Assessment in Health Psychology

Prof. Dr. Talat Sohail

Lecture 1

- What is assessment?
- It is general term that includes full range of procedures used to gain information about student's learning such as observation,projects, paper and pencil tests, ratings of performance and judgment.

- So assessment is variety of procedures used to obtain information about a student
- About a patient
- About a client
- Assessment answers the question how well does the individual performs?

- What is meant by a test ?
- Test is a particular type of assessment that typically consists of a set of questions administered during a fixed period of time under comparable conditions for all students.

- Test can be an instrument used by doctor or psychologist
- Test can be a systematic procedure used by a teacher for measuring a sample of behavior by posing a set of questions in a uniform manner.

- What is measurement?
- Measurement is the assigning of numbers to the results of a test or other type of assessment according to a specific rule.
- Measurement answers the question how much?
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- Principles of assessment
- 1-Clearly specify what is to be assessed.
- 2-An assessment procedure should be selected.
- 3-Comprehensive assessment requires a variety of procedures.

- 4-Proper use of the assessment procedures require an awareness of their limitations.
- 5-Assessment is a means to an end , not an end in its self.

- The purpose of classroom instruction is to help students achieve a set of learning goals such as in the sphere of intellectual, emotional and physical. When classroom instruction is viewed in the light of assessment it becomes a part of teaching – learning process.

- Measurement and assessment are the essential elements of effective teaching.
- There is an inter dependence of the three that is measurement, assessment and effective teaching.

- Steps of effective teaching include
- 1-Identify instructional goals
- 2-Pre-assess the learner's needs
- 3-Provide relevant instruction
- 4-Assess the intended learning outcomes
- 5-Use the results effectively

- Assess the intended learning outcomes
- 1-Improve the learning and instruction
- 2-Mark and report to parents
- 3-Use for other school purposes

Types of assessment procedures

- 1-Maximum performance versus typical performance
- 2-Fixed choice tests and complex performance assessments

- 3-a-Placement assessment to determine student performance in the beginning
- -b-Formative assessment to monitor student learning progress during instruction
- -c-Diagnostic assessment to diagnose learning difficulties during instruction.

- -d-Summative assessment to assess achievement at the end of instruction.
- 4-norm referenced and criterion referenced measurement.

- norm referenced assessment a test or other type of assessment designed to provide a measure of performance that is interpretable in terms of an individual's relative standing in some known group.

- criterion referenced assessment a test or other type of assessment designed to provide a measure of performance that is interpretable in terms of of clearly defined and delimited domain of learning tasks.

- other terms used that are less used but have similar meanings to criterion referenced standards based, objective referenced, content referenced, domain referenced and universe referenced.

Common characteristics of NRTs and CRTs

- 1-Both require specification of the achievement domain to be covered.
- 2-Both require relevant and representative sample.
- 3-Both use same type of test items.
- 4-Both use same rules of item writing.
- 5-Both are judged by same qualities of goodness (validity and reliability)
- 6-Both are useful in educational assessment.

Differences between NRTs and CRTs

- 1-Differences between the two are following nrt covers large domain of learning tasks while crt covers delimited domain of learning tasks with a large no. of items measuring each specific task.
- 2-Nrt emphasis is on discrimination between individuals in terms of learning
- Crt emphasis is on which tasks individual can and cannot perform.

- 3-Nrt favors items of average difficulty and leaves out the easy and difficult ones.
- Crt matches item difficulty to learning task.
- 4-Nrt requires a clearly defined group
- Crt requires a clearly defined group and a delimited achievement domain.

- Important types of tests.
- 1-Informal vs standardized tests
- Informal ones are made by teachers while the professionals/specialists develop administer score standardized ones.

- 2-Individual vs group tests administered on the basis of one-one can be oral or written like intelligence or achievement where as others involve group administration .

- Mastery vs survey tests
- 3-Mastery tests are CRT and survey tests are NRT but some criterion referenced interpretation is there in survey tests.
- 4-Supply vs fixed response tests
- Some tests require examinees to supply answers like essay type tests where as others require them to select an option from the given ones.

- 5-Speed vs power tests a speed test is designed to measure the number of items an individual can complete in a given time where as power tests have items arranged in difficulty level.
- 6-objective vs subjective tests
- Objective one are like MCQs and subjective ones like essay type.

Significance of Measurement in Psychology and in Health Psychology

Lecture 2
By
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Importance of Measurement

- Measurement gives us a picture of what's going on. Imagine that someone asks you how long your desk is. How are you going to tell him? Will you get on a ruler and give me the number of inches? Will you please hand down and let me know that it is nine hands across?
- Whether you use a ruler or your hand, your measure will let you communicate with the other person about the length of your desk.
- That's all that measurement is: A way to understand what's going on and communicate it to others so that they, too, will understand.

Psychological Measurement

- Psychological measurement is the development of procedures to measure people's characteristics like intelligence or personality.
- The aptitude for a job or the presence of emotional disturbance can be determined applying standardized tests. Also known as psychological measurement or testing.
- In psychological research, we are comparing one thing to another. This could be comparing two groups, like doing a study to see whether people given a specific treatment for depression become less depressed after the treatment. Either way, we want to see if there are difference. In order to see that we have to measure something: the number of depression symptoms, patients suffer from.

Significance of Measurement in Psychology

- Whether it is a clinical psychologist, a school psychologist, a human resources director, or a teacher, his work might require him to make decisions on the basis of scores obtained from some kind psychological test. When a patient responds to a psychopathology assessment, when a student completes a test of cognitive ability, there is an attempt to measure some type of psychological characteristics.
- Whether your area is psychology, education, or any other behavioral science measurement is at heart of your research process.

Application of Psychological Measurement In Different Settings

- Psychologists work in a wide range setting and psychological measurement are used in all these settings;
- Forensic Setting
- Business and Military Setting
- Educational Setting
- Counseling Setting
- Clinical Setting

Significance of Measurement in Health Psychology

- **What is health psychology?**
  - Health psychology is a specialty area that focuses on understanding the role of psychological variables in the onset, course, treatment, and prevention of illness, disease and disability.
- **Different task performed in health psychology**
  - Health psychologist are involved in teaching, research, or direct service activities designed to promote good health.
- **Application of measurement in Health Psychology**
  - Measures are useful to the extant that they permit valid inferences in the service of given research goals, and health psychology research encompasses a variety of goals and audience.

Continue....

- Individual interviews, surveys and paper and pencil test are some of the tools that may be employed to help assess a current state of affairs with regard to some diseases or condition, gauge treatment progress, and evaluate outcome of intervention.
- One research approach in health psychology entails reporting on the nature of the psychological adjustment, the nature of coping, measures or the nature of the quality of life of members of targeted groups.
- Another line of research in health psychology focuses on aspects of personality, behavior, or life style as they relate to variables ranging from good physical health and longevity to sudden death by heart attack

Correlational Research in Health Psychology

- When health psychologists are interested in what factors predict or related to either disease or healthy functioning they use co-relational research.
  - For example; imagine that a health psychologist is interested in testing the claim that people with more friends tend to be healthier. She surveys 500 people in her community, asking them how many friends they have and getting get some measures of their overall health, then she makes a scatter plot and sees that there is a positive correlation between these variables.

Cross-sectional Studies in Health Psychology

- When researchers want to compare different age groups they rely on cross-sectional studies.
  - For example; they might choose to measure cholesterol levels in daily walkers across two age groups, over 40 and under 40 and compare these two cholesterol levels among non-walkers in the same age groups, researcher might even create subgroups for gender.
- The benefit of a cross-sectional study design is that it allows researchers to compare many different variables at the same time.

Longitudinal Studies in Health Psychology

- When health psychologist desire information on stability or instability of health status or some other characteristic over a period of time they use longitudinal studies.

The Assumptions of Health Psychology

By
Prof. Dr. Talat Sohail

The Assumptions of Health Psychology

Several assumptions central to health psychology have been highlighted. These include the following.

- The mind–body split
- Dividing up the soup
- The problem of progression
- The problem of methodology
- The problem of measurement
- Integrating the individual with their social context
- Data are collected in order to develop theories; these theories are not data
- Theories concerning different areas of health psychology are distinct from each other
- Studying a discipline
- A critical health psychology

The Mind–body Split

Health psychology sets out to provide an integrated model of the individual by establishing a holistic approach to health. Therefore it challenges the traditional medical model of the mind–body split and provides theories and research to support the notion of a mind and body that are one.

For example, it suggests that beliefs influence behavior, which in turn influences health; that stress can cause illness and that pain is a perception rather than a sensation. In addition, it argues that illness cognitions relate to recovery from illness and coping relates to longevity. However, does this approach really represent an integrated individual? Although all these perspectives and the research that has been carried out in their support indicate that the mind and the body interact, they are still defined as separate. The mind reflects the individuals' psychological states (i.e. their beliefs, cognitions, perceptions), which influence but are separate to their bodies (i.e. the illness, the body, the body's systems).

Dividing up the soup

Health psychology describes variables such as beliefs (risk perception, outcome expectancies, costs and benefits, intentions, implementation intentions), emotions (fear, depression, anxiety) and behaviors (smoking, drinking, eating, screening) as separate and discrete. It then develops models and theories to examine how these variables interrelate.

For example, it asks, 'What beliefs predict smoking?', 'What emotions relate to screening?' Therefore it separates out 'the soup' into discrete entities and then tries to put them back together. However, perhaps these different beliefs, emotions and behaviours were not separate until psychology came along. Is there really a difference between all the different beliefs? Is the thought 'I am depressed' a cognition or an emotion? When I am sitting quietly thinking, am I behaving? Health psychology assumes differences and then looks for association. However, perhaps without the original separation there would be nothing to associate!

The problem of progression

This book has illustrated how theories, such as those relating to addictions, stress and screening, have changed over time. In addition, it presents new developments in the areas of social cognition models and PNI.

For example, early models of stress focused on a simple stimulus–response approach. Nowadays we focus on appraisal. Furthermore, nineteenth century models of addiction believed that it was the fault of the drug. In the early twenty-first century, we see addiction as being a product of learning. Health psychology assumes that these shifts in theory represent improvement in our knowledge about the world. We know more than we did a hundred years ago and our theories are more accurate. However, perhaps such changes indicate different, not better, ways of viewing the world. Perhaps these theories tell us more about how we see the world now compared with then, rather than simply that we have got better at seeing the world.

The problem of methodology

In health psychology we carry out research to collect data about the world. We then analyse these data to find out how the world is, and we assume that our methodologies are separate to the data we are collecting.

In line with this, if we ask someone about their implementation intentions it is assumed that they have such intentions before we ask them.

Further, if we ask someone about their anxieties we assume that they have an emotion called anxiety, regardless of whether or not they are talking to us or answering our questionnaire. However, how do we know that our methods are separate from the data we collect? How do we know that these objects of research (beliefs, emotions and behaviours) exist prior to when we study them? Perhaps by studying the world we are not objectively examining what is really going on but are actually changing and possibly even creating it.

The problem of measurement

In line with the problem of methodology is the problem of measurement. Throughout the different areas of health psychology, researchers develop research tools to assess quality of life, pain, stress, beliefs and behaviours. These tools are then used by the researchers to examine how the subjects in the research feel/think/behave.

However, this process involves an enormous leap of faith – that our measurement tool actually measures something out there. How do we know this? Perhaps what the tool measures is simply what the tool measures. A depression scale may not assess 'depression' but only the score on the scale. Likewise, a quality-of-life scale may not assess quality of life but simply how someone completes the questionnaire.

Integrating the individual with their social context

Psychology is traditionally the study of the individual. Sociology is traditionally the study of the social context. Recently, however, health psychologists have made moves to integrate this individual with their social world. To do this they turn to social epidemiology (i.e. explore class, gender and ethnicity), social psychology (i.e. turn to subjective norms) or social constructionism (i.e. turn to qualitative methods). Therefore health psychologists access either the individuals' location within their social world via their demographic factors or ask the individuals for their beliefs about the social world.

Data are collected in order to develop theories; these theories are not data

Health psychologists collect data and develop theories about the individual, for example theories about smoking, eating, stress and pain.

These theories are then used to tell us something about the world. However, these theories could also be used as data, and in the same way that we study the world, we could study our theories about the world.

Perhaps this would not tell us about the world *per se but about how we see it. Furthermore, changes in theories could also tell* us about the way in which we see the world has changed. Likewise we could study our methods and our measurement tools. Do these also tell us something about the changing psychology of the past hundred years?

Theories concerning different areas of health psychology are distinct from each other

There are many theories relating to stress, pain and health behaviours, but has not examined parallels within these theories. Perhaps there are patterns within these different theories that reflect 'umbrella' changes within health psychology. Perhaps also these changes indicate consistent shifts in the way psychological theory describes the individual.

