

Quantitative data collection

Designing a questionnaire

Training course in research methodology, research protocol development and scientific writing
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GENEVA FOUNDATION FOR MEDICAL EDUCATION AND RESEARCH

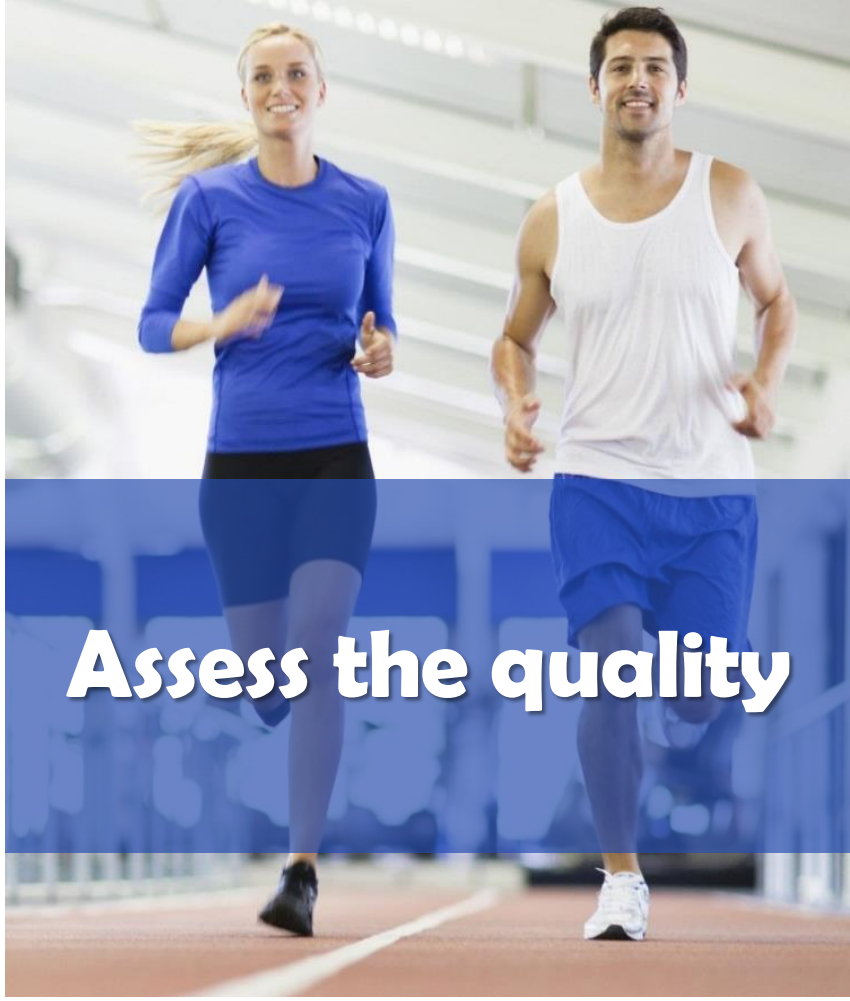
Learning outcomes

By the end of this session you should be able to:

- Conduct preparation steps to design a questionnaire
- Design a questionnaire
- Assess the quality of your questionnaire

