Case Series, Descriptive, and Cross-Sectional Studies

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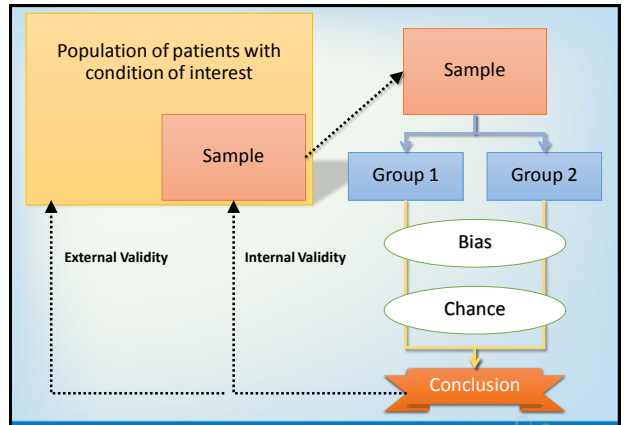

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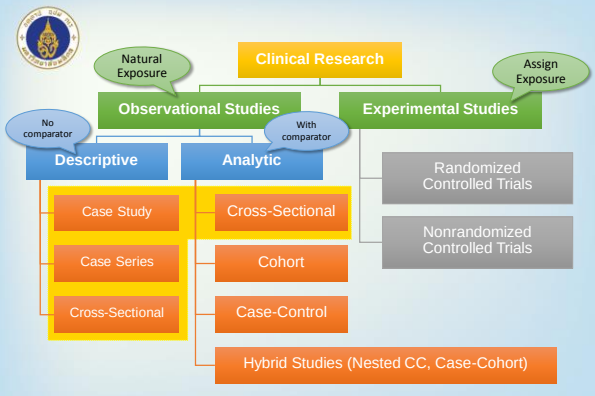

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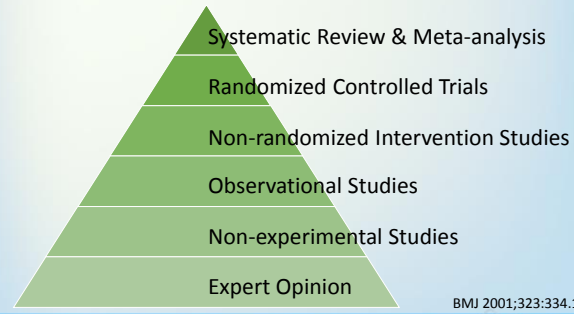
Hierarchy of evidence



BMJ 2001;323:334.1

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Descriptive Studies

- Concerned about **disease burden**
- Attempt to answer question
  - Who?
  - What?
  - Where?
  - When?
- *"First ideas"* about causality and generate hypothesis for further studies

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Case report and Case series

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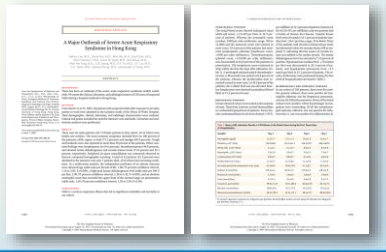
Case report and Case series

- Detailed description of one or more cases of a disease that are unusual for some reason
  - Never seen before
  - Occur in unexpected individuals
  - Occur in unexpected places

Example

- Description of series of infants born with congenital cataracts and cardiac abnormalities in Australia (Gregg 1941)
  - Severe epidemic of rubella 6-9 mo. before children born
  - *Now:* we know that rubella affect babies born from infected mother