Studying a discipline

Therefore there are many assumptions underlying the discipline of health psychology. Acknowledging and understanding these assumptions provides the basis of a more critical perspective on research.

Findings from research are not taken for granted and theories can be seen within their inherent limitations. However, these assumptions themselves provide a basis for research – research into how a discipline has changed.

In addition, this kind of research can provide insights into how the focus of that discipline (the individual) has also changed. This approach provides a basis for a social study of a discipline. In the same way that sociologists study scientists, biographers study authors and literary theorists study literature, a discipline can also be studied.

A critical health psychology

Over the past few years a subsection of health psychology has developed which has become known as 'critical health psychology'. Researchers within this area emphasize the qualitative, critical and alternative approaches to understanding health and illness.

Further, they highlight the role of the social context and the political dimensions to health. Some of the assumptions addressed in this chapter are also addressed within the domain of critical health psychology.

Health Beliefs

By: Prof. Dr. Talat Sohail

What are health behaviors?

Kasl and Cobb (1966) defined three types of health-related behaviors. They suggested that:

- a health behavior was a behavior aimed to prevent disease (e.g. eating a healthy diet)
- an illness behavior was a behavior aimed to seek remedy (e.g. going to the doctor)
- a sick role behavior was any activity aimed to get well (e.g. taking prescribed medication,
- resting).

Health behaviors were further defined by Matarazzo (1984) in terms of either:

- health-impairing habits, which he called 'behavioral pathogens' (e.g. smoking, eating a high fat diet), or
- health protective behaviors, which he defined as 'behavioral immunogens' (e.g. attending a health check).

Predicting health behaviors

Much research has used quantitative methods to explore and predict health behaviors. For example, Kristiansen (1985) carried out a correlational study looking at the seven health behaviors defined by Belloc and Breslow (1972) and their relationship to a set of beliefs. She reported that these seven health behaviors were correlated with (1) a high value on health; (2) a belief in world peace; and (3) a low value on an exciting life. Obviously there are problems with defining these different beliefs, but the study suggested that it is perhaps possible to predict health behaviors.

- Leventhal et al. (1985) described factors that they believed predicted health behaviors:
  - social factors, such as learning, reinforcement, modelling and social norms
  - genetics, suggesting that perhaps there was some evidence for a genetic basis for alcohol use
  - emotional factors, such as anxiety, stress, tension and fear
  - perceived symptoms, such as pain, breathlessness or fatigue
  - the beliefs of the patient
  - the beliefs of the health professionals.

Leventhal et al. suggested that a combination of these factors could be used to predict and promote health-related behavior.

Health Belief Theories

- **Lay theories about health**

Such research has examined lay theories about health and has tended to use a qualitative methodology rather than a quantitative one. In particular medical sociologists and social anthropologists have examined beliefs about health in terms of lay theories or lay representations. Using in-depth interviews to encourage subjects to talk freely, studies have explored the complex and elaborate beliefs that individuals have.

Attribution theory

- Kelley (1967, 1971) developed these original ideas and proposed a clearly defined attribution theory suggesting that attributions about causality were structured according to causal schemata made up of the following criteria:
  - *Distinctiveness*: the attribution about the cause of a behavior is specific to the individual carrying out the behavior.
  - *Consensus*: the attribution about the cause of a behavior would be shared by others.
  - *Consistency over time*: the same attribution about causality would be made at any other time.
  - *Consistency over modality*: the same attribution would be made in a different situation.

- Since its original formulation, attribution theory has been developed extensively and differentiations have been made between self-attributions (i.e. attributions about one's own behavior) and other attributions (i.e. attributions made about the behavior of others). In addition, the dimensions of attribution have been redefined as follows:
  - ■ *internal versus external* (e.g. my failure to get a job is due to my poor performance in the interview versus the interviewer's prejudice)
  - ■ *stable versus unstable* (e.g. the cause of my failure to get a job will always be around versus was specific to that one event)
  - ■ *global versus specific* (e.g. the cause of my failure to get the job influences other areas of my life versus only influenced this specific job interview)
  - ■ *controllable versus uncontrollable* (e.g. the cause of my failure to get a job was controllable by me versus was uncontrollable by me).

Interview

By
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Interview

- An interview is a particular kind of conversation between people
- It has a set of assumptions that do not apply to normal conversation. Usually one person has a purpose for undertaking the interview; they want to gain information from other. They usually have an agenda particularly issues they want to find out about. A detailed conversation for gathering information.

Types of Interview

- Structured Interview
- Semi-structured Interview
- Unstructured Interview

Continue….

- Structured Interview
  - These use pre-determined, standardized, identical questions for every interviewee.
- Semi-structured Interview
  - You still have a list of themes to be covered and questions you want to ask, you can change your question, order of questions depending on the flow of conversation.
- Unstructured Interview
  - The interviewer has less control. You start things off by introducing a topic and then let the interviewee develop their ideas, talking freely about events, behavior or believes. Open ended questions are the example of unstructured question.

Qualification Criteria for Interview

1. Knowledge
   - being familiar with topic
2. Structure
   - outline the procedure of interview
3. Clear simple
   -easy and short questions
4. Gentle
   - being tolerant
5. Steering
   -to control the course of interview
6. Critical
   -to test the reliability and validity .
7. Interpreting- provide interpretation of what is said by the interviewee
8. Remembering –retain the subject information

Training of the Interviewer

- Since the interviewer can control the quality of results his/her training become crucial. It is important to organize in detail and rehearse the interviewing process before the beginning the formal study. Simply how to conduct the interview itself. They should have back ground of the study and why the study is important.

Explain the sampling logic & process

- Interviewer may not understand why sampling is so important. They may wonder why you go through all the difficulties of selecting the sample so carefully.

Interviewer Bias

- Interviewer needs to know the many ways that they can inadvertently bias the results. Understand why it is important that they not bias the study. By slanting the results they might jeopardize the results or purpose of the study.

Preparation of Interview

- Explain the purpose of interview
- Explain the format of interview
- Choose the setting with the least direction
- Indicate how long the interview usually takes
- Provide contact information to the interviewer
- Address terms of confidentiality
- Allow interviewee to clarify any doubts about the interview
- Prepare the method for recording data, e.g., take notes.

Explain the purpose of interview

- The interviewer wants to determine:
  - Can the candidate do the job?
  - Will the candidate fit in?
  - Do I want this job?
- To enhance your success at interviewing there are things you need to do before, during and after the interview.

Typical Stages of Interview

1. Introductory stage
2. Information from the interviewer to the candidate
3. Question from the interviewer(s) to the candidate
4. Opportunity given to the interviewee to ask question
5. Conclusion
6. Follow up

Important Points for interview

- Choose the setting with the least distraction
- Indicate how long the interview usually takes
- Address term of confidentiality
- Prepare a method for recording data
- Checks
  - An action to influence that stop motion or expression, e.g., what this means, then, is that…….
- Prompts
  - Encourage to say something, e.g., Remain silent, Repeat your question
- Probes
  - An exploratory action, e.g., could you give me some examples of that?
- Transcribing
  - The interviewer transcribes the tape because it is much easier. Analyze the data in written form. If you are slow writer or tape quality is poor, transcribing is laborious, but it is also rewarding because it brings the interview back life again, and it is your first real chance to start thinking about analyzing the data.

Types of interview questions with example

- Introducing questions
  - Can you tell me about…….?
- Follow up questions
  - Direct questioning of what has just been said, nodding, "mm", repeating significant words.
- Probing questions
  - Could you say something more about that?
- Specifying question
  - What did you think then?
- Direct questions
  - Have you ever received money for good grades?
- Indirect questions
  - How do you believe other pupils regard the competition of grades?
- Structuring questions
  - Indicating when a theme is exhausted by breaking off long irrelevant answers, "I would now like to introduce another topic….."

- Silence
  - By allowing pauses in interviewees have ample time to associate and reflect and break the silence themselves. With significant information.
- Interpreting questions
  - You then mean that….?
  - Is it correct that you feel that….?

Other types of Interviews

- Behavioral Interview
  - A behavioral interview is designed to provide the employer with an in depth look at your abilities.
- Committee Interview
  - In a committee interview you will face several members who will be actively involved in the hiring decisions
- Group Interview
  - The group interview is usually designed to illustrate the leadership potential of prospective managers and employees who will be dealing with the public
- Lunch Interview
  - The same guidelines apply in lunch interviews as those for typical site interviews.
- Video Conferencing
  - Video conferencing is often used as a more personalized version of the telephone interview.
- Phone Interview
  - The phone interview is a screening device meant to eliminate candidates and narrow the pool of applicants for personal interviews.

Disadvantages

- People may not have telephone or internet
- People often dislike the intrusion of a call to their home
- Telephone interviews need to be relatively short or people feel imposed upon.
- Many people don't have publicly listed telephone numbers.

Case Study Research Strategy

By
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Introduction

- The case study method one of the inevitable research method in qualitative research is not the only method for conducting social research, but it does represent a significant methodological tool and strategy for the social scientists (Ganon, 2012)

Definition

- Case study is in depth, multifaceted investigation, using qualitative research methods, of a single social phenomenon. The study is conducted in great detail and often relies on the use of several data sources (Feagin, 1991)

Characteristics of Case Study

- Focus on depth rather than breadth
  - The researcher obtains as much details as possible about one instance of phenomenon under investigation
- Natural Setting
  - The case or instance examined in its natural setting, not in the laboratory or other artificial situation. The case existed prior to the researcher arriving on the scene, and, normally continues to exist after the researcher has moved on.
- Holistic Study
  - The label holistic implies that the researcher take into account the every aspect of the case such as focus is on the complexity of relationship and processes.

Continue….

- Multiple sources and method
  - The researcher uses a wide range of data sources, for examples, if studying a department, a researcher will try to focus and talk to as many people as possible about life and work in the department, rather just one or two people, to obtain multiple perceptions about the department and how it operate.
- Qualitative method and case stud
  - A case study usually contains qualitative as well as quantitative element, and many other subjects are arranged und3er the flag of qualitative methods, such as
  - In depth interview
  - Qualitative content analysis of text, films, photographs, videotapes, and emails, narrative analysis, understructure observation and most historical methods.

Types of Case Studies

- There are three basic types of studies that are:
  - Exploratory study
  - Descriptive study
  - Explanatory study

Continue…..

- Exploratory study
  - Exploratory study is used to define the questions or hypothesis to be used in subsequent study. It is used to help a researcher understand a problem.
- Descriptive study
  - Descriptive study lead to a rich, detailed analysis of a particular phenomenon and its context. The analysis tells a story, including discussion of what occurred and how did different people perceived what occurred.

Continue….

- Explanatory study goes further than a descriptive study in trying to explain why events happened as they did or particular outcomes occurred. The case study analysis seeks to identify the multiple, often inter-linked, factors that had an effect, or compares what was found in the case to theories from the literature in order to see weather one theory matches the case better than others (Oates, 2007).

Case study according to approach to time

- Case study also vary in their approach to time;
  - A historical study
    - A historical study examines what happened in the past in the past by asking people what they remember about their earlier events and analyzing documents produced at the time.
  - A short term contemporary study
    - A short term contemporary study examines what is occurring in the case now. The researcher observes what occurs and asks people to talk about and explain what is going on.
  - A longitudinal study
    - It involves the researcher investigating the case over time, analyzing those processes and relationships that are continuous and those that change.

Selection of cases

- Its important to choose the right case/instance for case study and be able to justify this. The choice of a particular case might be based on:
  - Typical instance
    - Choose a typical case that may represent the whole class of society
  - Extreme instance
    - The chosen case is not typical of others but provides a contrast with the norms.
  - Test bed for theory
    - The case contains elements that make it suitable from testing an existing theory

Continue…..

- Convenience
  - People in the chosen case have agreed to give the researcher access, and it is convenient in terms of time and resources.
- Unique opportunity
  - The chance arises to study something that the researcher had not previously planned for, and that may not occurred again

Strengths of Case Study

- In depth study
- Good method to study rare pheromone
- Good method to challenge theoretical assumption
- Suitable for both theory binding and theory testing
- Deals with complex situations
- Close to people's experience –people enjoy reading case stories.

Drawbacks of Case Study

- It is difficult and time consuming
- Hard to draw cause-effect conclusion
- Possible biases in data collection and interpretation
- Presence of researcher can affect how people behave
- No set rules to follow in case study research strategy

Research Paradigms

By:
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Research Paradigms and Social Research

Synoptic View of PARADIGM ?

