Research methods in Emergency Medicine

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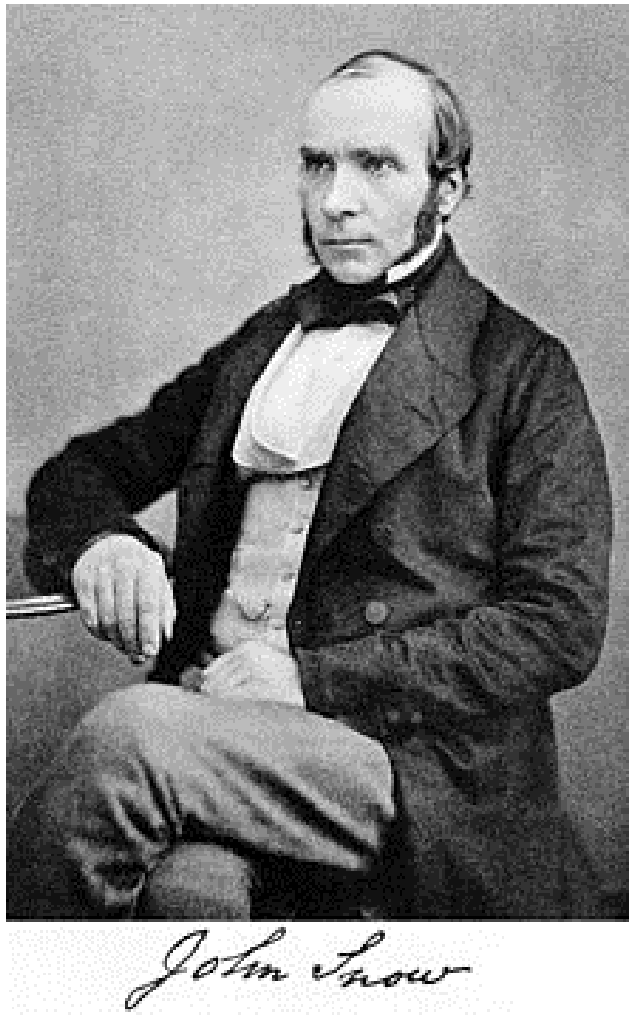
No conflicts of interest..

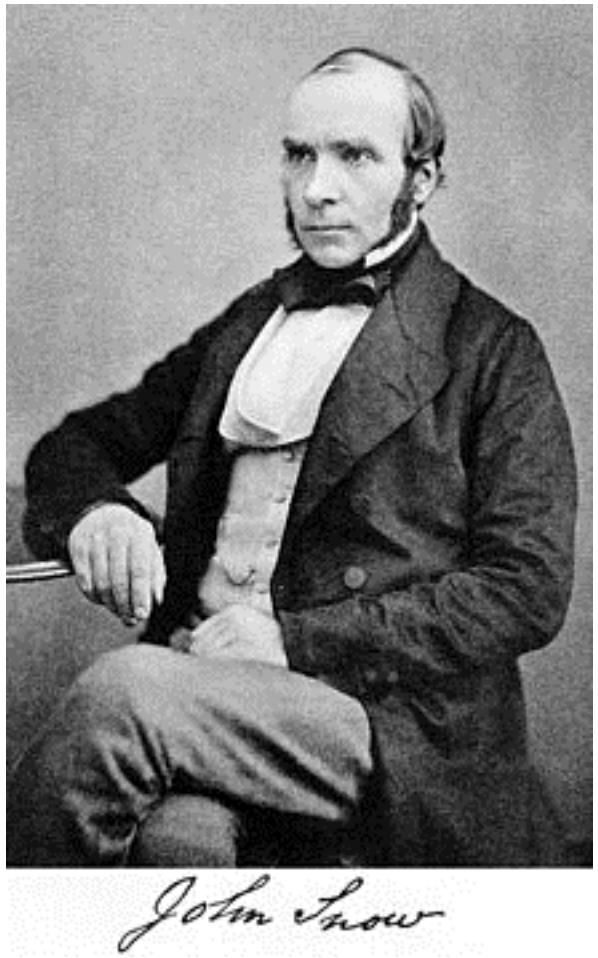
Who knows John Snow ?

Not that one !



