

How to measure the construct - operationalisation

Alice Ørts Hansen

Associate professor

Department of Ortopaedic

Odense University Hospital and Svendborg Hospital

Department of Clinical Research, University of Southern Denmark, Odense, Denmark.



Agenda

Time	Contents	Pages	Teacher
9.00– 10.00	Introduction to questionnaires - conceptualisation	7-13, 33-35	AØH
10.00 – 11.00	Exercise: Conceptualisation		AØH
11.00 – 12.30	Concepts in questionnaire technique • Observed vs. latent variables • Conceptual frameworks • Reflective and formative models • Scales vs. indexes COSMIN taxonomy and requirements to questionnaire validation	13-17, 35-37 Vodcast Articles on www*	AØH
12.30 – 13.00	<i>Lunch</i>		
13.00 – 13.45	How to measure the construct – operationalisation • Preparing items and answer categories	35-37 41-50	AØH
13.45 – 14.30	Exercise: Preparing items and answer categories		AØH
14.30 – 15.00	Structure and design of a questionnaire study Q & A about own study		AØH

* www = see www.clinimetrics.sdu.dk

From construct to questionnaire

From concept to construct

Concept: *“Global definition and demarcation of the subject of measurement”*

Construct: *“A well-defined and precisely demarcated subject of measurement e.g. intelligence, depression, HRQOL”*

From “what to measure” to “how to measure it”

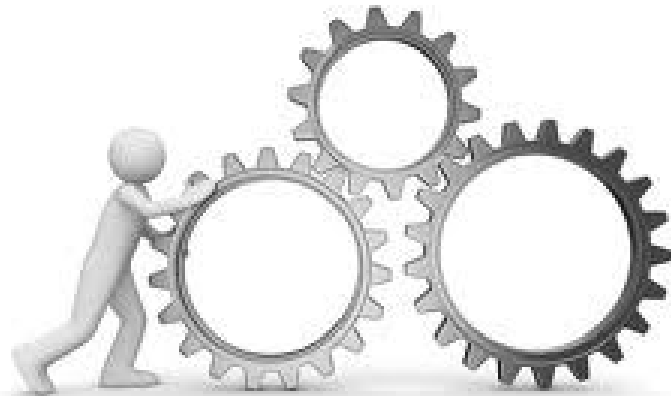
Operationalization



Operationalization

Definition:

Operationalisation is the process of translating a theoretically defined concept into observable and measurable items, questions, tasks, or parameters



Things to consider

What do you want to measure – and how precise?

- Which constructs are found within your concepts? Is it a combination of several constructs?
- Which variables/items do you actually need? One or multiple?

What is the target population?

- Items should be tailored to the target population: age range, illness status, gender etc.
- Illness characteristics: range of diseases and treatments
- Difficulty of the items

For which purpose?

- Discrimination between groups (better vs. worse QoL)
- Evaluation (changes over time)
- Prediction



Continued example

Conceptualization, operationalization, and content validity of the EQOL-questionnaire measuring quality of life and participation for persons with disabilities

Louise Norman Jespersen*, Susan Ishøy Michelsen, Bjørn Evald Holstein, Tine Tjørnhøj-Thomsen and Pernille Due