- Identify potential health problems in outbreaks: SARS, bird flu, swine flu



Propranolol vs. Infantile Hemangioma

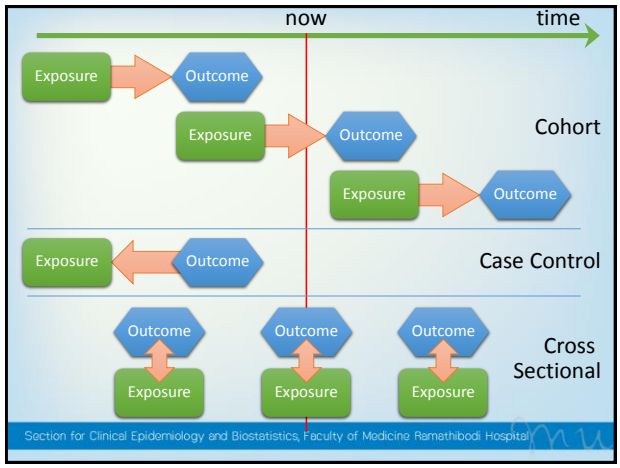
- Léauté-Labrèze 2008. Case report of successful treatment of a child with infantile hemangioma with obstructive cardiomyopathy with propranolol

Léauté-Labrèze C et al. N Engl J Med 2008;358:2649-2651.

Propranolol vs. Infantile Hemangioma

- **2008:** First case report
  - *Almost everyone still use Steroids*
  - *Multiple case reports follow*
- **2011:** First RCT
  - *Positive result*
  - *Multiple RCTs follow*
- **2013:** Meta-analysis
- Nowadays
  - *Almost everyone now try propranolol first*

Cross-sectional Studies



Principle of X-Sectional Studies

- Conducted at "single point" in time
  - *(Or a relatively short period)*
  - "Snapshot" of population
- **Exposure and Outcome measured at one point in time or over a period***
  - Often in the same time
- Can be **descriptive** or **analytic**
  - Depend on design
  - Prevalence study (descriptive)
  - Comparison of prevalence among exposed and non exposed (analytic)

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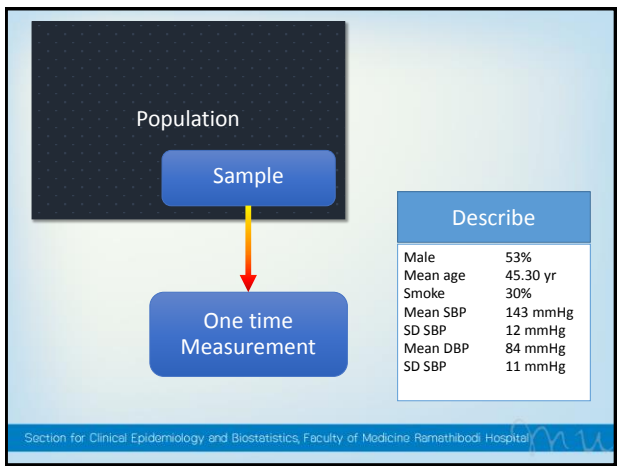

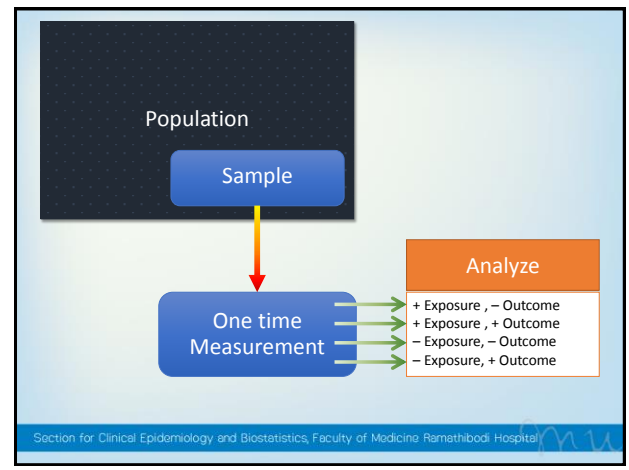

Example

- Prevalence of disease
  - Prevalence of Hand-Foot-Mouth disease in Bangkok
- Morbidity Survey
  - Prevalence of post anesthetic spinal headache
- Distribution
  - Mean and SD of length of descending branch of lateral circumflex femoral artery in Thai people