- a mental model
- a way of seeing
- a filter for one's perceptions
- a frame of reference
- a framework of thought or beliefs through which one's world or reality is interpreted
- an example used to define a phenomenon
- a commonly held belief among a group of people, such as scientists of a given discipline

Basic Beliefs (Metaphysics) of Alternative Inquiry Paradigms

Item	Positivism	Post Positivism	Critical Theory, et al	Constructivism (learning theory)
Ontology	Naïve realism—"real" reality but apprehend able	Critical realism—"real" reality but only imperfectly and probabilistically apprehend able	Historical realism—virtual reality shaped by social, political, cultural, economic, ethnic, and gender values; crystallized over time	Relativism—local and specific constructed realities
Epistemology	Dualist/ objectivist; findings true	Modified dualist/ objectivist; critical tradition/community; findings probably true	Transactional/ subjectivist; value-mediated findings	Transactional/ subjectivist; created findings
Methodology	Experimental/ manipulative; verification of hypotheses; chiefly quantitative methods methods	Modified experimental/ manipulative; critical multiplism; falsification of hypotheses; may include qualitative	Dialogic/dialectical	Hermeneutical/ dialectical

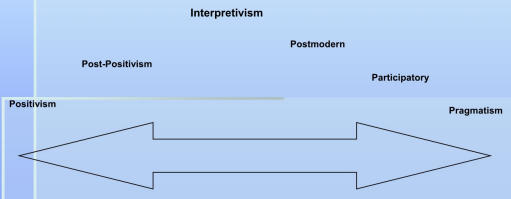
Paradigm Positions on Selected Practical Issues

Issue	Positivism	Post Positivism	Critical Theory, et al	Constructivism
Nature of knowledge	Verified hypotheses established as facts or laws	Non falsified hypotheses that are probable facts or laws	Structural/historical insights	Individual reconstructions coalescing around consensus
Inquiry aim	explanation	Prediction and control	Critique and transformation, restitution and emancipation	Understanding; reconstruction
Knowledge accumulation	Accretion – "building blocks" adding to "edifice of knowledge"; generalizations and cause-effect linkages		Historical situatedness; generalization by similarity	More informed and sophisticated reconstructions, vicarious experience
Goodness or quality criteria	Conventional benchmarks of "rigor" internal and external validity, reliability and objectivity		Historical situatedness; erosion of ignorance and misapprehensions, action stimulus	Trustworthiness and authenticity
Values	Excluded – influence denied		Included -- formative	

Paradigm Positions on Selected Practical Issues (Continued)

Issue	Positivism	Post Positivism	Critical Theory, et al	Constructivism
Ethics	Extrinsic; tilt towards deception		Intrinsic; tilt towards moral elevation	Intrinsic; process tilt towards revelation; special problems
Voice	"disinterested scientist" as informer of decision makers, policy makers, and change agents		"transformative intellectual" as advocate and activist	"passionate participant" as facilitator of multi-voice reconstruction
Training	Technical and quantitative; substantive theories	Technical; quantitative and qualitative; substantive theories	Re-socialization; qualitative and quantitative; history; values of altruism and empowerment	
Accommodation	Commensurable		Incommensurable	
Hegemony	In control of publication, funding, promotion, and tenure		Seeking recognition and input	

Theoretical Perspective History



Positivism, Critical Theory et. al, Interpretivism/Constructivism: A Comparison Among Paradigms

Positivism

Quantitative purists (Positivists):

- **Believe that social observations should be treated as entities in much the same way that physical scientists treat physical phenomena.**
- **Contend that the observer is separate from the entities that are subject to observation.**
- **Maintain that social science inquiry should be objective.**
- **That time- and context-free generalizations (Nagel, 1986) are desirable and possible, and**
- **Real causes of social scientific outcomes can be determined reliably and validly.**

Interpretivism / Constructivism

- Qualitative purists (also called *constructivists* and *interpretivists*) reject positivism.
- Argue for the superiority of constructivism, idealism, relativism, humanism, hermeneutics, and sometimes, postmodernism.
- Contend that multiple-constructed realities abound,
- That time- and context-free generalizations are neither desirable nor possible,

Interpretivism/Constructivism (Cont'd)

- That research is value-bound,
- That it is impossible to differentiate fully causes and effects,
- That logic flows from specific to general (e.g., explanations are generated inductively from the data), and
- That knower and known cannot be separated because the subjective knower is the only source of reality.

Understanding Critical Theory

Two Propositions

- 1) People are a product of the society in which they live. Hence this implies that their is no such thing as an objective fact that can be known outside of structure.
- 2) Intellectuals should not try to be objective and separate value judgments from their work

Table 1.1 Positivism and Social Constructionism and Research

	Positivism	Social Constructionism
The researcher	independent, objective	part of what he or she is studying
Human interest, intuition, reflection	detached, irrelevant	crucial to research process and investigation
Research goal	demonstrate causality	increase general understanding of situation
Research process	progress made through hypotheses and deductions	probing rich data to increase understanding
Concepts and variables	must be operationalized for measurement and quantitative analysis	should incorporate stakeholder perspectives
Unit of analysis	identifiable and reduced to simplest terms	may include complexity of whole
Generalization patterns	statistical probability	theoretical abstraction
Sampling requirements	probability sampling with adequate sampling size	may be non-probability sampling method with a small number of cases for specific reasons[6]

Logic of Inquiry: Research Strategies

Induction

The Inductive approach to enquiry builds generalizations out of observations of specific events. It starts with singular or particular statements and ends up with general or universal propositions.

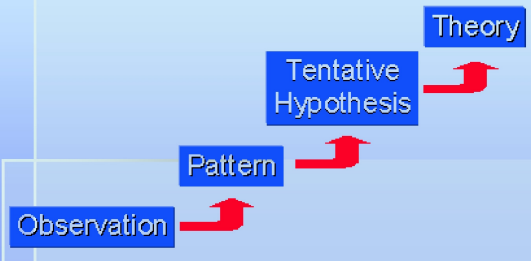
It presupposes that explanations about the workings of the world should be based on facts gained from pure, dispassionate and neutral observation, rather than on preconceived notions; that nature will reveal itself to a passively receptive mind.

Induction (Continued)

The Inductive strategy assumes that all science starts with observations which provide a secure basis from which knowledge can be derived and claims that reality impinges directly on the senses, hence there is a correspondence between sensory experiences, albeit extended by instrumentation, and the objects of those experiences. The conclusion of an inductive argument makes claims that exceed what is contained in the premises and so promises to extend knowledge by going beyond actual experience.

The more observations that demonstrate, say, a relationship between phenomena, the higher the probability that the general statement is true. Verification of derived generalizations comes through observations about particular phenomena that appear to support it.

Inductive Thinking

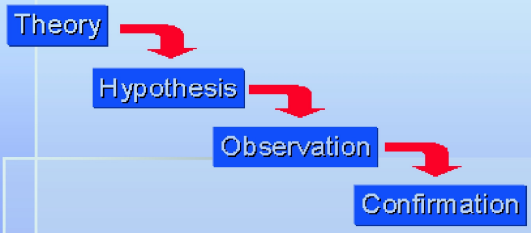


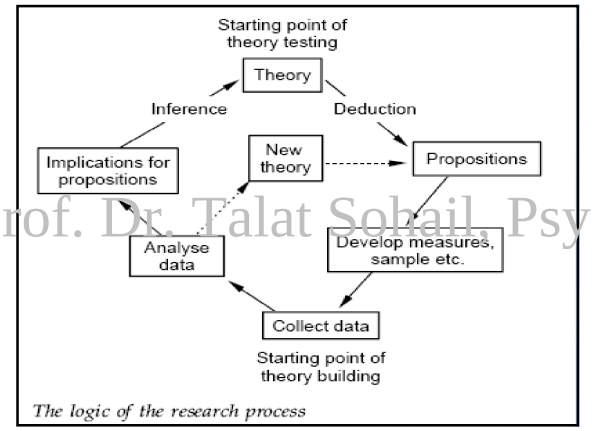
Deduction

The Deductive (hypothetico-deductive or falsificationist) approach is the reverse of an Inductive one. It begins explicitly with a tentative hypothesis or set of hypotheses that form a theory which could provide a possible answer or explanation for a particular problem, then proceeds to use observations to rigorously test the hypotheses.

The Deductive argument moves from premises, at least one of which is a general or universal statement, to a conclusion that is a singular statement. Deductive propositions form a hierarchy from theoretical to observational; from abstract to concrete. The Deductivist accepts that observation is guided and presupposed by the theory.

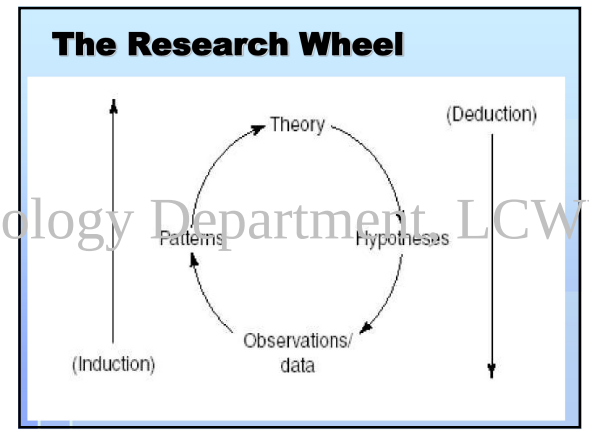
Deductive Thinking





The logic of the research process

The Research Wheel



Research Paradigms / Approaches & Basic Research in Health Psychology

By
Prof. Dr. Talat Sohail

What is a paradigm?

- A *paradigm* is a "worldview" or a set of assumptions about how things work.
- It pre-structures perceptions, conceptualization & understanding

Components of A Paradigm

- **Epistemology** – "The branch of philosophy concerned with the origin, nature, methods & limits of knowledge"
- **Ontology** – "concerned with being" or reality.
- **Research Methods and Methodology**
  - Methodology refers to general principles which underline how we investigate the social world and how we demonstrate that the knowledge generated is valid.
  - Research methods refers to the more practical issues of choosing an appropriate research design – perhaps an experiment or a survey – to answer a research question, and then designing instruments to generate data.

Research Paradigms / Approaches

- Two primary research paradigms are:
- Positivism – associated with quantitative research. Involves hypothesis testing to obtain "objective" truth. Also used to predict what may happen at a future date. Critical realism is a subtype of positivism that incorporates some value assumption on the part of the researcher. It involves looking at power in society. Researchers primarily rely on quantitative data to do this.
- Interpretivism –associated with qualitative research. Used to obtain an understanding of the word from an individual perspective. Critical Humanism is a subtype of the Interpretive paradigm. The critical humanism approach is one in which the researcher involves people studied in the research process. Data is used for social change.

Paradigm	Ontology *What is reality?*	Epistemology *How can I know reality?*	Theoretical Perspective *Which approach do you use to know something?*	Methodology *How do you go about finding out?*	Method *What techniques do you use to find out?*
Positivism	There is a single reality or truth (more realist).	Reality can be measured and hence the focus is on reliable and valid tools to obtain that.	Positivism Post-positivism	Experimental research Survey research	Usually quantitative, could include: Sampling Measurement and scaling Statistical analysis Questionnaire Focus group Interview
Constructivist / Interpretive	There is no single reality or truth. Reality is created by individuals in groups (less realist).	Therefore, reality needs to be interpreted. It is used to discover the underlying meaning of events and activities.	Interpretivism (reality needs to be interpreted) • Phenomenology • Symbolic interactionism • Hermeneutics Critical Inquiry Feminism	Ethnography Grounded Theory Phenomenological research Heuristic inquiry Action Research Discourse Analysis Femenist Standpoint research etc	Usually qualitative, could include: Qualitative interview Observation Participant Non participant Case study Life history Narrative Theme identification etc
Pragmatism	Reality is constantly renegotiated, debated, interpreted in light of its usefulness in new unpredictable situations.	The best method is one that solves problems. Finding out is the means, change is the underlying aim.	Deweyan pragmatism *Research through design*	Mixed methods Design-based research Action research	Combination of any of the above and more, such as data mining expert review, usability testing, physical prototype
Subjectivism	Reality is what we perceive to be real	All knowledge is purely a matter of perspective.	Postmodernism Structuralism Post-structuralism	Discourse theory Archaeology Genealogy Deconstruction etc.	Autoethnography Semiotics Literary analysis Pastiche Intertextuality etc.
Critical	Realities are socially constructed entities that are under constant internal influence.	Reality and knowledge is both socially constructed and influenced by power relations from within society	Marxism Queer theory feminism	critical discourse analysis, critical ethnography action research ideology critique	Ideological review Civil actions open-ended interviews, focus groups, open-ended questionnaires, open-ended observations, and journals

Qualitative vs. Quantitative Research

- Qualitative Research
- Involves unstructured interviews, observation, and content analysis.
- Subjective
- Inductive
- Little structure
- Little manipulation of subjects
- Takes a great deal of time to conduct
- Little social distance between researcher and subject

- Quantitative Research
- Involves experiments, surveys, testing, and structured content analysis, interviews, and observation.
- Objective
- Deductive
- High degree of structure
- Some manipulation of subjects
- May take little time to conduct
- Much social distance between researcher and subject

What is Qualitative Research?