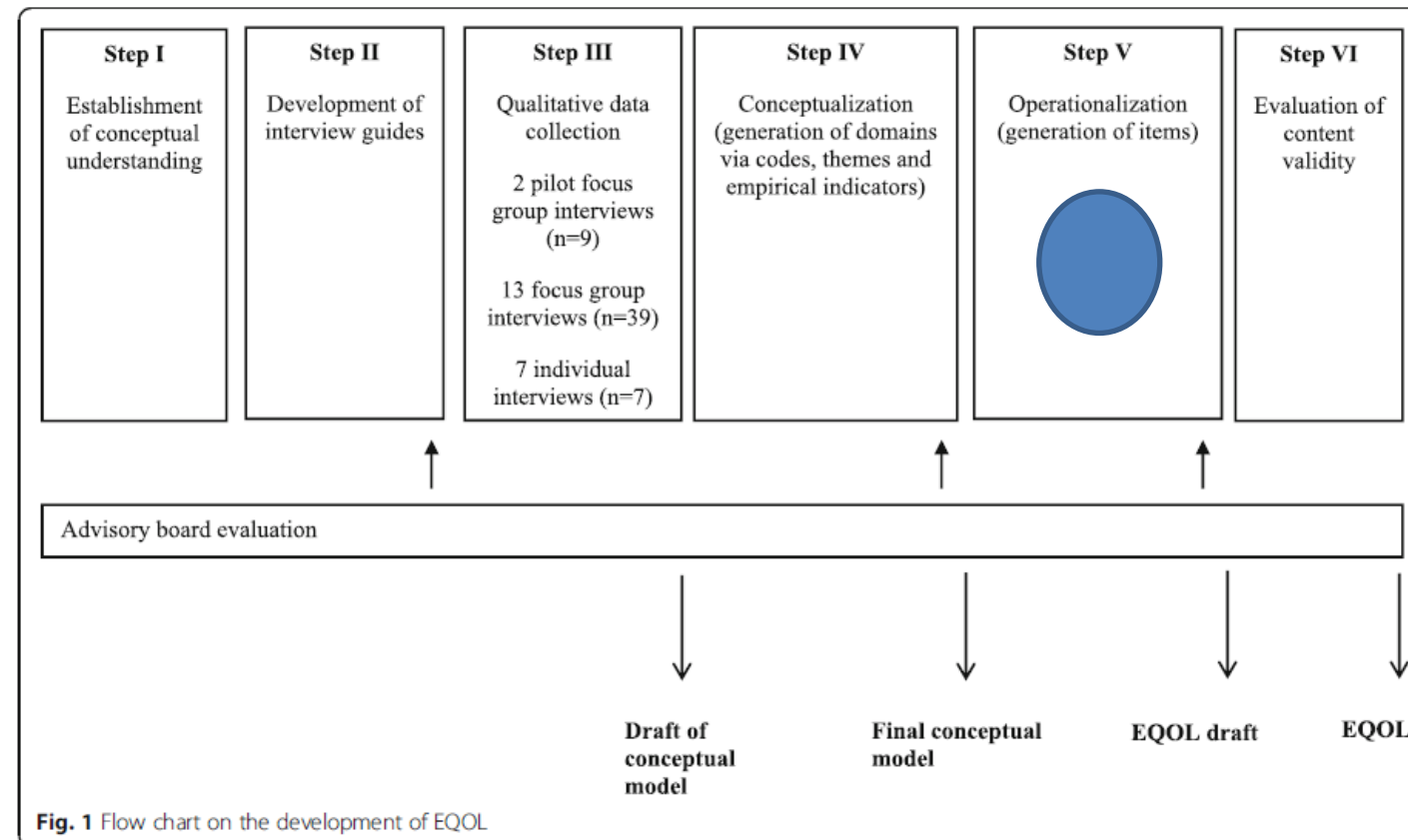
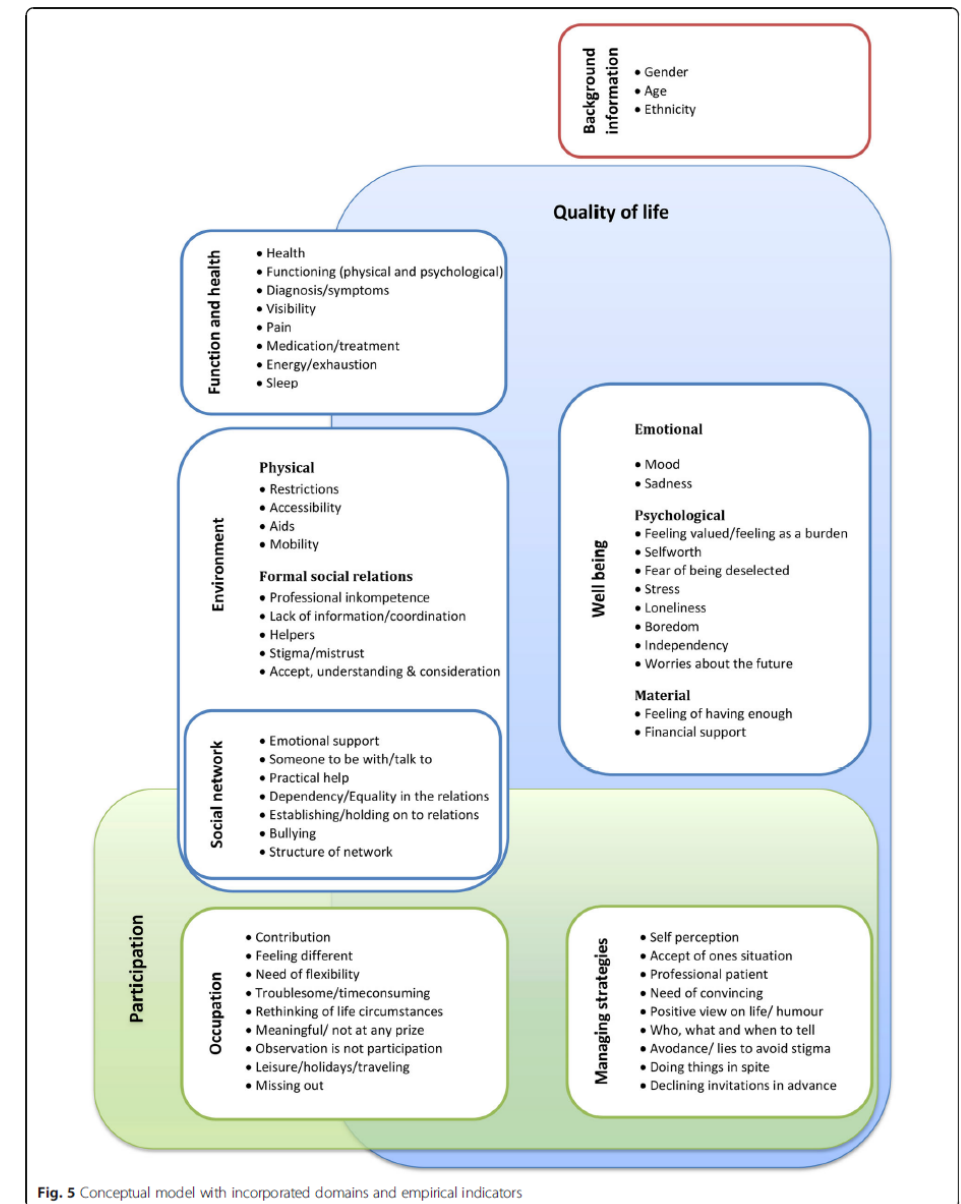


