Hypotheses
lecture: 5
Scientific Research

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Hypotheses Definitions

- Hypotheses are predictions about the relationship among two or more variables or groups based on a theory or previous research.
- Hypotheses are assumptions or theories that a researcher makes and tests.

Why the Hypotheses is important in scientific research:

1. Direct our observations

- Identifies the variables examined and data to be collected

2. Describe a relationship among variables

- Can state that as one variable increases, the other will decrease; as one variables increases, the other will increase, and so on.

3. Refer to populations

- Hypotheses help researchers infer that results of a sample will translate to a population

Functions of Hypotheses

- Hypotheses can:
  1. Estimate Population Characteristics, Correlate Variables
  2. Display Differences among Two or more populations
  3. show possible Cause and Effect.
  4. ***What research designs relate to each of these 4 functions?***

Symbols used in Hypotheses

- *M*= mean
- μ (mu: mew)= *population mean*
- Greek Letters (e.g., α, β) are used to represent parameters
- α= significance level; probability of committing a Type I Error (α= .05)
- *p*= probability value (*p*= .05)
- Null Hypothesis= (H_0: $\mu_1 - \mu_2 = 0$ or H_0: $\mu_1 = \mu_2$)
- Alternative Hypothesis= (H_1: $\mu_1 - \mu_2 \neq 0$ or H_1: $\mu_1 \neq \mu_2$)
  - Sometimes you may see it noted as H_A

Types of Hypotheses

- Research Hypotheses
- Statistical Hypotheses

1. Research Hypotheses:

- Research Hypothesis: A statement of the relationship among two or more variables or groups.
- The acceptance or non-acceptance of which is based on resolving a logical alternative with a null hypothesis.

- Example: Graduate students who read the text in research methods will score higher on their comprehensive exams than graduate students who did not read their research methods text.

Research hypotheses divided to:

A. **Directional hypotheses :**predict the specific relationship among two or more variables or groups:

- Graduate students who read the text in research methods will score higher on their comprehensive exams than graduate students who did not read their research methods text.
- IQ scores will correlate in a positive manner with Self Esteem Scores

Research Hypotheses Cont.

B. Non-Directional Hypotheses: predict that there will be differences among two or more groups, but ***do not specify the direction of the differences***

- Men and Women will differ in their recall of phone numbers
- The scores on the Geriatric Depression Scale will differ between people with Stroke and people with Alzheimer's disease
- IQ scores will correlate with Self Esteem scores

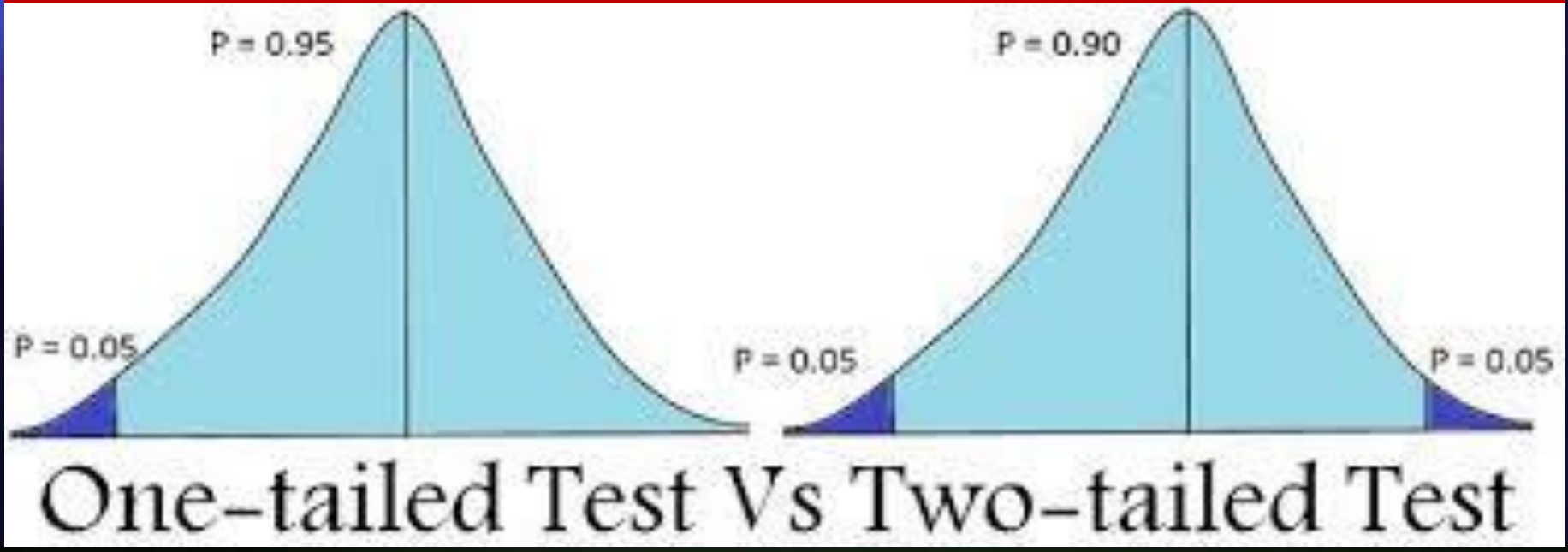
$H_0: \mu_1 = \mu_2$ $H_1: \mu_1 \neq \mu_2$

A **one-tailed test** is used when you have a directional hypothesis (e.g., a drug will lower blood pressure),

a two-tailed test is used for a non-directional hypothesis (e.g., a drug will change blood pressure).