Preparation

Designing



Assess the quality

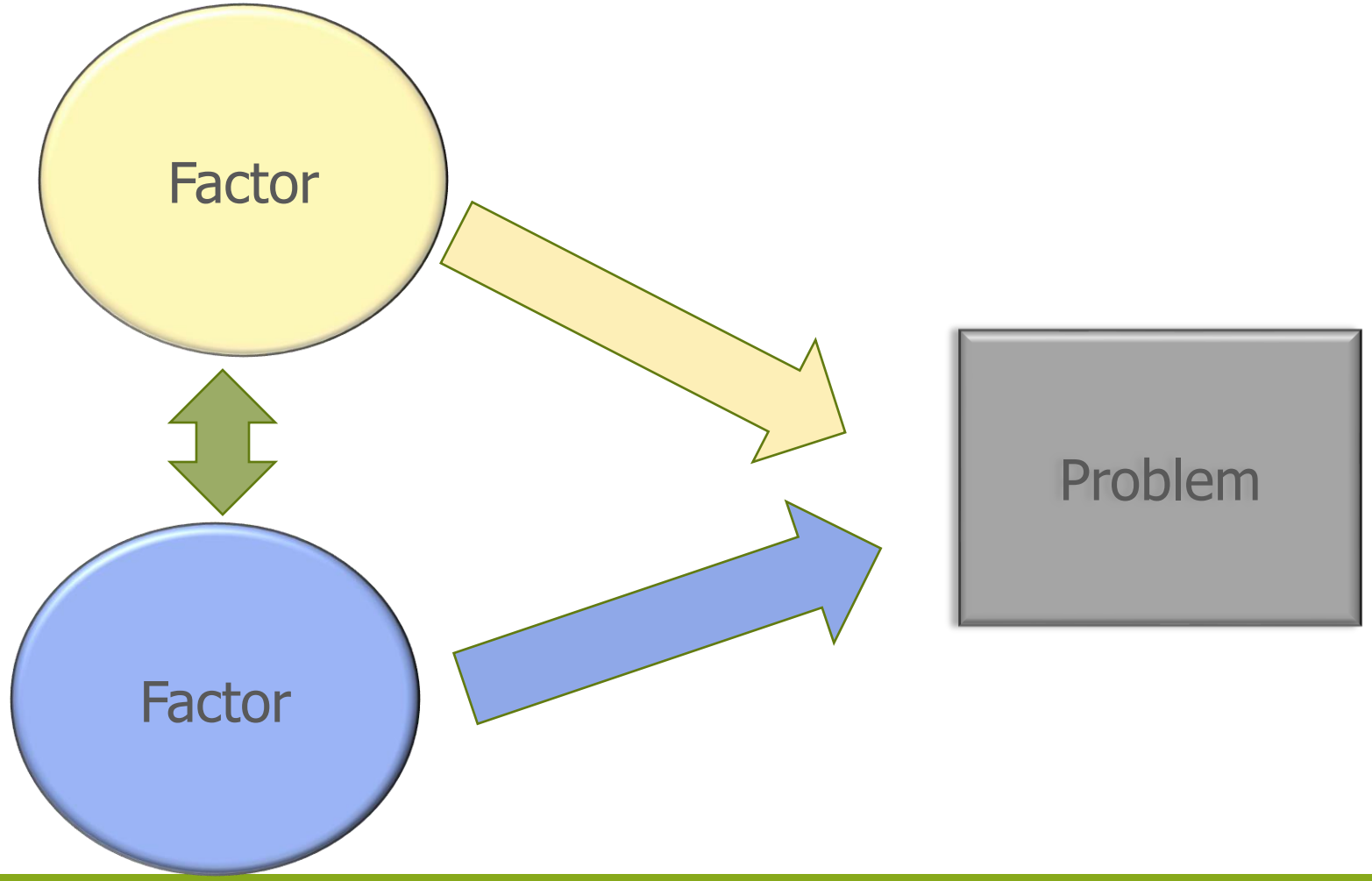
Content of this session

1. Preparation steps to design your questionnaire

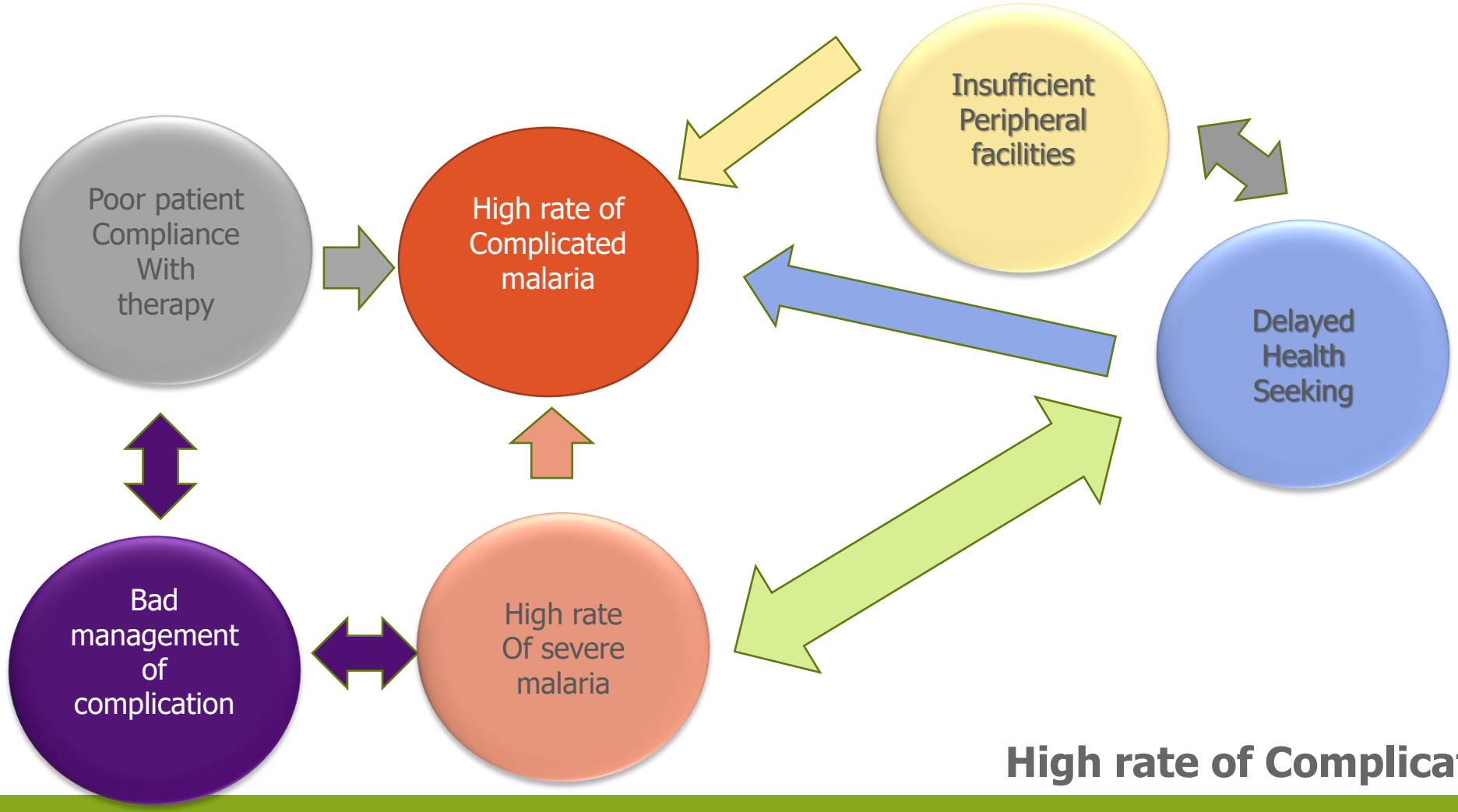
Preparation steps to design your questionnaire