Fig. 1 Flow chart on the development of EQOL

Step V: Operationalization of empirical indicators into items

Items

Initial item formulations was made by one of the authors (LNJ) based on the condensed descriptions of the domains and based on the conceptual model. For each empirical indicator, the composed item(s) was constructed to reflect that specific aspect of the domain. As an example, the empirical indicator “*Fear of being left by partner*” was operationalized as follows: *Does your disability cause fear of being left by your partner/ potential partner?* Whenever possible, precise words or phrases used by participants in the interviews were applied. The item formulation and the original purpose of each empirical indicator were then compared and discussed in detail by the external advisory board and the author group. Subsequently, items were discussed and adjusted several times until consensus was reached within the author group, so that the item seemed to reproduce the content of the empirical indicator and that the items appeared relevant and understandable to the target group. The





Continued example

Conceptualization, operationalization, and content validity of the EQOL-questionnaire measuring quality of life and participation for persons with disabilities

Louise Norman Jespersen*, Susan Ishøy Michelsen, Bjørn Evald Holstein, Tine Tjørnhøj-Thomsen and Pernille Due

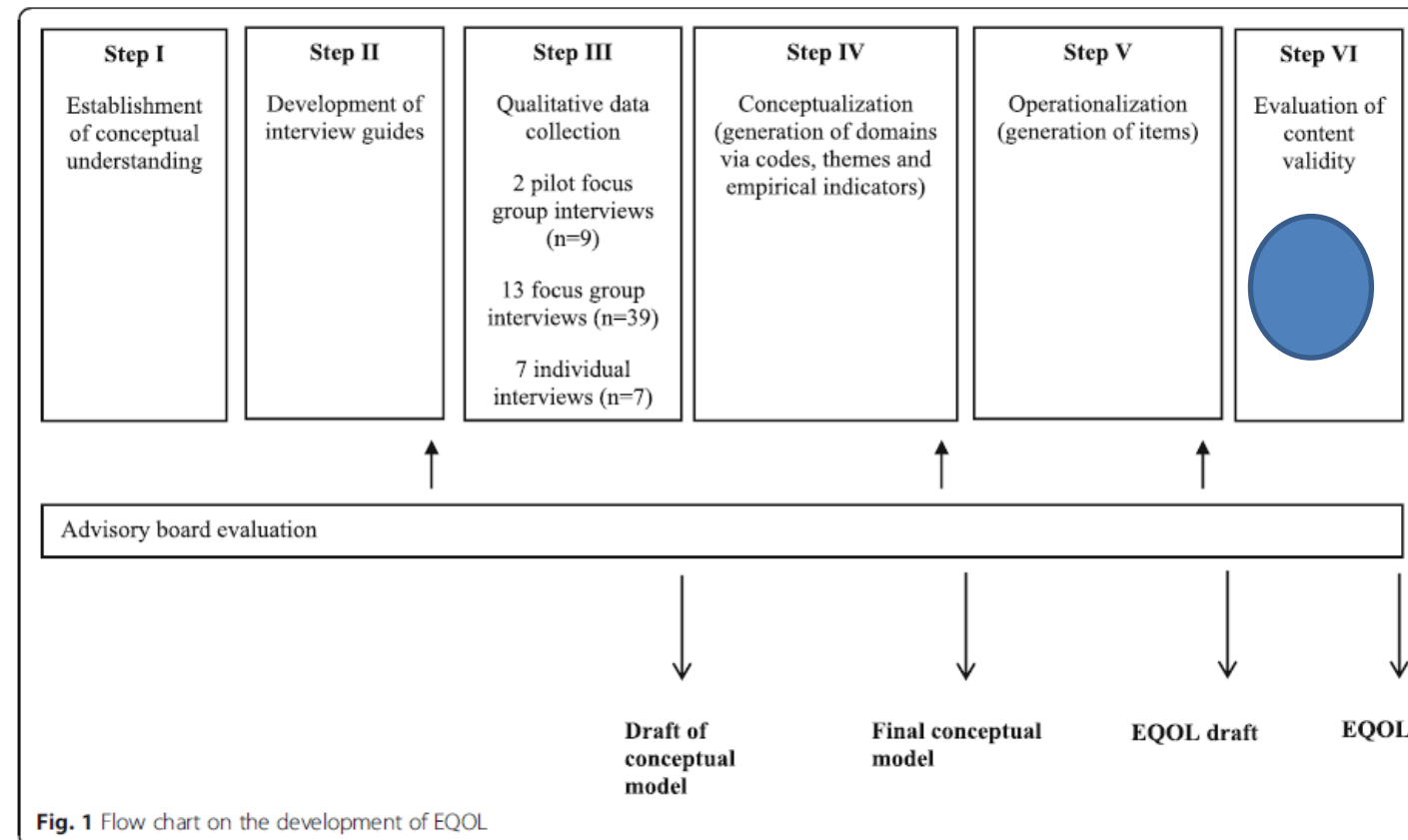
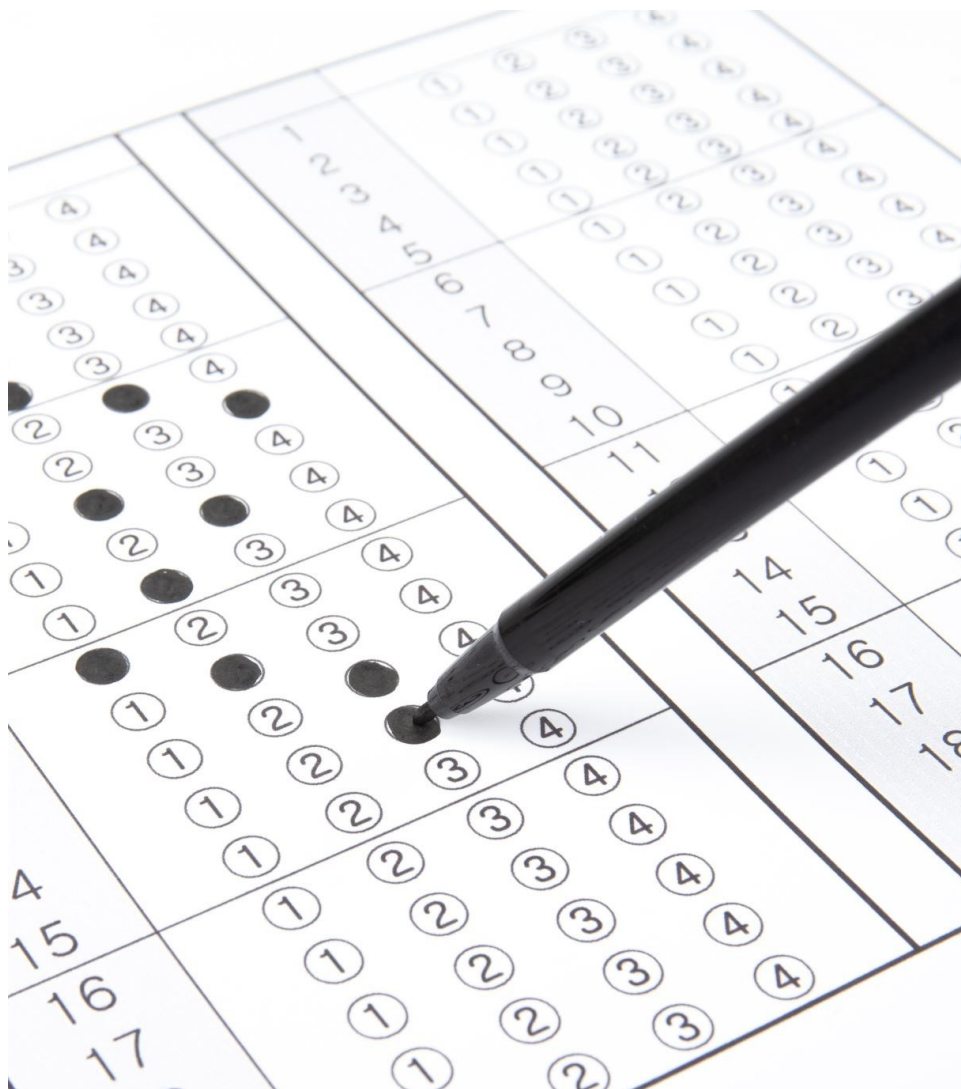