The main difference is where the significance level (\(\alpha \)) is placed: a one-tailed test puts all of \(\alpha \) in one tail of the distribution,

while a two-tailed test splits \(\alpha \) between both tails. This affects the critical values and sample size needed to detect a significant difference.



One-tailed Test Vs Two-tailed Test

Choosing between them:

Choose a one-tailed test when you have a strong theoretical reason or prior evidence to believe the effect, if any, will be in a specific direction.

Choose a two-tailed test when you are open to the possibility of a significant effect in either direction, or when you want to detect any change at all.

Note: Two-tailed tests are more common in practice, as they are more conservative and consider both possibilities.

A one-tailed test may require a smaller sample size, but a two-tailed test can sometimes be more powerful for detecting a difference in a specific direction.

2. Statistical Hypotheses

Are mathematical, or logical statements that help researchers interpret the results of research

- Statistical hypotheses consist of the ***Null Hypothesis*** (H_0), the hypothesis of no difference and the ***Alternative Hypothesis*** (H_1 or H_A) which is similar in form to the research hypothesis.
  - Null: (H_0: $\mu 1 - \mu 2 = 0$)
  - Alternative: (H_1: $\mu 1 - \mu 2 \neq 0$)

- Written out examples:
  - **Null:** There will be no difference in the comprehensive test scores of graduate students who read the text in research methods and those who did not read their research methods text.
  - **Alternative**: Graduate students who read the text in research methods will score higher on their comprehensive exams than graduate students who did not read their research methods text.

Statistical Hypotheses Cont.

- **The null hypothesis always implies that there is no relation or statistical difference between variables or groups**
- **The alternative hypothesis implies that there is a meaningful relationship among variables or groups**

Examples

- RESEARCH: If children watch violent TV, then they will act more aggressively at recess.
- ALTERNATIVE: Children prone to aggression simply watch more violent TV.
- NULL: In a population of school-age children there is no relationship between TV violence and aggressive behavior.

Testing Hypotheses.

- We use a variety of statistical procedures to test null hypotheses. The choice of which procedure we use depends on a variety of factors including:
  - the research hypothesis,
  - the data,
  - the sampling strategy,
  - and what we want to be able to say as a result of our testing.

Objectives of Hypothesis Testable

- Variable are clearly measured and able to be manipulated
- Relationship between variables is supported or not
- Causal link between the independent and dependent variable is evaluated using statistical tests

Error Types:

- In hypothesis testing, we must contend with two types of errors -- Type I and Type II.
  - Errors are mistakes that we can make when judging the null hypothesis

- **Type I error:** is what happens when the tested hypothesis is falsely rejected. (It is when you say you found something, but that something is really an error.) A type I error is a false positive.

- Type I error by rejecting the null hypothesis when it is, in fact, true. For instance, if we concluded that the experimental treatment was more effective than the control condition in alleviating patients' anxiety, when in fact observed differences in anxiety scores resulted from sampling fluctuations, we would be making a Type I error.

type I Error Causes

The main "cause" of a Type I error is

1. chance/random sampling error leading to an unrepresentative sample.

2. The probability of this error is directly controlled by the researcher through the preset significance level (\(\alpha \)):

Type II error: is what happens when a false tested hypothesis is not rejected. (It is when you don't find something that is, in fact, there.) A type II error is a false negative.

Type II Error Causes Type II errors are often caused by a test having low statistical power:

1. **Small sample size**: A study with too few participants may not be able to detect a real effect or difference that exists in the population.
2. **Small effect size**: It is harder to detect a small true difference than a large one.High variability in the data.

To reduce Type II errors, researchers can increase the sample size or increase the significance level (α), which in turn increases the test's power ($1-\beta$).

Concept of Nursing Research: lecture One

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Definition of Nursing Research

A scientific process that validates and refines existing knowledge and generates new knowledge that directly and indirectly influences nursing practice.

It is the key to building an evidence-based practice for nursing.

Systematic objective of process to generate knowledge for importance of nursing phenomena.

What are the objectives of nursing scientific research

- To acquire knowledge
- To build a theory base
- To validate reality
- To test reality
- A way of understanding the empirical world
- To test/confirm/refute a hypothesis

Types of research are Basic & Applied Research

Basic research: is concerned with generating new knowledge; undertaken to accumulate information, extending the base of knowledge in a discipline – why?

- Pure science (ie. Bench scientists/natural science)

Applied research:is concerned with using knowledge to solve immediate problems.

focuses on finding an immediate solution to an existing problem – what is the goal?

- Clinical science (ie. Practice setting)

Nursing Research Methods

1. **Qualitative research** is multimethod in focus, involving an interpretive, naturalistic approach to its subject matter. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them.