- Specify and describe the core research problem
- Identify factors and their interactions with the problem.
- Draw a simplified problem diagram.
- Organize related factors into larger categories
- Identify your variables

1) Analyse the problem by identifying factors and their interactions with the problem



2) Draw a simplified problem diagram



High rate of Complicated malaria

3) Organize related factors into larger categories

- Socio-cultural
  - Delayed health seeking behaviour
  - Poor patient compliance to therapy
- Service related
  - Insufficient peripheral facilities
  - Inappropriate management of complications
- Disease related
  - High rate of severe malaria

4) Identify your variables

- Now we have come to a stage where we must ask ourselves the question:

  ‘What information are we going to collect in our study **to meet our objectives?’**

- It is essential that we carefully define the problem itself, as well as each of the factors identified when analysing the problem

- Then we formulate the variables.
  - A **VARIABLE** is a characteristic of a person, object or phenomenon which can take on different values.

Negatively phrased ‘factors’ and how they can be rephrased as neutral ‘variables’

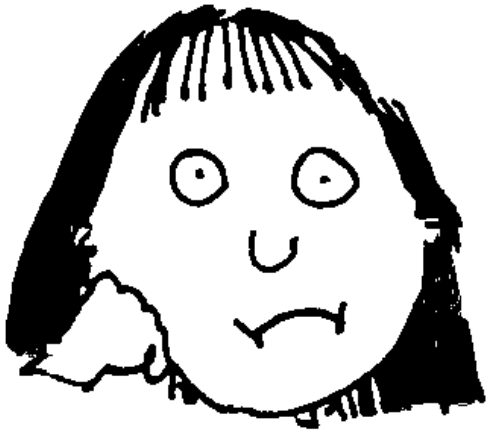
- When looking at your problem analysis diagram you will notice that most of what we called ‘factors’ are in fact variables which have negative values.

Examples of negatively phrased ‘factors’ and how they can be rephrased as neutral ‘variables’.

Negatively phrased ‘factors	Neutral ‘variables
Long waiting time	Waiting time
Absence of drug	Availability of drug
Lack of supervision	Frequency of supervisory visits
Poor knowledge	Level of knowledge

Identify your measurements

Some variables can be measured using direct measures that can be observed (**observable variables**) e.g. weight, service use rates.



Other variables (**soft outcomes**) need indirect measures and rely on interpretation (Latent variable) e.g. attitudes, confidence, knowledge, perceptions, behaviour etc

Other variables (**Latent variable** / **soft outcomes**) are not directly observed or measured but are rather need indirect measures from other variables that are observed (directly measured).

5. Operationalization

- Operationalization is the process of strictly defining Latent variable into measurable scale or index.
- The process defines fuzzy concepts and allows them to be measured, empirically and quantitatively.
- Operationalising variables means that you make them ‘measurable’
- Example:
  - Stigma
  - Burnout
  - Level of knowledge
  - Nutritional status

level of knowledge

- You would need to develop a series of questions to assess the knowledge.

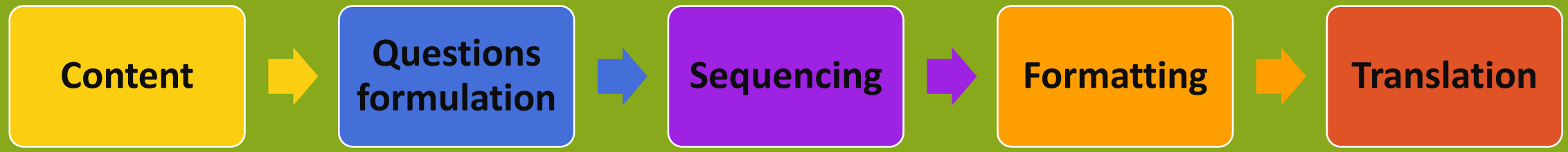
- The answers to these questions form an **scale** of someone's knowledge on this issue, which can then be categorised.