Fig. 1 Flow chart on the development of EQOL

Conceptualization/operationalization

- Conceptualization/operationalization are intertwined
 - Should be done thoroughly
- Proper conceptualization/operationalization
 - Makes validation easier
 - Gives a good idea of how to interpret our research results
 - Even if someone disagrees with our conceptualization
 - Saves time and saves you from a lot of fire extinguishing later
- A continuous process, but vital to address it at the beginning of any study design

” As a researcher, always be open to reexamining your concepts and definitions



Preparing items and
answer categori

Preparing items

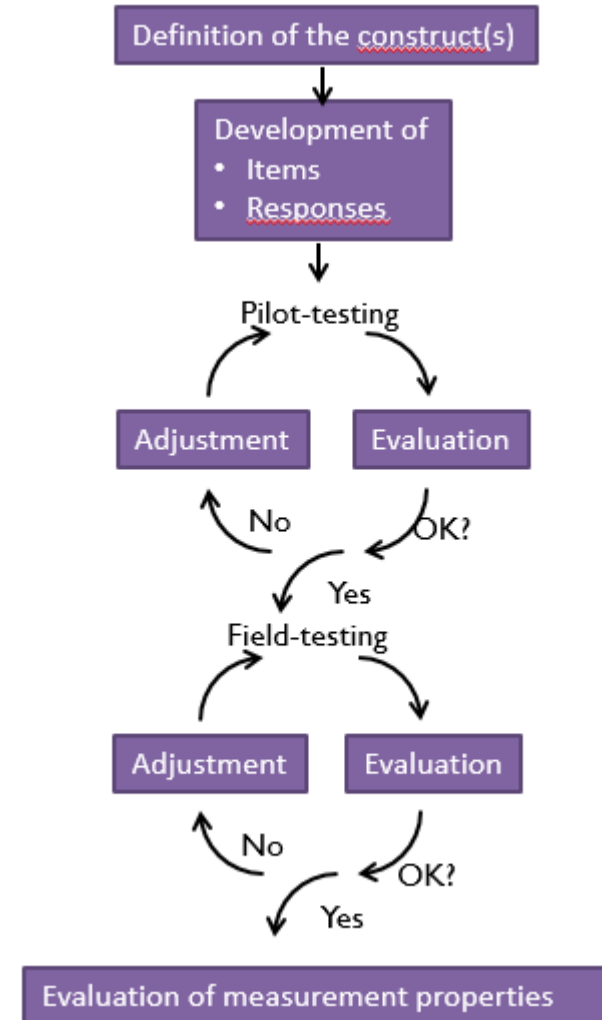
Generate an exhaustive list of items

Input for the items of a questionnaire

- Go through the literature/ theories
- Talk to experts

Deletion of items (part of pilot and field testing)

- Overlaps closely with other items?
- Irrelevant to the target group (Lack of importance)?



Preparing items

Formulating items

A challenging task

– Basic rules

1. Items should be comprehensible to target population
2. Ambiguous terms should be avoided
3. Items should be specific
4. Items should contain only one question
5. Negative wording should be avoided
6. Do not leave the question positive

First draft should contain as many items as possible

Things to keep in mind when formulating questions.

- Construct
- Purpose eg. Discriminate or evaluate
- Target population
- Reflective or formative model
- Difficulty of items in relation to the target population
- Application in research or clinical practice
- Correspondence with response options

Examples of response categories

Response categories

- Exhaustive and exclusive
- Meaningful
- Make it capable of measuring change
- Provide (enough) detailed information
- Ensure reproducible and valid answers