Soho Broad Street cholera (London) 1854

“the most terrible outbreak of cholera which ever occurred in this kingdom”



John Snow , Father of epidemiology
(15 March 1813 – 16 June 1858)

Difficulties for Research in Emergency Medicine

- The ED environment is not safe
- Staff rotation
- Few courses for research
- Expert supervision is low
- academic environment not supportive
- Funding is hard to found
- Ethical issues (informed consent)

Emergency Medicine Research Benefited Patients?

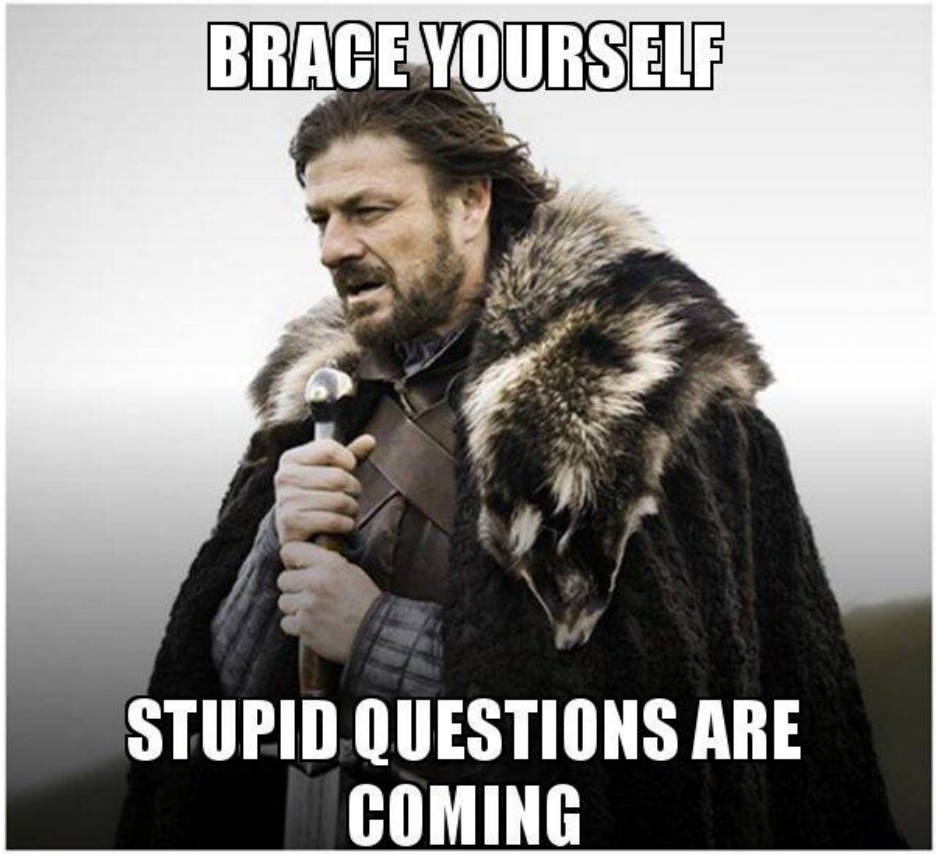
YES	NO
Development of specialty of EM	Clinical researchers physicians/ Patients research subjects
Diagnostic procedures (Imaging, Lab testing..)	Significance of Research : risks on patients
Therapeutic Procedures	Research Topics (Industry-sponsored studies of new drugs)
Systems/ Prevention	Research Subjects and Safety

Has Emergency Medicine Research Benefited Patients? An Ethical Question K.V. Iserson Sci Eng Ethics (2007) 13:289–295 DOI 10.1007/s11948-007-9025-6

Research Defined

The Scientific Method

- is a systematic way to find answers to questions
  - What is the research question?
  - What do we know to date?
  - What are the gaps in our knowledge?
  - Why is it important?
  - What is the objective?
  - What is the issue?
- is a creative process
- Knowledge acquisition gained through
  - reasoning
  - intuition
  - appropriate methods



Scientific Method

1. Choose a Question to investigate
2. Identify a hypothesis related to the question
3. Make testable predictions in the hypothesis
4. Design an experiment to answer hypothesis
5. Collect data in experiment
6. Determine results and assess their validity
7. Determine if results support or refute your hypothesis

How to choose a research question ?