- If 10 questions were asked, you might decide that the scale of knowledge of those with:
  - 0 to 3 correct answers is poor,
  - 4 to 6 correct answers is reasonable, and
  - 7 to 10 correct answers is good.

Measurement

- Measurement is the assigning of numbers to observations in order to quantify phenomena.
- In health care, phenomena such as Quality of Life, patient adherence, burnout, stigma, perception, attitude, are abstract concepts known as theoretical constructs
- Measurement involves operationalization of these constructs into defined variables and the development and application of instruments to test or quantify these variables

2. Designing a Questionnaire



Step 1: Content

- **Take your objectives and variables as a starting point.**
- Decide what questions will be needed to measure your variables and reach your objectives.
- When developing the questionnaire, you should reconsider the variables you have chosen and, if necessary, add, drop or change some. You may even change some of your objectives at this stage.

Step 2: Formulating questions

- **Formulate one or more questions that will provide the information needed for each variable.**
- The question, as a rule, has to be broken up into different parts and made so specific that all informants focus on the same thing.
- Check whether each question measures one thing at a time.
- Avoid leading questions.
- Avoid words with double , complex or vaguely defined meanings or that are emotionally laden
- Ask sensitive questions in a socially acceptable way

Step 3: Sequencing the questions

- Design your interview schedule or questionnaire to be **'informant friendly'.**

- The sequence of questions must be logical for the informant and allow, as much as possible, for a **'natural' conversation**, even in more structured interviews.

- At the beginning of the interview a limited number of questions concerning 'background variables' (e.g., age, education, marital status) may be asked.

Step 3: Sequencing the questions cont'd

- **Start with an interesting but non-controversial question** that is directly related to the subject of the study. This type of beginning should help to raise the informants' interest and lessen suspicions concerning the purpose of the interview.

- **Pose more sensitive questions as late as possible** in the interview (e.g., questions pertaining to income, political matters, sexual behaviour, or stigma experienced in case of stigmatising diseases).

- Use simple, everyday language

Step 4: Formatting the questionnaire

When you finalise your questionnaire, be sure that:

- A separate, **introductory page** is attached to each questionnaire, explaining the purpose of the study, requesting the informant's consent to be interviewed and assuring confidentiality of the data obtained.

- Each questionnaire has a **heading and space** to insert the number, date and location of the interview

Step 4: Formatting the questionnaire cont'd

- Make sure that **questions belonging together appear together** visually. If the questionnaire is long, you may use subheadings for groups of questions.

- Sufficient space is provided for answers to **open-ended questions**, categories such as '**other**' and for comments on pre-categorised questions.

- **Boxes** for pre-categorised answers are placed in a consistent manner.

Step 5: Translation

- If interviews will be conducted in one or more **local languages**, the questionnaire should be translated in order to standardise the way questions will be asked.

- After having it translated you should have it retranslated into the original language by a different person.

- You can then compare the two versions for differences and make decisions concerning the final phrasing of difficult concepts.

Problems with responses

Effort required to answer questions

Example:

- During your last consultation with your doctor, did the doctor discuss medications to help lower your blood pressure?
  - What is meant by discuss?; relies on recall of discussion
- Many respondents will tick a response that is ‘satisfactory’; that is, to just ‘tick a box’.

Fatigue / disinterest

- Agree with everything
- Just say ‘don’t know’
- Always choose first response
- ‘randomly’ respond without considering the question
- Aversion to extreme ends of the scale

Minimising fatigue / disinterest

- **Keep questions simple**
  - *easier to recall more recent events*
- **Keep words short and easy to understand**
- **Maintain motivation of participants**
  - *ensure task is relevant*
- Avoid absolutes '**never**', '**always**'

Ordering questions

- **Sequence** should be logical to the respondents and flow smoothly from one question to the next

- **Questions tend to flow from:**
  - *General to specific*
  - *Impersonal to personal*
  - *Easy to difficult*

Layout

- Cover letter/introductory page giving study title, organisation, aims of the survey
- Enough space for open-ended questions
- Font large enough to read without strain
- Consistent and clear instructions
- Don’t split questions or answers across pages
- Enough white space

3. Assess the quality of your questionnaire

Evaluation of survey questions: Cognitive interviews / pilot study

- Cognitive interviews to understand question meaning.