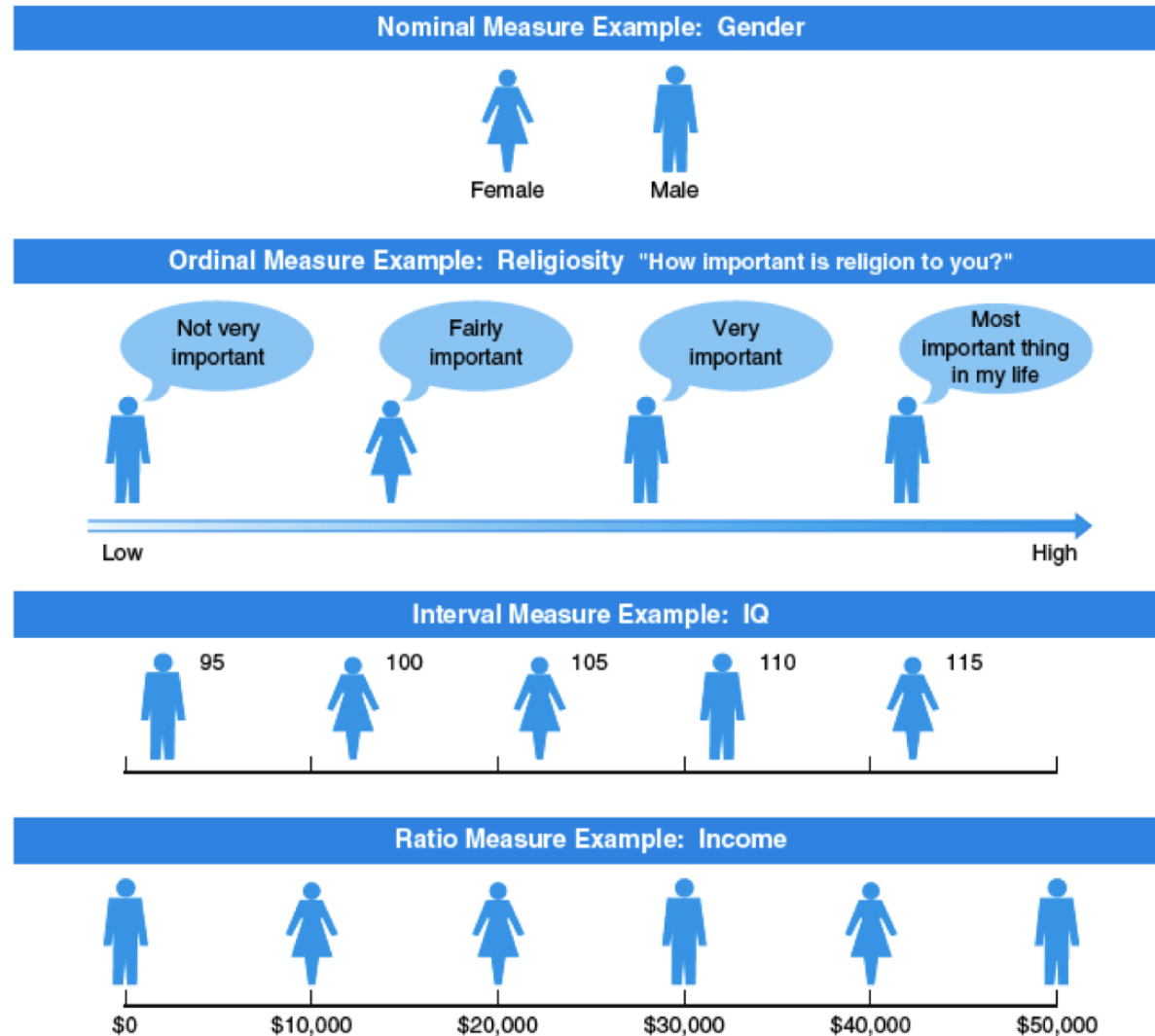


Examples of response categories

Patient Global Impression of Change (PGIC)

No change (or condition has got worse)	☐	1
Almost the same, hardly any change at all	☐	2
A little better, but no noticeable change	☐	3
Somewhat better, but the change has not made any real difference	☐	4
Moderately better, and a slight but noticeable change	☐	5
Better, and a definite improvement that has made a real and worthwhile difference	☐	6
A great deal better, and a considerable improvement that has made all the difference	☐	7

Levels of measurement



Categorical

Continuous

Levels of measurement

Categorical data

- Measured on nominal and ordinal scale
- NO equidistance between different categories
 - We can not add and subtract
 - Mean, standard deviation and differences makes no sense
- Calculate frequencies
- We can analyze data using ordinary, ordered or multinomial logistic regression, regression models for relative risks or risk differences

Examples of response categories

Labelled categorical scale

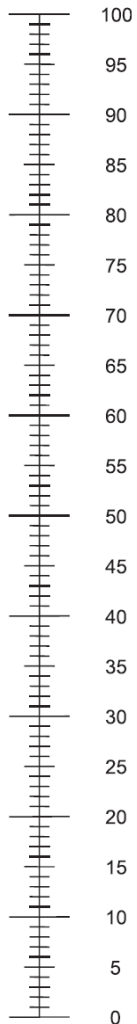
- ‘How is your health?’: Excellent, very good, good, not so good, bad.
- ‘Smoking is bad for your health? ’: 3, 5 or 7 classes ranging from ‘strongly disagree’ to ‘strongly agree’

Levels of measurement

Continuous data

- Measured on ratio and interval scale
- Conversion of data to lower level possible
- Equidistance between different categories (scores)
 - We can add and subtract
- We can analyze data using t-test, linear regression, ANOVA, linear mixed models etc.
- Lacks descriptors and cut-points
 - E.g. No pain/mild pain/moderate pain/severe pain

Examples of response categories



Visual Analogue Scale (VAS)

- ‘On a scale from (0-10 or 0-100) how much pain do you feel right now’
- ‘How satisfied are you with your treatment’
 - Not satisfied_____Satisfied

