

Research Process

BACKGROUND

- Standard VII of the American Nurses Association's *Standards for Nursing Professional Development—Research*: “The nursing professional development educator participates in and uses evidence-based research to identify strategies for improving professional development activities, nursing practice, and patient outcomes” (ANA, 2000, p. 20)
- Research competencies for the nursing professional development educator identified by Brunt (2007):
 - Supports integration of research into practice
 - Incorporates research findings from a variety of disciplines into programs
 - Accesses resources needed to facilitate research
 - Develops and conducts research

IDENTIFY THE PROBLEM

- Cannot be general; must be narrowed to reflect a specific problem.
- Guides the research process.
- Must be clearly stated before research can begin.
- Requires considerable thought, imagination, creativity.
- Must be significant, researchable, and feasible.
- Needs to be an area of interest (Polit & Beck, 2007; Wood & Ross-Kerr, 2006).

Sources of Research Problems

- Experience: immediate needs that are relevant and interesting
- Nursing literature: regular reading of research literature can identify areas of interest, problems, or inconsistencies that need to be addressed
- Theory: test applicability to nursing or nursing education
- Ideas from external sources: a direct suggestion from faculty, employer, or funding agencies (Polit & Beck, 2007)

Searching the Literature

- May use librarian for assistance.
- Access online databases for nursing, medical, and healthcare information (e.g., PubMed, Medscape, Nursing Center) as well as non-healthcare resources if applicable to the topic area.
- Helps researcher become familiar with current knowledge in area of interest.
- Helps refine the research problem.
- Determines if there are similar studies that could be replicated or refined.
- May reveal previous methods that have proven useful in similar circumstances.
- Can solidify need for or significance of research in problem area.
- Using original (i.e., primary) sources rather than secondary sources.
- Needs to be comprehensive and include all relevant literature (Wood & Ross-Kerr, 2006).

Evaluating Research Articles

- Using the ASK (Applicability, Science, Knowledge) model
- *Applicability*
 - Is this study relevant to practice?
 - Do the findings suggest that the interventions tested made statistical or clinical improvements to practice?
 - Does the benefit to the subject outweigh the risk of implementation?
 - Is the change cost-effective in terms of human and material resources?
 - Is the potential outcome for the subject or organization worth the effort to implement the change?

- *Science*
 - The science is evaluated using standard criteria regardless of the practice area
 - “SPRMA” or “SPRTMA”—acronyms to help reviewers remember the key components of research
 - **S** – Statement of the problem
 - **P** – Purpose
 - **R** – Research question
 - **T** – Theoretical framework
 - **M** – Methodology
 - **A** – Analysis
- *Knowledge*
 - Do the results fit the existing knowledge base?
 - Do the research findings have meaning to the reader’s knowledge base?
 - Why wouldn’t or shouldn’t I use this idea? (Dittman, 2002)

Research Aims, Questions, Hypotheses, and Operational Definitions

- *Aim* outlines what the study is trying to achieve.
- Research *questions* narrow the original problem to a more concise statement that is measurable.
- *Hypothesis* is a statement about a relationship between two or more variables and predicts an expected outcome.
- The *independent variable* is the variable that the researcher chooses to control.
- The *dependent variable* is the variable that is affected by the independent variable.
- *Operational definitions* state the meanings of terms and how the terms will be measured (Polit & Beck, 2007).