Think aloud:

- Facilitate respondent revealing full thought process

Active probing:

- Identify specific problems ad answer specific questions

Measurement

Since the construct that we are measuring is abstract, the relevant questions to raise are:

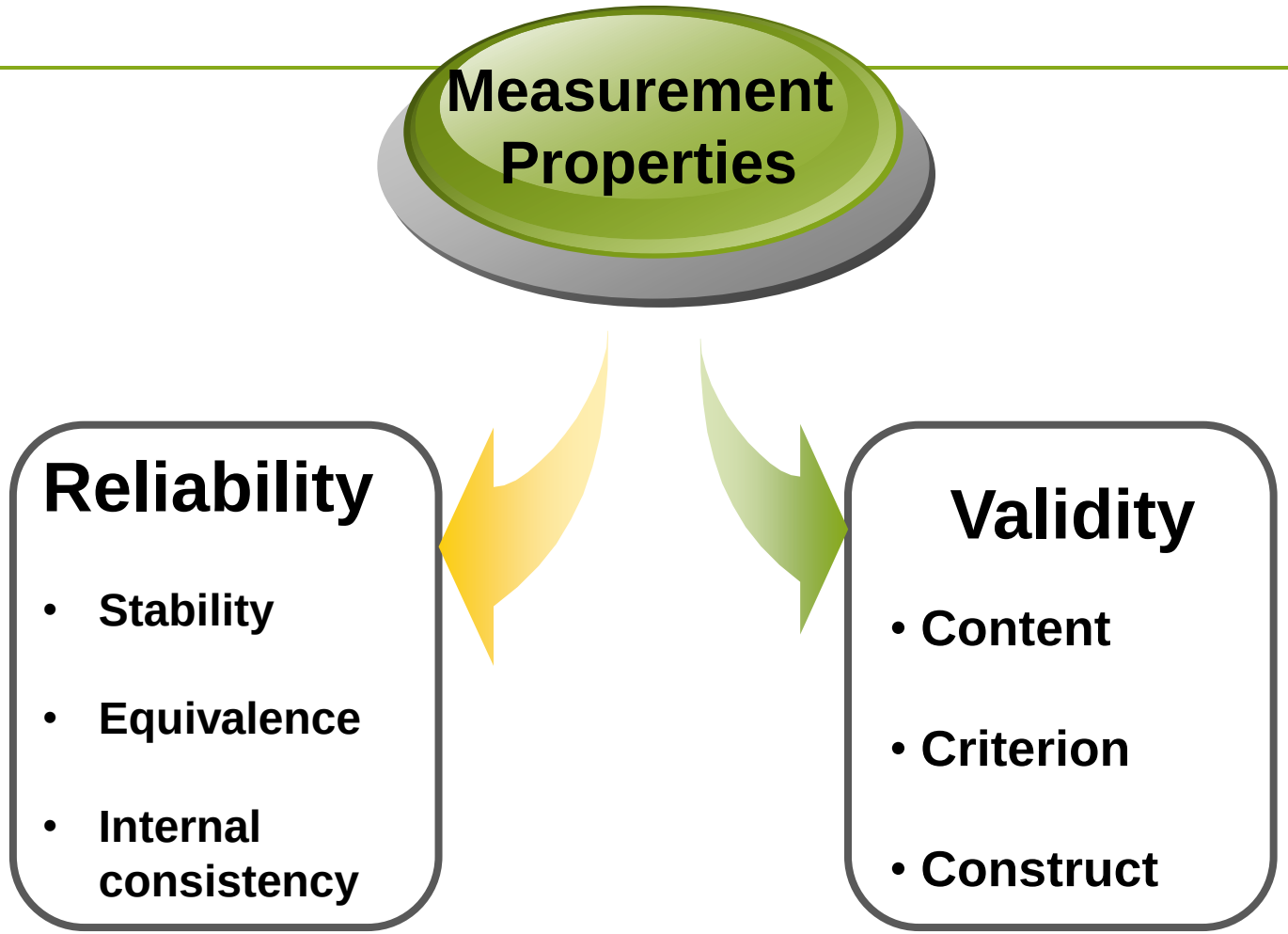
1. How do we know that we are indeed measuring what we want to measure?

Validity

2. Can we be sure that if we repeated the measurement we will get the same result?

Reliability

Validity and reliability are two important characteristics of behavioral measure or quality indicators of a measuring instrument referred to as psychometric properties.


Measurement Properties
Reliability
• Stability
• Equivalence
• Internal consistency
Validity
• Content
• Criterion
• Construct

Validity

Validity

- **Validity** is defined as the extent to which the instrument measures what it purports to measure
- **Validity** is the credibility and believability of our measurement
  - **For example,** a valid pain assessment tool measures pain intensity rather than anxiety

There are several measures of validity that provide evidence of the quality of a study:

1. **Content validity**
2. **Criterion validity**
3. **Construct validity**

1. Content validity

Ask experts

- **Content validity** is concerned with how well the content of the tool covers the subject area.
  - **For example,** a depression scale may lack content validity if it only assesses the affective dimension of depression but fails to take into account the behavioural dimension.

Each item is examined for its relevance, often by:

- Exploring the literature
- Exploring previous studies
- Asks few people (Informally; Face validity)
- Ask experts in the field to rate item relevance (Content validity index “CVI”)

2. Criterion validity

Compare with other tools

- **Criterion validity** relates to how well the tool compares with previous tools
  - **For example:** how does the Waterlow pressure sore risk assessment tool compare with the Norton score?

Criterion validity can be measure by:

- Develop a tool
- Test the tool on the participants
- Compare results with already existing and well-accepted tool
- Look for correlation

3. Construct validity

Experiment

Construct validity is the degree to which an instrument measures the theoretical construct that it is intended to measure.