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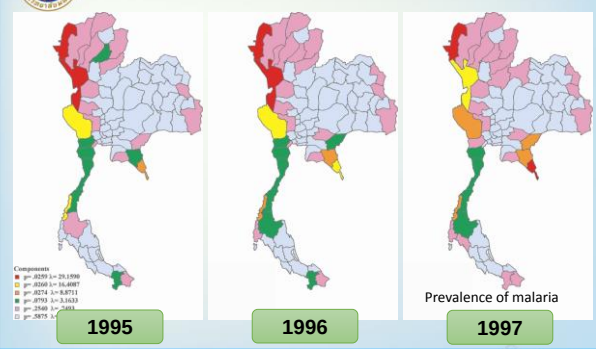
Snapshots of Disease



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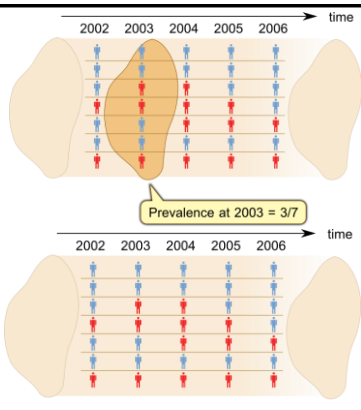
Descriptive Cross-Sectional Studies

- What they can do
  - Trend analysis (forecasting)
  - Planning
  - Clue about cause (generate hypothesis)
- What they **CANNOT do**
  - Conclusion about *cause* of disease
  - Over- or misinterpretation of data

Prevalence vs. Incidence

- Prevalence
  - Fraction of a group of people possessing a clinical condition/outcome at given point in time
- Incidence
  - Fraction of group of people initially free of outcome but develops condition over a given period of time



Incidence 2002-2006
= New cases / Person-time at risk observed
= 2 / (5 x 4) = 2 / 20 Case/Person-Year

Problem about descriptive data

- Vitamin C reduce URI symptom 70%
- Placebo reduce URI symptom 60%

- Which one should we use?

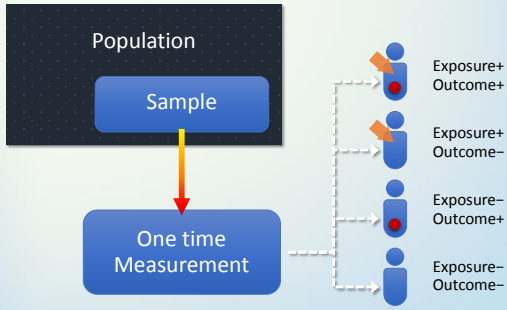
Descriptive vs. Analytic

Descriptive	Analytic
• Describe	• Explain

Analytic Cross-Sectional Studies

- Prevalence
- *Measurement of association*
  - *Prevalence ratio*
  - *Prevalence odds ratio*
- Diagnostic studies
  - Sensitivity
  - Specificity
  - Predictive values
  - Accuracy

Analytic Cross-Sectional Studies



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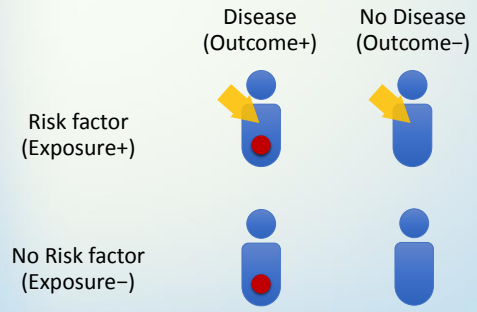
2x2 Table



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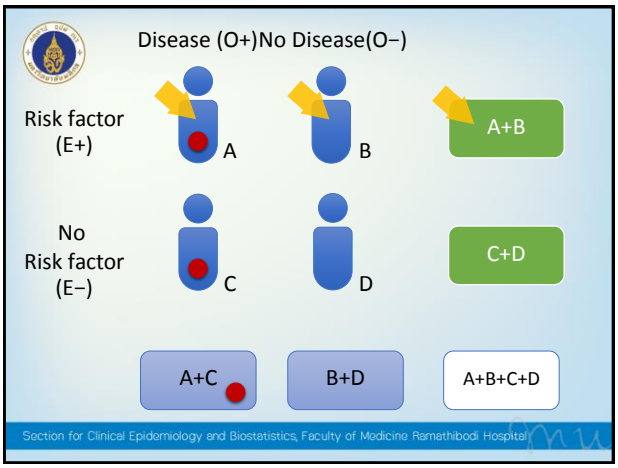