- What in unknown in Emergency Medicine ?
- What do other Emergency Physicians wish to know ?
- Is our clinical experience is uncommon ?
- Research question must be descriptive or analytic
- Specify the population (men, women, elders, youth, ..)

top 10 research priorities in emergency medicine

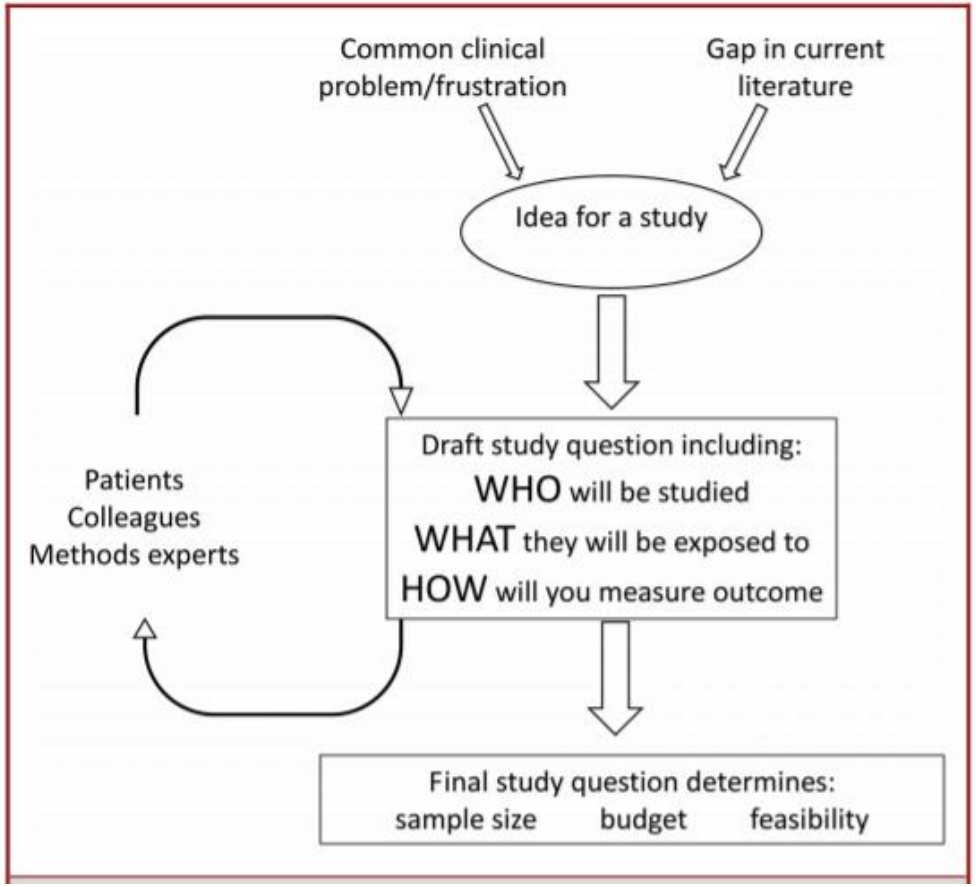
1. ED crowding
2. frail elderly patients
3. mental health patients
4. ED staff development
5. End-of-life care in the ED
6. New techniques to assess patients with chest pain
7. Staffing for current EM practice
8. Antibiotics in suspected severe sepsis
9. Trauma and cervical spine immobilisation
10. Which trauma patients should be transferred to a major trauma centre

Smith J, et al. Emerg Med J 2017;**34**:454–456. doi:10.1136/emermed-2017-206702

The Scientific Method

Suspicion that a factor (exposure) may influence occurrence of disease or a health outcome

- Observations in clinical practice
- Examination of disease/outcome patterns
- Observations in laboratory research
- Theoretical speculation



Good research question "*FINER*"

Feasible

- Subjects
- Resources
- Data available?