Some constructs are not easily observable e.g. anxiety, therefore, we translate the concept into a functioning and operating reality e.g. sweaty palms, tachycardia, difficulty concentrating . We then need to concern ourselves about **how well we operationalized the construct**

For example

- We developed a **new tool to measure intelligence**. To test its construct validity, we used it to measure the intelligence among **PhD researchers** and among **students** who failed to gain entry to college. We found that there was **no differences in intelligence** between the two group. We concluded that this tool has a **poor construct validity** because it did not **measure the theoretical construct** that it is intended to measure.

Reliability

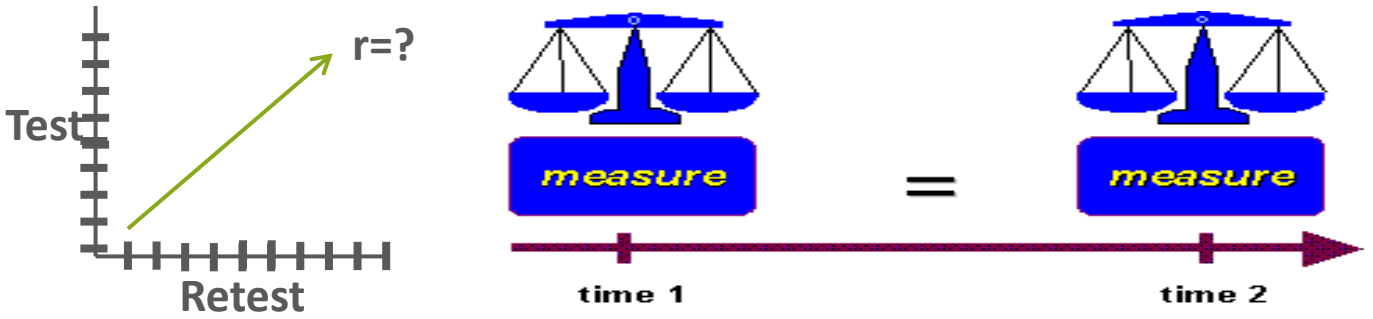
Reliability

Reliability is defined as the extent to which a questionnaire produces the same results on repeated trials

When selecting a tool for a research the following needs to be considered:

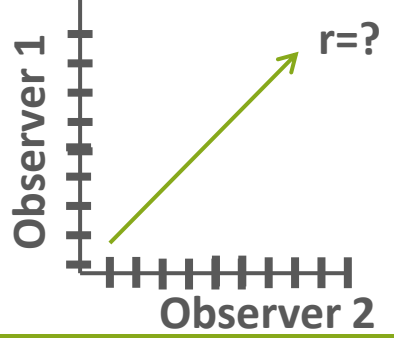
1. **Stability**
2. **Equivalence**
3. **Internal consistency**

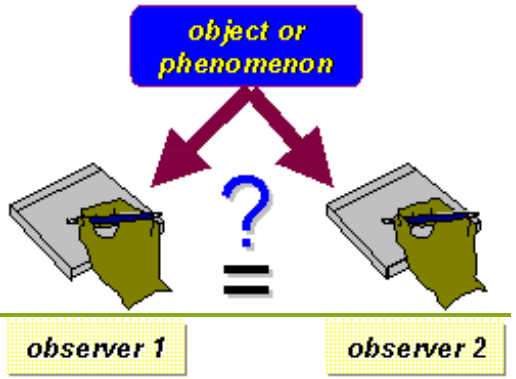
1. Stability



- **Stability means that the same results will be achieved with repeated testing using the tool**
- It estimates the stability of measures administered **at different times** to the **same individuals**
- Stability is ascertained through **Test-retest Reliability**
- The tool is administered to the same subjects with a time gap in between
- It is estimated by determining the correlation between the score of the test and score of the retest
  - Timing of the second administration is critical – not too long or too short e.g. memory, change in health status

2. Equivalence





- **Equivalence means that the same results will be achieved by two or more researchers using the same tool**
- It estimates the agreement of scores administered by different researchers using the same tool
- The equivalence of the tool is measured by inter-rater reliability
- Two researchers score an event independently using agreed scoring criteria, correlation coefficients between the scores are calculated

3. Internal consistency

The internal consistency means **homogeneity of the various items within an instrument**

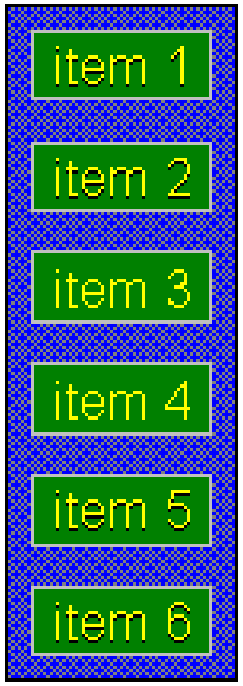
- All the subparts of the instrument consistently measure the same characteristic and yield similar results.