- Qualitative research is multi-method in focus, involving an interpretative, naturalistic approach to its subject matter.
- Qualitative Researchers study "things" (people and their thoughts) in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them.
- Qualitative research involves the studied use and collection of a variety of empirical materials - case study, personal experience, introspective, life story, interview, observational, historical, interactional, and visual texts-that describe routine and problematic moments and meanings in individuals lives.

What is Quantitative Research?

- Formal, objective, rigorous, systematic process for generating information
- Describes new situations, events, or concepts
- Examines relationships among variables
- Determines the effectiveness of treatments

Important Concepts in the Quantitative Research Process

Types of Quantitative Research

Descriptive Research

- Descriptive, which defines the magnitude of a concept and its characteristics;
- Descriptive research is research designed to provide a snapshot of the current state of affairs.

Correlational Research

- Correlational research is research designed to discover relationships among variables and to allow the prediction of future events from present knowledge
- Determines the strength and type of relationship
- Explains what is seen
- No cause and effect

Quasi-experimental Research

- Examines cause-and-effect relationships
- Less control by researcher than true experimental designs
- Samples are not randomly selected.
- All variables in the study cannot be controlled by the researcher.

Experimental Research

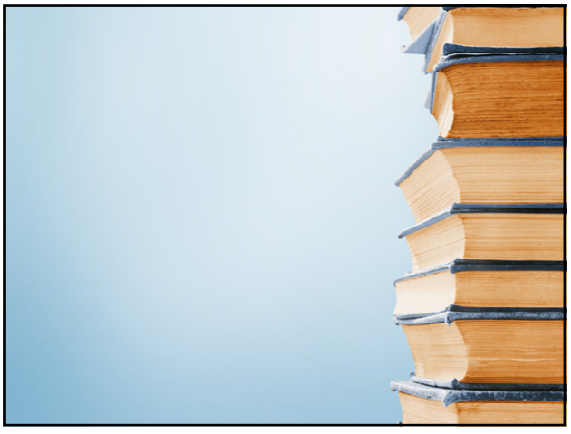
- Experimental research is research in which initial equivalence among research participants in more than one group is created, followed by a manipulation of a given experience for these groups and a measurement of the influence of the manipulation. Each of the three research designs varies according to its strengths and limitations, and it is important to understand how each differs.
- Controlled manipulation of at least one independent variable
- Uses experimental and control groups
- Random assignment of the sample to the experimental and control groups
- Looks at cause-and-effect relationships
- Highly controlled, objective, systematic studies
- Involves the measurement of independent and dependent variables

Control in Quantitative Research

Type of Quantitative Research	Researcher Control	Research Setting
Descriptive	Uncontrolled	Natural or partially controlled
Correlational	Uncontrolled or partially controlled	Natural or partially controlled
Quasi-experimental	Partially controlled	Partially controlled
Experimental	Highly controlled	Laboratory

Characteristics of the Three Research Designs

Research design	Goal	Advantages	Disadvantages
Descriptive	To create a snapshot of the current state of affairs	Provides a relatively complete picture of what is occurring at a given time. Allows the development of questions for further study.	Does not assess relationships among variables. May be unethical if participants do not know they are being observed.
Correlational	To assess the relationships between and among two or more variables	Allows testing of expected relationships between and among variables and the making of predictions. Can assess these relationships in everyday life events.	Cannot be used to draw inferences about the causal relationships between and among the variables.
Experimental	To assess the causal impact of one or more experimental manipulations on a dependent variable	Allows drawing of conclusions about the causal relationships among variables.	Cannot experimentally manipulate many important variables. May be expensive and time consuming.



CROSS-SECTIONAL STUDY

By:
Prof. Dr. Talat Sohail

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CONTENTS

- History and classification
- Difference between descriptive and analytical
- Attributes
- Advantages and disadvantages
- Case scenario
- Guidelines

2

- History
- Developments in modern epidemiology
- Scope of clinical epidemiology
- Definitions
- Need for epidemiological studies

3

WHY SHOULD MEDICAL STUDENTS KNOW METHODS IN EPIDEMIOLOGY?

- Research as lifetime carrier
- Service providers as clinicians
- consumers of research need to know basic methods in epidemiology - read articles

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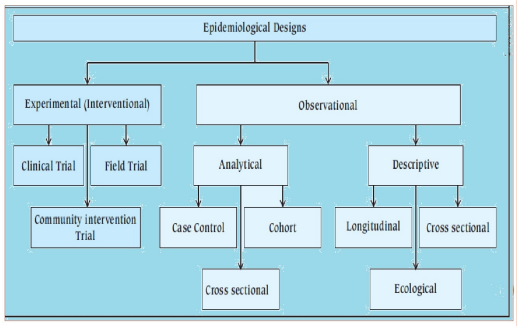
CLASSIFICATION



HIERARCHY OF SCIENTIFIC EVIDENCE

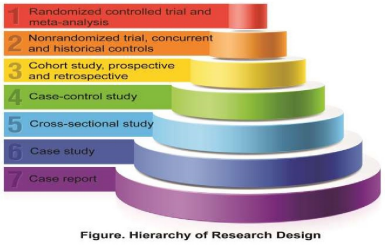


Figure. Hierarchy of Research Design

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INTRODUCTION

- Cross sectional studies entail collection of data
- A cross section of a population
- Comprise of whole population or a sample of the whole population

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cross sectional studies otherwise called **prevalence studies**

$$\text{Prevalence Rate} = \frac{\text{Number of prevailing cases of a disease (old \& new) existing at a given point of time}}{\text{Estimated population at the same point of time (Multiplying factor can be chosen as appropriate)}} \times 1000$$

8

OBSERVATIONAL STUDY

- single examination of population at one point in time
- individual based
- measures exposure & effect
- exposure precedes or follows the effect not k

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DESCRIPTIVE CROSS SECTIONAL STUDY / POPULATION (COMMUNITY) SURVEY / PREVALENCE SURVEY

- Information about single /multiple variables
- Estimate problem – Prevalence.

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- Point prevalence
- Period prevalence
- Disease & suspected risk factors population /specific individuals

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ANALYTICAL CROSS-SECTIONAL STUDY

- information - presence & strength of association
- testing of hypothesis

12

DEFINITION

- "an analytic investigation in which subjects are sampled at a fixed point or period of time, and then the association between the concurrent presence or absence of risk factors and diseases are investigated".

(Raymond S.Greenberg et el-1995)

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Descriptive Cross sectional studies

- Presence of disease, disability and symptoms of ill-health
- Dimensions of Positive health such as fitness
- Attributes related to health -Body measurements, blood pressure etc

14

Analytical Cross sectional

- Strength of association between disease & Risk factors
- Determinants of disease / conditions
- Predictors of disease / condition

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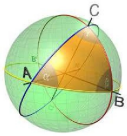
ATTRIBUTES OF CROSS SECTIONAL STUDIES

- Population studied comprise of survivors at a point / period of time
- Attrition may have occurred before the study
- Describes association between exposure and disease simultaneously



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- Measures prevalence of disease in exposed and unexposed
- Risk measurements are Prevalence Ratio (inexact estimate of Relative risk) & Odds ratio
- Evidence for causality is only suggestive
- More prone for selection bias

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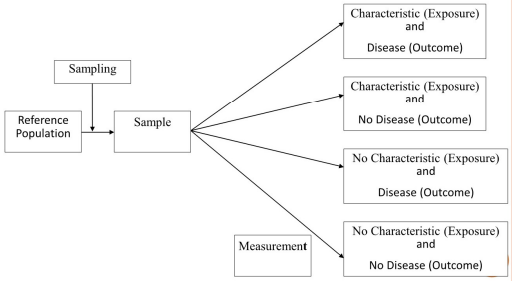
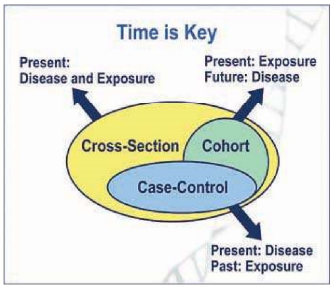
DESIGN OF CROSS SECTIONAL STUDY



Exposure and Disease Measures Simultaneously



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Steps in conducting Cross sectional studies

- State the criteria for the disease / condition clearly
- Define co-variables to be measured
- Examine ethical issues
- Identify the reference population
- inclusion / exclusion criteria

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- Determine minimum number of Sample required
- Select study subjects through appropriate sampling procedure
- Define measurement procedures
- Carry out data collection
- Clinical examination (Laboratory investigations)

21

- Clinical records and other documents
- Interviews and Questionnaires
- Summarize data
- Analyze and interpret finding
- Report

22

Analysis of Data in Cross sectional studies

A. Descriptive cross sectional Studies (Measurement of variables)

- For Continuous Variables (Measurement Data)
  Mean, Standard Deviation, Median & Percentiles
- Nominal Data (Count Data)
  Prevalence Rates and Proportions

95 % CI can also be calculated

23

B. Analytical cross sectional Studies (Measurement of association between variables)

- For Continuous Variables (Measurement Data)
  Correlation and regression co-efficient
- Nominal Data (Count Data)
  Odds Ratio, Rate Ratio (Prevalence ratios) and Exposure ratio

24

Basic form of Data construction in Analytical cross-sectional Studies with Nominal Data

Exposure (Risk Factor)	Disease		Total
	Present	Absent	
Exposed (Present)	a	b	a + b
Not Exposed (Absent)	c	d	c + d
Total	a + c	b + d	n

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Some common applications of Cross-sectional studies

- In Community Health Care
- In Clinical practice and Patient Care
- In Programme evaluation
- In acquiring new knowledge

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BIASES IN CROSS SECTIONAL STUDIES

- Choice of sampling frame
- Non – response
- Information bias
- Observer bias
- Prevalence Bias in Hospital Studies

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ADVANTAGES OF CROSS SECTIONAL STUDIES

- Provides estimate of the disease burden (prevalence)
- Relatively short duration
- Easy and quick
- Less costly
- Useful for chronic conditions with low case fatality

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- Starting point for cohort study for screening existing diseases
- Provide wealth of data for further research
- Allow a risk statement, although these are not precise

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DISADVANTAGES OF CROSS SECTIONAL STUDIES

- Does not provide estimate of disease occurrence (incidence)
- No direct estimate of risk possible
- Rare diseases, short duration, high case fatality not detected
- Natural history of disease information minimal

30

- Prone for biases from selective survival
- Not possible to establish temporality
- Therefore, it is a weak design for proving causality

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Some important methods in Cross sectional studies

Rapid epidemiological assessment procedures

- Simple, inexpensive but adequate enough to provide estimates for programme decisions
- Useful in emergent situations for appraisal of health needs

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Examples

- Coverage evaluation survey in EPI
- Cataract surveys by trained paramedicals
- Identification of Low Birth Weight newborns by Trained Birth Attendants using colour coded weighing machines

33

In a study to assess the prevalence of Hypertension among adult male population, 1000 men above 30 years of age were examined. Detailed history about lifestyle issues were also collected from them. Blood pressures were recorded as per the WHO guide ines. Hypertensive's were identified as per JNC guidelines; the data is presented as follows.

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(Exposure) (Risk Factor) Smoking	Disease (Hypertension)		Total
	Present	Absent	
(Exposed) (Present) Smokers	120	280	400
(Not Exposed) (Absent) Non-smokers	30	570	600
Total	150	850	1000

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(Exposure) (Risk Factor) Smoking	Disease (Hypertension)		Total
	Present	Absent	
(Exposed) (Present) Smokers	120 a	280 b	400
(Not Exposed) (Absent) Non-smokers	30 c	570 d	600
Total	150	850	1000

- Prevalence of Hypertension among Smokers (Cases among Exposed) $= \frac{a}{a+b} = \frac{120}{400} = 0.3$
- Prevalence of Hypertension among Non-smokers = (Cases among Un-exposed) $\frac{c}{c+d} = \frac{30}{600} = 0.05$

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(Exposure) (Risk Factor) Smoking	Disease (Hypertension) Present	Absent	Total
(Exposed) (Present) Smokers	120 a	280 b	400
(Not Exposed) (Absent) Non-smokers	30 c	570 d	600
Total	150	850	1000

- Rate Ratio (Prevalence Ratio) = Prevalence among exposed / Prevalence among un-exposed = 0.3 / 0.05 = 6.0
- Odds Ratio = ad/bc = 120* 570 / 280* 30 = 68400 / 8400 = 8.14

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Applications of different observational study designs

Objective	Ecological	Cross-sectional	Case-control	Cohort
Investigation of rare disease	++++	–	+++++	–
Investigation of rare cause	++	–	–	+++++
Testing multiple effects of cause	+	++	–	+++++
Study of multiple exposures and determinants	++	++	++++	+++
Measurements of time relationship	++	–	+[b]	+++++
Direct measurement of incidence	–	–	+[c]	+++++
Investigation of long latent periods	–	–	+++	–

[a] +...+++++ indicates the general degree of suitability; there are exceptions – not suitable.
[b] If prospective.
[c] If population-based.

