproducibility
- Agreement

Precision (الدقة)

- **A very precise measurement is a one that has nearly the same value each time it is measured.**
- **A quantitative measurement is more precise than a qualitative one.**
- ***The readings, more repeated is the correct..***
- Random errors present in all experiments, the researcher should be prepared for them.
- Random errors are not predictable, difficult to detect but can be removed by averaging.

The more precise a measurement the greater the statistical power.

Precision is a function of random errors (chance), there are 3 sources of such errors:

- **Subjective:- 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… **due to fluctuating** or instability of the attribute in **environmental factors such as temperature, background noise,…**
- All will affect reliability which will invariably threats the power of the study and validity.

Strategies For enhancing precision:

Through decreasing "random errors", done by:

1- Standardizing the measurement method.. Why?

2- Training & certifying the observer

3- Refining the instruments or maneuver.

4- Automating the instruments… WHY?

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

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

Testing reliability of instrument or questionnaire.

- ***External reliability:*** ***Test-retest method.***

The consistency of a measure across time. (More common). (Kappa test).

- ***Internal reliability:*** *Is the degree to which items on an instrument are consistent among themselves and with the instrument as a whole. Either:*

✓ ***The split-half technique.*** Dividing an instrument into 2 equivalent halves and correlating the scores of each half. and

✓ ***Cronbach's Alpha.*** determining how all items of an instrument relate to all other items and to the overall instrument

- ***Example***. *Suppose you develop a questionnaire to ascertain the prevalence of domestic violence in a community. You administer this questionnaire and find that domestic violence prevalence is, 5%.*
- *If you do another survey using the same questionnaire on the same population under the same conditions, and discover that the prevalence of domestic violence is, 15%.*
- **What does this mean?**
- **It is unreliable.**

The less the difference between the two sets of results, the higher the reliability of the instrument.

The factors affecting reliability of questionnaire:

1. *The wording of questions – A slight ambiguity can affect the interpretation and the response.*
2. *The physical setting – any change in the physical setting may affect the responses & reliability.*
3. *The respondent's mood – A change in a respondent's mood may affect the reliability.*
4. *The interviewer's mood – can affect motivation and interaction of the interviewer, then reliability.*
5. *The regression effect – thereby affecting reliability.*

ASSESSING PRECISION STATISTICALLY

- **Using S. D.**
- **Using Coefficient of variance. or correlation coefficient r2**
- **Using Kappa statistic**
- **Using Cronbach's alpha (r=reliability coefficient)**

- How to control random errors in general and manage the precision in our study?

Validity

- 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 Bias"***

- **Validity, Accuracy, Conformity**

Validity

As ***inaccuracies*** can be introduced into a study at any stage, ***SO the Q is;***

Are the provided answers to the research questions, were by using appropriate methods and procedures?

Depends on validity of the research process as a whole, or to any of its steps i.e;

- **Is attributed to:**
  - **Methodological aspect of study design or analysis**
  - **Selection of subject**
  - **Quality of information obtained**
  - **Confounding, and extraneous factors, Misclassification ..**
  - **Data processing, analysis...**
  - **Inferences concluded.**

Validity

- Refers to the degree of ***closeness*** between what is measured and the true value. (comparison with the true)
- These definitions raise a key questions:
- ***Who decides whether an instrument is measuring what it is supposed to measure?***
  - ***The researcher, the experts, the readership.***

Accuracy is a function of systematic errors (bias).

there are 3 main sources of invalid results:

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

2- Observer: ***Did the test in falsely, Gave the question in differently. OR understood the answer differently, consciously or unconscious, improper Selection….***

3- Instruments: which are not calibrated well.

Types of validity

- ***Content validity***: evaluates how well a test measures all what is suppose to measure. based upon the logical link between the questions and the objectives of the study.
- ***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 ..

Validity

- *E.g: Suppose you have designed a study to ascertain the health needs of a community.*
- *You have developed an interview schedule. Most of its questions relate to the attitude towards the health services.*
- *Did your instrument, measure what it is designed to measure??*
- *Invalid instrument → Content invalid*

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
7. Calibrating the instrument

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

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 (sens. &spec. of a test), or compare the measure, or the results to other established relevant data or theory of the same concepts, OR experts' assessment in …. ??.

How questionnaire validity be assessed ?

- Requires expertise and care in their construction…
- *Ask colleagues, experts to review questionnaire considering the content and clarity. why??*

(content validity and internal validity)

It refers to the truthfulness of a measure

- *Does it measure what it intends to measure?*
- *How it will measure what intends to measure?*

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)… ??

   (Content validity)

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

   (External validity)

3. Valid methods of data collection. Valid data analysis .. this ensures a valid conclusions***… ??***

   (Internal validity) *Means the results corresponds to real properties….*

Does a reliable measurement is always valid??

- Though **reliability** importantly contributes to the validity of a test, it is independent of **validity**
- ***A very reliable test but not always very accurate***…
- ***But if not reliable it probably not valid …***
- *Thermometer is not calibrated properly (1 degree lower) it is?*

Reliable but not valid

- *If thermometer is malfunctioning (different results)it is?*

Not valid, Not reliable.

- ***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, and sample …
- Valid and reliable the measurements and tools.
- Control for any possible bias, and errors..
- Good cooperation between
  - * research group and
  - * study population

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