Numerische rating skala (NRS)

Advantage:

Easy to understand
Validated for some conditions
(e.g. pain)

Disadvantage:

Unrealistic impression of accuracy
Low reliability
More difficult to answer than a Likert item

Construction of response categories

- Categorical vs. continuous scale
 - If possible use continuous (e.g. exact age or height)
- Number of response categories
 - No more than 7. Between 4-7 is optimal
- Even or uneven number of response categories
 - Even: Force respondents to 'have' an opinion
 - Uneven: It is possible for respondents to be neutral
- Be sure the categories are relevant, exhaustive and exclusive

Interpretations of words used to indicate frequencies

Word	Interpretation (range of mean percentages)	Definition in the <i>Oxford English Dictionary</i>
Invariably/always	91-100	At every time, on every occasion, at all times, on all occasions. Opposed to sometimes, occasionally
Almost always	85-94	—
Normally	71-81	Under normal or ordinary conditions; as a rule, ordinarily
Usually	70-84	In a usual or wonted manner; according to customary, established, or frequent usage; commonly, customarily, ordinarily; as a rule
More often than not	64	—
Common(ly)	56-69	As a usual circumstance; as a general thing; in ordinary cases; usually, ordinarily, generally
Often	42-71	Many times; at many times; on numerous occasions; frequently; for a significant amount or proportion of the time
Frequent(ly)	36-72	At frequent or short intervals, often, repeatedly
Not infrequently	24-35	Rather frequently
Occasionally	17-21	Now and then, at times, sometimes; irregularly and infrequently
On occasion	12	As need or opportunity arises; now and then, occasionally
Infrequently	12-14	Not frequently; somewhat rarely, seldom
Sometimes	11-33	On some occasions; at times; now and then
Seldom	7-8	On few occasions, in few cases or instances, not often; rarely, infrequently
Almost never	2	Scarcely ever
Very rare(ly)	0.8-3	—
Rare(ly)	0.5-9	Seldom, infrequently, in few instances
Exceptionally	0.4-1	Uncommonly, unusually
Never	0-2	At no time or moment; on no occasion; not ever

Exercise PRWHE

Name: _____

Date: _____

PATIENT RATED WRIST/HAND EVALUATION

*The questions below will help us understand how much difficulty you have had with your wrist/hand in the past week. You will be describing your **average** wrist symptoms **over the past week** on a scale of 0-10. Please provide an answer for **ALL** questions. If you did not perform an activity, please **ESTIMATE** the pain or difficulty you would expect. If you have **never** performed the activity, you may leave it blank.*

1. PAIN

Rate the average amount of pain in your wrist/hand over the past week by circling the number that best describes your pain on a scale from 0-10. A zero (0) means that you did not have any pain and a ten (10) means that the pain is the worst possible (i.e. worst you have ever experienced or that you could not do the activity because of pain).

RATE YOUR PAIN:	None	Worst
At rest	0 1 2 3 4 5 6 7 8 9 10	
When doing a task with a repeated wrist/hand movement	0 1 2 3 4 5 6 7 8 9 10	
When lifting a heavy object	0 1 2 3 4 5 6 7 8 9 10	
When it is at its worst	0 1 2 3 4 5 6 7 8 9 10	
How often do you have pain?	0 1 2 3 4 5 6 7 8 9 10	
	Never	Always

Please turn the page.....

2. FUNCTION

A. SPECIFIC ACTIVITIES

Rate the **amount of difficulty** you experienced performing each of the items listed below - over the past week, by circling the number that describes your difficulty on a scale of 0-10. A **zero (0)** means you did not experience any difficulty and a **ten (10)** means it was so difficult you were unable to do it at all.

	No Difficulty	Unsure To Do
Turn a door knob using my affected hand	0 1 2 3 4 5 6 7 8 9 10	
Cut meat using a knife in my affected hand	0 1 2 3 4 5 6 7 8 9 10	
Fasten buttons on my shirt	0 1 2 3 4 5 6 7 8 9 10	
Use my affected hand to push up from a chair	0 1 2 3 4 5 6 7 8 9 10	
Carry a 10lb object in my affected hand	0 1 2 3 4 5 6 7 8 9 10	
Use bathroom tissue with my affected hand	0 1 2 3 4 5 6 7 8 9 10	

B. USUAL ACTIVITIES

Rate the **amount of difficulty** you experienced performing your **usual** activities in each of the areas listed below, over the past week, by circling the number that best describes your difficulty on a scale of 0-10. By "usual activities", we mean the activities you performed **before** you started having a problem with your wrist/hand. A **zero (0)** means that you did not experience any difficulty and a **ten (10)** means it was so difficult you were unable to do any of your usual activities.