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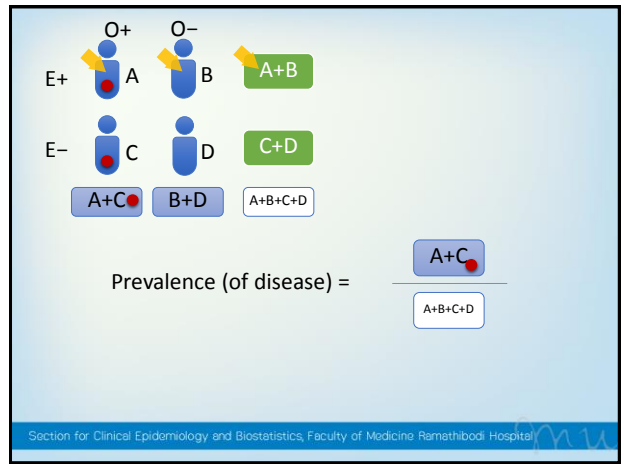

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Measurement of Association

- Prevalence Ratio (PR)
- Prevalence Odds Ratio (POR)

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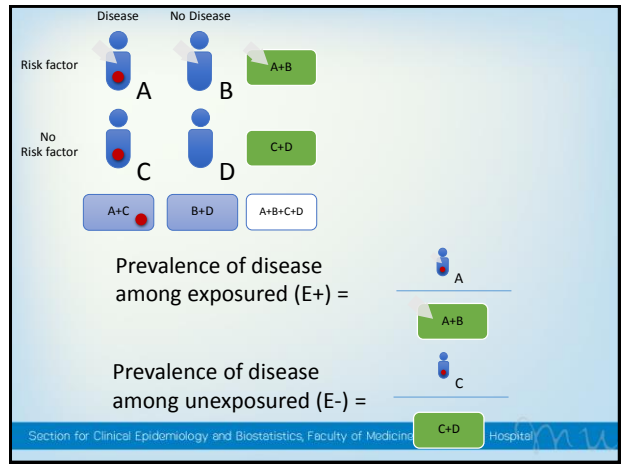

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1. Prevalence Ratio

$$= \frac{Prevalence\ of\ disease\ among\ exposure}{Prevalence\ of\ disease\ among\ non\ exposure}$$
$$= \frac{A}{A+B} \div \frac{C}{C+D}$$

2. Prevalence Odds Ratio

Odds of Exposure among Cases

$$= \frac{Exposed\ cases}{All\ cases} \div \frac{Unexposed\ cases}{All\ cases}$$
$$= \frac{A}{A+C} \div \frac{C}{A+C}$$
$$= A \div C$$

Odds of Exposure among Non-cases

$$= \frac{Exposed\ noncases}{All\ noncases} \div \frac{Unexposed\ noncases}{All\ noncases}$$
$$= \frac{B}{B+D} \div \frac{D}{B+D}$$
$$= B \div D$$

$$Prevalence\ Odds\ Ratio = \frac{Odds\ of\ exposure\ among\ cases}{Odds\ of\ exposure\ among\ non-cases}$$
$$= \frac{A}{C} \div \frac{B}{D} = \frac{A \times D}{B \times C}$$

Example: OA knee and Obesity

	OA Knee	No OA Knee	Total
Obesity	80	20	100
No Obesity	40	60	100
	120	80	200

	OA Knee	No OA Knee	Total
Obesity	80	20	100
No Obesity	40	60	100
	120	80	200

Prevalence of OA knee	120 / 200 = 0.6
Prevalence of OA knee among obese subjects	80 / 100 = 0.8
Prevalence of OA knee among non-obese subjects	40 / 100 = 0.4
Prevalence Ratio	0.8 / 0.4 = 2.0

Interpretration: The *probability* of OA is 2 times higher for obese subjects than non-obese subjects. **OR**
the probability of OA is 100% higher for obese subjects than non-obese subjects.