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Advantages and disadvantages of observational study designs

	Ecological	Cross-sectional	Case-control	Cohort
Probability of:				
selection bias	NA	medium	high	low
recall bias	NA	high	high	low
loss to follow-up	NA	NA	low	high
confounding	High	medium	medium	medium
time required	Low	medium	medium	high
cost	Low	medium	medium	high

NA: not applicable.

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Guidelines

1. Are the results of the study valid?

Primary guides

a) What were the criteria used for the disease/condition under study?
b) Was the population adequately defined?
c) Was sampling method proper?
d) How were the measurements made?

40

Secondary guides

Are there any biases that the investigator did not address?

2. What were the results?
   a) How large was the point estimate?
   b) How precise was the point estimate? (95% C.I.)

3. Will the results help me?
   a) Are the results applicable to my population?
   b) What is the magnitude of the problem?

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Cross Sectional Studies

By
Prof. Dr. Talat Sohail

Cross-sectional Study

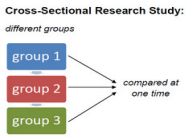
- A **cross-sectional study is an observational study in which exposure and disease are determined at the same point in time in a given population**

Cross-sectional Study

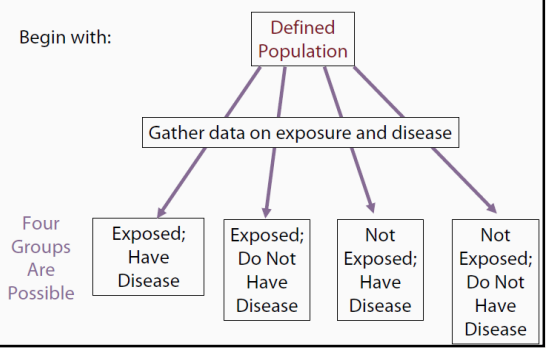
- **Cross-sectional study** is a research tool used to capture information based on data gathered for a specific point in time. The data gathered is from a pool of participants with varied characteristics and demographics known as variables. Age, gender, income, education, geographical locations, and ethnicity are all examples of variables. The variables, or demographics, used in a single study are based on the type of research being conducted and on what the study aims to prove or validate. The research findings help remove assumptions and replace them with actual data on the specific variables studied during the time period accounted for in the cross-sectional study.

Characteristics Cross-sectional studies

- Cross-sectional research studies all have the following characteristics:
  - Takes place at a single point in time
  - Variables are not manipulated by researchers
- Cross-sectional research studies are based on observations that take place in different groups at one time. This means there is no experimental procedure, so no variables are manipulated by the researcher.



Design of a Cross-Sectional Study



Design and Analysis of a Cross-Sectional Study

	Disease	No Disease
Exposed	a	b
Not Exposed	c	d

	Disease	No Disease
Exposed	a	b
Not Exposed	c	d

	Disease	No Disease
Exposed	a	b
Not Exposed	c	d

Ways to use cross-sectional studies

- Cross-sectional studies are used both descriptively and analytically.
  - *Descriptive Cross-sectional studies*
  - *analytical cross-sectional studies*

Descriptive Cross-sectional Studies

- *Descriptive cross-sectional studies simply characterize the prevalence of a health outcome in a specified population. Prevalence can be assessed at either one point in time (point prevalence) or over a defined period of time (period prevalence). Period prevalence is required when it takes time to accumulate sufficient information on a disease in a population, e.g. what proportion of persons served by a public health clinic over a year have hypertension. These prevalence measures are commonly used in public health; often the point or period aspect is not specified.*

Analytical Cross-sectional Studies

- In *analytical cross-sectional studies, data on the prevalence of both exposure and a health outcome are obtained for the purpose of comparing health outcome differences between exposed and unexposed.* Analytical studies attempt to describe the prevalence of, for example, disease or non-disease by first beginning with a population base.

Calculating prevalence

- The prevalence of a health outcome is simply the proportion of individuals with the health outcome in a population.

Prevalence = cases / total population

Example

- For the following example, two different sub-measures of prevalence can be calculated: the prevalence of coronary heart disease (CHD) among the exposed (people who are not active) and the prevalence of CHD among the unexposed.

Example:

	Present CHD		Absent CHD		Total
Not active	50	a	b	200	250
Active	50	c	d	700	750
Total	100			900	1000

P_1= a/a+b= 50/250 = 20.0% prevalence of CHD among people who are not active.

P_0= c/c+d = 50/750 = 6.7% prevalence of CHD among people who are active.

Advantages of Cross-Sectional Study

- The advantages of cross-sectional study include:
  - Used to prove and/or disprove assumptions
  - Not costly to perform and does not require a lot of time
  - Captures a specific point in time
  - Contains multiple variables at the time of the data snapshot
  - The data can be used for various types of research
  - Many findings and outcomes can be analyzed to create new theories/studies or in-depth research

Disadvantages of Cross-Sectional Study

- The disadvantages of cross-sectional study include:
  - Cannot be used to analyze behavior over a period to time
  - Does not help determine cause and effect
  - The timing of the snapshot is not guaranteed to be representative
  - Findings can be flawed or skewed if there is a conflict of interest with the funding source
  - May face some challenges putting together the sampling pool based on the variables of the population being studied

Intervention Studies

By
Prof. Dr. Talat Sohail

What are intervention studies?

- Intervention (or Experimental) studies differ from observational studies in that the investigator assigns the exposure. They are used to determine the effectiveness of an intervention or the effectiveness of a health service delivery. They can also be used to establish the safety, cost-effectiveness and acceptability of an intervention. In contrast, analytical observational studies (i.e. cohort and case control studies) look at the relationships between risk factors or characteristics of patients and their likelihood of getting a particular disease.

Intervention Studies

- Intervention studies are considered to provide the most reliable evidence in epidemiological research. Intervention studies can generally be considered as either preventative or therapeutic.
  - **Therapeutic trials** are conducted among individuals with a particular disease to assess the effectiveness of an agent or procedure to diminish symptoms, prevent recurrence, or reduce mortality from the disease.
  - **Preventative trials** are conducted to evaluate whether an agent or procedure reduces the risk of developing a particular disease among individuals free from that disease at the beginning of the trial, for example, vaccine trials. Preventative trials may be conducted among individuals or among entire communities

Interventions Defined

- Health-promoting activities that originate from a health promotion team with the intention of instilling/maintaining health-related attitudes, norms, and behaviors in a specific target.

Types of Experimental Interventions May Include

- Therapeutic agents
- Prophylactic agents
- Diagnostic agents
- Surgical procedures
- Health service strategies

Characteristics of an Intervention Study

- A distinguishing characteristic of an intervention study is that the intervention (the preventative or therapeutic measure) being tested is allocated by the investigator to a group of two or more study subjects (individuals, households, communities).
- Subjects are followed prospectively to compare the intervention vs. the control (standard treatment, no treatment or placebo).

Types of Intervention Studies

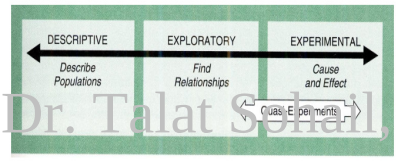
There are two types of intervention studies:

- Randomized Controlled Trials
  - The randomized controlled trial is considered as the most rigorous method of determining whether a cause-effect relationship exists between an intervention and outcome. The strength of the RCT lies in the process of randomization which is unique to this type of study design.
  - Generally, in a randomized controlled trial study participants are randomly assigned to one of two groups, the experimental group who will receive the intervention being tested, and a comparison group (controls) who receive a conventional treatment or placebo. These groups are then followed prospectively to assess the effectiveness of the intervention compared with the standard or placebo treatment.

Non-randomized Trials

- A study where participants have been assigned to the treatment, procedure, or intervention alternatives by a method that is not random. The investigator defines and manages the alternatives.

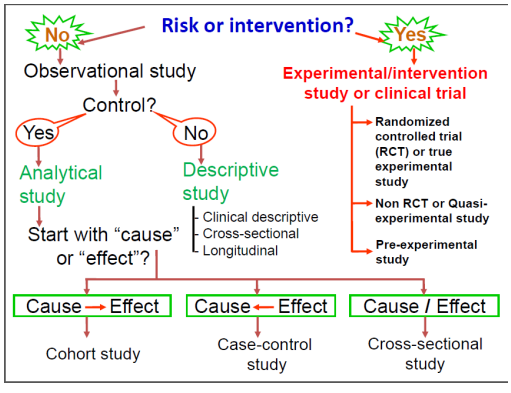
Non-randomized trials are a type of quasi-experimental design



Quasi-experimental designs are those that do not meet the criteria for a true experimental design such as random assignment of participants to groups or having a control group.

Advantages/Disadvantages of Randomization

- Eliminates confounding - tends to create groups that are comparable for all factors that influence outcome, known, unknown or difficult to measure. Therefore, the only difference between the groups should be the intervention.
- Eliminates treatment selection bias.
- Gives validity to statistical tests based on probability theory.
- Any baseline differences that exist between study groups are attributable to chance rather than bias. Though this should still be considered as a potential concern.
- Does not guarantee comparable groups as differences in confounding variables may arise by chance.



Thank You

Epidemiology

A Brief Introduction

By:

Prof. Dr. Talat Sohail

Epidemiology - definition

- epi – means “on, upon, befall”
  - epidermis: upon the body, skin
- demo – means “people, population, man”
  - demographics
- ology – means study of
- Literally epidemiology: that which befalls man

Epidemiology - definition

- Some see epidemiology as science, others see it as a method.
- Generally seen as a scientific method to investigate disease
- **Def:** an investigative method used to detect the cause or source of diseases, disorders, syndromes, conditions, or perils that cause pain, injury illness, disability, or death in human populations or groups

Epidemiology – What is it?

- The study of the nature, cause, control, and determinants of the frequency and distribution of disease, disability, and death in human populations.
- Also involves characterizing the distribution of heath status, diseases, or other health problems in terms of age, sex, race, geography, religion, education, occupation, behaviors, time, place, person, etc.
- This characterization is done in order to explain the distribution of a disease or health related problems in terms of the causal factors

Epidemiology – What is it?

- Serves as the foundation and logic of interventions made in the interest of public health and preventive medicine.
- It is considered a cornerstone methodology of public health research, and is highly regarded in evidence-based medicine for identifying risk factors for disease and determining optimal treatment approaches to clinical practice.

Epidemiology – What is it?

- In the work of communicable and non-communicable diseases, the work of epidemiologists range from outbreak investigation to study design, data collection and analysis including the development of statistical models to test hypotheses and the documentation of results for submission to peer-reviewed journals.
- Epidemiologists may draw on a number of other scientific disciplines such as biology in understanding disease processes and social science disciplines including sociology and philosophy in order to better understand proximate and distal risk factors

History

- The Greek physician Hippocrates is sometimes said to be the father of epidemiology. He is the first person known to have examined the relationships between the occurrence of disease and environmental influences. He coined the terms *endemic* (for diseases usually found in some places but not in others) and *epidemic* (for disease that are seen at some times but not others).
- One of the earliest theories on the origin of disease was that it was primarily the fault of human luxury. This was expressed by philosophers such as Plato and Rousseau, and social critics like Jonathan Swift

History

- In the medieval Islamic world, physicians discovered the contagious nature of infectious disease. In particular, the Persian physician Avicenna, considered a "father of modern medicine," in *The Canon of Medicine* (1020s), discovered the contagious nature of tuberculosis and sexually transmitted disease, and the distribution of disease through water and soil.
- Avicenna stated that bodily secretion is contaminated by foul foreign earthly bodies before being infected. He introduced the method of quarantine as a means of limiting the spread of contagious disease.
- He also used the method of risk factor analysis, and proposed the idea of a syndrome in the diagnosis of specific diseases.

History

- When the Black Death (bubonic plague) reached Al Andalus in the 14th century, Ibn Khatima hypothesized that infectious diseases are caused by small "minute bodies" which enter the human body and cause disease.
- Another 14th century Andalusian-Arabian physician, Ibn al-Khatib (1313–1374), wrote a treatise called *On the Plague*, in which he stated how infectious disease can be transmitted through bodily contact and "through garments, vessels and earrings."

History

- In the middle of the 16th century, a famous Italian doctor from Verona named Girolamo Fracastoro was the first to propose a theory that these very small, unseeable, particles that cause disease were alive.
- They were considered to be able to spread by air, multiply by themselves and to be destroyable by fire. In this way he refuted Galen's theory of miasms (poison gas in sick people).
- In 1543 he wrote a book *De contagione et contagiosis morbis*, in which he was the first to promote personal and environmental hygiene to prevent disease.