Personal care activities (dressing, washing)	0	1	2	3	4	5	6	7	8	9	10
Household work (cleaning, maintenance)	0	1	2	3	4	5	6	7	8	9	10
Work (your job or usual everyday work)	0	1	2	3	4	5	6	7	8	9	10
Recreational activities	0	1	2	3	4	5	6	7	8	9	10

APPEARANCE- OPTIONAL

How important is the appearance of your hand? ☐ Very Much ☐ Somewhat ☐ Not at all

Rate how dissatisfied you were with the appearance of your wrist/hand during the past week.

0 1 2 3 4 5 6 7 8 9 10
No Dissatisfaction Complete Dissatisfaction

Any other comments?

Exercise PRWHE

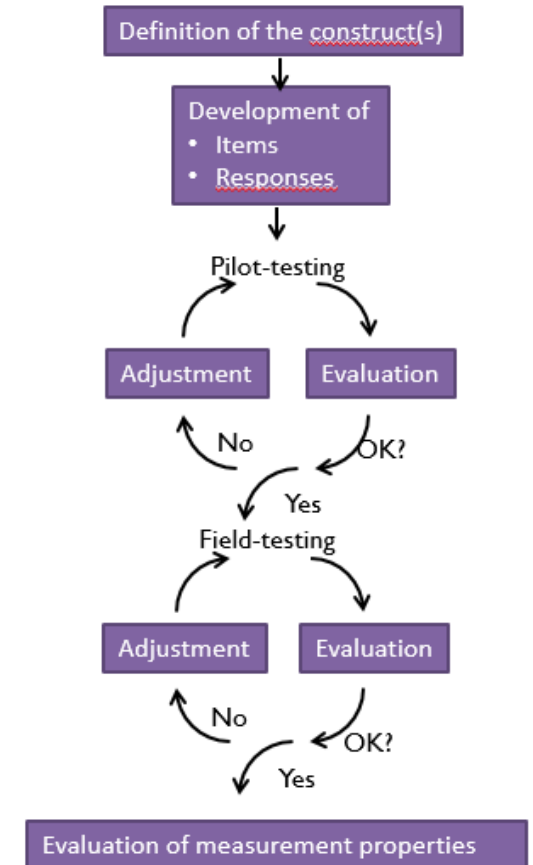
- You want to use this questionnaire in a Danish context with patients with hand-related disorders.
 - Is there anything to be aware of?
 - Any difficult items?

Implication of bad items

- More missing values
- Sampling bias (missing response within different groups)
- Item bias (different understanding in different groups)

In general developing a questionnaire

- The layout should be user-friendly, simple and unambiguous
- Make a clear instruction on how to fill in the questionnaire
- Get others to go through the questionnaire
 - Experts (within the area) and "civilians".
 - Patients
- Pilottest and fieldtest in the target population

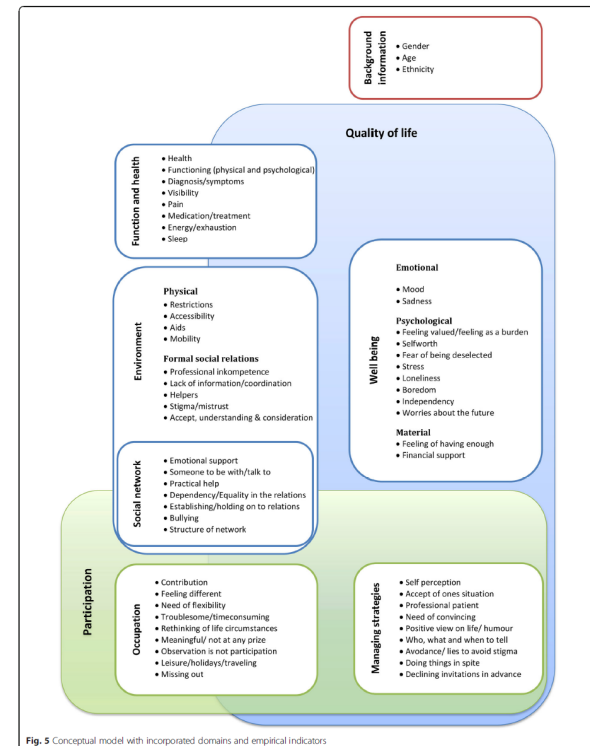


Exercise 2A

A questionnaire survey is intended to assess the concept of "health and disability" in Denmark. For this purpose formulate questions/items concerning

1. The patient (age, gender, socio-demographics, health etc.)
2. Some of the constructs from the conceptual model in the previous session.

- Create (at least) 3 items for each of the two points
- Consider the scale you use for your responses?
 - Nominal, ordinal, interval or ratio?



Exercise 2B

Errors in development of items – What is the problem?

1. error

- Has your child had diarrhoea for more than 2 weeks?
- How many days have you had headack within the last year?
- Which examinations have you been through within the last year?