There are a wide variety of internal consistency measures that can be used:

A. **Average Inter-item Correlation**
B. **Split-Half Reliability**
C. **Cronbach's Alpha** (α)

A. Average Inter-item Correlation

- Uses all of the items on an instrument that are designed to measure the same construct
- Compute the correlation between each pair of items.
- The average inter-item correlation is simply the average of all these correlations.



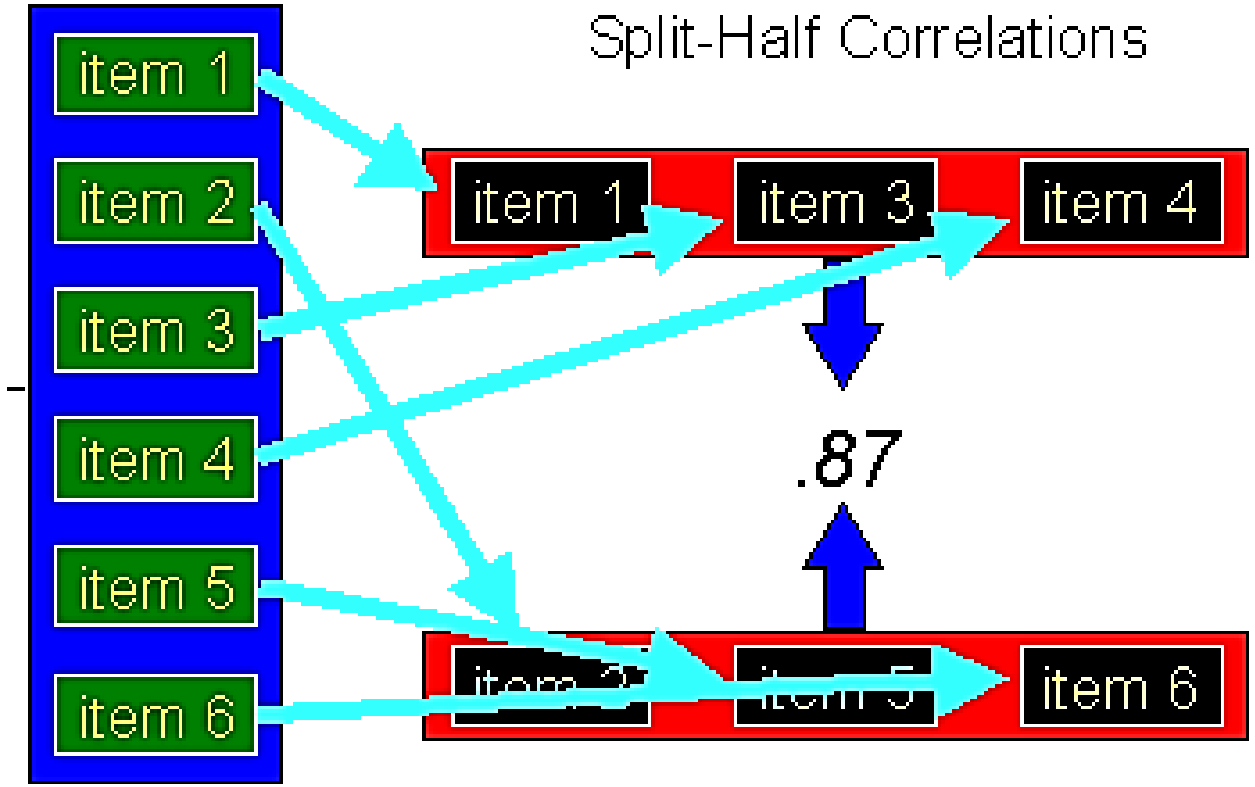
Average Inter-Item Correlation

	I_1	I_2	I_3	I_4	I_5	I_6
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

.90

B. Split-Half Reliability

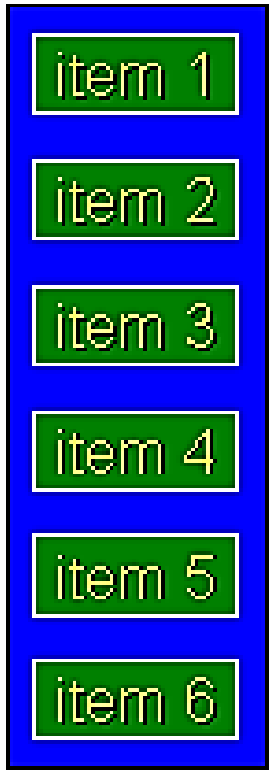
- Randomly divide all items that measure the same construct into two sets.
- Compute the correlation between the scores of each set.