History

- The **miasmatic theory of disease** held that diseases such as cholera or the Black Death were caused by a *miasma* (Greek language: "pollution"), a noxious form of "bad air". In general, this concept has been supplanted by the more scientifically founded germ theory of disease.
- The development of a sufficiently powerful microscope by Anton van Leeuwenhoek in 1675 provided visual evidence of living particles consistent with a germ theory of disease.

History

- John Graunt, a professional haberdasher and serious amateur scientist, published *Natural and Political Observations ... upon the Bills of Mortality* in 1662. In it, he used analysis of the mortality rolls in London before the Great Plague to present one of the first life tables and report time trends for many diseases, new and old.
- He provided statistical evidence for many theories on disease, and also refuted many widespread ideas on them.

History

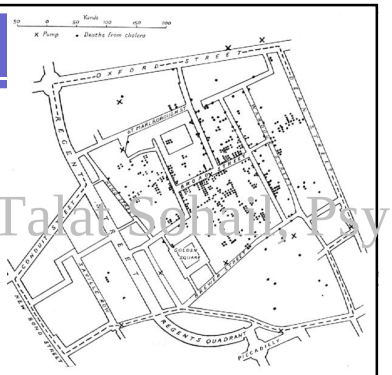
- Dr. John Snow is famous for his investigations into the causes of the 19th Century Cholera epidemics.
- He began with a comparison between the death rates from areas supplied by two adjacent water companies in Southwark.
- His identification of the Broad Street pump as the cause of the SoHo epidemic is considered the classic example of epidemiology.

History

- He used chlorine in an attempt to clean the water and had the handle removed, thus ending the outbreak. (It has been questioned as to whether the epidemic was already in decline when Snow took action.)
- This has been perceived as a major event in the history of public health and can be regarded as the founding event of the science of epidemiology.

History

- Map of Cholera outbreaks in London



History

- Other pioneers include Danish physician P. A. Schleisner, who in 1849 related his work on the prevention of the epidemic of tetanus neonatorum on the Vestmanna Islands in Iceland.
- Another important pioneer was Hungarian physician Ignaz Semmelweis, who in 1847 brought down infant mortality at a Vienna hospital by instituting a disinfection procedure.
  - His findings were published in 1850, but his work was ill received by his colleagues, who discontinued the procedure.
  - Disinfection did not become widely practiced until British surgeon Joseph Lister 'discovered' antiseptics in 1865 in light of the work of Louis Pasteur.
- In the early 20th century, mathematical methods were introduced into epidemiology by Ronald Ross, Anderson Gray McKendrick and others.

Purposes of Epidemiology

- To explain the etiology (cause) of a single disease or group of diseases using information management
- To determine if data are consistent with proposed hypothesis
- To provide a basis for developing control measures and prevention procedures for groups and at risk populations

Terms to know

- **Disease** a pattern of response by a living organism to some form of invasion by a foreign substance or injury which causes an alteration of the organisms normal functioning
  - also – an abnormal state in which the body is not capable of responding to or carrying on its normally required functions
- **Pathogens** organisms or substances such as bacteria, viruses, or parasites that are capable of producing diseases
- **Pathogenesis** the development, production, or process of generating a disease
- **Pathogenic** means disease causing or producing
- **Pathogenicity** describes the potential ability and strength of a pathogenic substance to cause disease

Terms to know

- **Infective** diseases are those which the pathogen or agent has the capability to enter, survive, and multiply in the host
- **Virulence** the extent of pathogenicity or strength of different organisms
  - the ability of the pathogen to grow, thrive, and to develop all factor into virulence
  - the capacity and strength of the disease to produce severe and fatal cases of illness
- **Invasiveness** the ability to get into a susceptible host and cause a disease within the host
  - The capacity of a microorganism o enter into and grow in or upon tissues of a host

Terms to know

- **Etiology** the factors contributing to the source of or causation of a disease
- **Toxins** a poisonous substance that is a specific product of the metabolic activities of a living organism and is usually very unstable
  - notably toxic when introduced into the tissues, and typically capable of inducing antibody formation
- **Antibiotics** a substance produced by or a semisynthetic substance derived from a microorganism and able in dilute solution to inhibit or kill another microorganism

Terms to know

- **endemic:** the ongoing, usual level of, or constant presence of a disease in a given population
- **hyperendemic:** persistent level of activity beyond or above the expected prevalence
- **holoendemic:** a disease that is highly prevalent in a population and is commonly acquired early in life in most all of the children of the population

Terms to know

- **epidemic:** outbreak or occurrence of one specific disease from a single source, in a group population, community, or geographical area, in excess of the usual level of expectancy
- **pandemic:** epidemic that is widespread across a country, continent, or large populace, possible worldwide
- **incidence:** the extent that people, within a population who do not have a disease, develop the disease during a specific time period

Terms to know

- **prevalence:** the number of people within a population who have a certain disease at a given point in time
- **point prevalence:** how many cases of a disease exist in a group of people at that moment.
- prevalence relies on 2 factors:
  - How many people have had the disease in the past
  - Duration of the disease in the population

7 Uses of Epidemiology

1. To study the history of the disease
   - Studies trends of a disease for the prediction of trends
   - Results of studies are useful in planning for health services and public health
2. Community diagnosis
   - What diseases, conditions, injuries, disorders, disabilities, defects causing illness, health problems, or death in a community or region
3. Look at risks of individuals as they affect populations
   - What are the risk factors, problems, behaviors that affect groups
   - Groups are studied by doing risk factor assessments
4. Assessment, evaluation and research
   - How well do public health and health services meet the problems and needs of the population
   - Effectiveness; efficiency; quality; access; availability of services to treat, control or prevent disease

7 Uses of Epidemiology

5. Completing the clinical picture
   - Identification and diagnostic process to establish that a condition exists or that a person has a specific disease
   - Cause effect relationships are determined, e.g. strep throat can cause rheumatic fever
6. Identification of syndromes
   - Help to establish and set criteria to define syndromes, some examples are: Down, fetal alcohol, sudden death in infants, etc.
7. Determine the causes and sources of diseases
   - Findings allow for control prevention, and elimination of the causes of disease, conditions, injury, disability, or death

The Epidemiology Triangle

- Many diseases rely on an **agent** or single factor for an infectious disease to occur.
- Epidemiologist use an ecological view to assess the interaction of various elements and factors in the environment and disease-related implications
- When more than a single cause must be present for a disease to occur, this is called **multiple causation**

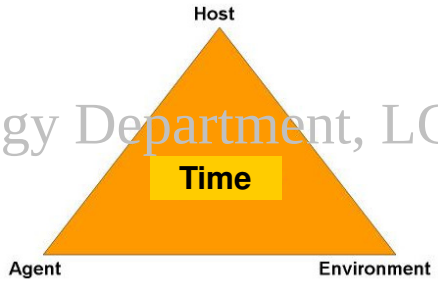
The Epidemiology Triangle

The interrelatedness of 4 factors contribute to the outbreak of a disease

1. Role of the host
2. Agent
3. Environmental circumstances
4. Time

The epidemiology triangle is used to analyze the role and interrelatedness of each of the four factors in epidemiology of infectious diseases, that is the influence, reactivity and effect each factor has on the other three

The Epidemiology Triangle

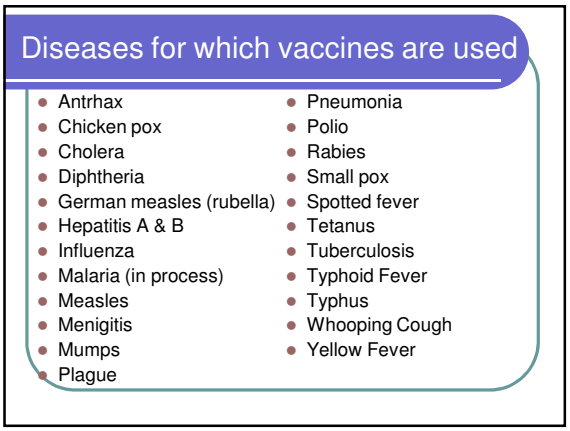


Immunity and Immunization

- History
  - Before polio vaccine became available in 1955, 58,000 cases of polio occurred in peak years. ½ of these cases resulted in permanent paralysis
  - Prior to measles vaccine in 1963, 4,000,000 cases per year
  - Immunization of 60 million children from 1963-1972 cost $180 million, but saved $1.3 billion
  - Mumps used to be the leading cause of child deafness
  - 10% of children with diphtheria died

Immunity and Immunization

- According to CDC, unless 80% or greater of the population is vaccinated, epidemics can occur
- Three types of immunity possible in humans
  - **Acquired Immunity** obtained by having had a dose of a disease that stimulates the natural immune system or artificially stimulating immune system
  - **Active Immunity** body produces its own antibodies
    - can occur through a vaccine or in response to having a similar disease
    - Similar to acquired
  - **Passive Immunity (natural passive)** acquired through transplacental transfer of a mother's immunity to diseases to the unborn child (also via breastfeeding)
    - can also come from the introduction of already produced antibodies into a susceptible case



Epidemiology

By

Prof. Dr. Talat Sohail

What is Epidemiology?

Epidemiology is the study of the determinants, distribution, and frequency of disease (who gets the disease and why)

- Epidemiologists study sick people
- Epidemiologists study healthy people
- To determine the crucial difference between those
- who get the disease and those who are spared
- Epidemiologists study exposed people
- Epidemiologists study non-exposed people
- To determine the crucial effect of the exposure

Epidemiology

- The study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to control of health problems.
- Epidemiology is the study of the distribution and determinants of health-related states or events (including disease), and the application of this study to the control of diseases and other health problems. Various methods can be used to carry out epidemiological investigations: surveillance and descriptive studies can be used to study distribution; analytical studies are used to study determinants (WHO)

Uses of Epidemiology

- To determine, describe, and report on the natural course of disease, disability, injury, and death
- To aid in the planning and development of health services and programs
- To provide administrative and planning data
- To study the cause (or etiology) of disease(s), or conditions, disorders, disabilities, etc.
- To determine the primary agent responsible or ascertain causative factors
- To determine the characteristics of the agent or causative factors
- To determine the mode of transmission
- To determine contributing factors
- To identify and determine geographic patterns

Epidemiology Purposes in Public Health Practice

- Discover the agent, host, and environmental factors that affect health
- Determine the relative importance of causes of illness, disability, and death
- Identify those segments of the population that have the greatest risk from specific causes of ill health
- Evaluate the effectiveness of health programs and services in improving population health

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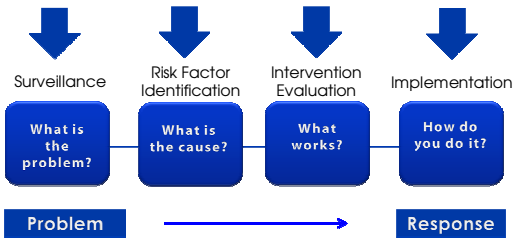
A Public Health Approach



Epidemiology Key Terms

Epidemic or outbreak: disease occurrence among a population that is in excess of what is expected in a given time and place.

Cluster: group of cases in a specific time and place that might be more than expected.

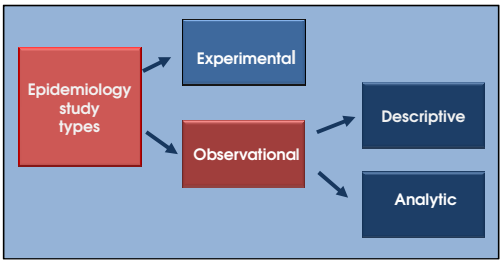
Endemic: disease or condition present among a population at all times.

Pandemic: a disease or condition that spreads across regions.

Rate: number of cases occurring during a specific period; always dependent on the size of the population during that period.

7

Epidemiology Study Types



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Experimental studies

- In an experimental study, the investigator determines through a controlled process the exposure for each individual (clinical trial) or community (community trial), and then tracks the individuals or communities over time to detect the effects of the exposure.
  - For example, in a clinical trial of a new vaccine, the investigator may randomly assign some of the participants to receive the new vaccine while others receive a placebo shot. The investigator then tracks all participants to observe who gets the disease that the new vaccine is intended to prevent, and compares the two groups (new vaccine vs. placebo) to see whether the vaccine group has a lower rate of disease. Similarly, in a trial to prevent onset of diabetes among high-risk individuals, investigators randomly assigned enrollees to one of three groups — placebo, an anti-diabetes drug, or lifestyle intervention. At the end of the follow-up period, investigators found the lowest incidence of diabetes in the lifestyle intervention group, the next lowest in the anti-diabetic drug group, and the highest in the placebo group.