Interesting

Novel

In relation to previous findings
New setting, new population

Ethical

- Social value
- Scientific value
- Safe

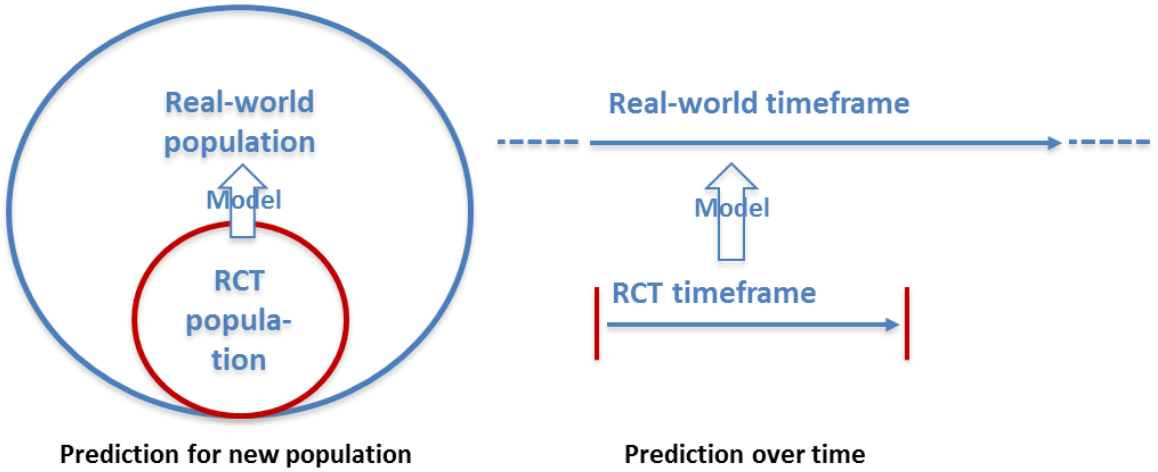
Relevant

Advance scientific knowledge? Influence clinical practice?
Impact health policy? Guide future research?

A Research Question Must Identify

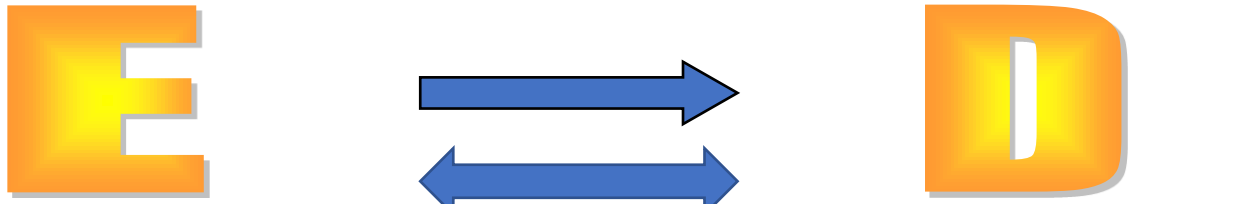
1. The **variables** under study
   - Have 2 or more properties or qualities
   - Is one variable related to another?
   - Are they dependant/independent ?

2. The **Population** being studied
   - Describe issues related to **disease or exposure** in populations
   - Usually rely upon routinely **collected data** from established surveillance or notifiable disease systems



3. The **Testability** of the question

Is there an relationship between ?



Exposure

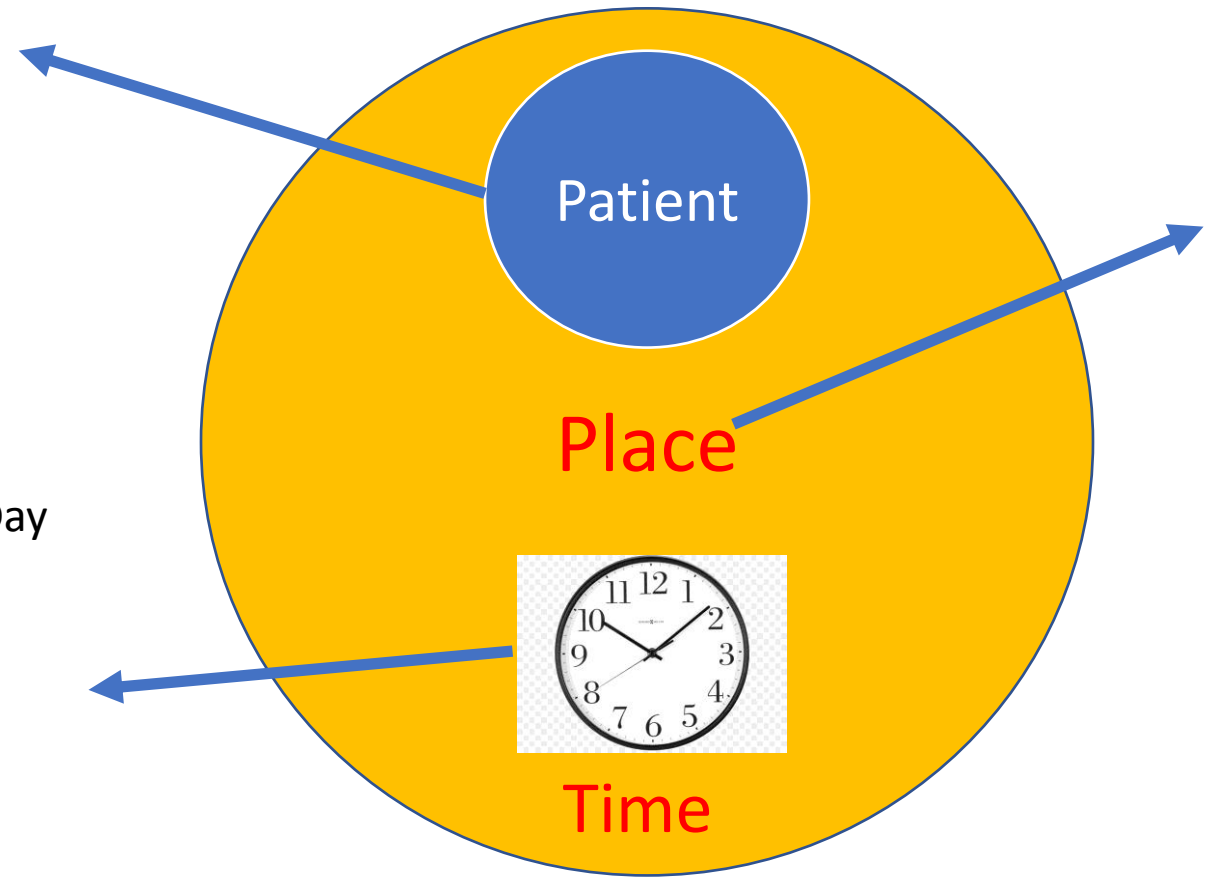
(risk factor, protective factor, predictor variable, treatment)