Prevalence odds ratio

- The odds is the ratio of the probability that the event of interest occurs to the probability that it does not.
- This is often estimated by the ratio of the number of times that the event of interest occurs to the number of times that it does not

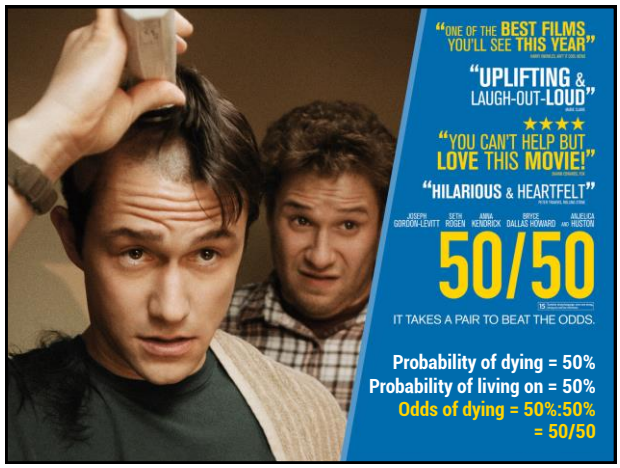
Odds ratio

- Probability of winning = 60%
- Odds of winning = ?

Odds ratio

- Probability of winning = 60%
- Odds of winning = 60% : 40%

= P : 1-P
= 0.6 : 1- 0.6
= 0.6 : 0.4
= 1.5



	OA Knee	No OA Knee	Total
Obesity	80	20	100
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Prevalence of OA knee among non-obese subjects	40 / 100 = 0.4
Prevalence Ratio	0.8 / 0.4 = 2.0
Prevalence Odds Ratio	80:20 / 40:60 80x60 / 20x40 = 6.0

Prevalence Odds Ratio

Prevalence Odds Ratio

$$= \frac{80 \times 60}{20 \times 40} = 6.0$$

Interpretation: The ratio of the odds of having OA in the obese group relative to the odds in favor of having OA in non-obese group.

Usefulness of Cross-sectional study

- Community
  - Screening (normal population)
  - Health status
  - Associations between variables
  - Surveillance: repeated cross-sectional studies
- Clinical practice
  - Diagnostic study (illness)

When we found association…

- Spuriousness or artifact
- Confounding
- Chance
- Causation

Hill's causal criteria

Facet	Case Series	Cross Sectional Studies	Case Control Studies	Cohort Studies	Randomized Controlled Trials
Temporality	X	X	√	√	√
Strength	X	Up to the result			
Dose-response	X	Up to the result			
Consistency	X	Up to the result			
Biologic Plausibility	N/A				
Reversibility	N/A				
Specificity	N/A				
Analogy	N/A				
Experimental evidence	X	X	X	X	√

Advantages of cross-sectional studies

- Good for describing the magnitude and distribution of health problems.
- Generalizability.
- Quick, conducted over short period of time, easy, inexpensive.
- Can study multiple exposures and disease outcomes simultaneously.

Disadvantages of cross-sectional studies (1)

- **Length biased sampling:** diseases that have long duration will over-represent the magnitude of illness while short duration will under-represent illness
- **Prevalent rather than incident** cases of disease are identified – exposures may be associated with survival rather than risk of development of disease.

Disadvantages of cross-sectional studies (2)

- Difficult to separate **cause** from effect, because measurement of exposure and outcome are conducted at the same time (difficult to establish temporal relationship)
- Can assess only association but not a "causal association".

Disadvantages of cross-sectional studies (3)

- Confounding factors may not be equally distributed between the groups being compared and this unequal distribution may lead to bias and subsequent misinterpretation.

Bias in Cross-Sectional Studies

1. Selection bias
   - Sampling bias
   - Response and non-response bias
2. Information bias
3. Confounding