Observational Studies

Cross-Sectional Study. Subjects are selected because they are members of a certain population subset at a certain time.

Cohort Study. Subjects are categorized on the basis of their exposure to one or more risk factors.

Case-Control Study. Subjects identified as having a disease or condition are compared with subjects without the same disease or condition

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Descriptive and Analytic Epidemiology

Descriptive epidemiology	Analytic epidemiology
When was the population affected?	How was the population affected?
Where was the population affected?	Why was the population affected?
Who was affected?	

11

Data Sources and Collection Methods

Source	Method	Example
Individual persons	• Questionnaire • Survey	• Foodborne illness outbreak • CDC's National Health and Nutrition Examination Survey • Health data on U.S. residents
Environment	• Samples from the environment (river water, soil) • Sensors for environmental changes	• Collection of water from area streams — check for chemical pollutants • Air-quality ratings
Health care providers	• Notifications to health department if cases of certain diseases are observed	• Report cases of meningitis to health department
Nonhealth-related sources (financial, legal)	• Sales records • Court records	• Cigarette sales • Intoxicated driver arrests

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Limitations of Epidemiology

Every epidemiological tool has limitations.

- Of course, epidemiology depends on valid data. Often in emergencies, the ability to gather data is severely restricted. This may be due to insecurity preventing survey workers from carrying out data collection or lack of resources preventing health workers from submitting surveillance data. Lack of access may also be due to difficulties in communication and transport to remote areas.
- Epidemiology is also constrained by the rapid changes in the health and nutritional status of many emergency-affected populations. By the time appropriate data and collected and analyzed, the conclusions and recommendations derived from these analyses may be out of date.

Continue……

- Another major limitation of epidemiology is in programmed evaluation. Policy-makers sometimes expect that organizations delivering a certain intervention will be able to demonstrate an "impact" on health that is unequivocally traceable to that intervention alone. This is often nearly impossible to achieve without very complex and expensive studies, such as randomized trials, because many different factors can simultaneously affect a specific health outcome or indicator. For example, imagine trying to establish a causal link between an agency's distribution of hygiene kits and deaths due to diarrheal disease in a camp where many other factors are changing simultaneously, such as the prevalence of malnutrition, water quantity and quality, excreta disposal, individual behavior, etc

Continue….

- Finally, perhaps the most important limitation of epidemiology is that epidemiology and the data gathered by epidemiologic methods are routinely ignored. Many major decisions during humanitarian relief are not made on the basis of data or evidence, political concerns, resource limitations, personal priorities, public relations and many other non-scientific factors may result in irrational policy or program decisions

Epidemiological statistics

Stages of epidemiological investigations

By:
Prof. Dr. Talat Sohail

Epidemiological statistics

- **Epidemiology:** The branch of medicine dealing with the **incidence and prevalence of disease in large populations and with detection of the source and cause** of epidemics of infectious disease.
- **Epidemiology statistics:** Epidemiological statistics is the science that is primarily concerned with **making inferences about population parameters using sampled measurement, statistical methods** provide the tools for epidemiological research.

Objectives of epidemiology

- To identify the cause of disease and risk factors
- To determine the extent of disease found in community
- To study natural history and prognosis of disease
- To evaluate existing and new preventive measures
- To provide foundation for developing public policies

Stages of epidemiological investigations

- A diagnostic phase (conformation of presence of the diseases)
- A descriptive phase (formation of hypotheses)
- An investigative phase (normally involves the implementation of a series of field studies to test these hypotheses)
- An experimental phase (experiment will be conduced under controlled conditions to test the hypotheses)
- An analytical phase (analysis of research data)
- An intervention phase (method for control of disease are examined either under experimental condition or field)
- A decision-making phase.
- A monitoring phase (implementation of the control measures)

Stages of epidemiological investigations

- **Diagnostic phase**
  - Presence of disease is conformed with evidence of clinical findings and laboratory diagnosis.
  - Route cause of the disease is identified.
- **Descriptive phase**
  - Describes the populations at risk and the distribution of the disease, both in time and space, within these populations.
  - This may then **allow a series of hypotheses to be formed** about the likely determinants of the disease and the effects of these on the frequency with which the disease occurs in the populations at risk.
- **Investigative phase**
  - Implementation of the study hypothesis
  - Study plan
  - Study filing

Stages of epidemiological investigations

- **Experimental phase**
  - Testing hypothesis
  - Exposure of the drug
  - Study the effect of drug/ placebo
  - Collect the clinical data
  - Monitor the effect of drug
- **Analytical phase**
  - Arrangement of data
  - Data mining
  - Statistical analysis
  - Data interpretation
- **Intervention phase**
  - **Testing the hypothesis under control environment**
  - Appropriate methods for the control of the disease are examined either under experimental conditions or in the field.
  - Interventions in the disease process are effected by manipulating existing determinants or introducing new ones.

Stages of epidemiological investigations

- **Decision-making phase**
  - Knowledge of the epidemiology of the disease is used to explore the various options available for its control.
  - This often involves the **modelling of the effects that these different options** are likely to have on the incidence of the disease.
  - These **models can be combined with other models that examine the costs of the various control measures and compare them with the benefits**, in terms of increased productivity, that these measures are likely to produce.
  - The optimum control strategy can then be selected as a result of the expected decrease in disease incidence in the populations of livestock at risk.

Stages of epidemiological investigations

- **monitoring phase**
  - Which takes place during the implementation of the control measures to ensure that these measures are being properly applied, are having the desired effect on reducing disease incidence.
  - In this phase, success of the control programme are quickly detected.

STANDARDIZED RATES AND RATIOS

MORTALITY RATES

(mortality rates are usually incidence rates, and therefore need a time dimension)

1. (All-cause or crude) mortality rate =

$$\frac{\text{total deaths in a year}}{\text{Estimate of people alive during that year*}}$$

*** Often referred to as the mid-point population**

Is the mortality rate an incidence density or a cumulative incidence?

OTHER FEATURES OF THE (CRUDE) MORTALITY RATE

- **Usually denominatored to 1,000**
- **Numerator is usually from death certificates**
- **Denominator is usually from census**
- **Generally synonymous with all-cause mortality rate, and to be distinguished from:**
  - **Cause-specific mortality rate**
  - **Age-adjusted/standardized mortality rate**
  - **Age, gender, or ethnicity-specific mortality rate**

CAUSE-SPECIFIC MORTALITY

2. Cause-specific mortality rate =

$$\frac{\text{annual deaths from a specific cause}}{\text{Mid-point population at risk of that disease}}$$

- **Usually denominatored to 100,000**

CASE FATALITY RATE

3. Case fatality rate =

$$\frac{\text{Deaths from a specific disease}}{\text{Cases of that disease}}$$

- Note that time is commonly undefined, because this measure is generally used when mortality occurs only during a fixed period of time, as with acute infections.

Mortality Rates Cont'd

4. Proportionate mortality rate =

$$\frac{\text{Deaths from a specific cause}}{\text{Deaths from all causes}}$$

- Note that this can be a misleading rate; Use with care, if at all. Almost all autopsy series base conclusions on proportionate mortality rate. Note that this is a proportion, and since it has no population denominator, is neither an incidence nor a prevalence rate.

SURVIVAL RATES

5. Five-year survival rate =

$$\frac{\text{Number of people alive after five years}}{\text{Number alive at beginning of the interval}}$$

- Commonly used in chronic diseases such as cancer, where mortality may be spread out over several years. Usually disease-specific. Any interval can be used, 10 years also fairly common.

SPECIFIC MORTALITY RATES

6. Specific (or stratum-specific) mortality rate =

A mortality rate in a specific segment of the population, such as 55-60 year olds (age-specific), or in men (sex-specific) or in a population group (e.g. hispanic mortality rates) any other stratum of the population. Generally applied to all-cause mortality, though can be applied to cause-specific mortality as well

STANDARDIZED MORTALITY RATES

7. Standardized (adjusted) rate =

A rate which differs from a crude rate in having been standardized to a different population (usually to a standard population) to remove the influence of some extraneous variable, such as age.

STANDARDIZATION OF MORTALITY RATES

- Standardization is nothing more than obtaining a weighted average. The weighting is derived from a standard population.
- Two forms of standardization are commonly used: direct and indirect
- Adjustment is another term used for standardization

All forms of standardization involve first breaking down or decomposing a population's mortality rate into two components:

- Component 1: The distribution of people in the population in groups (strata) having certain characteristics in common. For example, when we standardize for age, we often create strata of people of the same 10-year age stratum (e.g. 25-34 years, 35-44 years, etc). We call these stratum-specific proportions.
- Component 2: The mortality rates in each of the strata. We call these stratum-specific mortality rates. For example, the mortality for 25-34 year olds.

Standardization involves the use of data from two populations

- Population 1: The population of interest or the population being standardized.
- Population 2: The standard population. For many years, the standard population used to directly age-adjust US mortality rates was the population of the US in 1940. In 2001, the standard population was changed to the US population of 2000

PARTIAL DECOMPOSITION OF CRUDE MORTALITY RATE

STRATUM SPECIFIC PROPORTION	STRATUM SPECIFIC MORTALITY RATE
% OF POPULATION AGE 15-24	1 per 1,000
% OF POPULATION AGE 15-24	2 per 1,000
% OF POPULATION AGE 15-24	3 per 1,000
ENTIRE POPULATION	CRUDE MORTALITY RATE

STATISTICS OF STANDARDIZATION - RATES

1. RATES

C = crude rate for the population being standardized.

C_i = stratum-specific rate for the population being standardized.

C_s = crude rate for the standard population.

C_{si} = stratum-specific rate for the standard population.

STATISTICS OF STANDARDIZATION - PROPORTIONS

2. PROPORTIONS

P_i = Stratum-specific proportion in the population being standardized

P_{si} = Stratum-specific proportion in the standard population

PRODUCTS OF STANDARDIZATION

C_{direct} = directly standardized rate.

$C_{indirect}$ = indirectly standardized rate.

DIRECT STANDARDIZATION

The directly standardized mortality rate is:

The sum of the product of stratum-specific mortality rates in a specific population being standardized and the stratum-specific proportions of those strata in a standard population.

FORMULA FOR DIRECT STANDARDIZATION OF RATES

Formula for direct standardization:

$$C_{DIRECT} = \sum_{0}^{i} (C_i \times P_{si})$$

The sum of the product of stratum-specific mortality rates in a specific population being standardized and the stratum- specific proportions of those strata in a standard population.

INDIRECT STANDARDIZATION

The indirectly adjusted mortality rate is:

The sum of the product of stratum-specific mortality rates in a standard population and the proportional representation of those strata in the population being standardized is used to produce expected deaths.

We add a second step in indirect standardization –

The *actual* deaths in the population being standardized are divided by the *expected* deaths to produce the standardized mortality ratio.

FORMULA FOR INDIRECT STANDARDIZATION

$C_{INDIRECT}$ is calculated in two steps:

1. Calculate expected N of deaths in the population of interest:

$$ED = \sum_{0}^{i} (C_{si} \times P_i) \times 1{,}000$$

2. Divide the actual deaths by the expected deaths (ED) to obtain the standardized mortality ratio (SMR).

SMR = actual deaths/expected deaths

COMPARING STANDARDIZED MORTALITY RATES

Direct standardization yields an expected rate (or standardized rate) which can then be compared to the crude rate, or to any other similarly standardized rate.

Indirect standardization yields an expected number of deaths, which can then be compared to the number of actual deaths, as in the SMR, or to the expected number of deaths in another population.

MNEMONIC DEVICE

- When you use the MORTALITY RATES of the POPULATION OF INTEREST, you are DIRECTLY standardizing.
- When you use the MORTALITY RATES of the STANDARD POPULATION, you are INDIRECTLY standardizing.

STANDARDIZATION EXERCISE

- Assume the crude mortality rate in the US is 11/1,000 and in Michigan it is also 11/1,000
- Assume that the population of both the US and Michigan have been divided into four age groups, and that we know both the number of people in each age group, and the mortality rate for each age group, in both populations
- How do we calculate the age-adjusted mortality for Michigan, both directly and indirectly?

	US proportion	US mortality rate*	MI proportion	MI mortality rate*
Very Young	30%	24%	3	3
Young	28%	22%	8	6
Middle-aged	22%	27%	14	12
Old	20%	27%	23	21
Total	100%	100%	11	11

* Mortality rates are per 1,000 population

A. To *directly* standardize, use the standard population distribution (the US), and the age-specific mortality rates for the population of interest (Michigan). Then calculate the mortality rate that would apply in Michigan if it had the same age distribution as the US.

US POP		MI RATE	
.30	x	3/1,000 =	0.90/1,000 +
.28	x	6/1,000 =	1.68/1,000 +
.22	x	12/1,000 =	2.64/1,000 +
.20	x	21/1,000 =	4.20/1,000 +

This sum adds up to the Age-standardized MI mortality rate of 9.42/1,000.