Disease / Health

Outcome

3 essential characteristics to measure in descriptive studies

- Age, gender, race, ethnicity
- Genetic predisposition
- Concurrent disease
- Diet, exercise, smoking
- Risk taking behavior
- Education, occupation



- Residence
- Occupation
- Climate
- Geology
- population density
- economic development
- nutritional practices
- medical practices

- Calendar Time / Time of Day
- Time since an event
- Date of onset
- Age
- Seasonality
- Temporal trends

Main research methods

	Experimental Studies	Observational Studies
Examples	Randomized Clinical Trial	Cohort Case-control Cross-sectional Case Series
Group Assignment is Based On	Researcher assigns groups	"Natural Conditions" (personal preference, genetics, social determinants, environment…)
Use	"Gold Standard" for studying therapeutic interventions (treatments) or prophylactic interventions (prevention)	Associations between health outcomes and exposures. This can include studies on diagnosis, prognosis, etiology or harm

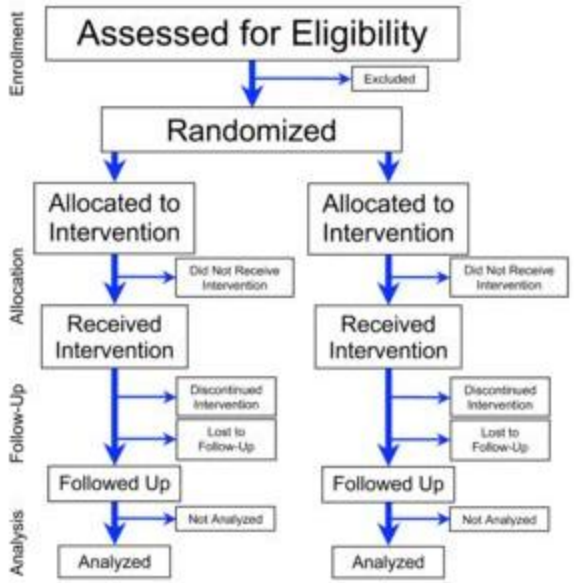
TYPES OF RCT:

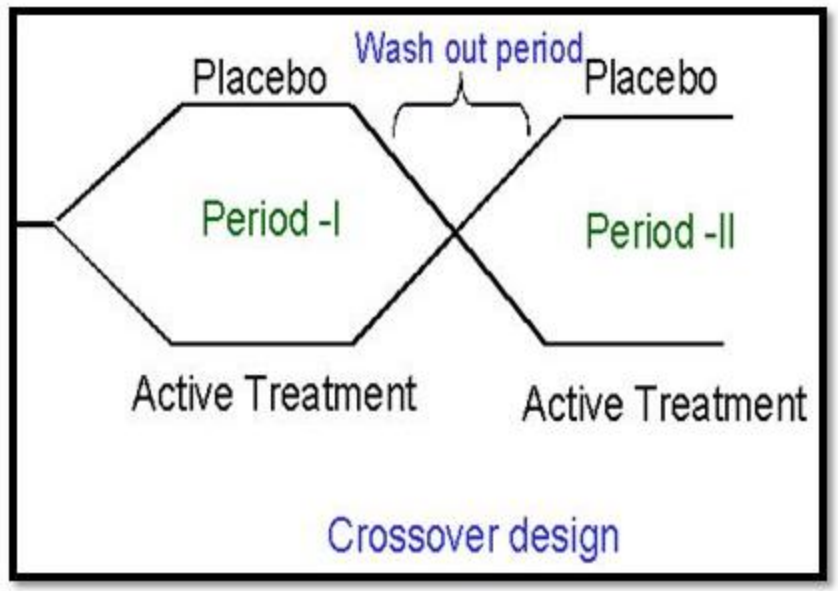
According to Participants' Exposure and Response to the Intervention

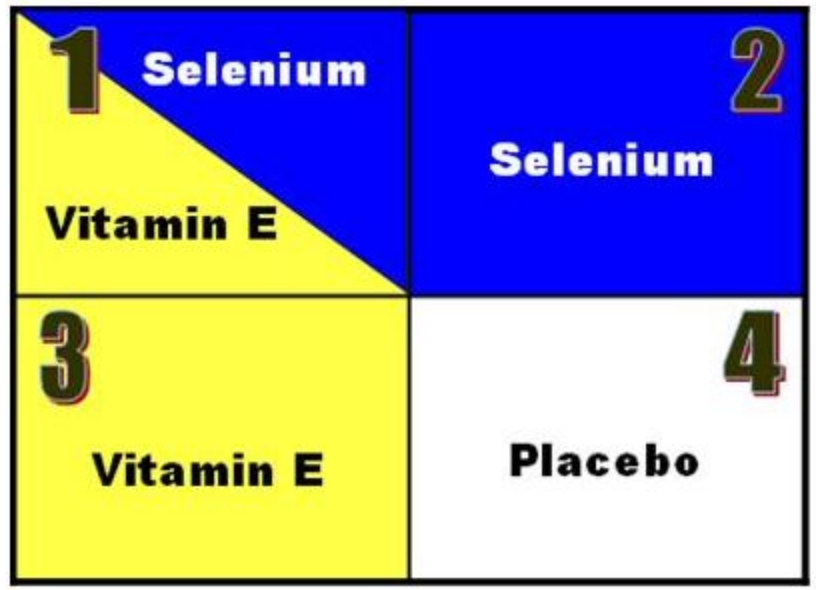
Parallel design:
each group of participants is exposed to only one of the study interventions

Crossover design:
each of the participants is given all of the study interventions in successive periods.

Factorial design:
when two or more experimental interventions are not only evaluated separately but also in combination and against a control.