Qualitative Research Methods

1. Phenomenological research
2. Ground theory research
3. Ethnographic research
4. Historical research
5. Focus groups

2. Quantitative research:

is **expressed in numbers and graphs**. It is **used to test or confirm** theories and assumptions. This type of research can be used to establish **generalizable facts** about a topic.

Purpose of Qualitative &Quantitative Research

Specific Purposes:

(1) Description

(2) Exploration

(3) Explanation

(4) Prediction and Control

Description

Identifying and understanding the nature of nursing phenomena and the relationships among the phenomena to:

- Describe what exists in nursing practice.
- Discover new information.
- Promote understanding of situations.
- Classify information for use in the discipline.

Explanation

Clarifying the relationships among phenomena and identifying the reasons why certain events occur.

exploratory research : It is usually conducted when the researcher does not know much about the problems.

investigates the full nature of the phenomenon, the manner in which it is manifested, and the other factors to which it is related. For example, a descriptive quantitative

Prediction

Estimating and anticipating the outcomes in a particular situation

Control

Manipulating a situation so as to achieve a particular outcome

Evidence Based practice and Major Steps in Nursing Scientific Research

Evidence-Based Nursing Practice

EBNP is the process by which nurses make clinical decisions based on the best available research evidence.

Practice based on evidence from nursing research is an approach that enables clinicians to provide the highest quality of care in meeting the multifaceted needs of patients and families.

Budin, 2008

What are the relationship between the scientific research and evidence based practice?

Develops empirical knowledge base to Identifies best practices that are based on clinical practices for Improves outcomes for:

- Patient and family
- Nurse
- Health care system

Concept of Nursing Research: lecture two

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What are Research Topics?

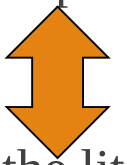
1. Observations
2. Behaviors
3. Concepts
4. Theories
5. Testing of assessment and intervention strategies

Sources of Knowledge - Ways of Acquiring Knowledge

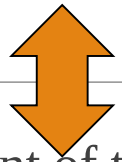
1. - **tradition**
2. - **authority**
3. - **trial and error**
4. - **assemble information**
5. - **personal/clinical experience**
6. - **intuition**
7. - **logical reasoning**
8.

‘Eight’ stages of Research process

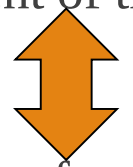
Selection of topic



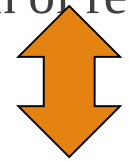
Reviewing the literature



Development of theoretical and conceptual frameworks

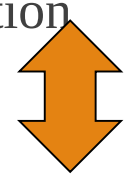


Clarification of research question/hypothesis

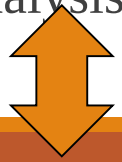


S. Research design

Data collection



Data analysis



Drawing conclusions and recommendation

1. Problem Definition

- **set of concept derived from one or more than phenomena and concept.**

- a crucial stage, as an inappropriate topic or question will often lead to irretrievable difficulties later in the research, so it is worth dealing with this stage carefully.

- Inform reader about the scope of the study, including defining any terms, limitations, or restrictions

Literature Review

Gives theoretical rationale of problem being studied, what research has been done and how it relates to the problem

- Helpful to divide the literature into sub-topics for ease of reading
- Quality of literature should be assessed

Development of theoretical and conceptual frameworks

Theoretical framework **study** is based on an existing **theory** or **theories** (e.g., a **theory** of motivation. refers to the underlying theoretical approach that you adopt to underpin your study, for example social learning theory, or theories of self-efficacy.

The conceptual framework defines and organises the concepts important within the study. The conceptual framework, on the other hand, is something you can develop yourself based on this theory

Clarification of research question/hypothesis

investigated and often rejected for a number of reasons, for example:

- The question lacks sufficient focus. defining and/or measuring the appropriate concepts.
- There are too many moderating or intervening variables.
- The project is unfeasible in terms of complexity access, facilities or resources.

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Selection of Research Design

The research design indicates the steps that will need to be take and the sequence they will occur also plan for study

Each design can rely on one ore more data collection technique

Purpose:

Assess reliability and validity

Critical consideration in determining methodology is the selection of subjects

Data Gathering or collection

Must pretest

Questionnaires must be coded

Concept within Sampling

Population: entire collection of people/things

Parameter: # that results from measuring all units in population

Sampling frame: specific data from which sample is drawn

Unit of analysis: type of object of interest

Sample: a subset of some of the units in the population

Statistic: # that results from measuring all units in the sample

Data processing and analysis

Describe demographics of the data

Compare behavior (if applicable)

Choose appropriate statistical technique (if applicable)

Look for patterns in data (if applicable)

Interpreting the Results

Discuss implications for the population of interest and future research

Stage 8. Drawing conclusions and Recommendation

This should relate back to the focused research question. Here, the answer to the research question(s) should be clearly stated. You can evaluate how **successful you have been in achieving your research objectives, and highlight the strengths and weaknesses of the research**. You may also want to make recommendations for further research.


thank
you