Case Series, Descriptive, and Cross-Sectional Studies

Pawin Numthavaj, M.D.
Section for Clinical Epidemiology & Biostatistics
Faculty of Medicine Ramathibodi Hospital
Mahidol University
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Case Series, Descriptive, and Cross-Sectional Studies

Population of patients with condition of interest

Sample

Group 1

Group 2

External Validity

Internal Validity

Bias

Chance

Conclusion

Descriptive Studies

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

Case report and Case series
**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

**Propranolol vs. Infantile Hemangioma**

**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**
Case Series, Descriptive, and 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)

**Population**
- Sample
  - One time Measurement
  - Describe
    - Male: 53%
    - Mean age: 45.30 yr
    - Smoke: 30%
    - Mean SBP: 143 mmHg
    - SD SBP: 12 mmHg
    - Mean DBP: 84 mmHg
    - SD DBP: 11 mmHg

**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

**Snapshots of Disease**
- 1995
- 1996
- 1997
  - Prevalence of malaria
**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 a given point in time
- **Incidence**
  - Fraction of group of people initially free of outcome but develops condition over a given period of time

**Problem about descriptive data**

- Vitamin C reduce URI symptom 70%
- Placebo reduce URI symptom 60%
- Which one should we use?

**Descriptive vs. Analytic**

- **Descriptive**
  - Describe
- **Analytic**
  - Explain

**Analytic Cross-Sectional Studies**

- **Prevalence**
- **Measurement of association**
  - Prevalence ratio
  - Prevalence odds ratio
- **Diagnostic studies**
  - Sensitivity
  - Specificity
  - Predictive values
  - Accuracy
Case Series, Descriptive, and Cross-Sectional Studies

**Analytic Cross-Sectional Studies**

Population

Sample

One time Measurement

**2x2 Table**

Disease (Outcome+)

No Disease (Outcome−)

Risk factor (Exposure+)

No Risk factor (Exposure−)

**Measurement of Association**

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

Prevalence of disease among exposed (E+) = \frac{A}{A+B+C+D}

Prevalence of disease among unexposed (E−) = \frac{C}{A+B+C+D}
1. Prevalence Ratio

\[
\text{Prevalence Ratio} = \frac{\text{Prevalence of disease among exposure}}{\text{Prevalence of disease among non-exposure}} = \frac{A}{A+B} : \frac{C}{C+D}
\]

2. Prevalence Odds Ratio

\[
\text{Odds of Exposure among Cases} = \frac{\text{Exposed cases}}{\text{All cases}} = \frac{A}{A+C} : \frac{A+E}{A+C} = \frac{A}{C}
\]

\[
\text{Odds of Exposure among Non-cases} = \frac{\text{Exposed non-cases}}{\text{All non-cases}} = \frac{B}{B+D} : \frac{B+D}{B+D} = \frac{B}{D}
\]

\[
\text{Prevalence Odds Ratio} = \frac{\text{Odds of exposure among cases}}{\text{Odds of exposure among non-cases}} = \frac{A}{C} : \frac{B}{D} = \frac{A \times D}{B \times C}
\]

Example: OA knee and Obesity

<table>
<thead>
<tr>
<th></th>
<th>OA Knee</th>
<th>No OA Knee</th>
<th>Total</th>
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<tbody>
<tr>
<td>Obesity</td>
<td>80</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>No Obesity</td>
<td>40</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>80</td>
<td>200</td>
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</table>

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

Interpretation: 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

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

Prevalence Odds Ratio
80 / 20 / 40 / 60
80x60 / 20x40 = 6.0

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

<table>
<thead>
<tr>
<th>Facet</th>
<th>Case Series</th>
<th>Cross-Sectional Studies</th>
<th>Case Control Studies</th>
<th>Cohort Studies</th>
<th>Randomized Controlled Trials</th>
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<td>Temporality</td>
<td>X</td>
<td>X</td>
<td>√</td>
<td>√</td>
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<tr>
<td>Strength</td>
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<td>Up to the result</td>
<td></td>
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<tr>
<td>Dose-response</td>
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<tr>
<td>Consistency</td>
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<td>Biologic Plausibility</td>
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<td>Reversibility</td>
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<td>Specificity</td>
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<td>Experimental evidence</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>v</td>
</tr>
</tbody>
</table>

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