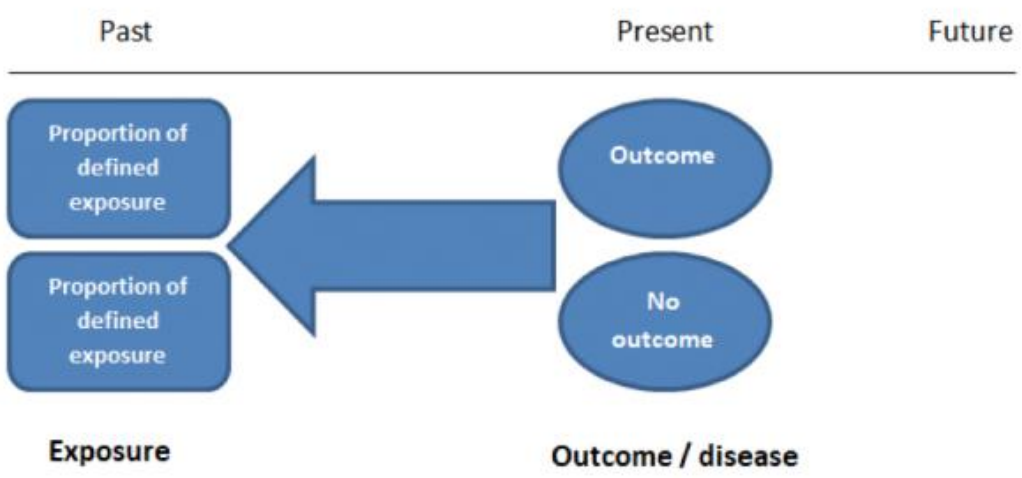






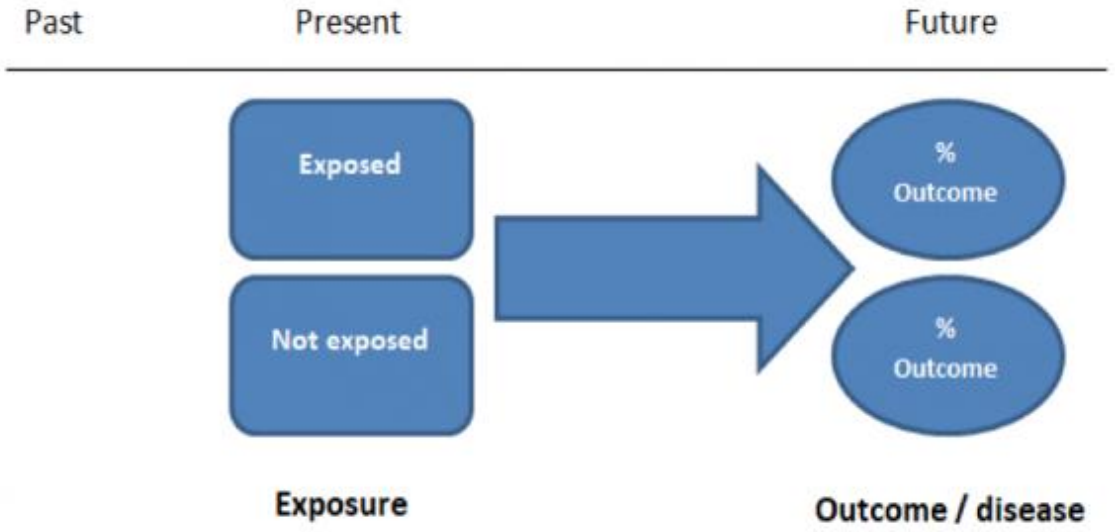
Observational studies

Case-control study design.



Case-control studies	
Advantages	**Disadvantages**
Cheaper	Retrospective / more prone to bias
Quicker / easier to conduct	Can only assess one outcome / disease
Good for diseases with long latency periods	Cannot establish risk
Can assess multiple exposures	Cannot establish prevalence
Good for rare diseases	

Cohort study design



Cohort studies	
Advantages	**Disadvantages**
Prospective (usually)	More expensive
Can establish risk directly	Longer / harder to conduct
Can assess multiple outcomes / diseases	Not good for rare diseases
Good for rare exposures	Not good for diseases with long latency periods

What are the different types of observational studies ?

Type of observational studies	When risk factors are measured	Advantages	Disadvantages
Cross sectional	Outcome At the same time	Determines prevalence	Weak evidence of causality
Prospective cohort	Prior to the outcome	Decreased likelihood that reverse causality is cause of association, eliminates recall bias and determines incidence	Expensive, time consuming
Case control	After the outcome	Efficient method for identifying cases (uncommon diseases)	Selection bias and recall bias
Nested case-control	Prior to the outcome	Efficient method for identifying cases and controls, minimizes recall bias	Requires foresight in the design of the prospective cohort
Ecologic study (aggregate data)	varies	Allows study of broad social policy questions	Subject to ecologic bias

Minimize expense

- Observational studies are less expensive than RCT
- Prospective cohort designs are the most expensive
- RCT : when subjects are enrolled in a RCT will pre paying for all the intervention

What are the results ?

- What have we learned from the research?
- Does the result of the findings has changed the standard practice of the field?
- Is the result generalizable?
- Can the result be applied to other areas of the field?
- What are the open problems?

Take Home Message
The Key Features for Research Project

ATUDER
Acil Tıp Uzmanları Derneği
1999

1. **T**est Question
2. **H**ypothesis
3. **R**eplication
4. **O**bjectivity
5. **N**on Predictable ?
6. **E**mpirical Evidence

Algorithm

Timeline

Understand the research problem?

Does the work had been already published ?

Experimental method ?

Research area?

Summary:
There **is no best study** design

- Feasable
- Cost
- Time
- Choose one that have an impact
  - Improve health, population
  - identifying Risks/Benefits factors
  - Improving diagnoses
  - Finding new treatments

Don’t forget the target !

sağol!