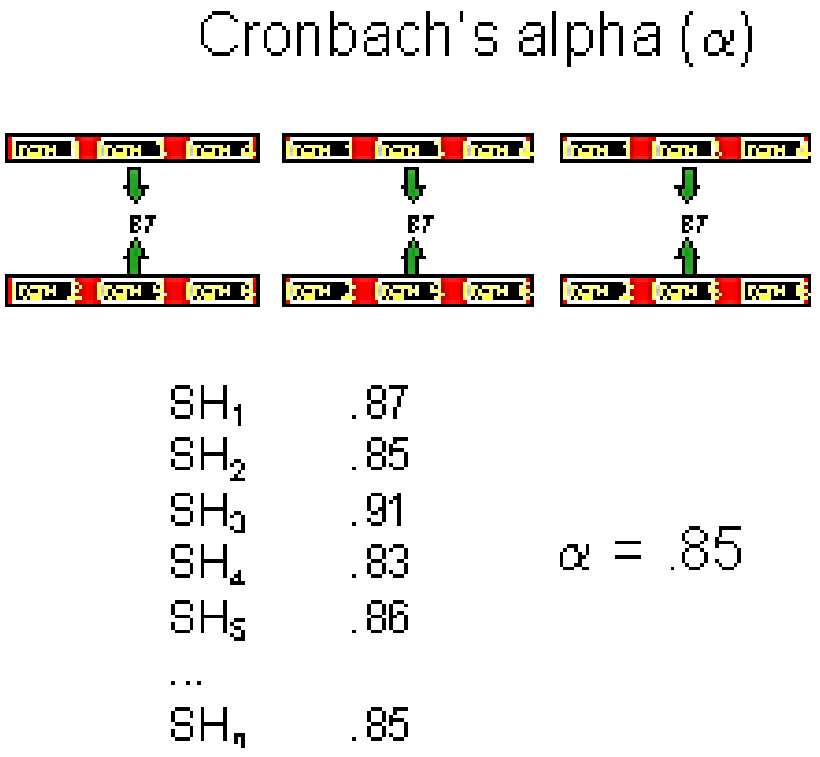


C. Cronbach's Alpha (α)

- Cronbach's Alpha is mathematically equivalent to the average of all possible split-half estimates

- Statistical software does the random subsets of items. Compute the average of resulting correlations





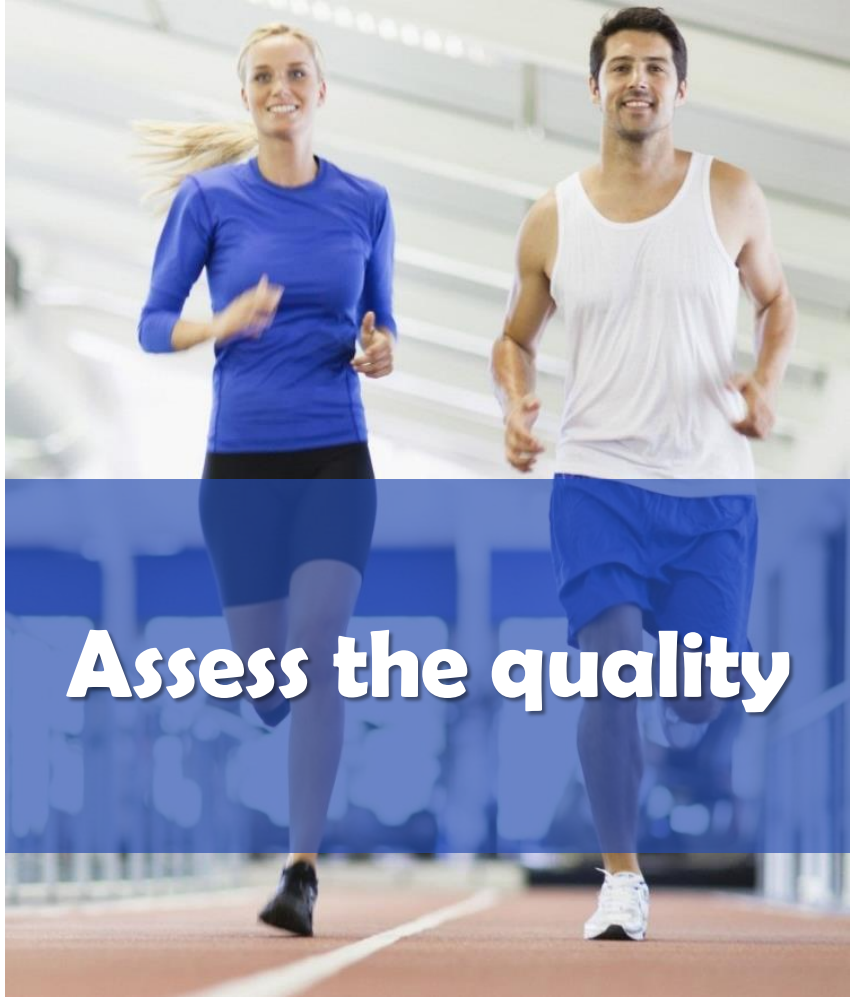
Selecting an Existing Instrument

Selecting an Existing Instrument

- You must have a clearly defined construct or concept that you wish to measure, along with an operational definition.
- Before developing a new measure, identify existing instruments that measure the construct of interest.
- It is more cost effective than starting from scratch to develop and validate an instrument.

Preparation

Designing



Assess the quality

Quantitative data collection

Designing a questionnaire