- Compare this directly age-standardized MI mortality rate of 9.42/1,000 both to the *crude* MI rate of 11.0/1,000 and to the *crude* US mortality rates of 11.0/1,000 given in the exercise.
- What does this mean?

COMPARING DIRECTLY AGE-STANDARDIZED AND CRUDE MORTALITY RATES IN MICHIGAN

The difference between the crude and directly age-adjusted MI mortality rates (11 vs 9.4) indicates that MI must have a more unfavorable *age distribution* than does the US. Since both the crude and adjusted rates for MI use the same age-specific mortality rates (those of MI), age-specific mortality can play no role in the change due to adjustment.

Generalization: if direct age adjustment produces a *lower* mortality rate, then it must mean that the population of interest has a more unfavorable age distribution than the standard population.

COMPARING DIRECTLY AGE-STANDARDIZED MI MORTALITY RATES TO US MORTALITY RATES

The difference between the directly age-adjusted MI mortality and the crude US mortality indicates that MI has, on average, lower *age-specific mortality rates*. Both statistics have the same age distribution.

Generalization: if direct age-adjustment produces a *lower* mortality rate in the population of interest, then it must mean that the standard population has a more unfavorable age-specific mortality.

INDIRECT STANDARDIZATION

To *indirectly* standardize, use the age distribution of the population of interest (Michigan) and the age-specific mortality rates of the standard population (the US) and calculate the *expected* number of deaths that would occur in Michigan, if the US age-specific mortality rates were to apply.

INDIRECT STANDARDIZATION STEP 1 – CALCULATE EXPECTED DEATHS

1. Calculate the no. of expected deaths (ED). Assume a population of 1,000 distributed as in Michigan, then

MI POP		US RATE	
240	x	3/1,000 =	0.72 ED +
220	x	8/1,000 =	1.76 ED +
270	x	14/1,000 =	3.78 ED +
270	x	23/1,000 =	6.21 ED +

This adds up to 12.47 expected deaths

STEP 2: CALCULATE THE STANDARDIZED MORTALITY RATIO

The *standardized mortality ratio (SMR)* is 11/12.47 or 0.88 (*actual deaths/expected deaths).*

What does it mean when the SMR is less than one?

STEP 2: INTERPRETING THE SMR

The SMR tells us that MI would be expected to have had 12.47 deaths/1,000, instead of the 11 it actually had. *if it had the same age-specific mortality as the U.S.* But it didn't. It had just 11 deaths/1,000. So its age-specific mortality rate must be better than the US.

RECAP - WHAT DOES STANDARDIZATION DO?

1. Standardization is used to remove the effect of an unwanted variable, such as age, from a comparison between two populations

2. Direct standardization is used whenever stable stratum-specific rates are available

3. Indirect standardization is used when stratum-specific rates are unavailable or unstable because of small numbers

4. Remember than standardized rates are averaged across all strata: a standardized rate can conceal interesting differences between strata - therefore looking at a standardized rates should not substitute for looking at specific rates whenever possible.

ODDS RATIOS & RELATIVE RISK

➢ODDS:
Chance of event occurring divided by chance of event not occurring.
- For example, in 100 births, the probability of a delivery being a boy is 51% and being a girl is 49%
- The odds of a delivery being a boy is 51/49 = 1.04

➢In simpler term, an odds of an event can be calculated as : Number of events divided by number of non-events

ODDS RATIO

An odds ratio is the odds of the event in one group , for example, those exposed to a drug, divided by the odds of the event in another group not exposed

Odd ratio in epidemiology:

- In case control study since the incidence is not available so relative risk can not be calculated directly.
- Therefore Odd ratio is obtained which is a measure of strength of association between exposure and outcome

Odd ratio in case control study

	Case	control
Exposed	a	b
unexposed	c	d

Odd of exposure among the cases : a/c

Odd of exposure among the control: b/d

Therefore Exposure odd ratio is: $\frac{a/c}{b/d} = \frac{ad}{bc}$

Odd ratio of x indicated the cases are x times more likely to exposed to the risk factor than the control

Odds ratio in cohort study

	Outcome YES	Outcome No
Exposed	a	b
unexposed	c	d

Odd of outcome among exposed=a/b

Odd of outcome among unexposed=c/d

Odd ratio= $\frac{a/b}{c/d}$ =ad/bc

- Odds ratio can be calculated in a cohort study and in a case-control study.
- The exposure odds ratio is equal to the disease odds ratio.
- Relative risk can only be calculated in a cohort study.
- Odds ratio can be a measure of relative risk in case control study.

Relationship between OR and RR

	Outcome yes	Outcome no
Exposed	a	b
Un exposed	c	d

Incidence of outcome among the exposed= a/ a+b

Incidence of outcome among the unexposed= c/c+d

Relative risk =a/ a+b / c/c+d

=a/b / c/d =ad/bc

a<<<b a+b=b

c<<<d; c+d=d

Relative risk= Odds ratio

Odds ratio is a measure of true relative risk when:

- The outcome is relatively rare. (prevalence is 10% or less in general population)
- The cases must be representative of the cases in the population.
- The controls must be representative of the controls in the population.

Interpretation of odds ratio (OR) :

- OR of >1 indicates that the exposure is associated with an increased risk of developing the disease.
- OR of <1 indicates that the exposure is associated with the reduced risk of (protect against) developing the outcome.
- Closer the value of OR to 0 greater the protection.
- The OR will rarely equal to 1 in absence of true risk or protection.

Match paired Case control study

- Paired Matching: In paired matched case-control study each case is matched to a control .
- The pairing is done independent of the exposure status under study.
- Data are analyzed in terms of case-control pairs rather than for individual subjects.
- Four types of case-control combinations are possible in regard to exposure history.

CASES \ CONTROL	Exposed	Unexposed
Exposed	A	B
Unexposed	C	D

- Concordant pairs are ignored since they don't contribute in calculation of OR .
- Discordant pairs of cases and controls are used to calculate the matched OR.
- Matched OR = Ratio of discordant pairs

pairs in which cases exposed / pairs in which controls were exposed

Testing of statistical significance of OR

- Constructing a confidence interval (95% or 99%) around the observed OR.
- If the CI does not contain null value then it indicates significant association.
- By performing chi square test on 2 by 2 table used to generate OR the statistical significance of OR is automatically assessed.

ADJUSTED OR

When the observed OR is adjusted against the confounders by multiple regression technique the outcome is adjusted OR

Uses of OR=

1. OR are appropriate measure of RR in case control studies.
2. OR are commonly used in meta analysis.
3. OR are the output of logistic regression analysis.

Disadvantages of OR=

OR exaggerate RR in common outcomes(prevalence>10). In those cases if OR >1 it is larger than the true RR and conversely if OR<1 it is smaller than the true relative risk.

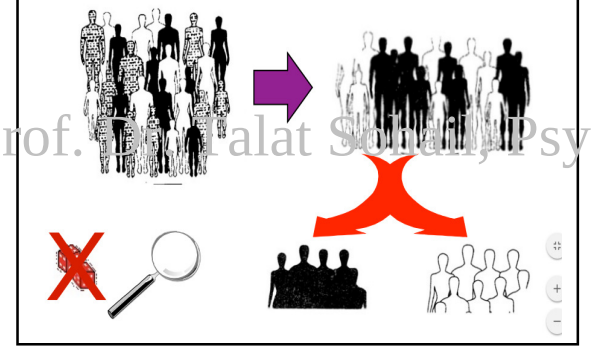
PROSPECTIVE & Retrospective Studies

By
Prof. Dr. Talat Sohail

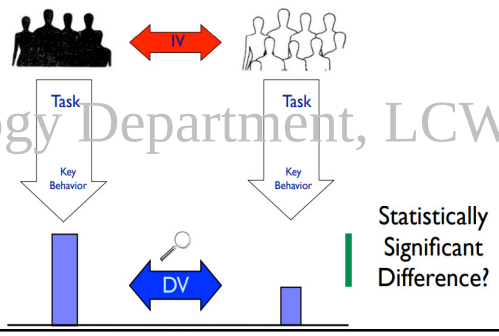
Prospective Studies

- Identify groups in terms of possible cause variables and measure possible effect variables

Prospective studies



Prospective studies



Retrospective Studies

- Identify groups in terms of possible effect variables and measure possible cause variables

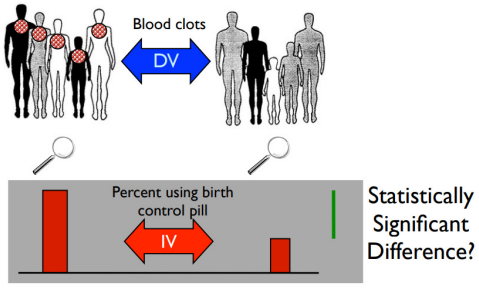
Retrospective Studies

- Both experiments and prospective studies begin with the groups identified in terms of the *independent variable* (suspected cause)
  - Either assign or select subjects
  - Measure the *dependent variable* (suspected effect)
- Retrospective studies work the other way around
  - Begin with subjects who show the value on the *dependent variable* (suspected effect)
  - Match them with others who lack the value on the dependent variable
  - Measure the presence or absence of the *independent variable* (suspected cause)

Why retrospective studies?

- An effect occurs but we are lacking in good hypotheses as to what might cause it
  - making it hard to do either an experiment or a prospective study
- The effect (dependent variable) of interest occurs very infrequently
  - which would require enormously large samples to get enough cases with the effect
  - but we still want to know why it occurs
- There is not time for a prospective or an experimental study
  - but we need answers NOW

Retrospective Design



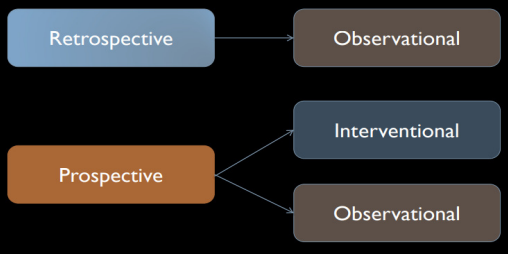
Confounds in retrospective studies

- Must match on the Dependent Variable
- Must be able to *detect differences* in the Independent Variable
  - Only look for those differences you suspect are relevant
  - Often this requires relying on *memory* of the participants
    - Memory of those with the value of interest on the dependent variable, especially if it is negative, may differ from those without it

From Prospective to Retrospective Studies

- To do a **prospective study** you must identify groups based on the relevant independent variable, then wait until you can measure the dependent variable
  - In some cases of interest, that may mean waiting years
- Alternative strategy is to start with the effect and look backwards to isolate the possible cause
  - This is what a **retrospective study** attempts to do

Retrospective vs. Prospective



- Observational Study:
  - a study in which participants are not randomized or otherwise pre-assigned to an 67 exposure. The choice of treatments is up to patients and their physicians (subject to any third party 68 payer constraints).
- Prospective Observational Study:
  - an observational study in which the consequential outcomes of 71 interest occur after the creation of a study protocol and analysis plan, and study commencement.

Prospective cohort studies

- A group of people is chosen who do not have the outcome of interest (for example, myocardial infarction). The investigator then measures a variety of variables that might be relevant to the development of the condition. Over a period of time the people in the sample are observed to see whether they develop the outcome of interest (that is, myocardial infarction). In single cohort studies those people who do not develop the outcome of interest are used as internal controls. Where two cohorts are used, one group has been exposed to or treated with the agent of interest and the other has not, thereby acting as an external control.

Retrospective cohort studies

- These use data already collected for other purposes. The methodology is the same but the study is performed post-hoc. The cohort is "followed up" retrospectively. The study period may be many years but the time to complete the study is only as long as it takes to collate and analyze the data.

Advantages and disadvantages

- The use of cohorts is often mandatory as a randomized controlled trial may be unethical;
- As cohort studies measure potential causes before the outcome has occurred the study can demonstrate that these "causes" preceded the outcome, thereby avoiding the debate as to which is cause and which is effect.

CONTINUE…..

- A further advantage is that a single study can examine various outcome variables.
- Cohorts permit calculation of the effect of each variable on the probability of developing the outcome of interest (relative risk). However, where a certain outcome is rare then a prospective cohort study is inefficient.

CONTINUE…..

- The efficiency of a prospective cohort study increases as the incidence of any particular outcome increases. Thus a study of patients with a diagnosis of deliberate self harm in the 12 months after initial presentation would be efficiently studied using a cohort design.

CONTINUE…..

- Another problem with prospective cohort studies is the loss of some subjects to follow up. This can significantly affect the outcome. Taking incidence analysis as an example (incidence = cases/per period of time), it can be seen that the loss of a few cases will seriously affect the numerator and hence the calculated incidence. The rarer the condition the more significant this effect. Retrospective studies are much cheaper as the data have already been collected.