RESEARCH DESIGN

- The research design guides the researcher in an organized fashion throughout the study.
- Strategies for sampling, data collection, and analysis of findings are determined by selection of a research design.
- A pilot study may be used to test the reliability and validity of data collection tools, or allow the researcher to practice research skills, such as interviewing techniques.
- Provides a plan or blueprint to answer the research question.
- Internal and external validity as concepts basic to the issue of control.
 - *Internal validity*: The extent to which the results of the study can actually be attributed to the action of the independent variable and not something else
 - *External validity*: the degree to which the findings of the study are generalizable to the target population (Wood & Ross-Kerr, 2006)

Types of Research Designs

- **Descriptive**: Results in a description of the data, whether in words, pictures, charts, or tables, and whether the data analysis shows statistical or merely descriptive relationships

- Experimental: Results in inferences drawn from the data that explain the relationships between the variables
- Types of quantitative research designs
 - *Experimental*: Subjects are randomly assigned to treatment or control group where the researcher manipulates the *independent variable* (the intervention, treatment, or condition introduced) and measures the effect achieved by the independent variable on the *dependent variable*
 - *Quasi-experimental*: Experimental treatment with a nonequivalent control group or no randomization, such as data collection before and after a treatment, or a time series design in which data are obtained from one group at several points before and after the treatment
 - *Nonexperimental*: Researcher collects data without making changes or introducing an intervention
 - Exploratory: Provides in-depth exploration of a single process or variable
 - Descriptive: Identifies characteristics of a specific population at one point
 - Retrospective: Ex post facto studies in which the researcher identifies a current phenomenon and collects data from the past in an attempt to identify possible causal factors
 - Prospective: Type of longitudinal study in which a group of subjects with a condition at present is followed over time to identify outcomes
 - Correlational: Used to examine the type and degree of the relationship between two variables
 - Case control studies: Descriptive study of a group of subjects with a condition compared to a group of subjects without the condition
- Surveys look at variables in a specific population or groups through self-report information.
- Needs assessments provide basis for development of a policy or program.
- Methodology studies examine the validity and reliability of instruments (Parker, 2009).

DATA COLLECTION

Sampling Techniques

- *Probability sampling* reflects the use of random selection, with every member of the target population having an equal chance of being included in the sample; includes simple random sampling, stratified random sampling, and cluster sampling.
 - *Simple random sampling* uses a table of random numbers to ensure that each unit in the population has an equal and independent chance of being selected.
 - *Stratified random sampling* divides the population into strata based on the sample criteria, then draws a predetermined number from each group using random sampling techniques.
 - *Cluster sampling* involves repeated random sampling progressing from large to small units over two or more stages (e.g., choosing a selection of samples from home health agencies, then selecting a sample of nurse case managers in home health agencies).
- *Nonprobability (convenience) sampling* reflects selection without the use of random selection; includes convenience, quota, systematic, and network sampling.
 - *Convenience sampling*: A minimum number of subjects or time frame is determined and everyone who meets the criteria is invited to participate.

- *Quota sampling*: Criteria to divide the sample into groups are identified, and then convenience sampling is used to fill the quota in each group.
- *Systematic sampling*: Selection of every *n*th number of the available population, after beginning with a random start.
- *Network sampling*: An individual or group meeting the sample criteria is identified, and the first and each subsequent member of the sample are asked to provide names of other individuals meeting the sample criteria (Wood & Ross-Kerr, 2006).

Data Collection Techniques

- Data collection methods are based on the hypothesis, research design, and characteristics of the population being studied.
- Methods of data collection:
 - Observation
 - Questionnaires
 - Interviews
 - Available data
 - Physiological measures
- Instruments must be reliable and valid.
 - Reliability addresses consistency, stability, repeatability, dependability, predictability, and accuracy of the measurement.
 - Validity is concerned with how well the instrument measures what it is intended to measure (Parker, 2009; Polit & Beck, 2007; Wood & Ross-Kerr, 2006).

