Research in Nursing

Topic: Psychometric Properties

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Learning Outcome

- Measurement
- Instrument
- Validity
- Reliability

Measurement

- **Measurement** is the process of assigning numbers to objects, events, or situations in accord with some rule (Kaplan, 1963).
- The numbers assigned can indicate numerical values or categories for the objects being measured for research or practice.

Instruments

- **Instrumentation-**

a component of measurement, is the application of specific rules to develop a measurement device such as a scale or questionnaire.

Types of measurement

- Direct : height, weight, vital signs, and oxygen saturation etc.
- Indirect:
  - the complex concept of coping might be defined by the frequency of identifying problems,
  - the creativity in selecting solutions, and the speed or effectiveness in resolving the problem.

Measurement Error

- Measurement error is the difference between what exists in reality and what is measured by an instrument.
- Measurement error exists in both direct and indirect For example-
- the weight scale may not be accurate.
- Efforts to measure concepts usually result in capturing only part of the concept but also contain other elements that are not part of the concept.
- Error mainly 2 types
  - Random error & Systematic Error:

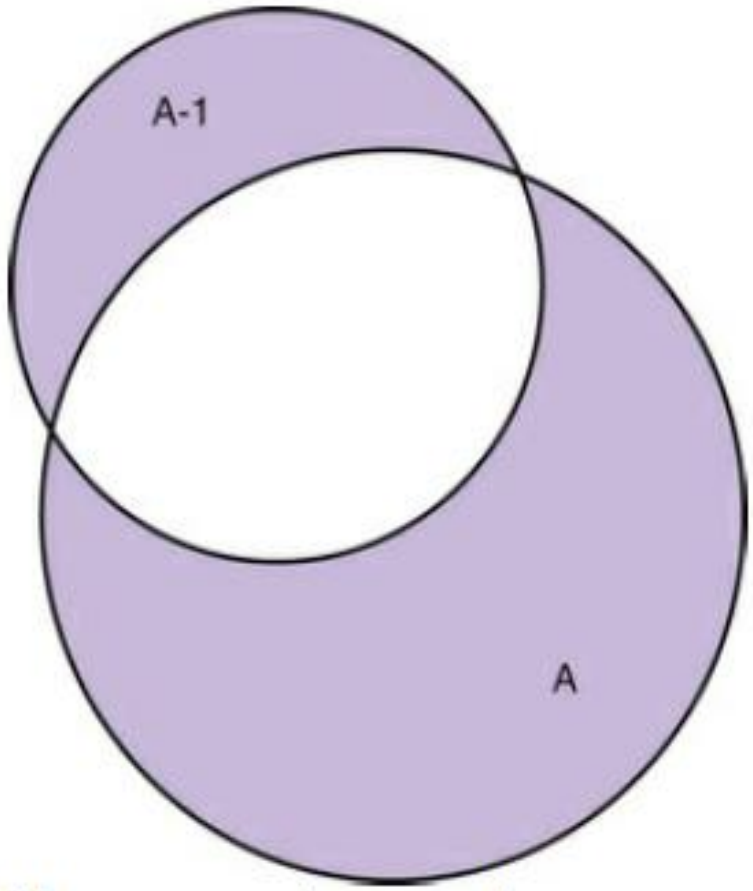

FIGURE 16-1 Measurement error when measuring a concept.

Levels of Measurement

1. **Nominal level of measurement**

- Diagnoses of chronic diseases

  a- hypertension

  b -type 2 diabetes

  c- dyslipidemia

2. **Ordinal Level of Measurement**

- Daily amount of exercise –
  - 0 = no exercise;
  - 1 = moderate exercise (no sweating)
  - 2 = exercise to the point of sweating;
  - 3 = strenuous exercise with sweating 30 minutes/ day;
  - 4 = strenuous exercise with sweating for 1 hour/day.

3. Interval Level of Measurement

- SBP –
  - a. 100-120 mm of Hg
  - b. 120-140 mmo Hg
  - c. 120-140 mm of Hg
  - b. >140 mmo Hg

4. Ratio Level of Measurement (absolute zero point)

Age …. Yrs fbs …….. Mmol/dl

Importance of Level of Measurement

- Statistical analysis
- The data may needed change one level to another.

Reference Testing Measurement

- Reference testing involves comparing a subject's score against a standard.
- Its 2 types-
  - Norm referenced testing
  - criterion-referenced testing

Reliability

- The reliability of an instrument denotes the consistency of the measures obtained of an attribute, concept, or situation in a study or in clinical practice.
- Reliability coefficients of 0.80 or higher would indicate strong reliability for a psychosocial scale.

Types of reliability

1. **Stability reliability:** Consistency of repeated measures of the same concept or attribute with an instrument or scale over time.
2. **Equivalence reliability:** interrater reliability + alternate reliability.
3. **Interrater reliability:** Comparison of two observers in a study
4. **Alternate forms reliability:** Comparison of two paper-and-pencil instruments.

5. **Internal consistency:** where each item on the scale is correlated with all other items to determine the consistency of the scale in measuring a concept.
- **Cronbach's alpha coefficient is the statistical** procedure used for calculating internal consistency. Result .8 or more
6. **Validity Face validity:** Verifies that an instrument looks like it.

Psychometric Properties of Major Study Instruments

Instrument	Cronbach's Alpha	*M* (*SD*)	S
Perceived stress scale (10-item)	0.91	19.13 (7.53)	4
Sleep Quality Index (7-item)	0.70	6.56 (3.70)	1
Loneliness scale (20-item)	0.92	40.07 (10.66)	2
Self-esteem scale (10-item)	0.94	20.65 (7.03)	3

Validity

- **validity** is the extent to which an instrument measures what it is supposed to.
- Validity is established by correlating the scores with a similar instrument.
- Also, expert review establishes validity.

Types of validity

- **Face validity:** Verifies that an instrument looks like it is valid or gives the appearance of measuring the construct it is to measure.
- **Content validity:** Examines all the elements of instrument.
- **Construct validity:** Focuses on determining whether the instrument actually measures the theoretical construct that it purports to measure, which involves examining the fit between the conceptual and operational definitions of a variable.
- **Criterion-related validity:** focuses on how well the instrument compares with external variables considered to be direct measures of the characteristic or behavior being examined. (IQ)

Item Content Validity Based on Proportion of Ratings of Relevant or Very Relevant by Seven Experts

Dimension	Item	I-CVI
Patient advocacy for patient rights	1. Informed consent to a medical intervention	0.86
	2. Accurate medical information	0.86
	3. Confidential medical information	0.71
	4. Advanced directives	0.86
	5. Competence to make medical decisions	0.86
Patient advocacy for quality care	6. Lack of evidence-based health care	0.71
	7. Medical errors	1.00
	8. Whether to take specific diagnostic tests	1.00
	9. Fragmented care[a]	1.00
	10. Non-beneficial treatment	1.00
Patient advocacy for culturally competent care	11. Information in patients' preferred language	1.00
	12. Communication with persons with limited literacy or health knowledge	1.00
	13. Religious, spiritual, and cultural practices[a]	0.86
	14. Use of complementary and alternative medicine[a]	0.57
Patient advocacy for preventive care	15. Wellness exams	0.86
	16. At-risk factors[a]	1.00
	17. Chronic disease care	1.00
	18. Immunizations[a]	1.00
Patient advocacy for affordable care	19. Financing medications and healthcare needs	1.00

Some definition

- **Accuracy** involves determining the closeness of the agreement between the measured value and the true value of the quantity being measured.
- **Precision** is the degree of consistency or reproducibility of measurements made with physiological instruments or devices.