DATA ANALYSIS

- Purpose of data analysis “is to reduce, organize, and give meaning to data” (Parker, 2009, p. 501).
- Types of data:
 - Qualitative: Verbal, narrative pieces of information
 - Quantitative: Numerical information
- Four levels of quantitative measurement:
 - *Nominal*: Mutually exclusive variables are organized into categories that cannot be compared, such as gender or marital status
 - *Ordinal*: Categories are ranked by the interval between rankings and are not necessarily equal, such as levels of pain or educational levels
 - *Interval*: Equal numerical distances exist between variables, such as a 1–5 rating scale
 - *Ratio*: Highest measurement form expressing a continuum of values with an absolute zero, such as weight
- Statistical analysis is used for quantitative data.
 - *Descriptive statistics* describe data (e.g., frequency, mean, range, standard deviation, correlation)
 - *Inferential statistics* draw conclusions about population from relationships between variables (e.g., *t* test, analysis of variance, chi-square, regression)

- Existence: Does a relationship exist between variables?
- Magnitude: What is the strength of the relationship between variables?
- Nature: What type of relationship exists between variables?
- Data analysis can be about one (univariate), two (bivariate), or three or more (multivariate) variables.
- Data analysis is done for different purposes.
 - Data cleaning: Done before analysis to find errors in data entry
 - Sample description: Summarize sample attributes (i.e., demographics)
 - Assessment of bias: Identify systematic biases (e.g., characteristics of volunteer subjects)
 - Evaluation of measurement tools: Analysis of validity and reliability of instruments
 - Evaluation of the need for transformations: How to handle missing values
 - Addressing research questions
- When addressing research question(s), statistical tests reject or accept the null (no difference) hypothesis.
- Type I error: Determine a difference exists when in actuality no difference exists.
 - Control for Type I error with “level of significance” (e.g., 0.05 or 0.01 levels of significance)
- Type II error: Determine no difference exists when in actuality a difference does exist.
 - Control for Type II error through power analysis (e.g., reaching sample size to a power of 0.80; typically determined prior to data collection)
- Biostatisticians can be helpful in determining sample size needed and identifying statistical tests to be done.
- Generally, a computer software program is used to analyze data.
- Create and follow a data analysis plan to decrease measurement error.
- Data analysis occurs during data collection to clean data, assess bias, evaluate measurement tools, and address missing data problems.

Interpreting the Results

- Explore significance of results.
- Describe limitations.
- Formulate conclusions.
- Identify implications and recommendations for future studies.
- Communicate findings.
 - Descriptive statistics—narrative, graph(s), table(s)
 - Inferential statistics—narrative, table(s)
 - Report to stakeholders
 - Poster or paper presentations
 - Manuscript (Parker, 2009; Polit, 1996)

INSTITUTIONAL REVIEW BOARD (IRB)

- Prior to implementation, all research should be approved by a qualified review board to ensure patient protection and ethical integrity.
- The IRB is a group that approves, monitors, and reviews biomedical research involving human subjects.

- Assures “that appropriate steps are taken to protect the rights and welfare of humans participating as subjects in research” (Food and Drug Administration, 2009).
- Issues of particular concern to the IRB are ethics, informed consent, confidentiality, and patient safety.
- Educational research typically falls under an expedited review.
- An expedited review can be done by the chair of the IRB or a designee rather than full IRB membership.
- Expedited review is used for research when:
 - The research poses minimal risk to the subject.
 - Data collection is noninvasive.
 - Data was or will be collected normally as a part of clinical practice (e.g., medical diagnosis).
 - Research is on individual or group characteristics or behavior (e.g., cognition, motivation, social behavior).
 - Research uses survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies (Health and Human Services, 1998).

Elements of Informed Consent

- Purpose and procedures of the research
- Description of subject selection process
- Description of potential risks, discomfort, and/or benefits to the subject or others
- Statement of how confidentiality of records will be maintained
- Compensation, if any, is discussed
- Alternative procedures, if any, are disclosed
- Right to refuse to participate or withdraw from study without penalty is assured
- The IRB may waive some or all of the informed consent process when:
 - No more than minimal risk to subject is involved,
 - Absence of informed consent does not adversely affect the subjects' rights and welfare,
 - The research could not be carried out without the waiver, and
 - When possible, the subjects are provided with information after participation (Health and Human Services, n.d.).

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